Kingston Home Energy Retrofit Program (KHERP)

Rationale and Design Study

Climate Leadership Division

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EXECUTIVE SUMMARY

Council's 2019 - 2022 Strategic Plan includes a commitment to develop an energy retrofit program that targets high capital cost improvements that result in high carbon reduction impact for property owners. The program referred to as "The Kingston Home Energy Retrofit Program (KHERP)" has been designed to assist residents reduce their greenhouse gas (GHG) emissions at home with the potential to also decrease their energy costs. Residential energy use accounts for 14% of community GHGs, and the retrofit program will help towards achieving the community's carbon neutrality target. Annually residents collectively spend about $100 million on energy used in their homes which emphasizes the important value of managing energy efficiency and conservation.

The program will focus on property owners of one-family dwellings located within the City of Kingston. This group of homes represent almost 60% of the housing supply within Kingston. Based on a recent survey of residents conducted in early 2020, 73% of respondents were interested in a home energy retrofit program that would help them reduce energy use and GHGs. Multi-residential buildings such as rental apartments, are out of scope for the initial four years of KHERP as part of eligibility requirements for the FCM Community Energy Financing program (CEF), a critical resource for the start-up of KHERP. A broader building scope will be considered in later stages as the program is further developed over time and the necessary resources are available.

KHERP will provide property owners access to expertise, financing and incentives to implement energy efficiency upgrades within their homes. Loans will either be paid back through property tax bills via the municipal Local Improvement Charge (LIC) mechanism or other third-party financing. On-bill financing through local utilities, contractors or equipment suppliers as well as traditional lending from financial institutions such as secured lines of credit may also be used to finance home energy retrofits. For the initial 4 years of the program, and subject to securing funding resources, performance-based incentives are proposed dependent on emissions or energy reduction levels achieved as a result of completing the retrofits or on the basis of financial need. These incentives will help lower the retrofit cost and the loans required for associated upfront expenses.

The program design includes several features that help address noted barriers such as lack of upfront capital for retrofits or knowledge of how to reduce home energy use. Home energy assessments using the federal EnerGuide Rating System will determine the most effective retrofit measures based on the specific equipment, insulation levels and other relevant conditions of participating homes. An Energy Coach service and other tools are proposed within the delivery of KHERP to support decision-making of homeowners throughout the retrofit process. Table 1 provides a summary overview of the main program design features of KHERP.

Table 1. Summary Program Design - Kingston Home Energy Retrofit Program

Goal	Retrofit 20 - 50% of Kingston's pre-1991 construction one-family homes by 2040 achieving an average carbon reduction impact of 30% per home.
Objectives *(Condensed)*	1. To enable residents to contribute to achieving the goal of carbon neutrality in Kingston. 2. To provide homeowners with a user-friendly retrofit program that enables them to reduce energy, emissions and potentially utility bills. 3. Provide homeowners access to the expertise, financing and incentives to implement cost-effective energy efficiency upgrades within their homes. 4. To stimulate opportunities for local investment, job creation and have fewer energy dollars leave the local economy.
Program Delivery	Through area utility providers within their respective service areas along with an Energy Coach supporting homeowners with the process.
Housing Focus (phase 1)	• One family homes (attached, detached, rowhouse) constructed pre-1991 and post 1990s homes with at least 20% GHG/energy savings potential
Homeowner Eligibility	• All owners of property must consent • Good property tax standing (paid in full at time of application)
Eligible Retrofits (examples)	• HVAC and DHW systems such as air/ground source heat pumps, solar thermal hot water, electric thermal storage, drain water heat recovery • Thermal envelope upgrades: insulation, windows, doors, air-sealing • Solar PV and energy storage technologies to store electricity or heat • Other works that enable energy conservation retrofits (i.e. Electrical panels required to handle loads if fuel-switching)
Eligible Costs	• Cost of equipment and related materials including installation • Cost of Energy Audit *(if not covered by other rebate/incentive)* • Commissioning of advanced equipment and up to one-year service maintenance/warranty if not provided with equipment purchase.
LIC Loan Terms	• Up to 20 years but not surpassing the life expectancy of the retrofit • Low interest rate (To be determined)
Underwriting Criteria	• Retrofit costs up to the lesser of 10% of the current value assessment of the property (as determined by the Municipal Property Assessment Corporation), or $40,000. • Homeowner must notify its mortgage lender (if applicable) of its intention to participate in the KHERP using the City's prescribed form (re LIC lien)
Risk Mitigation	• Loan loss reserve, channel partnerships, training and education campaigns, equipment commissioning and maintenance warranties, retrofit insurance requirements

There are five target market segments identified for the implementation of KHERP:

- One-family dwellings constructed prior to 1991;
- Homes using fossil fuels for HVAC/DHW needs (fuel oil, propane, natural gas);
- Homes being renovated or with major energy equipment due for replacement;
- Households experiencing a high energy cost burden; and,
- Homeowners who have identified that they want to reduce their home carbon footprint as indicated in local survey responses.

The technically feasible potential of KHERP includes a scenario of retrofitting up to 16,800 homes which would take 25 - 30 years to implement and leading to an estimated reduction of over 33,000 tonnes in annual GHGs. Using an economic potential lens, including estimated market penetration rates, a more realistic estimate of potential impact indicates that KHERP would be most cost-effective in reducing emissions, energy consumption and utility bills, in about 6,100 homes while potentially reducing homeowner energy costs from 10% - 50%. This more conservative estimate of program uptake could be achieved over 12 -15 years, leading to annual GHG reductions of up to 18,000 tonnes, or approximately 11% of residential emissions within the community.

KHERP will also help create demand for energy audit and trades jobs as well as stimulate local economic activity for the purchase of related products and services. In the first four years of the program, an estimated 200 to 375 jobs could be created from these retrofit projects which will increase as participation in KHERP incrementally grows over time. This number reflects a multiplier of 16 to 30 jobs for every $1,000,000 spent on retrofitting as described in the recent report “Bridge to the Future: Final Report from the Task Force for a Resilient Recovery” published in September 2020.

The City aims to build on existing relationships with utilities serving the Kingston area as well as other community stakeholders to support implementation and training for the program. The utility companies are important program delivery partners as they already have an established relationship with residents in terms of providing power and heating to homes. Electric and natural gas utilities also have experience in implementing related incentive programs and energy efficiency education campaigns. Additional channel partners are identified to help cross promote the program and reach the target markets.

An LIC by-law approved by City Council is a necessary next step to allow the City to provide loans to homeowners. Approval of the by-law will need to be followed by a funding application to the FCM CEF program to start-up and launch implementation of KHERP and to build community awareness and participation from 2021 - 2025. The program will be evaluated after three years of retrofits using several progress indicators to further scale-up its success. Long-term financial sustainability of the program will also be considered during the evaluation in consultation with program and channel partners.

1.0 INTRODUCTION

There is widespread recognition that climate change is already significantly impacting communities around the world which is affecting our infrastructure, food production, health and safety. In its latest report, the Intergovernmental Panel on Climate Change (IPCC) stated that limiting global temperature increases to 1.5 °Celsius above pre-industrialization levels requires expedited and transformational changes to land use, energy, industry, buildings and transportation. Cities, with their increasing population density and human activity, are at the core of this challenge.

Canada signed onto the Paris Agreement in 2015 which involves a commitment to reduce annual greenhouse gas (GHG) emissions to 30 percent below 2005 levels by the year 2030 and, more recently to net zero emissions by 2050.[i] However, as our national emissions have only declined 0.1% between 2005 and 2018,[ii] the reality is that most Canadians lead high carbon lifestyles including living and working in energy inefficient buildings that contribute significantly to GHG emissions. In Ontario, buildings were the second largest contributor of total GHGs in 2018 (24%), following transportation (35%).[iii] Just over half of these building emissions come from personal residences and the average resident in Ontario causes more than twice as much carbon pollution as the global average.[iv]

Municipalities across the country are acknowledging that they can play a key role in tackling climate change in their jurisdictions. Hundreds of communities across Canada have developed, or are in the process of developing, climate action plans or community energy plans. Municipalities are in a position to help Canada achieve its Paris targets, and to help residents lower their carbon footprint. Energy retrofit programs can play an important role in reaching the science based GHG reduction targets that are necessary to help avoid catastrophic levels of climate change.[v]

Within the City of Kingston 2019 -2022 Strategic Plan, City Council has committed to Demonstrate Leadership on Climate Action. Included among the directives within the Plan is the development and promotion of incentives for residents to reduce their energy use and become part of city-wide solutions to meet Kingston's long-term carbon neutral target by 2040. Kingston also has a target of reducing GHGs 30% below 2011 emission levels by 2030.

One of the ways the City will achieve these goals is to create a residential energy retrofit program that targets specific equipment and systems with high carbon reduction potential particularly with respect to space and water heating and cooling where most household energy use occurs. Addressing emissions from residential buildings is critical to helping municipalities, provinces, and Canada reach emissions reduction targets while stimulating local economic activity.

2.0 DEFINING THE PROBLEM

Municipal climate mitigation plans across Canada commonly address their three main sources of GHGs: transportation, buildings, and waste. The buildings sector includes residential dwellings as well as commercial, industrial, and institutional facilities. This program rationale and design document focusses on the residential sector.

There is an increasing push for high efficiency new home construction such as Energy Star, Passive House and Net Zero homes. However, it is estimated that 75% of homes that will exist in 2030 are already built[vi] and 50% of existing homes will still be in place by 2050.[vii] In order for Kingston to meet its GHG reduction carbon neutrality target, emissions from existing buildings will need to be reduced substantially, including those in the residential sector which was the source of approximately 170,000 tonnes of community GHGs in 2018.[viii] An estimated 83% of residential energy use is associated with low-rise residential buildings which includes single-detached and single-attached house types as defined by Statistics Canada and Natural Resources Canada.

Canada is currently improving its energy efficiency at a rate of 1% per year which needs to significantly increase as a part of a national transition towards a low-carbon economy.[ix] This flags the need for energy saving programs to be driven mainly by the provinces and territories as the jurisdictional authority over relevant policy areas regarding utility regulation and building energy codes. Efficiency Canada recently prepared their Provincial Energy Efficiency Policy Scorecard which benchmarks progress and assesses relevant policies and performance in energy efficiency programs and other enabling measures.[x] Although Ontario ranked 4th, energy policy and provincial support for energy efficiency programming has fluctuated fairly significantly over the past several years despite achieving noteworthy results.

During 2010 - 2018, the provincially supported Save On Energy program was administered through local utility companies. A wide variety of incentive and rebate programs were available to homeowners during this time which was predicated on the fact that energy conservation is the cheapest kilowatt hour compared to any energy generation source.[xi] Ontario homes consumed 37% less energy per square metre in 2016 than in 1990 in part due to the investment in energy conservation and demand management.[xii] Although this reduction in energy intensity is also affected by new homes being constructed to improved building code standards, existing older homes would still be the dominant portion of the housing stock in most cities.

Despite the progress made, in March 2019, the Ontario Ministry of Energy cut several conservation and demand management programs affecting homes and focussed on energy prices rather than managing consumption.[xiii] Although the federal government has recently attempted to fill some gaps by offering equipment rebate programs focused

on household appliances,[xiv] there is currently no comprehensive program offering homeowners assistance with a streamlined application process and available incentives regardless of their primary source of space and water heating.[xv]

Much like climate change, energy has become highly politicized over the years leading to misconceptions and confusion amongst consumers about energy policy, pricing and the most influential way to lower our home utility bills. Regardless of political perspectives, energy consumption in homes remains a significant cost to residents which also results in emissions that have an environmental impact. Individuals, in this case homeowners, will have much more influence in lowering their specific energy costs than over pricing structures for electricity or fuels used at home.

Prices per unit of energy in Canada fluctuate over time based on numerous factors such as infrastructure renewal and expansion. Energy prices have increased more than inflation since the year 2000, as can be seen in figure 1 which is particularly the case for electricity prices in Ontario.[xvi]

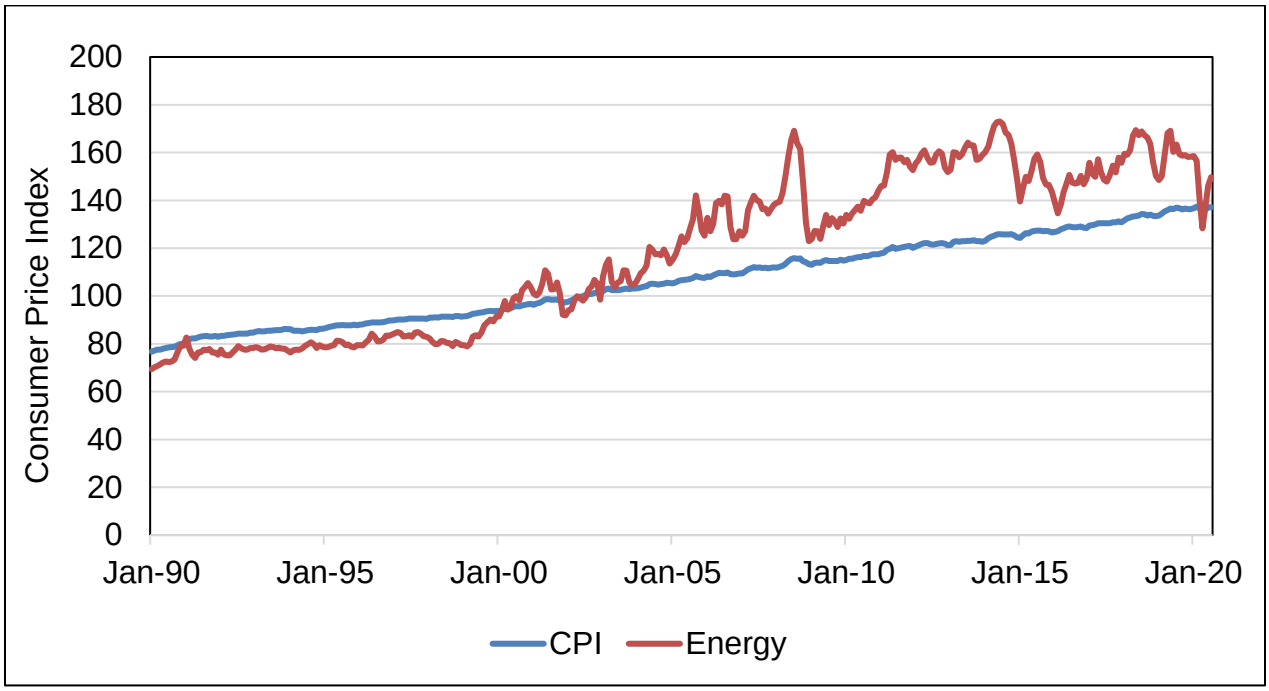


Figure 1. Energy prices rising faster than the Consumer Price Index[xvii]

Electricity and natural gas prices are set by the Ontario Energy Board influenced in part through formal submissions by utility companies for rate changes. Home energy consumption and associated costs on the other hand are directly affected by inefficiencies of space and water heating and space cooling equipment such as furnaces, hot water tanks and air conditioners. Homeowner utility bills are also influenced by the amount of air leakage from poor home insulation and lack of weather

stripping around doors and windows causing dollars spent on energy to literally slip between the cracks. These are common areas where homeowners can reduce their energy costs by minimizing waste of energy resources.

2.1 Energy Use and Carbon Footprint of Homes

The energy consumed to heat, cool and power homes represents an estimated 14% of Kingston's 1.2 million greenhouse gas emissions in 2018 (GHG) and about $100 million is spent on energy annually by local residents across the City.[xviii] Saving energy on home heating, cooling, and hot water heating can have a big impact on reducing the community's greenhouse gas emissions and will also help lower residents' energy bills. The 2014 Kingston Community Climate Action Plan estimated that retrofitting existing homes to improve energy efficiency could lead to a cumulative reduction of up to 18,000 tonnes of GHGs between 2011 and 2030.[xix]

Many energy conservation programs in the past have focused on standalone energy product or equipment discounts or rebates which do not address a more comprehensive deep energy retrofit approach treating the whole home as a system.[xx] Common examples of these programs are for light bulbs and household appliances such as clothes washers/dryers and dishwashers which typically use around 15% of an average home's energy consumption. Space and water heating are the biggest users of energy in Canadian homes which accounts for approximately 80% of residential energy consumption and 99% of GHG emissions in Ontario residences.[xxi]

The amount of heating and cooling used in a home will be influenced by the building envelope which includes the windows, doors and level of insulation in walls, floors and attics. The entire home needs to be considered when identifying retrofits that optimize reduction opportunities for energy, emissions and utility costs as illustrated in figure 2.

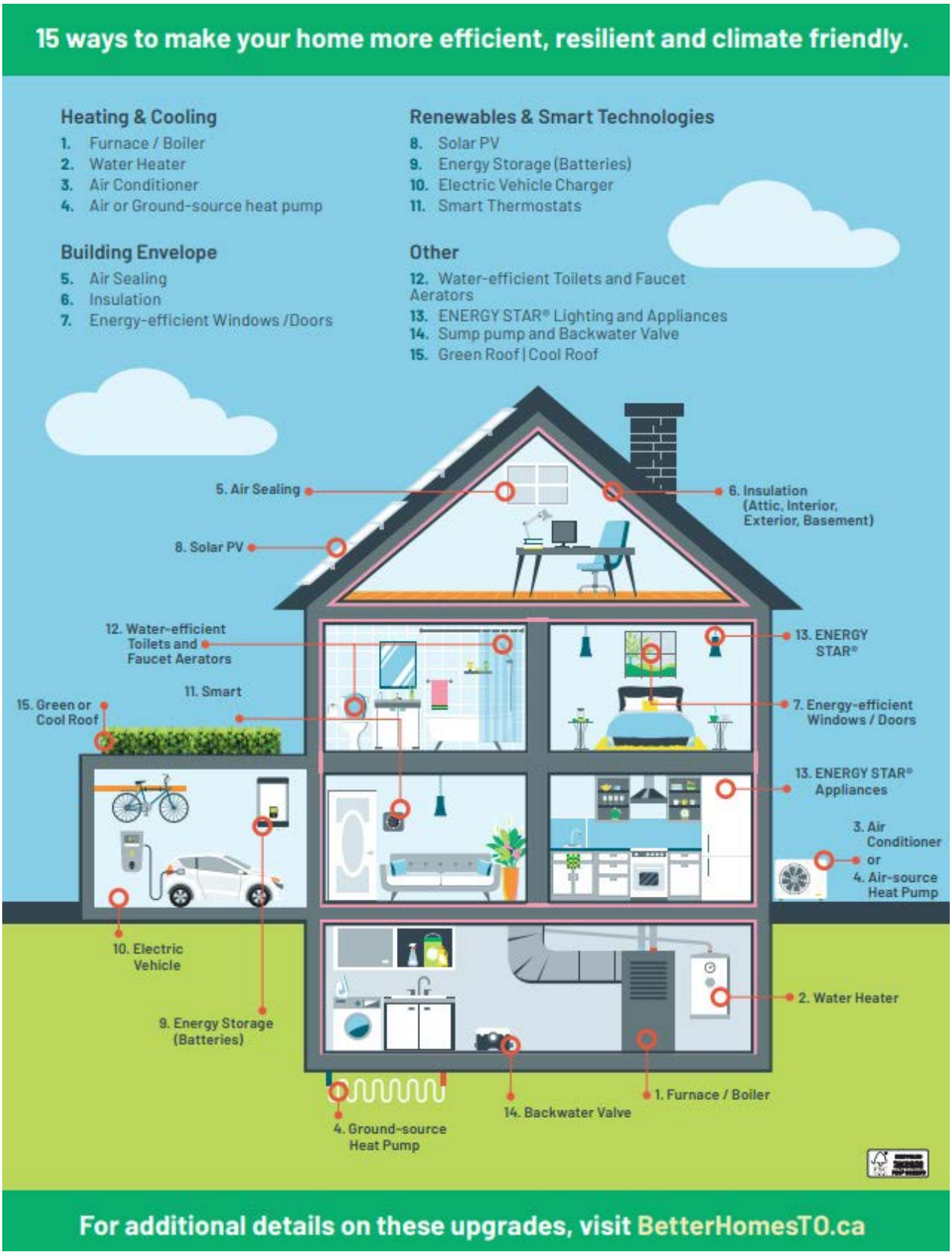


Figure 2. A whole home perspective of energy retrofit opportunities.[xxii]

The age of the home usually affects its energy efficiency with respect to the Ontario Building Code (OBC) at the time of construction. The OBC has significantly improved over time resulting in increased building envelope standards amongst many other areas regarding health and safety. For example, with the release of the Ontario Building Code energy efficiency related standards that came into force in 2017, energy efficiency in new homes and small buildings increased by 15%.[xxiii] In comparison to historical OBC levels, it has been estimated that homes built after 2017 can use up to half of the total energy as homes that were built between 1997 and 2005. [xxiv]

Generally, the potential for GHG reductions and utility bill savings can be achieved with energy retrofit projects will often increase with the age of the home. This is particularly the case for residential dwellings built before 1975 when building codes were first introduced in Ontario and many existing homes had very poor insulation if any at all at that time. However, this creates a very large target market in Canadas older Cities, with a wide variety of building envelope conditions as well as in the heating, ventilation and air conditioning (HVAC) and domestic hot water (DHW) equipment used. These different types of homes are also widely dispersed across an entire City as opposed to a single concentrated area for energy retrofits to occur. Over 70% of single-family homes within the City of Kingston are 30 years or older as indicated in Figure 3. The map in Appendix A provides a geospatial layout of where homes over 30 years of age are located within the City of Kingston Boundaries.

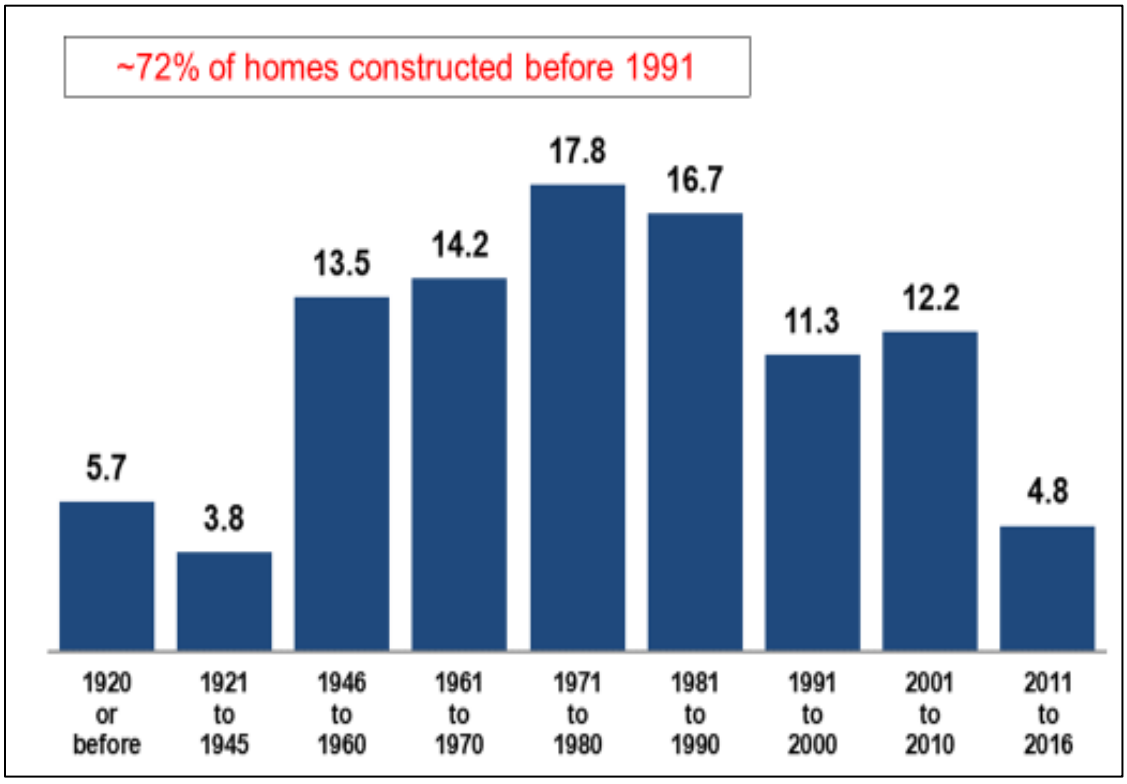


Figure 3. Homes in Kingston by Age of Construction (2016 Census)[xxv]

2.2 Household Energy Cost Burden

The Canadian Urban Sustainability Practitioners (CUSP) group of researchers and academics developed a database and mapping tool to identify areas of communities where a disproportionately high household energy cost burden is experienced. Home energy cost burden is calculated as a percentage of total after-tax household income that is spent on heating and electricity within the home.[xxvi]

The median Canadian household spends less than 3% of its after-tax income to pay for their home energy consumption. Households that spend more than twice this value on home energy services, can be said to experience high home energy cost burdens.[xxvii] For purposes of policy and program development, CUSP uses this 6% threshold of home energy cost burden as high, 10% as very high and 15% as extreme.

The CUSP Energy Poverty and Equity Explorer mapping tool utilizes 2016 Census data to enable users to see different levels of home-energy cost burdens, along with other variables such as housing quality and affordability indicators, income and other demographics at various geographical scales.[xxviii] Including all single and multi-family residential dwellings within the City, 10% of Kingston CMA households are experiencing very high energy cost burden. This ranks as the 6th highest out of 29 Cities included within the CUSP database as indicated in Figure 4. For further clarification, this ranking is heavily affected by the range of income levels and corresponding energy consumption levels and not just variances between energy prices amongst the cities.

City of Kingston Planning and GIS staff further refined these data sets to focus on the census tracts within City municipal boundaries. Due to data limitations, the focus is on one family dwellings defined as detached, semi-detached or row housing. Approximately 24% of one-family homes within the City of Kingston, or 8,175 households, have a high energy cost burden based on 2016 Census data. Using the CUSP definitions, over 8% of single-family homes within the City have a very high and about 4% with extreme energy cost burden. Appendix B provides a map of the Census Tracts with the highest proportion of households with a high energy cost burden within the City of Kingston.

This creates a paradox for many of the households that are struggling to pay disproportionately high energy bills relative to their disposable income. The lack of available capital or access to low cost borrowing options maybe a significant barrier to making the improvements within the home that would provide on-going and long-term relief on their utility costs. The upfront costs to improve energy efficiency is often prohibitive for these low-income households. In addition, many low-income households may also not own their home and have no authority to make such improvements that would significantly affect their utility bills.

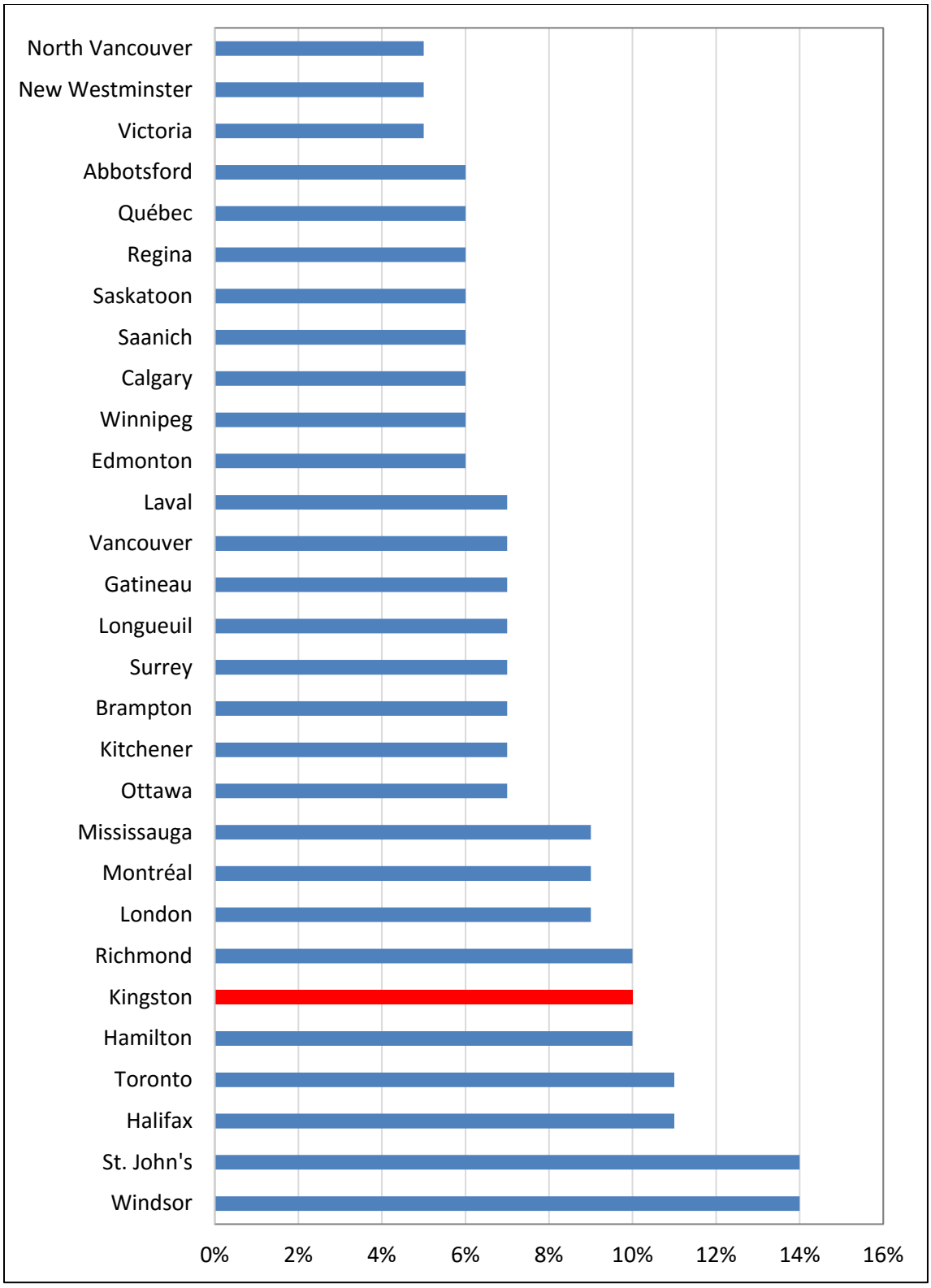


Figure 4. Proportion of households in select Canadian cities spending >10% of after-tax income on home energy costs (electricity and heating)[xxix]

2.3 Barriers to Residential Energy Efficiency Improvements

Based on primary and secondary research conducted to design Kingston's home retrofit program, the following list summarizes the main barriers for residents to implement energy improvements within their home. Further details on this research is included in Section 3 when characterizing the opportunity for a home energy retrofit program.

- Affordability of upfront retrofit costs - It is evident from a local survey conducted by City of Kingston staff in early 2020, that many households are concerned about the affordability of energy improvements even though they maybe struggling with high utility bills. Upfront costs for deep retrofits can exceed $20,000 and, although a loan-based retrofit program can help alleviate the lack of capital issue, consumers have come to expect rebates, not financing.[xxx]

- Duration of the business case for retrofits in relation to residents' ownership of the home - Some retrofits may have extended 10 to 20-year paybacks which may exceed their expected or actual ownership of the building. Therefore, some homeowners may be reluctant to take on such a long-term project, which may require using debt financing, as many residents may sell their homes within 5 - 8 years of acquisition.

- Understanding of the value of energy retrofits - Level of homeowner understanding of energy efficiency and conservation opportunities and benefits is important as these improvements can be disruptive for homeowners and retrofits are generally undervalued. This has been further hampered by political debate focussing on energy pricing and different sources of energy supply. The resulting policy interventions have often adversely impacted the cost-benefit equation of efficiency improvements even though the cheapest unit of energy is the one saved compared to providing any new energy sources and supply.

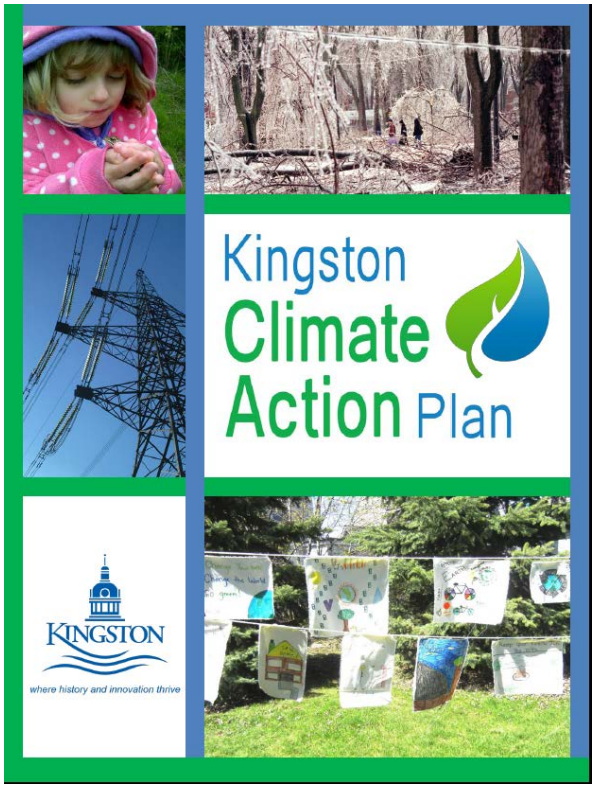
- Concerns from mortgage lenders or existing loan providers that homeowners currently use for financing has been an issue in the recent past. The creation of priority liens on a property, credit worthiness and loan default rates as well as overall homeowner debt capacity are aspects of risk management that need to be addressed in creating a viable financial model for program participation.

- Having an adequately sized, engaged and skilled local workforce has been noted as a critical success factor to implementing and sustaining long-term retrofit programs that reach their full local potential within the existing housing stock. Ensuring that contractors and energy auditors realize benefits from supporting the potentially increased demand for home energy retrofits is an important challenge to address within program design.[xxxi]

Section 4 includes the program design features which address how these barriers will be managed. Section 3 further characterizes the opportunity for home energy retrofits.

3.0 CHARACTERIZING THE OPPORTUNITY

Residential energy retrofits were acknowledged within Kingston's first Community Climate Action Plan in 2014 where it was estimated that using incentives and loans to support implementation of retrofits over a 20-year period could result in 18,000 tonnes of GHG emission reductions.[xxxii]



In 2018, the City of Kingston completed a community-wide Municipal Energy Study which also identified residential retrofits as a means to cut the fossil fuels used locally for space and water heating in homes in half by 2041.[xxxiii]

With this potential impact in mind, Kingston City Council identified the development of an energy retrofit program as one of the priorities within the City's Corporate Strategic Plan 2019 – 2022 as part of their commitment to Climate Leadership.[xxxiv] The Plan identifies the intent of the retrofit program to encourage residents to become part of city-wide solutions to meet the community's carbon neutral target

This section provides further details of the residential energy retrofit opportunity pertaining to feasibility, impact and program design considerations.

3.1 Triple Bottom Line Benefits

The triple bottom line benefits from investing in energy efficiency are spread over various financial, social and environmental variables such as economic growth and development, job creation and household energy savings, as well as reduced emissions and other environmental impacts on natural resources.

In 2018 Clean Energy Canada commissioned a report that indicated economy-wide energy efficiency measures could help reduce our national GHG emissions by 52 million tonnes by 2030 which equates to 25 percent of Canada's target under the Paris Accord.[xxxv] Also noteworthy in the report is that an estimated 118,000 jobs and 1% growth in Canada's GDP would be achieved as a result of implementing these measures.

The Clean Energy Canada report flags that if governments across the country adopted aggressive efficiency measures addressing electricity, natural gas and other fossil fuels, the potential impacts are significantly larger at 79 million tonnes of avoided emissions along with almost $600 billion in net economic activity.[xxxvi] Another study estimated that for every dollar spent on energy efficiency GDP increased by $5 to $8.[xxxvii]

Canadian households would save $1.4 billion each year on energy costs from this emphasized focus on improving energy efficiency. Job growth potential in Ontario from investments in energy efficiency are significant. According to another study by Efficiency Canada, it is estimated that deep energy savings programs for homes could create an extra 57,000 annual jobs on average by 2030.[xxxviii]

Achieving municipal community energy and GHG reduction goals can stimulate climate action that plays a key role in the post-pandemic economic recovery efforts by driving significant investment into the local economy, creating demand for skilled trades workers and releasing millions of dollars in untapped energy savings. The multiplier effect of households and businesses having reduced utility expenses can have a very positive impact on local economies in terms of job creation, value added to local economy from project expenditures as well as energy savings reinvested purchase of goods and services. [xxxix]

A long-term retrofit program can help support a market transformation of associated trades and audit services as well as related products and equipment as demand continues to build incrementally over time as the program is scaled up. Job creation for trades contractors for installation of equipment and residential insulation as well as for home energy assessments are also an opportunity to tap into local post-secondary schools to help grow the labour force to deliver this program to reach thousands of households within Kingston.

In addition to job creation, enabling deep energy savings can help improve housing affordability in terms of reduced operating expenses which can free up more disposable income of residents for other priorities. By using promotion of a retrofit program to raise energy literacy, informed homeowners can also make better decisions about their largest investment of their lives – purchasing a home. In the future, mandatory home energy labelling at time of sale could be an important tool for consumers concerned about operating costs, the indoor air quality and moisture control benefits as well as the environmental improvement from retrofits. This could become similar to comparing the fuel economy of automobiles for consumers whose operating costs and carbon footprint are important to their purchasing decision making process.[xl]

In addition to retrofits reducing energy use and GHG emissions at home, they can also improve resilience to changing climate conditions such as on-site energy storage during extreme weather-related power outages. As the number of hot days above 30 degrees Celsius increases over time, another resilience benefit involves the use of air source heat pumps and improved building envelope which can help provide cost-effective space cooling for households that use window units which are expensive to operate as well as homes that currently do not have air conditioning.

Improved building envelope also has health and quality of life benefits as it can greatly improve moisture control in homes which are often sources of mold and mildew. In addition, better indoor air quality and temperature control from improved air ventilation, air sealing and insulation will make homes more comfortable all year-round while potentially improving the durability of residential buildings by reducing premature degradation of the structure and its operational systems.

3.2 Experience in Other Communities

Energy efficiency program funding usually has ties to provincial, state or federal budgetary sources and legislation. Consequently, changes in the ruling political party have proven to be very challenging to keep some programs around long enough to determine if they can reach their intended potential. Energy Efficiency Alberta and the Connecticut Energy Efficiency Fund are good examples of the ebbs and flows of political support from high orders of governments and the impact on the availability of energy retrofit programs.[xli] Nevertheless, some programs have been around long enough to derive several lessons learned from the experience of implementation as well as innovative program design.

Residential retrofit programs have been operating for over a decade in the United States (U.S.) with approximately 220,000 homeowners participating and $5 billion invested in energy efficiency, renewable energy and water conservation measures which have also created an estimated 42,000 jobs as of May 2018.[xlii] About 36 different

states in the U.S. have enabling legislation for property assessed retrofit programs with California, Florida, Maine, and Missouri currently having active residential programs with many other states focused on retrofits in the commercial sector.

Retrofit programs in Canada using financing have had much lower levels of uptake. Toronto is the longest standing existing program that launched in 2014 and Nova Scotia currently has the most municipalities with active programs. Other cities in Alberta, Quebec and British Columbia have had or are proposing similar programs. Appendix C has a summary of several of these programs' attributes including participation rates, use of application fees and repayment terms where available.

Toronto achieved approximately 200 single family dwelling retrofits during 2014 - 2019 under its Home Energy Loan Program. The average single-family household energy savings realized was $560 with an average project cost of $22,000. Although uptake has been relatively low in Toronto, the energy and GHG savings per home of 30% and 28% respectively provide promising results for other municipalities developing retrofit programs. [xliii] These reductions were achieved primarily through traditional retrofit measures such as replacing windows or doors, improving air sealing and insulation and upgrading space and water heating systems.

Within Nova Scotia,10 municipalities have active residential retrofit financing programs or are developing such an initiative. The legislation in Nova Scotia is very broad which provides flexibility in program design for administrators who are either the municipality or a non-governmental organization. For municipal run programs, they pay for the retrofits and the debt is then attached to the building, not the property owner, with repayment attached to the local property tax bill (same as Ontario's Local Improvement Charge legislation). Legal counsel for many of the programs do not consider the loans as counting against the municipality's borrowing cap, as the loans are guaranteed by the province. However, for non-profit run retrofit programs, regulations do not require repayment of loans through the municipality's property tax repayment system. This has allowed seven different communities with retrofit programs to collect repayment monthly instead of the typical annual or semi-annual case with property taxes. Monthly repayment allows participants to better align energy cost savings on utility bills with the cost of program participation through regular repayment of the financing.[xliv]

Some programs in Nova Scotia are more specifically focused on renewable energy such as the award-winning Halifax Solar City program which provided financing for residential solar thermal hot water systems. The municipality provided financing to pay for equipment and installation of over 300 solar water heating systems in the program's first 14 months. The program also includes education on water efficiency, free water conservation retrofits and an optional performance tracking system among other tools.[xlv]

Although, British Columbia and Quebec ranked first and second respectively within Efficiency Canada's Provincial Energy Efficiency Policy Scorecard,[xlvi] neither province currently has an active loan-based residential retrofit program offered by municipalities due to lack of enabling legislation allowing for repayment via property tax bills. However, both provinces have had similar pilot retrofit programs in the past with mixed success.

Three Quebec municipalities had a program operated by a non-profit program administrator in 2016 and 2017. The program provided very low interest rates of 1% as it was financially resourced by municipal budget surpluses and had support of provincial incentives averaging $4,600. Although only 24 properties were retrofitted, they achieved efficiency improvements averaging 29% at an average cost per project of $13,000. Unfortunately, these programs were cancelled when the non-profit program administrator ceased operations.[xlvii] However, utilizing budget surpluses or reserves can enable municipalities to offer homeowners an inexpensive source of capital for retrofits.

Municipalities in B.C. do not currently have the legal authority to offer a loan-based retrofit program themselves. However, the City of Vancouver gained some experience through a pilot program during 2011-2012 using third party financing. Vancouver's Home Energy Loan Program utilized non-collateral low-interest loans through VanCity Credit Union. Rather than attaching debt to property tax bills, repayment was attached to a homeowner's municipal utility bills. The pilot program was discontinued due to lower than planned uptake. There is a current effort by the Union of BC Municipalities advocating for enabling provincial legislation for property assessed retrofit programs[xlviii] and the City of Vancouver is once again actively assessing the residential retrofit opportunity.[xlix]

Recently, in 2019, the province of Alberta passed enabling legislation for Local Improvement Charges to be used for financing community programs focused on energy efficiency retrofits and solar panel installation. [l] This program is currently being explored as a pilot initiative by the City of Edmonton who in June 2020 also released an incentive-based retrofit Accelerator program for a wide variety of building types including multi-residential dwellings.[li]

Even with limited success, insights can be derived from the experience to date in Canada. Experience within residential retrofit programs in Vancouver, Halifax and Toronto indicate the need for strong marketing efforts with enough resources and channel partners. Reaching the residential audience is difficult as they are geographically disbursed, and existing home energy efficiency levels can widely vary. Retrofit programs need to include a clear and simple application process that tradespeople understand to enable them to promote the retrofit program as a sales and

marketing channel as well as home renovation/hardware retail stores for do-it-yourself enthusiasts.

Due to limited awareness and uptake of Toronto's residential retrofit program, in 2019 they developed the Better Homes TO website to increase homeowner understanding of how to make their homes more energy efficient and numerous links for additional information and financial resources.[lii] The City of Toronto has also been providing contractor training to support project implementation and help promote customer awareness when homeowners take on renovation projects.

Other lessons learned from existing programs include the importance of the following:

- Engaging banks and other mortgage lenders to address issues around lender consent and LIC disclosure;
- Improving program workflows and examining opportunities to decrease administrative delays, while delivering excellent customer service;
- Allowing fixed financing terms for up to 20 years on qualifying projects given historic low interest rates to accommodate deep retrofits that have a longer payback period (i.e. solar PV, geothermal and air source heat pumps); and,
- Including smart (i.e. WIFI connected) Electric Vehicle Supply Equipment, energy storage technology, and energy efficient resilience measures as retrofits eligible for the LIC program.[liii]

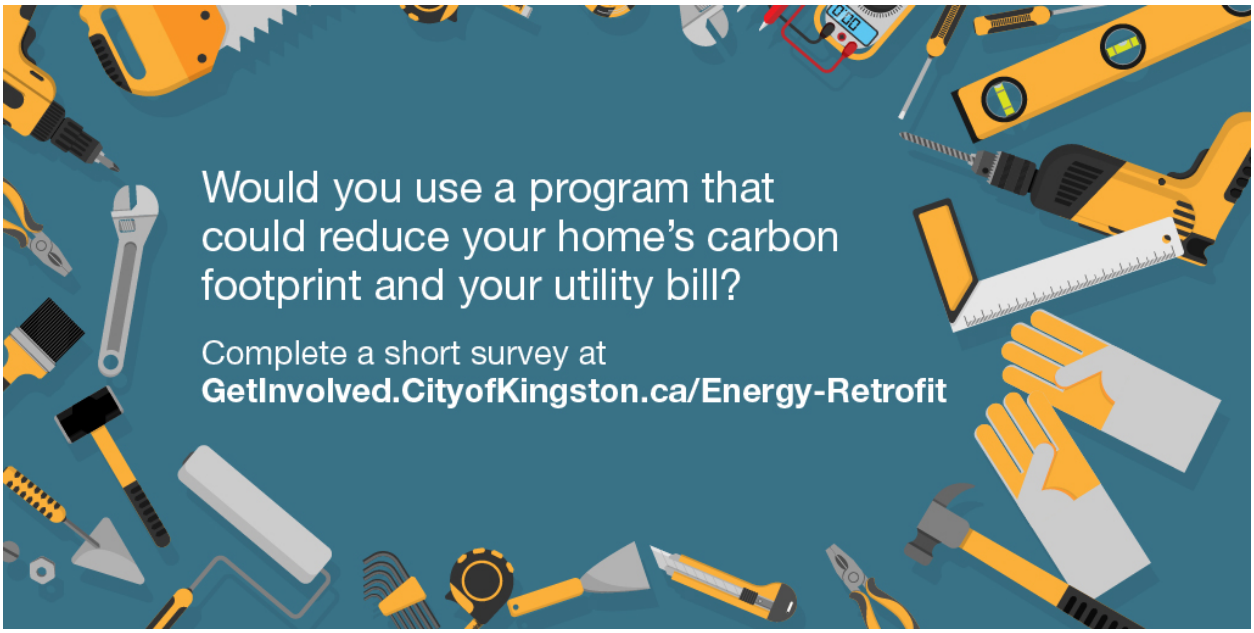
Effectively addressing these challenges may improve participation rates by actively providing education programming and using channel partners to reach target markets. A greater focus on promotion and incentivization of fuel switching initiatives could also potentially achieve deeper emission reductions particularly for those homeowners using fossil fuels for space and water heating.

3.3 Situational Scan

3.3.1 Local Residential Survey

Early in 2020, City of Kingston staff conducted a preliminary online survey of residents to help inform the development of the home energy retrofit program. The survey collected information from homeowners that related to:

- details about home heating/cooling and water heating systems currently used;
- the barriers residents face to making energy-saving choices; and
- how they might be motivated to make energy-saving improvements.



The survey captured a random sample of Kingston residents who voluntarily responded to about a dozen questions using the City's Get Involved online engagement platform. Over a three-week period that the on-line survey was open, 566 residents responded although 17 were excluded in the analysis due to being for households outside of the City's boundaries.

Demographic results indicated that 89% of respondents live in detached or semi-detached homes with the remaining 11% reside in townhouse, condominiums or apartment buildings. Homeowners represented 92% of survey respondents and 8% indicated they are renting.

Although natural gas is the dominant source of space and water heating, electricity and fuel oil/propane was used for DHW in 26% and 3% respectively within respondent households and almost 7% used fuel oil or propane for their primary heating source and about 6% had electric heating (i.e. baseboard).

Most survey respondents (73%) expressed interest in a retrofit program that enables them to switch or upgrade their heating, cooling and or hot water heating systems. Reducing their utility bills and GHG emissions from their home energy use were the top reasons for this willingness to make the energy improvements. However, many residents have made such changes in the past 5 years and are not interested in replacing equipment prematurely, although, a few indicated they would if their equipment was repurposed such as installing it in a low-income household as needed. Approximately 11% of respondents indicated that the timing is good for an energy upgrade as they are due for related equipment replacement in the next 12 - 18 months.

Of the respondents responding “Yes” to switching their HVAC or DHW systems, 40% indicated interest in Air or Ground Source Heat Pumps, 25% indicated interest in natural gas systems, 18% in electric systems and 5% in solar power PV or thermal. A few residents recognized the opportunity to use some of these as supplementary or secondary systems to their existing equipment such as for heating in cold basements.

In terms of influential factors that would stimulate implementation of these home energy retrofits, there were significantly more respondents interested in rebates or equipment discounts (51.5%) rather than accessing a low-interest loan (8.5%). However, when specifically asked if residents would access a low-interest loan from the City, 50% indicated maybe, 21% said yes, only 20% said no and 9% were unsure. Home energy audits and gaining more information on the cost savings and GHG benefits of alternate equipment (40% combined) were also noted as factors that would influence residents to doing energy retrofits. This interest in specific cost-benefit information addresses many survey respondents expressed need to see the payback or business case to consider implementing retrofits within their homes as included in their open-ended responses.

While some residents indicated they would not need a loan to do energy retrofits, many respondents were reluctant to access a loan through the City for reasons such as believing lower interest rates were available at a bank, concern of high administration fees and wait times for approval, or more related to their own personal debt capacity. Some respondents indicated that of more concern than the mechanism used to finance an energy retrofit was the existence of a reasonable payback business case for the retrofit investment.

Survey respondents overall desired benefits of participating in a retrofit program are listed and ranked below:

1. Reducing my monthly utility bill
2. Reducing my greenhouse gas emissions
3. Improving the reliability of my heating and cooling system
4. Improving the air quality inside my home
5. Reducing home insurance premiums
6. Freeing up more indoor space (i.e. from new smaller equipment)

Top barriers to making these energy improvements include already considering these changes in the past and not proceeding for a wide variety of reasons (32%) or not understanding the benefit of home retrofits (26%). Not expecting to live in their home for long enough to experience payback of the energy investment (21%) and not having

money for the upfront equipment and installation costs (12%) were also noted as barriers. Some respondents indicated they simply would not know what to do or how to make the changes (9%).

In terms of successful uptake of a residential retrofit program, the current understanding of home energy efficiency in general amongst Kingston residents will influence the level of participation. Many of the responses to open-ended questions indicated a limited level of energy literacy which is not uncommon.[liv] The indication that local Kingston survey respondents had "already looked into other options and decided to not to make a switch" raises question to if they systematically looked at their entire home energy efficiency level by having a home energy assessment completed or just relied on limited information through cursory retail or online inquiries pertaining to one piece of equipment. Other respondents showed a limited understanding of the benefits of an energy retrofit program when indicating they could not afford to do retrofits as they are currently struggling to pay their energy bills. This response was provided even though the question included the point that the program would provide loans for the upfront capital needed for the retrofit to which could help reduce their ongoing energy costs.

The City's retrofit program design needs to further consider the respondents strong interest expressed for flexibility built into the program offering such as:

- including building envelope improvements with frequent mention of improved insulation and new windows in older homes;
- inclusion of solar whether for hot water heating or for power production;
- include equipment rental options and/or on bill financing through the utility;
- engaging multi-residential building owners to make improvements for renters; and,
- ease of application and help with identifying reputable contractors to do the work.

In comparison to a recent survey of Hydro One customers in the Kingston area, the City's online survey had a higher proportion of respondents indicating they had a natural gas furnace as their primary heating source as well as the number of residents who don't have any air conditioning system within their homes. Regarding the primary heating source, this is likely due to the City's survey capturing more dwellings within the urban core whereas the Hydro One service area includes more rural residential dwellings in the outer limits of the City boundaries. As Hydro One's survey results are slightly biased towards the more rural customers, this inflates the oil and propane usage since they are more likely to have oil or propane than urban customers. Approximately one quarter of Hydro One's survey respondents indicated that they do not have access to natural gas service. Table 2 includes an estimate of primary heating energy source in Kingston based on these two localized surveys.

Table 2. Kingston residents survey responses on primary heating source

Heating source	City Survey (Feb. 2020)	Hydro One Survey (Nov. 2019)	Hydro One Survey Weighted to Population
Natural gas	81.8%	71.7%	75.3%
Electricity	5.8%	17.1%	13.4%
Fuel Oil	3.4%	3.6%	2.6%
Propane	3.2%	6.9%	4.6%
Don't know or Other	3.5%	- -	- -
Air/Ground source heat pump	1.8%	- -	3%
Wood	0.5%	1.7%	1.1%

For a more statistically representative picture, Hydro One applied the survey penetration rates to the entire population within their service territory within Kingston which provides an estimate of 690 customers using fuel oil and 1,200 customers using propane for their home heating needs. This would be in addition to older homes within the Kingston Hydro urban service area that are still using those fossil fuels. Additional analysis is being conducted in neighborhoods with older homes to identify absence of winter electricity peaks in areas without natural gas service as this will imply alternative heating fuel use such as oil, propane and wood.

The motivation for residents implementing energy retrofits were similar between the two surveys with regards to reducing energy costs as the number one reason indicated and the environment or climate change as number two. There was also a consistent interest amongst both surveys regarding respondent's desire to have support for building envelope improvements, home energy audits and solar panels.

The Hydro One survey also revealed interest in electric water heaters, electric thermal and battery storage as well as heat pumps but to a lesser degree than efficient HVAC appliances, building envelope improvements and solar panels. This is likely a reflection of a greater consumer understanding amongst the different technologies and could indicate an education opportunity with regards to efficiency, environmental and cost benefits of different options pertaining to their specific homes.

3.3.2 Existing Programs and Engaged Stakeholders

Many home energy incentives and rebates offered between 2010 and 2018 were discontinued following the last provincial election. However, electric and natural gas utilities serving the City of Kingston have efficiency and conservation education and information resources including some remaining incentive programs. Enbridge Gas has a Home Energy Rebate program still currently in place for natural gas customers that are directly related to options identified within a home energy assessment.[lv] Hydro One also has a fuel switching program for homes using fuel oil or propane for heating which is further described in section 4.4.

Even though the province-wide SaveOnEnergy initiative has significantly reduced financial support for energy retrofits compared to previous years, the potential for residential electricity and natural gas efficiency savings have been recently estimated at 25% and 31% respectively,[lvi] however, other studies have indicated greater efficiency savings are achievable.[lvii]

There are programs that still exist in Ontario particularly to help low-income households manage utility costs. Some of these programs are listed below.

- The Ontario Electricity Support Program (OESP) provides eligible low-income consumers with a monthly on-bill credit to reduce their electricity bill. It is an application-based program that includes eligibility and support levels dependent on household income by household size.
- The Low-income Energy Assistance Program (LEAP) provides emergency assistance to those in need and at risk of a disruption in service. This program is aimed at providing temporary assistance with paying utility bills rather than assisting with reducing household energy consumption levels.
- The Save on Energy Home Assistance Program offers a variety of free energy-efficiency upgrades for income-eligible homeowners and tenants, and eligible social housing providers, as well as an in-home energy assessment to help identify ways to save energy costs. This program is designed to help residents lower their monthly energy costs by improving the energy efficiency at home.
- Enbridge Gas Home Winterproofing Program
  Based on income-eligibility, this program offers free Home Winterproofing which entails improvements such as insulation and a programmable thermostat.

The Independent Electric System Operator (IESO) also has free energy-efficient upgrades to help on-reserve First Nations customers save energy. Many of these programs are currently being discontinued by year-end 2021. However, the province of Ontario has proposed a new Save On Energy conservation program although it appears

to primarily focus on the commercial, industrial and institutional sectors. Therefore, municipality-led retrofit programs, in collaboration with local stakeholder partners such as utilities, can fill the gap on providing energy efficiency and conservation programs to the residential sector.

Since 2012, the City has offered over 200 low-income households assistance through the Kingston Renovates Program with financial support from the Province of Ontario.[lviii] The program primarily addresses accessibility upgrades such as ramps or lifts as well as emergency repairs related to health and safety. However, energy efficiency installations to ensure the cost-effective comfort of a home including replacing furnaces, adding insulation or window replacement and structural repairs to ensure the integrity of a home's roof, foundation or other building supports are also eligible. Applicants may be eligible for grants up to $5,000 and/or interest free forgivable loans up to $10,000.

Aside from incentive programs, several organizations can influence the success of initiatives that target improving energy performance of buildings. Fortunately, all the necessary stakeholders required for the development and implementation of a residential energy retrofit program have a presence within the City of Kingston. Many organizational stakeholders are already engaged with City staff as they implement and update their existing energy or climate related action plans and strategies. In addition to the Municipality who has committed to development of this retrofit program through their new Climate Leadership Division, the organizations listed below are potentially key players in the success of Kingston's residential retrofit program.

- Utilities Kingston/Kingston Hydro – the electric and gas utility that serves the older centre of the City has experience in conservation and efficiency programs, and equipment rentals and is interested in being involved in program delivery.
- Hydro One and Enbridge provide energy utilities to the rest of the City and are also well versed with customer-oriented energy retrofit programs, including some fuel switching options, and are positioning themselves to support implementation of residential retrofit programs offered by municipalities.
- St. Lawrence College has an Energy Systems Engineering Technician and Technology program which provides training for energy auditing and HVAC systems among other relevant trades. College administrators have been initially engaged and made aware of the opportunity to fulfill the potential for increased labour demand and training associated with accelerated residential retrofits.
- Queens University is active in the energy policy space and is also a local leader in energy management and GHG emission reductions on campus including within their student housing buildings.

- SWITCH – which is a non-profit industry association with a wide variety of professionals, including contractors and energy auditors, who actively promote and advocate for environmental and sustainable energy leadership. Switch could potentially provide additional technical support and industry liaison as appropriate.

- Sustainable Kingston – a not-for-profit social enterprise that engages and supports organizations to make a commitment to reducing their environmental and carbon footprints including reporting on their progress. This includes promoting energy audits and retrofits in the ICI sector.

- 350 Kingston is a group of Kingston area citizens committed to acting on climate change. They are currently focusing on local government and participating in national and international campaigns and continue being supportive of local actions on climate change. The President of 350 Kingston is a retired Certified Energy Advisor and is interested in being involved in the retrofit program.

- Kingston Climate Hub - The Kingston Climate Hub was established in early 2018. KCH has worked to mobilize community support for the City's carbon neutrality target, electrification of transit, and building retrofits among other initiatives identified within the current Climate Action Plan.

- Since 2007, Red Squirrel Conservation Services (formerly Hearthmakers co-op) has conducted 30% of the local home energy assessments in Kingston using Natural Resources Canada's (NRCAN) Energuide Rating System which helps homeowners understand where the retrofit opportunities are within their home as well as access available utility energy reduction incentives.

Additional stakeholders will need to be engaged, for example, hardware retail outlets and trades contractors. A cursory scan indicates that the Kingston area has almost 60 different contractors involved in heating ventilation and air conditioning many of which also do building envelope improvements.[lix] Further details regarding the proposed involvement of key channel partners and stakeholders is captured in section 4.

3.3.3 Local Improvement Charges

Local Improvement Charges (LIC) may be used to finance energy efficiency, renewable energy, or water conservation measures carried out voluntarily by individual property owners on their buildings. Municipalities in Ontario are given broad legislative authority to use LICs in this manner by creating a program to provide homeowners with a loan to implement these measures on their property.[lx]

These loans, which are attached to the property and not the owner, can have much longer repayment terms and lower interest rates than conventional forms of borrowing from financial institutions. Repayment is arranged as an addition to individual property tax payments. The benefit of this is two-fold: i) it can assist homeowners with accessing capital for high upfront costs of retrofits and ii) enables transfer of the lien to a new owner in cases where the loan applicant wants to sell their house before the LIC repayment in full. The latter is particularly useful where the retrofits have a long-term payback period.

The legal premise for a municipality to use this mechanism for improvements on private property is within Ontario Regulation 586/06 - Local Improvement Charges – Priority Lien Status, which was enacted under the *Municipal Act*. Section 36.1 of the Regulation states that "a municipality may raise the cost of undertaking works as local improvements on private property by imposing special charges on the lots of the consenting property owners upon which all or part of the works are or will be located."[lxi]

To meet the requirements of the Ontario regulations for LIC loans, the applicant must meet the following criteria:

- The applicant is the homeowner of the property;
- All property owners' consent to participation in the program; and
- The property is located within the applicable municipality.[lxii]

The Regulation sets out several requirements for establishing a local improvement charge program to finance energy retrofits, including:

1. The City must enact a by-law to authorize the undertaking of energy efficiency works on private residential property as local improvements in accordance with Section 36.5 of the Regulation. This by-law may either (a) authorize the undertaking of a specific work for which the municipality has given public notice, or (b) authorize the undertaking of works which satisfy the requirements of a municipal program for which the municipality has given public notice.

2. Before passing a by-law to undertake work as a local improvement under Section 36.5 of the Regulation, the municipality must give public notice of its intention to pass the by-law in accordance with the requirements set out in Section 36.6 of the Regulation.

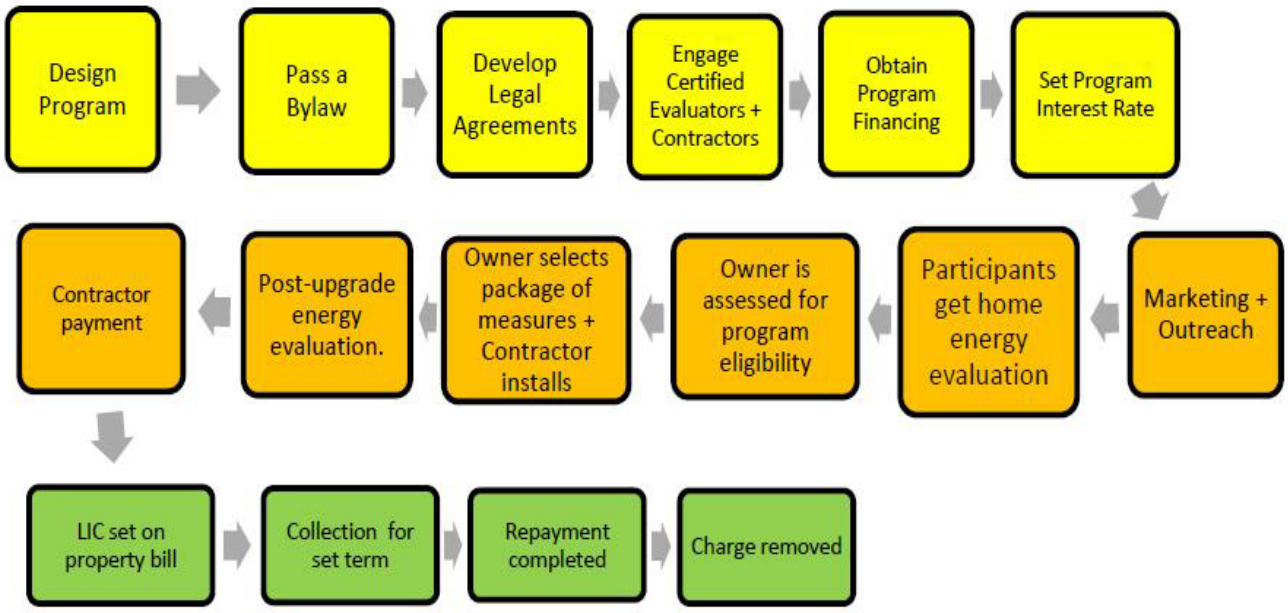
3. The municipality and the property owner must enter into an agreement in which the owner consents to their lot being specially charged. The agreement must contain the information prescribed by the Regulation.

4. The municipality will need to pass a by-law to establish a reserve fund for the local improvement charges.

A summary of the various procedural steps to embed the LIC within the retrofit program is listed below:

- City adopts Residential Retrofit Program
- City Council enacts a by-law authorizing the undertaking of energy efficiency and water conservation works (as it relates to reduced energy for heating water) as local improvements under the residential retrofit program;
- Following a home energy assessment, the City and property owner enter into Property Owner Agreement (POA) for the homeowner to undertake the retrofits as a local improvement on the benefitting property and to raise the cost of the work by imposing a special charge on the benefitting property;
- Retrofit work is completed and a post-retrofit home energy assessment is conducted;
- Local Improvement Roll is prepared setting out the cost of the work, the proposed special charges, when the charges are to be paid, and the lifetime of the work;
- City gives notice of the proposed Local Improvement Roll to the property owner and the municipal Treasurer certifies the proposed Local Improvement Roll;
- City enacts by-law providing that the amount specially charged on the lot set out in the roll is sufficient to raise the lot's share of the cost by a number of equal annual payments and that a special charge will be imposed in each year on the lot equal to the amount of the payment payable in that year; and.
- By-law is deemed to be repealed on the date that the Treasurer certifies that the special charge has been paid in full.

The overall process flow from program design to an LIC loan repayment is illustrated in Figure 5. Other financing options are further analyzed as part of program design in section 4.3.



(yellow = set-up phase; orange = delivery phase; green – collection phase)

Figure 5. Process Flow of an LIC Financed Home Energy Retrofit[lxiii]

3.4 Strategic Energy Management

A strategic approach to managing energy will help optimize impacts of retrofits so that the triple bottom line benefits can be realized in our economy, environment and society. This includes a logical sequence to planning energy retrofit measures as well as determining which residential dwellings and types of retrofits will yield the greatest results in terms of improved energy efficiency and reductions in GHG emissions.

At the earliest stage of considering retrofits within any existing building, the need to strategically manage energy involves prioritizing the planning of actions as illustrated in Figure 6 below. The greatest opportunities from a sustainability and energy management perspective are represented by the larger pieces of the hierarchy pyramid.

According to the IESO, the most cost-effective source of a unit of energy in Ontario is the one saved meaning that costs to improve efficiency and conservation are usually much less expensive than the costs associated with extraction, processing, generation and transmission/distribution of new energy resources.[lxiv] Therefore, reducing energy demand first is paramount in any retrofit program design for industrial, commercial, institutional and residential sectors before other measures are considered to avoid oversizing HVAC/DHW systems and other related equipment and appliances.

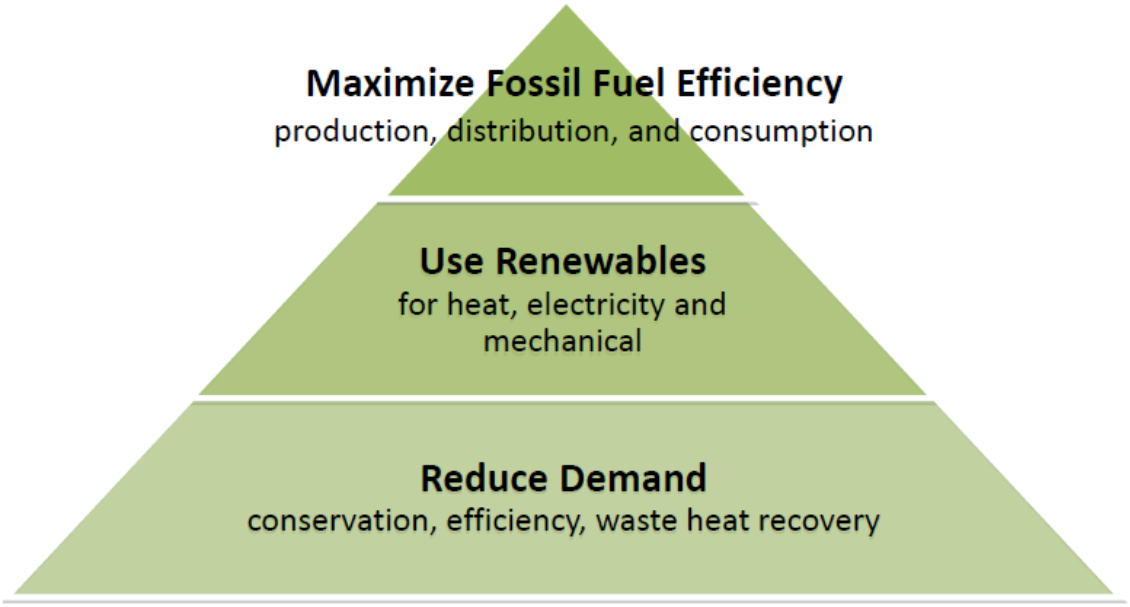


Figure 6. Sustainable energy hierarchy for prioritizing improvements in buildings

At home, reducing energy demand could include installing waste-heat recovery units that capture moist warm air exhausted from bathrooms or thermal energy from drain water in showers and kitchens. Improving insulation and windows so that heating and cooling efforts are more effective is another example of reducing demand that can potentially save energy costs and emissions as well as improve moisture control to avoid mold and mildew. This may also reduce the size of hot water heaters or furnaces needed based on the more efficient energy demand of the home.

Use of renewable energy is growing in demand such as solar roof-top photovoltaic systems to generate on-site electricity as well as ground-source heating and cooling systems. However, these systems should be considered after the entire house as a whole system has its potential for wasting energy minimized as outlined above. Solar thermal energy is another form of utilizing renewables to meet needs for heating water. Again, reducing demand for the volume of hot water should be considered first such as using low flow shower heads and faucet aerators as well as drain water heat recovery units. This will enable the renewable thermal energy system to fulfill a greater proportion of hot water needs at home.

If natural gas systems are used for HVAC/DHW, there are technologies that can improve energy efficiency such as gas absorption heat pumps compared to a conventional natural gas furnace. From a sustainable energy perspective, homeowners using fuel oil or propane should consider fuel switching before improving the efficiency of their heating equipment due to the higher GHG and other air emissions associated with combustion of fossil fuels. Appliances throughout the house that do use fossil fuels

should also have high EnerGuide ratings to optimize efficiency levels and help manage costs during their use. These ratings are usually shown on the appliances at time of purchase indicating if they are low or highly efficient to help inform consumers choice.

The most cost-effective opportunities to better manage energy consumption in homes will be mostly through reducing demand via conservation and efficiency. Based on an integrated electricity and natural gas Achievable Potential Study commissioned by the IESO, one family dwellings were identified as having the greatest opportunity within the residential sector for cost-effective energy reductions through conservation, efficiency and fuel switching measures.[lxv] The study identified that between 25% and 30% of all potential electricity and natural gas savings within Ontario during 2023 to 2038 come from the residential sector.

Space heating and cooling followed by water heating dominate the current energy uses within Ontario households and account for a significant amount of potential energy reductions from retrofits as can be seen in Figures 7 and 8. This reduction potential will also be affected by the building envelope of a residential dwelling and other energy conservation and demand management measures in place as previously outlined.

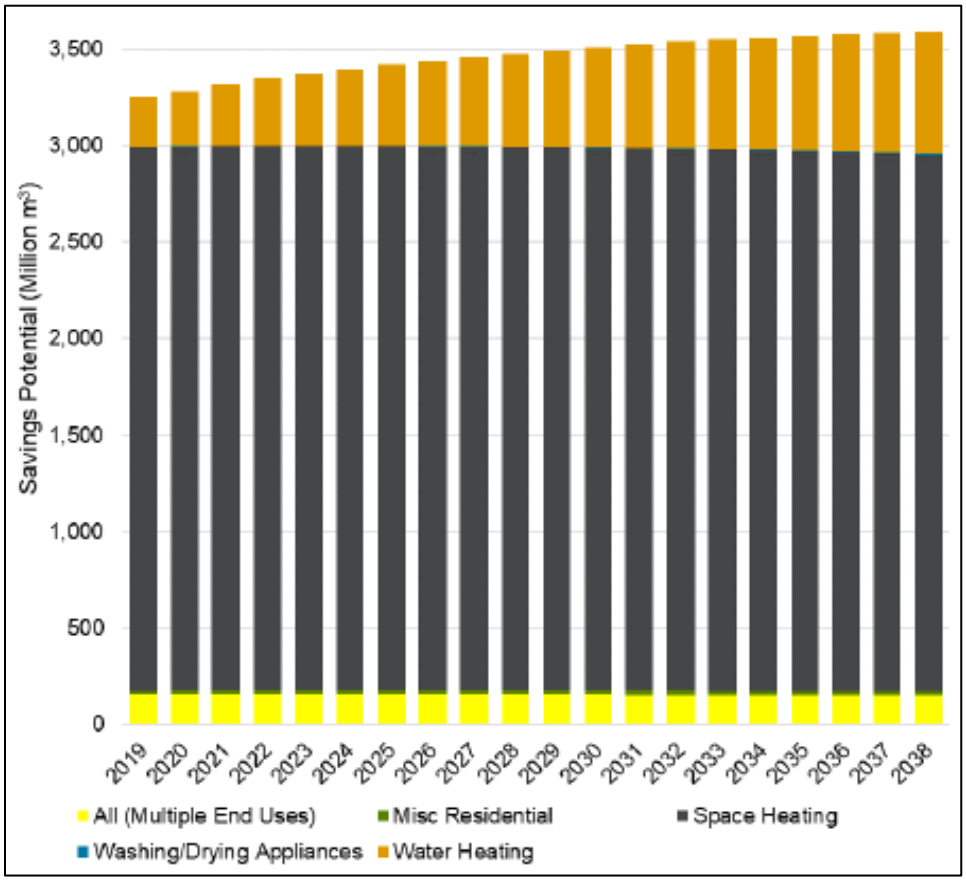


Figure 7. Residential Natural Gas Savings Potential by End Use [lxvi]

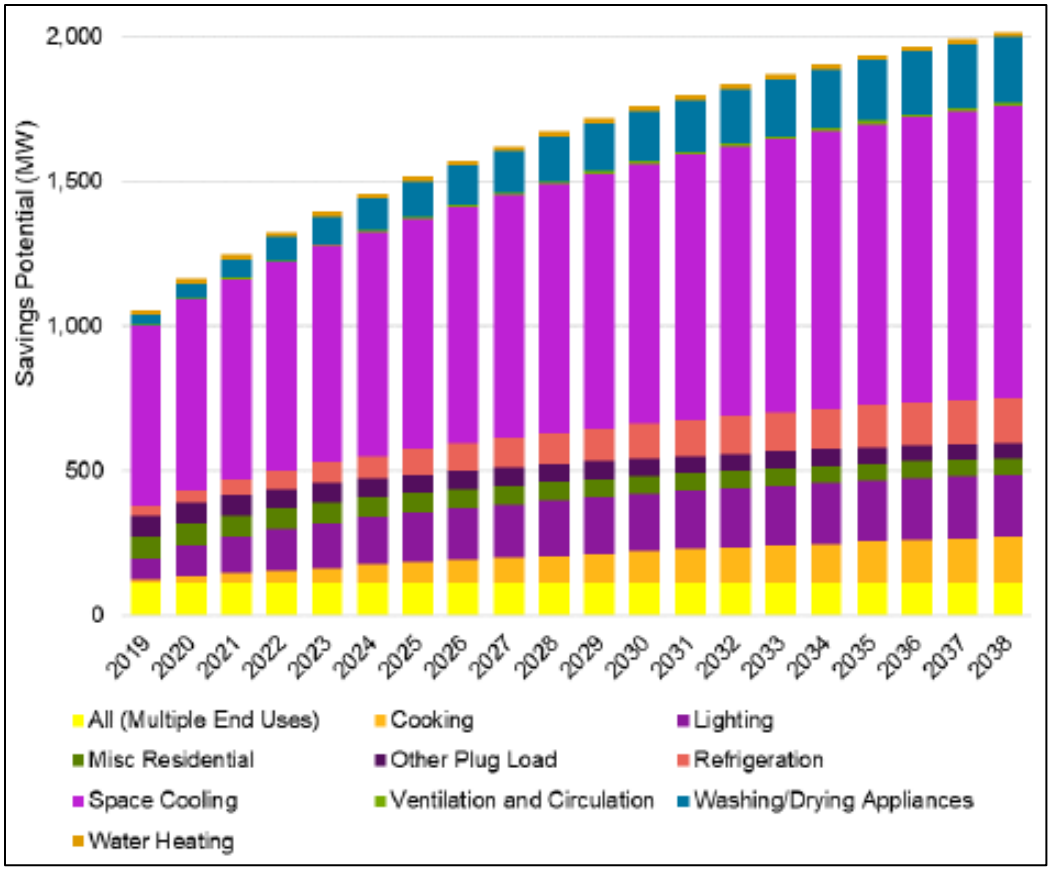


Figure 8. Residential Electricity Savings Potential by End Use [lxvii]

3.4.1 Prioritizing Types of Homes and their Location

The average Ontario household uses about 9000 kWh of electricity and 2400 m3 of natural gas each year [lxviii] at a combined average annual cost of $2165.[lxix] Home energy consumption will vary widely on factors such as the physical size and condition of the home, the number of people living in the household as well as the type of equipment used to heat and cool space and water as the largest energy consumption activities in a home. Annual variations in how cold a winter is and how hot the summer is will also affect residential energy consumption. In more rural areas where there may be no natural gas service available, homes may have much higher electricity consumption and may use an alternative such as fuel oil or propane for heating purposes.

Based on utility data from 2018 and 2019 within Kingston, the average energy use per single family household is lower than the provincial average for both electricity and natural gas consumption at approximately 8,500kWh and 2,200 m3, respectively. Appendix D provides a map of household energy consumption levels in relation to these averages for one family dwellings by postal code. There are homes that use

significantly above and below the average, and in many cases, homes consuming relatively higher amounts of energy may provide the greatest potential for energy reductions through retrofit improvements. Energy use intensity (EUI) can also help examine higher energy users by the amount of interior home area as measured in gigajoules (GJ) per square metre to account for any type of energy used within a home. EUI is addressed later in this section through discussion of analysis of home archetypes.

By using NRCANs data for Kingston, we can see in Table 3 that over 5400 pre-retrofit home energy assessments (or audits) were carried out locally between 2007 and 2020 (as of June 30th).[lxx] About 86% of these homes, or almost 4700, completed post-retrofit assessments and the associated home energy improvements that were implemented reduced nearly 8,000 tonnes of GHGs.

Table 3. - Home Energy Assessments in the Kingston Area: 2007 – 2020 [lxxi]

Year home was built	Pre-retrofit audits	Post-retrofit audits	GHGs* Before	GHGs* After	Change	Total GHGs** reduced
2000 - 2020	237	191	4.8	4.7	-2%	19
1975 - 1999	2237	1975	6.1	4.9	-20%	2370
1950 - 1974	1879	1595	7.5	5.7	-24%	2871
pre-1950	1091	905	9.9	7.0	-29%	2625
Totals	**5444**	**4666**	**7.1**	**5.6**	**Average -21%**	**7885**

* = Average Tonnes per year per home ** = Total Tonnes per year for all homes retrofitted

Most of these energy audits and retrofits were conducted in older homes which achieved a higher average and total amount of GHG reductions than newer homes. The overall average GHG reduction amongst these homes during this time frame was about 21% which is affected by the inclusion of retrofits in newer homes which show much lower impact. The retrofits completed in homes built before the year 2000 showed an average GHG reduction closer to 24%.

From the data in Table 3, it appears the overall average GHG reduction per home in Kingston was only 1.5 tonnes. However, it is likely that these retrofits did not utilize renewable energy or more advanced technologies and approaches that are currently available and needed to achieve deeper energy reductions. Additionally, if homeowners

did not improve their building envelope, improvements may have been limited to efficiency upgrades of equipment. Using a larger data set over a longer period of time from Waterloo Region, the average GHG reduction achieved after home energy retrofits is estimated at over 2.9 tonnes per home.[lxxii] It is noteworthy that this is what was achieved within homes that were constructed in Kingston before 1950.

Further insight can be gained by examining the energy audit data by forward sorting area (FSA) which are the first three digits of a postal code in Canada. The level of GHG reductions is significantly higher in the K7L area, which includes the downtown core as well as the more rural and/or older northern and eastern portions of the City as shown in Appendix E. Although K7N is outside of Kingston municipal boundaries, it could be considered a surrogate for the K0H households within the City that were not captured in this assessment data as they both include a small portion of the total number of households within the energy audit data.

Within Figure 9, we can see the number of home energy assessments commissioned by homeowners in Kingston have fluctuated. This has largely been due the relatively sporadic availability of energy rebate and incentive programs as well as subsidies for energy audits during the time period captured by this localized dataset.

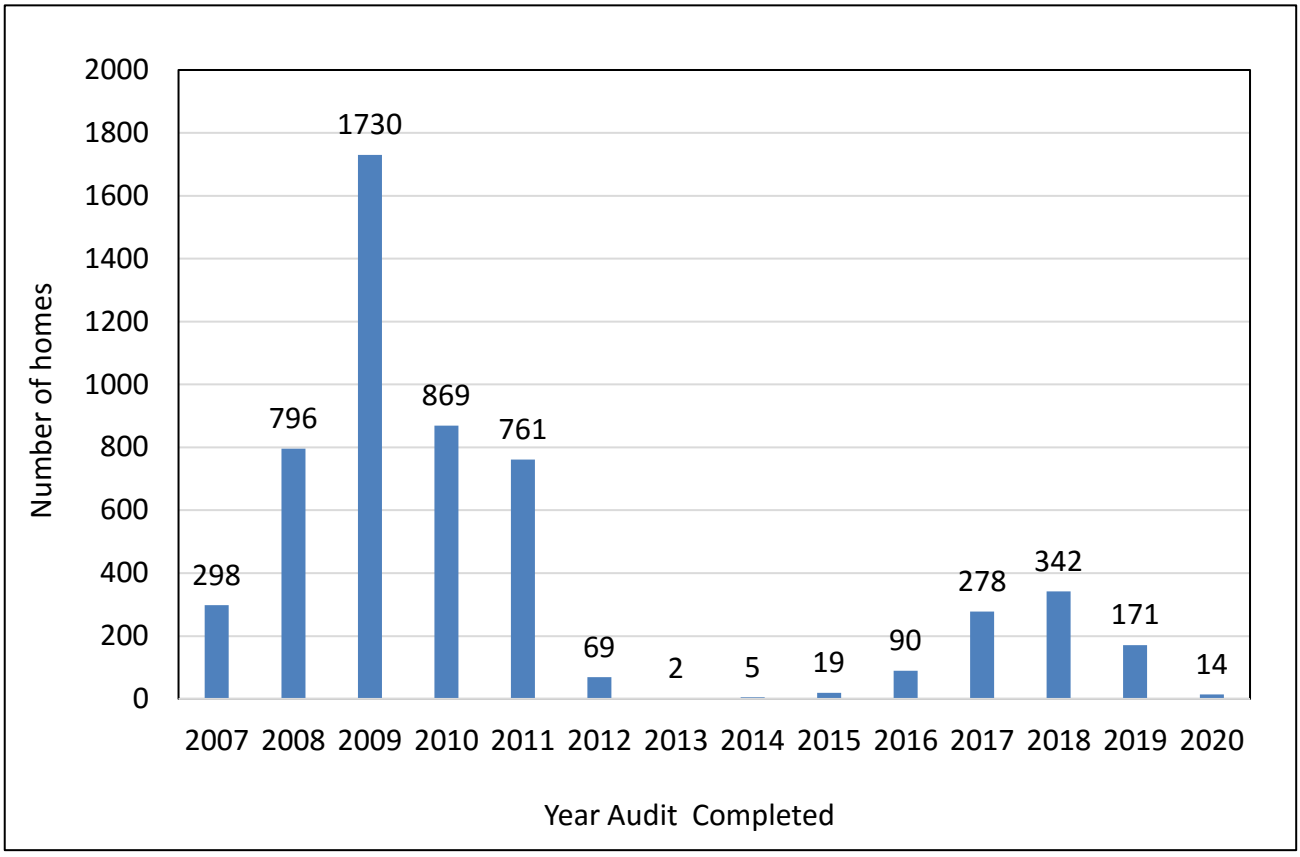


Figure 9. Pre-retrofit EnerGuide home energy audits in Kingston: 2007 – 2020 [lxxiii]

Support from federal and provincial governments for residential energy efficiency and conservation upgrades have varied over the past which have affected the number of both home energy assessment and retrofit projects completed. For example, NRCANs EcoEnergy program was a strong driver until it was closed in 2012. Natural gas and electric utilities serving the Kingston area have offered various mandated energy retrofit programs as directed by the Province but not necessarily requiring a home energy audit. A few years later, provincial programs supplemented utility programs until late 2018 and early 2019 when there were significant budget cuts to provincially funded incentive programs.

Development of residential archetypes were utilized to further examine the opportunity in terms of identifying the retrofit potential of one-family residential dwellings based on a variety of building information as it relates to energy use and GHG emissions. The archetype analysis involves using energy models and validation with actual data to align building characteristics, the efficiency of heating systems in place and building envelope performance ratings to help define energy and emission profiles for each archetype which can be considered categories of dwellings sharing similar characteristics.

The models used to develop the archetypes were validated against actual energy consumption data as well as the details within the NRCAN EnerGuide home energy assessment database for the Kingston area to further refine them to be reflective of the existing building stock. This also included additional energy audits completed within Kingston that were not captured in the previous tables within this section. This provides insight into the types of houses where the opportunities are most prevalent to reduce GHGs, total energy use and energy cost.

The analysis identified 12 archetypes that were differentiated primarily by the age and size of the dwellings, heating efficiency and building envelope ratings which influenced the energy and carbon intensity of the different categories of homes. Appendix F provides the complete suite of home energy and emission archetypes for Kingston. Table 4 provides a summary list of all 12 archetypes and their ranking in terms of how the average home performs from an emissions, energy consumption and cost perspective using relative intensity values to account for different sized homes. A rank of 1 indicates the best and 12 is the worst performer for three different intensity metrics including average emissions, energy and annual home energy cost per square metre for each archetype.

The insight gained from this analysis indicates which archetypes could achieve an optimal GHG reduction, decrease in energy costs or have the potential for increased overall energy efficiency with some cost and or GHG benefit. However, simple ranking

does not factor in practical considerations such as homes that already spend less than the provincial average on utilities as well as homes built in the last 15 years. In both of these examples, homeowners may be far less likely to invest in major efficiency upgrades due to limited room for improvement from an energy and cost perspective.

Table 4. Ranking Home Archetypes in Kingston by emissions, energy and cost.

Home Archetype (year built, heating source)	Emissions Intensity	Energy Intensity	Annual energy cost intensity
A: 1790-1945 Natural Gas	11	11	6
B: 1946-1970 Natural Gas	9	10	5
C: 1971-1990 Natural Gas	8	9	4
D: 1991-2005 Natural Gas	7	7	2
E: 2006-2019 Natural Gas	4	4	1
F: 1790-1945 Electric	3	8	11
G: 1946-1990 Electric	2	2	7
H: 1991-2019 Electric	1	1	3
I: Pre-1990 Oil	12	12	12
J: Post-1990 Oil	10	6	10
K: Pre-1990 Propane	6	5	9
L: Post-1990 Propane	5	3	8

A more market-oriented view needs to include the homeowner perspective such as looking for cost-effective solutions which provide a significant impact. This is characterized as the value proposition which can be seen as hot, warm and cool markets in terms of the likelihood of homeowner participation in the program and the type of improvement that retrofits could provide. The KHERP will be most effective in promoting a case for retrofits as follows:

- Hot market – homes using oil (archetypes I/J,) and propane heated homes (archetypes K/L) have the strongest likelihood to yield the most cost-effective improvements from fuel switching and insulation upgrades with the potential to

reduce from 80 – 90% of emissions in each home while also substantially lowering energy costs;

- Warm market – the oldest homes using natural gas (archetype A) and older electric homes (archetypes F/G) could achieve significant energy cost savings with heat pumps and building envelope improvements but only homes using natural gas would experience significant GHG reductions as electrically-heated homes already have a very low carbon footprint;

- Cool market – Natural gas heated homes built between 1946 and 1990 (archetypes B and C) have relatively high energy intensity but currently pay below the provincial average utility bills for power and heat combined. There are some improvements that could be made through retrofits for this group of homes, but it would be a tougher sell from a business case perspective. Homes replacing equipment, considering renovation projects or are supportive of climate action may contribute to fewer overall program participation.

Appendix G identifies the location of the priority archetypes by FSA in the hot, warm and cool market context.

The hot, warm and cold market analysis captures 9 of the 12 archetypes with a total number of over 24,000 residential dwellings, excluding the newest homes built to higher standards and/or are generally using relatively efficient heating equipment. However, 7,400 of the dwellings captured within the three market groups listed above have already had a home energy assessment in the past decade or so and maybe less likely to have another assessment conducted again or have already made improvements. By focussing only on unaudited one-family dwellings, the number of target homes is reduced to 16,800.

Applying realistic program participation rates significantly further reduces the level of market penetration considerably from the perspective of optimizing homeowner participation in the program as further analyzed in section 4.8.

3.5 Program Goals and Objectives

By defining the problem, understanding associated barriers and characterizing the opportunity, program goals and objectives can be established.

Kingston Home Energy Retrofit Program Goal:

> Retrofit 25 - 50% of Kingston's existing pre-1991 constructed one-family homes by 2040 achieving an average carbon reduction impact of 30% per home.

Objectives:

A. Encourage and incentivize homeowners to invest in retrofit projects that significantly reduce GHGs within their homes through conservation, energy efficiency and fuel switching improvements.

B. Utilize home energy assessments and deliver improved access to other tools that support resident's decision-making on the specific options in each household to optimize reductions of their emissions, energy consumption and utility costs.

C. Provide low-interest financing options to homeowners for implementing eligible retrofits identified within the home energy assessments as well as establish a loan loss reserve to address mortgage lender concerns.

D. Collaborate with area utilities serving the Kingston area and provide a one-window Energy Coach service to promote and streamline delivery of the program and support homeowner participation.

E. Stimulate the growth and development of a skilled local workforce to deliver trades and audit services that support implementation of the retrofit program that yield local benefits as part of Kingston's economic recovery.

The feasibility for the City of Kingston establishing a residential energy efficiency program is supported from various perspectives. Politically, there is explicit City Council support to champion the initiative and Council has directed staff to develop the retrofit program based on local needs. Within the community, residents have indicated a strong willingness to participate in a retrofit program in order to save money and reduce GHG emissions through two different city-wide surveys over the past year.

A baseline assessment of the local housing stock and current energy consumption and carbon emissions in Kingston identifies significant market opportunities for home energy upgrades to support substantial GHG reductions towards Kingston's established targets. The availability of a financing mechanism within the context of municipal law, as well as other financing options, will help address the high upfront cost for homeowners to implement energy efficiency and renewable energy upgrades. Preliminary

engagement with utilities, local post-secondary schools and other organizations showing strong interest in being part of the programs' success.

The City of Kingston has a strong foundation to build its proposed energy retrofit program including engaged key stakeholders to support implementation in the future. KHERP has the potential to fill gaps left by past programs targeted at home energy improvements and could provide stability and support for local programming over the next several years. Other municipalities in Ontario and across Canada are also developing and implementing similar programs which will assist in a broader market transformation to fuel a scaled impact for home energy retrofits.

4.0 DEVELOPING THE SOLUTION

This section describes the proposed design features of KHERP based on the potential of securing funding from the Federation of Canadian Municipalities Community Energy Financing (FCM-CEF) program. If the FCM funding is not secured, alternative financing sources and approaches to program design and delivery will need to be considered as well as possibly downscaling its scope and/or delaying implementation. A summary overview of the program design is included within the following paragraphs subject to changes from ongoing discussions with potential program partners.

As part of the proposed program design, target markets are identified to focus marketing and outreach efforts to drive awareness of KHERP amongst local homeowners and increase their understanding of the benefits of participation. A suite of financing options is proposed including LIC as a low-cost municipal loan program to stimulate capital investment in residential energy retrofits. Impact-based incentives are included during the program start-up and operation over the first few years to help develop momentum in program uptake. These incentives will encourage homeowners to carry out projects that could achieve deep GHG reductions such as fuel switching retrofits and comprehensive building envelope improvements that require high upfront capital investment and potentially reduce their overall energy expenditures.

Workforce engagement is also considered to stimulate development of an adequate supply of the necessary skilled workers needed for implementation as the program is scaled up over time. A high-level outline of the implementation plan is provided including support services to assist participating homeowners through the retrofit process towards meeting program goals and objectives while achieving a high-level of client satisfaction.

Management of program risk round out the description of the proposed retrofit program followed by the final section of this program design document which outlines the key

progress indicators and approach to continuous improvement of KHERP. Each of these program design elements are further detailed in the following nine sub-sections.

4.1 Target Markets

Based on primary and secondary research outlined in this document, the following are the target markets for KHERP:

- Single detached homes that are of the vintage 30 years old and over;
- Homes using fossil fuels for HVAC/DHW needs (fuel oil, propane, natural gas)
- Homes being renovated or due for replacement of major HVAC/DHW equipment;
- Households who have a high energy cost burden (as defined in section 2.2); and
- Homeowners who have identified that they want to reduce their home carbon footprint as indicated in local survey responses.

A brief overview of each of these target segments follows with additional details in sections 4.2 and 4.4 regarding Marketing and Outreach Channels and Incentives.

Almost two thirds of all households within Kingston are one family dwellings, that is dwellings that are single detached, semi-detached and row housing as summarized in Figure 11. As previously noted, approximately 70% of single-family homes in Kingston were constructed before 1991, or almost 24,000 dwellings.[lxxiv] As indicated in the energy audits conducted locally in the past, these older homes will yield the most GHG reductions. However, age of construction is not recommended necessarily as an eligibility requirement but will influence targeted marketing approaches (see section 4.2).

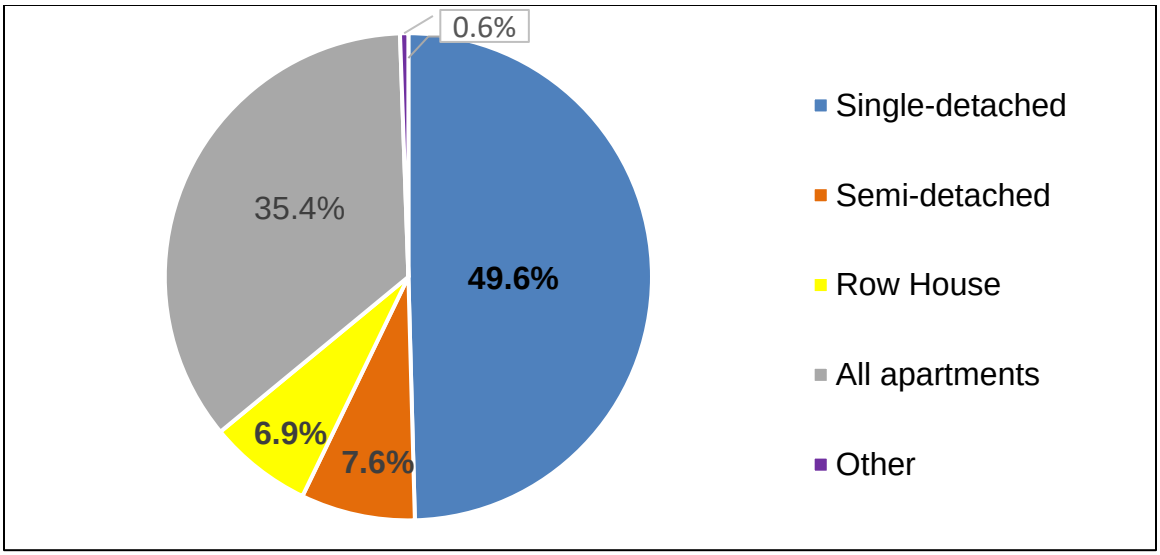


Figure 11. Housing Supply in Kingston by Dwelling Type (2016)[lxxv]

Kingston's retrofit program is being planned as a mid-to-long-term initiative that would take approximately 20 years to reach full implementation if all homes constructed before 1991 were retrofitted. The overall size of the target market for energy retrofits considering this vintage and ownership of one-family dwellings is broken down from the total housing stock as illustrated in Figure 12 (based on 2016 Census data):

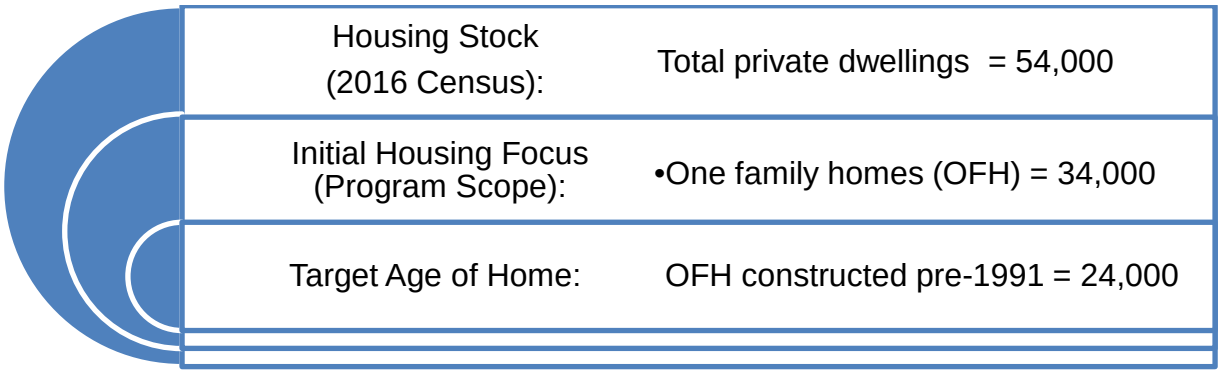


Figure 12. Target market of KHERP by home type and age (rounded)

Over 80% of homes in Kingston are using fuel oil, propane or natural gas for their HVAC/DHW needs. This represents a significant opportunity for deep GHG reductions when retrofitting to higher efficiency equipment, switching to electrically powered systems or use of renewable energy. From a GHG reduction perspective, fuel switching can be a very effective way to lower carbon emissions as can be seen in Table 5. Homes using fuel oil or propane can benefit most from switching to electric space and water heating systems in terms of lowering energy costs as well as emissions. Fossil fuel energy costs are also expected to be increasingly impacted by carbon pricing in the future. However, when promoting a retrofit program to homeowners, price per unit of

energy equivalent, such as a gigajoule (GJ), is only one of many variables to consider when aiming to reduce their energy costs.

Table 5. GHG intensity[lxxvi] and cost by energy source (average 2019 prices)

Energy Source	Kg CO2e per Gigajoule (GJ)	Cost per GJ*
Fuel Oil	75	$34.96 [lxxvii]
Propane	60	$35.36 [lxxviii]
Natural Gas	50	$10.27[lxxix]
Grid Electricity	8.3 [lxxx]	$34.54 [lxxxi]

* = Fuel oil and propane are commodity prices only and exclude delivery cost

Over the past decade or so, much political and media attention has been on energy pricing which under emphasizes the influential control individuals have in terms of cost-effectively meeting their home energy needs. Efficiency of heating and cooling systems and mechanical equipment are also important factors that influence both energy costs and GHG emissions. For example, older fuel oil and propane heating equipment will be much less efficient than modern day electric furnaces, air-source heat pumps and high efficiency natural gas furnaces which will require less energy to derive the same amount of heat comfort. Upgrading equipment to high efficiency levels can enable homeowners to use less GJ to meet their heating needs which in turn can lower their utility bills.

Equipment efficiency is only part of the picture as improvements to building envelope will also lower the amount of heat energy that is wasted as detailed in sections 2.1 and 3.4. Use of solar thermal DHW systems, ground source heat pumps as well as smart control gas absorption heat pumps are other examples to explore on a case-by-case basis which can further lower energy use and associated utility costs.

In the long-term, a homeowner's cost of electricity could potentially be improved by using rooftop solar photovoltaics (PV) for on-site power generation which enables them to reduce their needs from the provincial electricity grid thereby lowering their demand and consumption costs on their utility bill. In addition, there is also the potential to improve control of home electricity consumption by using energy storage to take advantage of lower time of use grid rates that may apply. Energy storage can also provide short-term back-up power during service interruptions from the electric grids' distribution and transmission system. In the near future, as costs for home energy storage come down in a similar way solar PV panels did over the past decade or so, these systems will be more viable and present a better business case even without subsidies or incentives. This is already the case for PV use in business operations.[lxxxii]

From a cost-effective perspective, the best solutions for residents will be dependent on a number of variables pertaining to characteristics of the home and available energy resources. Table 6 provides a few examples pertaining to lowering utility costs for meeting HVAC/DHW needs which in all cases assumes that moderately efficient equipment is currently being used and that building envelope improvements will also be implemented. These examples and others should be considered with the results of a home energy assessment to determine the most cost-effective solution for each home.

Table 6. Examples of home energy retrofits to evaluate for reducing utility costs

Existing home/energy system	Sample cost-effective solutions
Homes without natural gas service using fuel oil or propane for forced air heating (and cooling) and hot water needs	High efficiency electric furnaces, integrated heat pumps for secondary heat source, hot water and air conditioning needs,
Home without natural gas service using electric baseboards for heating (without air ducts), electric hot water heating and window air conditioning unit	High efficiency electric furnaces, integrated mini-split cold climate air-source heat pumps for secondary space heating source, hot water and air conditioning needs
Homes with natural gas service for both forced air and water heating, window air conditioning unit or no space cooling	Gas absorption heat pumps for space heating and cooling, tankless or condensing hot water heaters to lower energy requirements
Homes with natural gas fireplaces used for space heating (no air ducts), electric water heating, no air conditioning	Integrated mini-split cold climate air-source heat pumps for secondary heat source, hot water and air conditioning needs, electric thermal energy storage for basements

Home renovations also represent an excellent retrofit opportunity as they are an ideal time to incorporate energy efficiency improvements as they often cost less to implement when walls, floors and other aspects of the building envelope are opened during the home improvements. According to Statistics Canada data, 5.6% of single-family homes within Kingston require major repairs.[lxxxiii] However, more in-depth analysis shows that in 10 of the 29 census tracts within Kingston are above this City-wide average with a figure between 6% - 15% of homes needing major repairs.

Home improvements often go above and beyond required repairs and can involve more aesthetic or functional renovations and spatial expansions which has fueled the growth of a multi billion-dollar industry.[lxxxiv] Regardless of repairs being incorporated in with renovation projects, they can often be very costly and can include enlarging living areas

such as sunrooms, bedrooms, kitchens and bathrooms. The incremental cost to add-in enhanced insulation in a new addition for example will be lower during these types of projects and a fraction of the overall renovation cost while providing long-term home energy efficiency and indoor comfort benefits.

Research shows that a strategic approach can be used to influence renovations to include an energy efficient component with direct education and marketing. Specifically, the following cascading observations were identified from research with homeowners regarding their renovation plans and projects:

- "Energy efficiency is of potential appeal to all households considering major renovations to their homes regardless of the type of renovation work they are initially considering;
- Some households are motivated to reduce energy bills, but this is a small proportion of the total market, and intentions towards energy efficiency were weakened by uncertainty about future financial benefits; and,
- Viewing renovation decisions as a series of stages rather than one event reveals not only an extended window of opportunity to engage homeowners during the often lengthy renovation-decision process, but also a mechanism by which to identify efficiency renovators much earlier as they decide whether and how to improve their homes." [lxxxv]

Although this research is from a study in England, the observations on consumer attitudes are likely relevant to Ontario as well. This has implications for marketing and outreach efforts to promote KHERP through different channels and will help to reach homeowners as they begin their home renovation decision-making process. The next section explores this in more detail.

Households who have a high energy cost burden in many cases are also within areas of the City with older homes and have need for major repair. These communities can be part of targeted neighborhood approaches to KHERP promotion and engagement. It will be important for the program to help these homeowners make the most cost-effective retrofits that provide them with relief from high utility bills relative to their income level. The benefit to this target market can be further enhanced by encouraging these households to utilize the available income-eligible incentives that already exist within Ontario to help make these improvements more affordable.

Low-income households without central air conditioning for example often may also have window units which are usually high users of electricity that are inefficient and costly to operate. Air source heat pumps (ASHP) can provide a primary or secondary heating source for the home as well as a more efficient source of space cooling during hot summer months when peak electricity consumption is at the highest cost per kilowatt hour. Although ASHPs still uses electricity, they are far more cost effective in

providing space cooling than window air conditioning units with the added benefit that the one heat pump system can provide serve heating and cooling needs.

Many respondents to Kingston's local energy survey identified reducing their carbon footprint as one of their top priorities in terms of their interest in a City sponsored retrofit program. Some residents specifically identified the desire to stop using fossil fuels for environmental or climate change reasons regardless of the financial payback. Generally, residents have been very supportive of Kingston's commitment to Climate Leadership which is evident from the support for a carbon neutrality target, the council declaration of a climate emergency and ongoing participation in climate related events and engagement opportunities. For these 'green' minded residents, the GHG reduction potential may be a strong appeal for them to participate in the retrofit program.

4.2 Marketing and Outreach Channels

Marketing and outreach communications will aim to raise homeowner awareness, understanding and their participation in the retrofit program by including three main components: [lxxxvi]

1. **Education** on the overall value of home energy upgrades such as reduced energy bills as well as improved comfort and indoor air quality. This should help their awareness of the signs that their home could be improved for example: "Is it too hot or cold in different parts of your house throughout the year?" or "Are your home heating and electricity bills more than $200 a month?"
2. **Inform** homeowners of the specific program eligibility requirements as well as the benefits of participation such as attractive financing terms (see section 4.3), free home energy audits and other support tools (see sections 4.4 – 4.6). Messaging here should improve a homeowners' understanding of why they should apply to the program in terms of KHERP's value proposition.
3. **A call-to-action** for homeowners to use a phone number or visit a website to obtain more specific guidance on how to start the application process such as "Call your utility provider or contact one of our registered energy advisors today to learn how to take advantage of the incentives for the first 500 participants."

The marketing strategy used to promote KHERP will utilize a wide variety of methods, messaging and channel partners to reach homeowners in each target market with an aim to influence their decision-making process to participate in the program.

Table 7 provides a summarized list of several marketing methods and proposed channel partners that may be involved in program promotion and outreach. Most of the promotional and outreach methods outlined within the table have the potential to reach

all the target markets. However, some variation of the messaging within the communications will be utilized considering the channel partners involved and the specific intended audience such as displays, or advertising specifically geared towards home renovations. Radio ads and street-level billboard signage can also be used to communicate different messages over time to address each target market periodically.

Table 7. Proposed KHERP Marketing and Outreach Channels

Marketing methods	Channel Partners Involved	Target Market(s)
In branch displays	Credit unions and banks	All
In store displays	Home improvement retailers, hardware stores	All - particularly homeowners considering renovations
Cross promotion services	Trades contractors and Energy Auditors	All - particularly homeowners considering renovations
Social service agencies	Including United Way	high energy cost households
Digital marketing*	Third party vendors	All
Bill inserts	Utility companies	All
Street-level billboard signs	City Communications	All
Exterior transit ads	Kingston Transit	All
Direct outreach in target neighbourhoods	Utilities, Neighbourhood associations	Older homes, homes using fossil fuels, residents wanting to reduce GHGs, high energy cost households
Direct outreach to target trades	Utilities	All
Radio ads	Local radio stations	All
Social Media	City Communications staff and all program partners	All
City Facilities	Planning, Building and Licensing	All
News Releases	Local media outlets	All

* Digital marketing is applicable to any geocoded segment such as utilizing postal codes with other demographic information and market intelligence on home improvement gained from related internet searches and consumer sentiment by market segment.

Stages or marketing waves can be deployed to vary the messages over time. For example, homeowners may be more receptive to certain messages in the winter or

spring when they begin considering and planning improvements to their home. Home improvement exhibitions are also good opportunities to engage residents who are considering a variety of upgrades to their homes.

Homeowners may also be more receptive to information about financing for energy upgrades during their interactions with local contractors or their electricity or gas utility. Fall and early winter are often when retailers and contractors will remind people to check their furnaces and heating systems for repair and replacement as well as promote weather stripping and caulking around drafty areas of the home. Designing marketing materials for these different channel intersections with the consumer decision process will help reach the intended audience at their different stages of readiness for home energy upgrades.

The communication strategy will need to ensure the program offer meets homeowner needs and includes a compelling and actionable message. However, the values, needs and motivations of homeowners within the city will vary which will also need to influence the messaging used within marketing materials to have an effective reach across the different target markets.

The use of customer profiles can utilize knowledge of consumer behaviours and attitudes to help program administrators and channel partners better understand characteristics of prospective program participants.[lxxxvii] This is similar to using residential archetypes to better understand different energy and GHG emission profiles of homes based on variable characteristics. Using customer profiles helps improve understanding of different homeowner perspectives that will influence their interest, and ultimately whether they decide to participate in the retrofit program. Appendix H includes several sample customer profiles that are relevant to planning implementation of KHERP. Although the profiles referenced here identify a generalized characterization of ideal customers, they can allow program managers to design marketing approaches that appeal to the different segments of the target markets.[lxxxviii]

A final communication and marketing plan will be further developed in consultation with program partners, incorporating available market intelligence into promoting KHERP, once the City has secured funding for program start-up and launch. This may include consideration of initially focussing on a few target areas of the City where the greatest energy savings can be made based on the analysis covered within section 3.4. This approach could include developing a geo-coded index of variables such as target age of home, high energy consumers, fuel oil and propane users and high energy burden as examples, to prioritize which neighbourhoods are focussed on initially to achieve some quick wins during the early start-up phase (see section 4.8).

4.3 Financing Options

As previously acknowledged, one of the main barriers for homeowners to implement deep energy retrofits is the high upfront cost. KHERP recognizes that there are a variety of circumstances that homeowners face regarding access to capital, so it is important to incorporate flexibility to accommodate different situations. Therefore, three different financing options are proposed as part of the program as listed below which includes a summary of each option and an example of a current program in Canada using the specific financing mechanism. [lxxxix]

1. Local Improvement Charge (LIC) loan through the City of Kingston (as described in section 3.3.3):
    - Paid back on property tax bill semi-annually
    - Debt stays with property not the borrower – transfers at time of home sale
    - Example: Toronto Home Energy Loan Program

2. On-bill financing (OBF) or equipment rental through utility companies or trades contractors/equipment suppliers serving the Kingston area:
    - Costs added to monthly or bi-monthly utility bill
    - Debt/equipment rental agreement transferable at time of home sale
    - Example: Manitoba Hydro

3. Direct lending with preferred rates provided by partnering financial institutions:
    - Monthly repayment via pre-authorized debit
    - Debt stays with borrower
    - Example: Clean BC

Property-assessed financing mechanisms, such as LIC loans offered by municipalities, have the advantage of directly tying the energy efficiency investment to the property, mitigating the risk to the homeowner if their project payback period is longer than the time they may own the home. Below market interest rates and longer borrowing terms for LIC loans can also be provided to homeowners while reducing or eliminating their up-front capital costs for the retrofits.

The province has placed limitations on use of OBF by electrical utilities in that only allowed on bills in cases where there is a conservation benefit for Ontario's electricity grid. This means Hydro One for example could offer financing for customers converting from an electric resistance technology to a more efficient form such as a high efficiency electric furnace or a heat pump but not for fuel switching from oil/propane/natural gas to an electric source. In this case, either financing through equipment suppliers, LIC though the municipality or loans through financial institutions could be used.

The suitability of different financing options is influenced by the scope, complexity, cost and type of improvements being made within a home. Table 8 lists the options that are intended to be offered through KHERP and links them with examples of how to potentially match the appropriate financing mechanism to the scope of the retrofit project. The table excludes residents that have available cash on hand to make the energy improvements within the sample project scopes outlined which is assumed to cost between $5,000 and $35,000 for illustrative purposes.

Table 8. Sample scopes of home improvement projects and financing options

Scope of Project	Financing Mechanism	Comments
Home Renovations	Home equity loan (HELo), line of credit (LoC) or unsecured bank loan	Could include addition of new energy systems &/or insulation i.e. finishing basement; Term 5 - 10 yrs.;
Energy retrofits (HVAC, DHW, insulation)	LIC loan through Municipality	Paid back semi-annually via property tax bill with terms up to 20 years, % interest rate < bank loans/LoC
Single piece of equipment	On-bill financing (OBF) or equipment rental through utility, contractor, or equipment supplier	Examples: gas absorption or air source heat pumps, tankless hot water system;
Specialized systems	OBF or equipment rental from Utility, Bank loan or LoC) or, LIC loan from Municipality	Examples: Solar photovoltaic, energy storage, electric vehicle charging

Depending on individual financial situations, some homeowners may be better suited to access the LIC loan through the Municipality or OBF through their utility. Local credit unions are being approached to explore if they would offer discounted loan interest rates on deep energy retrofit projects especially if the Municipality can offer a loan loss reserve with FCM financing. In all cases, some type of credit check may be required in addition to ensuring applicants do not have a recent history of being in arrears on paying property taxes or utility bills.

Based on the City of Kingston's survey of local homeowners, 70% indicated interest in a program that offers some type of financing support. However, blended solutions for low-income households that involve a mix of existing provincial programs, equipment rentals and new KHERP incentives will be needed to minimize the added debt burden. Ultimately, applicant circumstance will influence the most appropriate financing option to match the retrofit measures that will optimally improve energy use in their home.

4.4 Eligible Measures and Incentives

Eligibility of retrofit measures under KHERP will also need to be flexible which was a key part of the feedback received during Kingston's online survey of residents. This enables homeowners across the different ages of homes and different types of HVAC/DHW systems to implement the upgrades that makes the most sense for their situation based on a home energy assessment (see section 4.5).

GHG performance improvement, or reduction threshold in energy consumption for electrically heated homes, will be the guiding factor on retrofit project eligibility as the primary directive from Kingston City Council is focused on emission reductions. A minimum of 20% will be required, to obtain LIC financing, based on potential improvements identified with the home energy assessment tools further described below. A list of sample measures and their estimated costs is included in Appendix I. Additional considerations of including costs for new equipment commissioning and a maintenance service package as eligible under KHERP are outlined in section 4.9.4.

Currently, the incentives available for resident energy improvements are related to appliance rebates (i.e. higher efficient dishwashers, washing machines, dryers and some furnaces and hot water heaters), home insulation and smart thermostats as well most of the costs associated with energy audits. The incentives that pertain to HVAC/DHW, building envelope and subsidized audits are primarily offered through the Enbridge Gas Home Efficiency Rebate program. One of the requirements to receive these current rebates is to maintain use or become a new consumer of natural gas.

For fuel switching initiatives that completely shift thermal energy needs to electric and other sources (air or ground source heat pumps, solar) the incentives from natural gas utilities would not apply. Fuel switching from fuel oil or propane to electricity can be very beneficial for lowering resident energy bills as well as GHG emissions. Hydro One currently has a fuel switching program that highlights the following benefits:

- Oil and propane represent 25% of the residential space heating and 11% of the water heating market in Ontario;
- Up to $1,000 incentive is available on select models of space heating equipment through installation partners;
- Relative to fuel oil, electricity is cheaper by about 32% for space heating and 17% for water heating, annually; and,
- Relative to propane, electricity is cheaper by 25% for space heating and 18% for water heating, annually. [xc]

Subject to successfully obtaining financial resources from the FCM-CEF funding program, KHERP will offer the first 500 applicant incentives for emission reductions which in many cases will involve fuel switching. A switch from natural gas to electricity

or renewable energy technologies for HVAC or DHW may not provide an acceptable financial payback for the resident at this time. Therefore, the incentives are primarily to entice early participants in Kingston's retrofit program. The business case for fuel switching is expected to improve as alternative technologies continually come down in price over time. As carbon pricing becomes more widespread internationally, natural gas prices are expected to rise from its current relatively inexpensive rates compared to other sources of home heating.

The proposed incentive levels are aligned with the quantity of GHG emission reductions achieved with the retrofits and installation of the fuel switching technology. The following are the proposed incentive levels based on the post-retrofit audit results of a home.

- 20% – 25% reduction in emissions or energy consumption = $1000
- >25% - 30%% reduction in emissions or energy consumption = $3000
- >30% reduction in emissions or energy consumption = $5000

The performance thresholds pertaining to energy consumption only apply to electrically heated homes whereas the emissions levels are applicable to fossil fuel heating systems (fuel oil, natural gas and propane). The incentive will not exceed the project cost in any case, the lesser being the maximum.

These incentives are expected to benefit residents who currently use natural gas, fuel oil or propane for their HVAC or DHW needs due to their higher carbon content compared to electricity. It is expected that the higher project costs of fuel switching will be associated with retrofits achieving deeper GHG reductions, including the addition building envelope improvements such as adding insulation or replacing old windows, which will trigger the performance based KHERP incentives as outlined above.

The availability of the incentives for the initial years of Kingston's loan-based retrofit program will focus on filling in gaps with other incentive programs regarding lower carbon retrofits (see Table 9). As these programs change periodically, efforts will be made to ensure KHERP incentives are complementary and not duplicative. Further consideration of optimally and fairly using incentives to maximize program participation and impact will be a part of future discussions with utility partners in 2021 prior to launching KHERP.

Table 9. Availability of Incentives through KHERP and other sources

Retrofit	Incentive provider	KHERP
Furnace/AC/hot water heaters – Natural Gas (NG)	Enbridge Gas	No
Furnace/AC/hot water heaters – electric, heat pumps, solar	- Municipality (proposed) with federal funding; - Hydro One in some cases	Yes
Building envelope	- Enbridge Gas if NG is used; - Municipality if NG not used*	Yes*
Home Energy Assessment	- Enbridge Gas if NG is used; - Municipality if NG not used*	Yes*
Solar PV or solar thermal and energy storage	Municipality (proposed) with federal funding	Yes
Lighting improvements (excluding energy efficient lightbulb rebates offered through retailers)	Utilities or Municipality[1] (i.e. multiple LED fixtures, dimmer switches and motion sensors)	Yes
Appliances (dishwashers, clothes washing machines and dryers)	Federal through retailers	No

Note 1: The proposed Save On Energy Program for 2021-2024 may incentivize entire home lighting retrofits. In absence of this provincially funded rebate program, KHERP incentives may apply.

With the incentives, and depending on the program interest rate, the energy savings from retrofits in most cases are expected to offset the cost of borrowing as illustrated in table 10. As a reference point, through the first five years of Toronto's Home Energy Loan program, the average household energy savings realized was $560 based on 30% energy reduction and an average project cost of $22,000.

The proposed incentives are expected to be phased out over time as market mechanisms improve the appeal of home energy retrofits including impacts of carbon pricing which should improve the comparative cost of alternatives to fossil fuels. Over the long-term, KHERP, and other similar municipal retrofit programs across the province, are expected to stimulate a market transformation that will incrementally improve the overall business case for retrofits through economies of scale and through the potential of home energy disclosure at time of its sale.[xci] Energy disclosure on homes can improve energy literacy of home buyers and sellers while homes with higher energy ratings can modestly increase resale value.[xcii]

Table 10. Required Annual Energy Cost Savings to Offset Loan Interest

Term	5 years	10 years	15 years	20 years	20 years	20 years	20 years
Interest rate	**$5,000**	**$10,000**	**$15,000**	**$20,000**	**$25,000**	**$30,000**	**$35,000**
2.50%	*$69.59*	$135.53	$204.02	$275.02	$271.35	$412.53	$ 481.29
2.75%	$76.64	$149.55	$225.52	$304.53	$343.78	$456.79	$532.92
3%	$83.71	$163.64	$247.21	$334.38	$417.98	$501.57	$585.17
3.50%	$97.88	$192.07	*$291.18*	$395.12	$493.90	$592.68	$691.46
4%	$112.12	$220.82	$335.89	$457.21	$571.51	$685.81	$800.11
4.50%	$126.43	$249.88	$381.34	$520.60	$650.76	$780.91	$911.06
5%	$140.79	$279.25	$427.51	$585.28	$731.60	$877.92	$1,024.24

4.5 Home Energy Assessments

A pre- and post-retrofit energy audit, also known as a home energy assessment or evaluation, conducted by a Registered Energy Advisor (REA) is an important program feature for the following reasons:

- The pre-retrofit assessment report enables homeowners to see the potential financial, energy and emissions benefits of different retrofit options relevant to their home;
- Post-retrofit assessments provide data that can be used to monitor and evaluate the impact of the overall retrofit program against its goals and objectives; and,
- It is a requirement of the FCM CEF funding program.

NRCAN certifies REAs after meeting training requirements which enable them to conduct on-site energy assessments using the EnerGuide Rating System (ERS). This provides homeowners with an energy efficiency rating specific to their dwelling as shown in Figure 13.

Currently, Enbridge Gas offers homeowners almost a full rebate of the cost for a home energy assessment if they implement at least two priority retrofits identified and where the homeowner remains a natural gas customer.

As KHERP aims to stimulate fuel switching to reduce overall fossil fuel consumption within Kingston, it is proposed that a supplementary rebate of the assessment cost will be offered where the homeowner does not qualify for the existing Enbridge rebate

program. The proposed rebate would cover 75% of the assessment cost at the pre-retrofit stage to establish the base case for a home. Homeowners can receive a full rebate of the entire pre- and post-retrofit assessment cost if they complete retrofit measures and a post-retrofit assessment indicating at least 20% reduction in emissions. Alternate arrangements for accessing the rebate could be provided to low-income households if the upfront cost of the energy assessment is prohibitive.

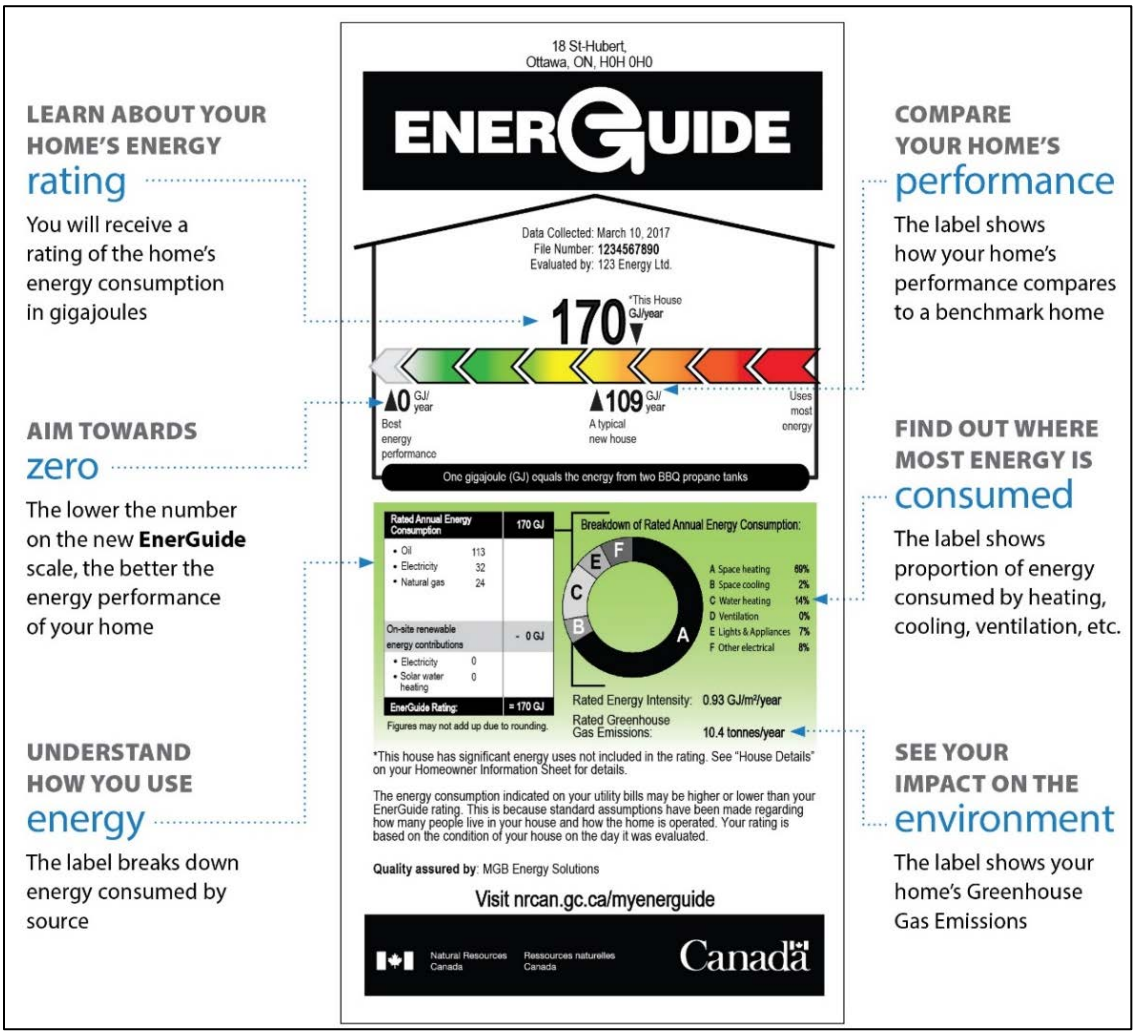


Figure 13. How to interpret a Home EnergGuide Rating Label [xciii]

Like the proposed incentives, subject to obtaining funding from the FCM CEF program, the assessment rebate will be offered to the first 500 program applicants where other applicable rebates do not apply. Once financial resources are exhausted for these incentives and rebates (expected during the first 3 - 4 years of program start-up and operation), they will be modified and/or incrementally phased out to reflect current market conditions at that time as well as the available financial resources from future program budgets.

Research has shown that a combination of rebates, incentives and loans support more substantial home energy retrofits that are also able to attract the attention of contractors with higher project volume and value.[xciv] However, additional support services are necessary to ensure homeowners and contractors are engaged effectively and that the necessary decision-support and streamlined application processes are provided to drive participation in the program.

4.6 Support Services

In addition to targeted marketing and financial incentives, support services are intended to be a part of delivering KHERP to help increase program uptake and impact. Three proposed program features are as follows:

A. A Home Energy Coach;

B. A one-window program application approach including streamlined access to energy assessment and trades contractors; and,

C. A mobile app for additional homeowner decision support on which retrofits to proceed with based on their budget and/or goals.

A Home Energy Coach can provide objective guidance to homeowners about the retrofit program, interpreting energy assessment reports and the different associated choices on financing and retrofit options. The provision of a Coach as a service can help residents understand and navigate through the program to reduce the time associated with all the steps in the process and improve satisfaction of participating homeowners.[xcv]

REEP Green Solutions piloted a Home Energy Coach program a few years ago in Waterloo Region with financial support from NRCAN. The Coach, in conjunction with utilizing the EnerGuide Home Evaluation, helped homeowners with planning advice to improve their home's energy efficiency, and guided them through implementation so that the retrofits provided a more comfortable home that reduced their energy costs. During the pilot, any resident that conducted a home energy evaluation could access the coach's expertise and ongoing advice at no additional charge.[xcvi]

Within the KHERP, the Coach position could provide additional value by assisting the homeowner in developing a retrofit plan to account for factors such as the scale of work to be completed, timing of replacing existing equipment, integration with any other planned home improvements and magnitude of retrofit costs in relation to its affordability to the homeowner as examples. This may allow for a staged approach to undertake deep energy retrofits over time that optimize both GHG reductions and optimizing the cost-effectiveness of the improvements. The homeowner may elect to install heat or energy recovery units, undertake comprehensive insulation and other

building envelope improvements first then replace the HVAC/DHW systems closer to the end of equipment life for example. This approach can potentially reduce the size of the new equipment needed based on lowered energy demand and may allow for a more affordable approach for some homeowners to incrementally implement the recommendations identified within the energy assessment over a longer period.

Closely related to the benefits of deploying an Energy Coach, a streamlined one-window approach will help to expedite the process for homeowners wanting to access KHERP. Given the current market fragmentation of energy related programs and services, it will be important for KHERP to offer homeowners a seamless, end-to-end service that results in energy performance improvements within their home. A service agreement with program delivery partners would have them coordinate this approach in conjunction with the Coach service to assist program applicants gain access to the financing, incentives and other supportive tools as a one-stop shop which also can be an important driver for uptake.[xcvii] This has been practiced in Alberta and in Ontario where local utilities and community organizations create a hub that provides all related information on retrofits and energy savings.[xcviii] The Coach would work with the homeowner, utilities and Registered Energy Advisor (REA) to support program participants gain the most benefits from Kingston's program.

Online tools may also be provided as part of implementing KHERP to further support homeowners with the retrofit decision-making process. There are several web-based tools that are essentially information clearinghouses as a passive resource to consumers considering making home energy improvements such as those offered by federal and provincial governments. [xcix] Other home energy software-as-a-service apps can improve connections between all stakeholders involved in the retrofit process by providing a digital platform to bring together homeowners, contractors, REA's and retrofit program managers/delivery partners all in one virtual location.

These software platforms are available on mobile devices and configured to be consistent and federal EnerGuide rating system to help homeowners reach their goals more easily and effectively. These tools can be used as the virtual portal to the one-stop shop window approach used by the program delivery partners and is intended to provide the homeowner with customized recommendations based on their home energy needs and budget. Figure 14 shows two examples of these types of digital integration and support tools. Digital tools can be used synergistically with the Energy Coach and home energy assessment data to consolidate information and simplify it for homeowners to understand the benefits of proceeding with making energy improvements within their home. This approach provides an improved format of the customized recommendations, estimated energy savings, applicable incentives with the

addition of a budget and sequential project planning aspect to enable program applicants to make informed decisions on the most cost-effective retrofits to implement.

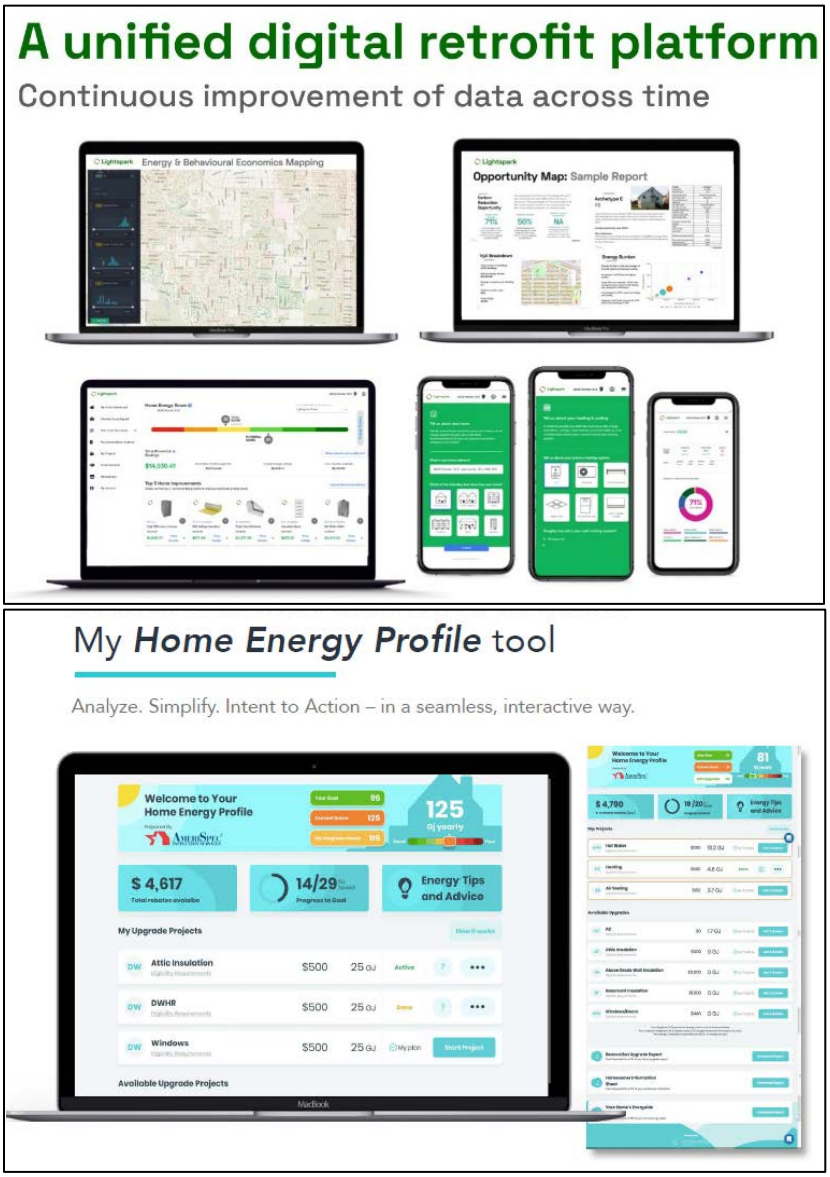


Figure 14. Examples of digital retrofit platforms for use by program stakeholders.

Combined with the one-window approach, these tools can improve KHERP so that it is a streamlined process from program application to completing the post-retrofit home energy evaluation. These complementary support services will enhance the customer experience of participating homeowners throughout the home upgrade project and help fast track the administrative process. As the customer journey through the KHERP process has multiple steps, as illustrated in figure 15, support services are important to both homeowners and program administrators. Positive customer experiences can help promotion of the program through social media and word of mouth within the family,

friend and co-worker circles of participating homeowners. Peer comparisons can also be facilitated through these types of software services to create some friendly competition within or between neighbourhoods.

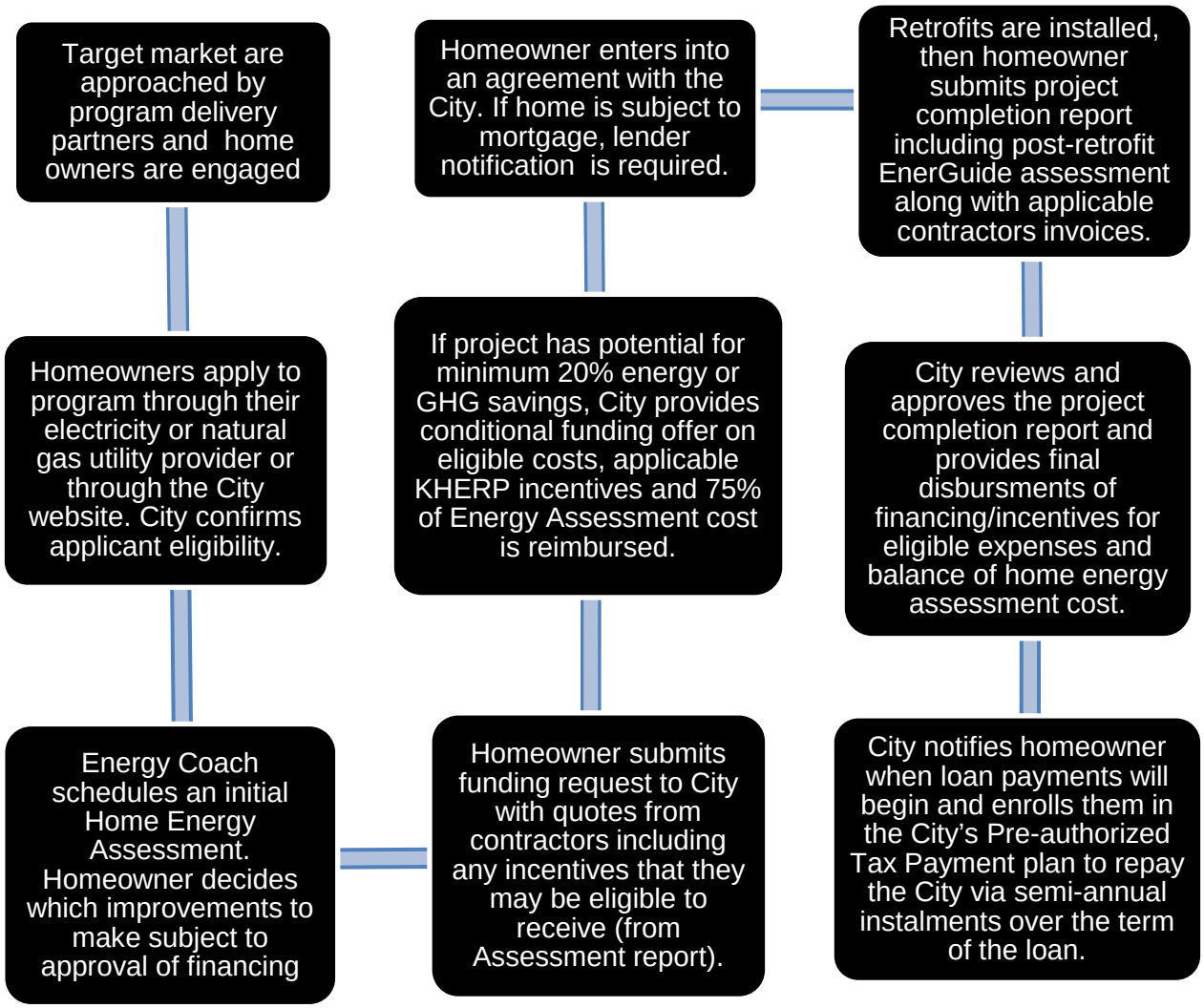


Figure 15. Customer journey of obtaining LIC financing for home energy retrofits

4.7 Implementation

4.7.1 Program Delivery and Workforce Engagement

City staff considered several options for program delivery including:

a) City staff-led (Toronto's HELP initiative);
b) Utility service delivery agent (Durham Region's program design)
c) Non-utility service delivery agent (many U.S. private sector led programs)
d) New Municipal Service Corporation (Guelph and Windsor's program designs)

Factors considered when assessing these options included City staff time and cost, administrative complexity, service fees in relation to elevating program impact, level of directly relevant expertise and homeowner familiarity with the service partner. Overall, a combination of a staff and utility-based delivery approach was deemed as having the strongest potential for success for the initial years of the program launch and brand awareness phase.

Utilities have robust relevant expertise and market insight as well as high familiarity with homeowners who already have regular interaction with the utility relevant to the focus of KHERP. Common program expenses and administration are proposed to be covered with FCM Community Energy Financing funding for the initial years of roll out with overall program management support provide by the new Energy Coach staff position. The staff position could reside within the municipality, one of the utilities or a third party that provides the resource to all three utilities serving the Kingston area.

Utilities Kingston (UK) is an existing Municipal Service Corporation that is affiliated with Kingston Hydro but is a separate organizational entity that is not limited to the parameters within Ontario Energy Board regulations for local utility distribution corporations within the province.[c] UK is in a good position to be a program delivery partner involved in launching and promoting KHERP in their service area including getting resident applications completed for the City to assess eligibility. Hydro One and Enbridge Gas are also important program delivery partners for their respective service areas with their relevant conservation programs as they continue to build bridges with Municipalities who are developing retrofit programs. All three utility-based organizations potentially have a key role to play in offering expertise as well as providing access to their existing energy auditor and contractor networks and applicable incentives.

City staff would remain responsible for program design and securing financing for program start-up and implementation, managing service agreements, LIC loan approval and establishing the property tax-based repayment, as well as monitoring, evaluation and reporting. The City also intends to work closely with other community partners such as St. Lawrence College for training of new energy auditors and contractors to address the expected increased demand for labour required for program implementation. Energy auditors within the Kingston area will be encouraged to work with students and recent graduates to provide on the job experience required for CEA accreditation. Red Squirrel currently already provides opportunities for students/graduates in this regard.

Workforce engagement will be important as implementation of the retrofit program over time will stimulate significant demand for both home energy assessments and trades contractors to perform the retrofits. Working through existing utility contractor networks, trades personnel active in the Kingston area will be provided with training on best practices and learn how to optimally present the program to potential customers while

promoting their own associated services. Companies offering associated trades and energy assessment services have already been initially engaged by City staff to start the dialogue as the program moves from design and full development to the launch stage. Input from the people who physically implement retrofits within homes will be valuable throughout this process from a logistics perspective.

Contractor networks available through the utilities as well as the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) and eRenovate can provide homeowners further assurance with their retrofit project in terms of quality of workmanship. HRAI is a non-profit national trade association that represents more than 900 member companies across Ontario in the heating, ventilation, air conditioning and refrigeration sector.[ci] Toronto-based Clean Air Partnership has already engaged HRAI as a program partner for residential retrofit programs and the City of Toronto's HELP initiative refers homeowners to the HRAI for choosing contractors to perform the retrofits. ERenovate provides homeowners with a bondable contractor matching service for their projects with a performance guarantee and insurance as well as user friendly tools to manage their project timelines and budget.

Other channel partners who will be engaged to support program implementation (as described in section 4.2) include local financial institutions for discounted renovation loans involving energy retrofits as well as home improvement and hardware stores in the Kingston area for program promotion. All these program stakeholders can be valuable marketing and co-branding partners to help drive awareness and demand for the program while benefitting their own businesses as the program drives demand for related products and services. The following diagram summarizes these broad roles:

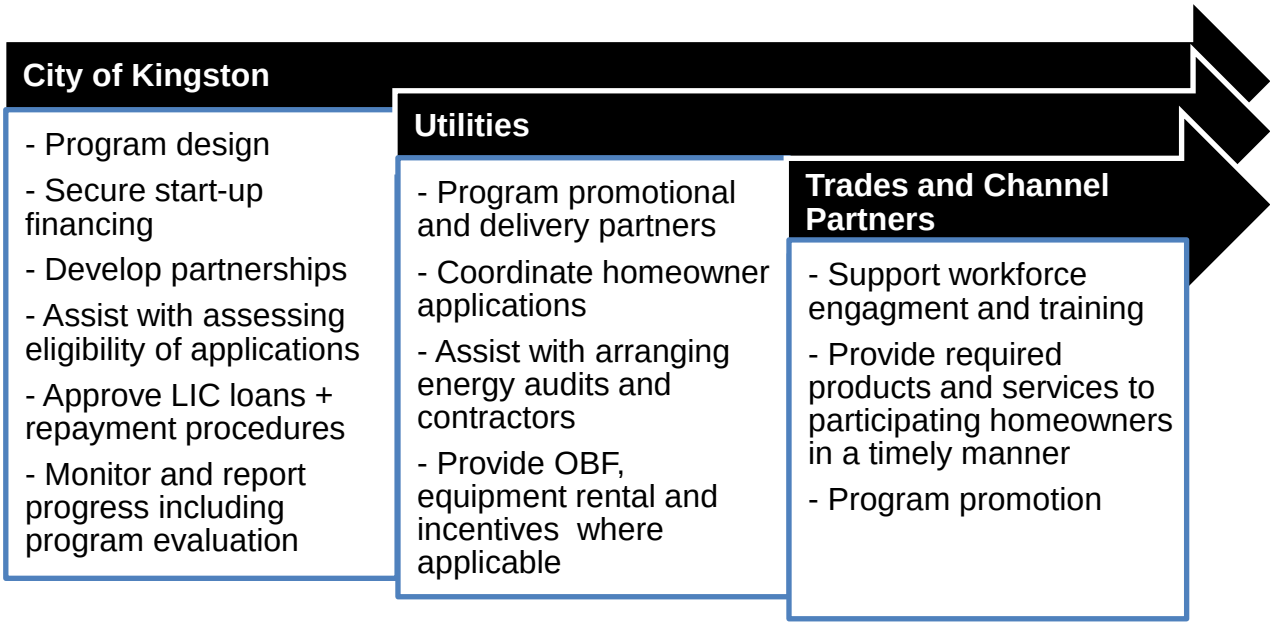


Figure 16. Summary of Key Stakeholder Roles for Program Implementation

4.7.2 Timelines

Throughout 2020, City staff have been compiling research and conducting preliminary stakeholder consultations to inform the program design process. The intent of KHERP is to establish a long-term residential retrofit program that stimulates related market development over the next 20 years in order to reach its full target market goals. Long-term timelines and targets for full program scale-up are projected within section 4.8. The following program timelines focus on the initial start-up and critical momentum building phase that the City will seek FCM funding to support:

A. Quarter 4 2020 - Program approval by City Council including the LIC by-law;
B. Q1 2021 – Secure FCM funding for program start-up;
C. Q2/3 2021 – Partnership development, service agreements and establish program administration (including application forms, marketing and outreach);
D. Q4 2021 - Program Launch
E. Q4 2024 - Evaluate results from the first 3 years of implementation
F. Q1 2025 – Progress report and revise program as needed to reach long-term targets

FCM-CEF funding is available for four years and as such the three-year implementation period is bookended by six-month periods for full program start-up and launch as well as evaluation towards the transition to the scale-up and project maturity phase. A more detailed work plan focussed on the initial four years will be developed as part of the City's funding application to FCM.

4.7.3 Resources

This section focusses on the initial four-year launch phase of the program as outlined above. Factors affecting long-term program scale-up and sustainability are also briefly considered and will be explored in more detail as the program is fully developed in 2021 subject to funding support.

Assuming program delivery partners and support services are utilized as previously described, the list enclosed below is a high-level summary of estimated costs for program start-up, approximately three years of retrofits as well as program evaluation. These estimated program costs assume a total of 500 retrofits are completed, at an average project cost of $25,000 for each home that are completed between fall 2021 and the fall/winter of 2024 including the post-retrofit home energy audits. The average cost considered here is only applicable to retrofits using LIC loans whereas additional borrowing and retrofits may occur using OBF or bank loans. However, it is intended that

the loan loss reserve would be extended to de-risk third party financing to entice involvement of private capital as this will be critical for long-term program success.

- Repayable loans to homeowners = $12.5 Million
- Incentives and audit subsidies @ maximum of $5700/home = $2.85 Million
- Service fees to Utilities for program delivery including marketing = $1.25 Million
- Loan loss reserve @ 5% of total loans = $625,000
- Training, software license fees and contingency = $600,000
- New staff - Energy Coach (1 FTE and overhead cost for 4 years) = $450,000
- Estimated City in-kind costs over 4 years (0.5 FTE) = $225,000

Service fees for program delivery were derived from feedback from utilities based on their related program experience, indicating 10% of retrofit projects costs represented by the total value of the loans to homeowners. The loan loss reserve is at the minimum FCM requirement of 5% which is still well above default rates typically associated with these programs in other communities. The Energy Coach position also supports homeowners and coordinates with utilities and contractor networks as a supplement, not a substitute, to the need for involving staff at the utilities.

The total estimated project costs for KHERP start-up, launch and operation during the initial four years is $18.5 million. Most of the total estimated program costs are comprised of the repayable loan portion leaving approximately one-third as non-repayable expenses including in-kind staff time. Participation levels lower than 500 homes during this time as well as lower average loans accessed per homeowner would result in lower financing costs. For example, if the average loan is closer to $20,000 for 500 homes, financing is reduced to $10 million. Alternatively, if only 300 homes access LIC financing through the City, even the higher average of $25,000 per home lowers the repayable loan component to $7.5 million.

It is also possible that some of the non-repayable variable costs such as the loan loss reserve and performance level incentives will not be fully accessed. Lower loan default rates and or lower levels of achievement related to the retrofit performance incentives would both lead to a reduction in these program line items. This would in turn result in decreased overall program start-up, launch and operating costs during the initial four-year phase of the program. A more detailed project budget will be developed as part of preparing the FCM funding application.

4.8 Program uptake and impact projections

An overview of short-term projections of homeowner participation in the program (program uptake) is provided below for the launch and momentum building phase followed by the long-term perspective for scaled ramp-up. Table 11 shows the associated milestones for the initial four years of the program that will be captured within the funding application to the FCM Community Energy Financing program which assumes implementation from the second quarter of 2021 to the first quarter of 2025.

Table 11. Projected Number of Homes Audited and Retrofitted during 2021 - 2024

	3rd party Financing*	LIC Loans	Total	Timelines following Program start-up during Q2/3 2021
Year 1	25 - 50	50 -100	75 - 150	Launch Q4 2021 – Q3 2022
Year 2	50 - 100	100 -150	150 - 250	Q4 2022 – Q3 2023
Year 3	75 - 150	150 -250	225 - 400	Q4 2023 – Q3 2024
TOTALS	**150 - 300**	**300 - 500**	**450 - 800**	Q4 2024 - Evaluate
*Includes on-bill financing or equipment rental from utilities or loans from financial institutions				Q1 2025 – Report and revise program for scale-up phase as needed

The projected environmental impact from this initial program period is estimated to be between 1,350 – 2,400 tonnes based on results in achieved Toronto and Waterloo Region in terms of averaging three tonnes of GHG reductions per home. Even at the upper range of emission reductions, this represents a high cost per tonne of GHG reduction at $2,500 when isolating the non-loan (repayable) portion of program expenses. However, the cost-effectiveness of this mitigation program is expected to dramatically improve as KHERP matures and achieves administrative efficiencies and economies of scale. After a few years of implementation, it will be clearer if some costs can be reduced such as the loan loss reserve and incentives. In addition, typically marketing costs are highest when launching programs compared to once they establish brand awareness within the market over time. Therefore, the total program cost is expected to decline per household retrofitted and per tonne of GHGs reduced as KHERP is incrementally ramped up over time.

In terms of economic impact, 500 LIC home energy retrofits could lead to the creation of 200 - 375 jobs assuming a total of $12.5 million in investment from the LIC loans for

retrofit projects. This job creation estimate is based on a multiplier of 16 - 30 jobs for every $1,000,000 spent on energy efficiency as referenced within the Bridge to the Future: Final Report from the Task Force for a Resilient Recovery published in September 2020.[cii] The job creation number increases when including retrofits completed with third party financing.

Longer-term program uptake and impact projections need to have a more in-depth market-based analysis. This was enabled in-part by the housing stock archetype analysis outlined in section 3.4.1 in the context of the target markets identified in section 4.1. Although the five market segments previously identified have a substantial potential for program implementation, a realistic look at technical and economic feasibility as well as homeowner participation is necessary for projecting full scale-up. The potential uptake and impact of KHERP can be characterized by cascading levels as follows:

- total scope of eligible dwellings as well as their age of construction, which addresses the theoretical potential of the program;
- the technical potential captures the group of homes where impact feasibility is based on additional characteristics of a home's current energy systems; and,
- the economic potential which is more narrowly focussed on where the optimal energy and GHG savings are realistically attainable.

The first level of potential is based on Statistics Canada data captured from the 2016 Census and is focussed on eligible dwellings for financial support from the FCM Community Energy Financing program. Multi-residential dwellings such as mid- and high-rise buildings are not currently eligible under this program but should be considered in the future as KHERP is further scaled-up. About 40% of all residential dwellings in Kingston (about 34,000 of the 59,000 total dwellings) are considered one-family homes namely single detached, semi-attached and row housing. Whereas 70% of one-family homes in Kingston were constructed before 1991 (24,000 homes) which can be considered the theoretical retrofit market potential based on the lower standards within building codes to which these eligible buildings were originally constructed.

The technically feasible potential considers the detailed analysis of housing and energy data, including type of current heating systems in homes, to inform where energy and emissions can be reasonably expected to be significantly reduced. This includes 16,800 eligible homes which would take about 25 - 30 years to retrofit and potentially leading to a reduction of over 33,000 tonnes in annual GHG emissions at an average of two tonnes per home. This average GHG reduction includes homes where there is less potential for emission reductions such as electrically heated homes.

The economic potential, a subset of the technical potential, primarily focusses on the archetypical homes that have the most opportunity for cost-effective reduction in emissions, energy consumption and utility bills. These are largely the homes that could cost-effectively switch from the more expensive fossil fuels (fuel oil and propane) to electric space and water heating or the oldest natural gas homes that could benefit from more efficient furnaces and improvements to the relatively low building envelope ratings. With this economic lens, it is recognized that since natural gas is much cheaper per GJ of energy, homes using this fossil fuel may consider efficiency upgrades but not switching to an energy source that could significantly increase their utility bills.

From this economic perspective, the potential impact of implementing KHERP would reach over 6,100 homes while potentially reducing homeowner energy costs from 10 - 50%. This more conservative estimate of program uptake and impact could be achieved over the next 12-15 years, leading to annual GHG reductions of over 18,000 tonnes which equates to approximately 11% of residential sector emissions of 2018 annual community emissions. This cascading estimate of program scope, focus and potential market size is illustrated in the following diagram:

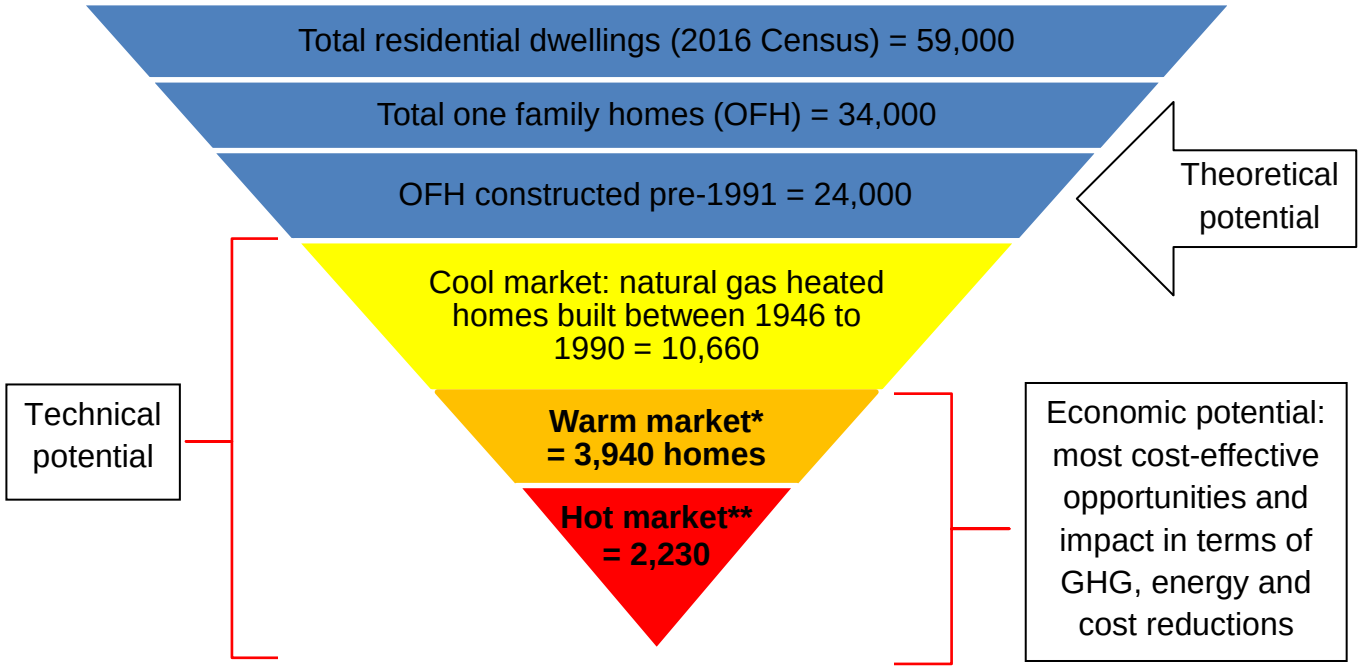


Figure 17. Market size analysis based on program value proposition and impact

****** Hot market (red): represents unaudited one-family homes with oil or propane heating which provide the best opportunity for reductions in GHG emissions, energy and costs.

*Warm market (orange): represents the oldest unaudited one-family homes that are heated with electricity or natural gas that provide an opportunity for moderate reductions in energy, costs and GHG emissions

The number of homes within the technical potential segments of figure 17 refer to homes where no energy audits were identified within the NRCAN EnerGuide database for the past 10-15 years. This group of homes represents by 9 of the 12 identified archetypes. The economic potential group captures 7 archetypes and considers the cost-effectiveness of retrofits and the potential for homeowner participation considering their current utility costs.

Different market penetration rates were also considered as not every home identified in the target archetype homes will participate in KHERP. Based on a 65% participation rate from homes that stand to reduce the most GHGs and energy costs ("hot markets"), 45% of the warm market and 25% participation of the cool market housing archetypes, approximately 5,900 homes may be successfully retrofitted through KHERP. This increases to over 6,100 homes if program participation includes 25% of hot market homes already audited in the past and 10% of previous audited homes within the warm and cool market groups.

A more modest uptake level was also considered with 50% program uptake in the hot market, 25% from the warm market and 10% from the cool market which results in under 3,200 homes retrofitted under KHERP including a portion of previously audited homes. These scenarios are shown in Appendix J.

Using a target figure of 6,100 homes retrofitted over 12-15 years, table 12 shows long-term implementation projections using two different uptake scenarios. This includes an incremental ramp-up of the number of retrofits completed in the early years to allow promotional momentum to build residential awareness of the program as well as the labour capacity to be progressively established through training and recruitment of skilled contractors and energy auditors.

There is additional program potential in terms of engaging remaining hot and warm market prospects as well as the cool market homes where the value proposition is expected to increase over time due to higher costs of natural gas and carbon. Potentially, any age of home will be eligible for KHERP, but the minimum GHG emission and energy reduction thresholds for program applicants to receive LIC financing and applicable incentives will be most attainable by older homes. This is supported by the existing energy audit data for the Kingston area.

Table 12. Retrofit Projections for KHERP Implementation

Program Year	LIC Loan	3rd Party Financing	Annual Retrofits	Cumulative Retrofits	Timeline Start
1	50 -100	25 - 50	75 - 150	75 - 150	Fall 2021
2	100 - 150	50 - 100	150 - 250	225 - 400	Fall 2022
3	150 - 250	75 - 150	225 - 400	450 - 800	Fall 2023
4	0	150 - 300	150 - 300	600 - 1100	Fall 2024
5	0	250 - 400	250 - 400	850 - 1500	Fall 2025
6	0	350 - 500	350 - 500	1200 - 2000	Fall 2026
7	0	450 - 600	450 - 600	1650 - 2600	Fall 2027
8	0	550 - 700	550 - 700	2200 - 3300	Fall 2028
9	0	650 - 800	650 - 800	2850 - 4100	Fall 2029
10	0	750 - 900	750 - 900	3600 - 5000	Fall 2030
11	0	550	550	4150 - 5550	Fall 2031
12	0	550	550	4700 - 6100	Fall 2032
13	0	500	500	5200 - *max*	Fall 2033
14	0	450	450	5650 - *max*	Fall 2034
15	0	450	450	6100 - *max*	Fall 2035

4.9 Risk Management

KHERP has the potential to alleviate many of the issues identified in the local residential survey responses through the coordinated provision of financial and technical support. The program design also considers barriers identified by other municipal retrofit programs as outlined in section 2. However, there are several risks that will need to be managed to achieve success in meeting the KHERP program goals and objectives. There are four main categories of risks that have been identified as follows:

- Financial: Loan defaults, potential impact on home resale from LIC liens
- Market risk: Lack of program uptake by homeowners or, inversely, escalation of market pricing due to high demand of related labour and equipment
- Human resources: Lack of qualified and/or available contractors and energy auditors in the area labour pool
- Technical: malfunctioning equipment leading to energy savings not realized

The potential impact for each of these risks are briefly examined here as well as probability where possible. Measures to decrease the probability and mitigate potential impacts are also included in summary form.

4.9.1 Financial Risks

Various stakeholders involved in providing financing for retrofits may have concerns about the risks associated with defaults on loan payments. These stakeholders include program administrators, mortgage lending agencies and other third parties such as financial institutions who provide loans for home improvements or utilities who may provide on-bill financing for specific equipment.

Generally, the concern is about lost revenues or added program costs from missed or default payments or if a property goes to a tax sale. LIC loans attached to the property tax roll exercise priority liens in the case of a tax sale, but only the payments in arrears are collected. Mortgage lender engagement is recommended for LIC financing where the mortgagor is not the retrofit financer. It is noteworthy that there is no evidence to date that indicates an increase in mortgage default rates on homes participating in LIC programs. [ciii]

Experience to date shows that these types of property assessed loan programs have a history of very low default rates in the US - lower than for mortgages and property taxes.[civ] For example, the state of California has had a $10M Loan Loss Reserve (LLR) in place for their home retrofit program since 2013 to mitigate potential losses resulting from their program. To date, no claims have been made against the reserve even with $3.6 billion in loans issued.[cv] However, establishing an LLR can help de-risk the

lending and therefore may justify the provision of lower interest rates and involvement of 3rd party lenders and private capital needed for long-term scale-up of the program.

In order to reduce the probability of loan defaults, it will be prudent to have the program application process potentially include credit checks and a historical analysis to ensure there are no arrears on property tax or utility bill payments as evidence of the credit worthiness of the applicant. Some retrofit programs have also placed limits on the amount of the loans available for retrofits such as 10% of the house value or a debt-to-income ratio to help keep loans at more manageable levels considering the homeowner income levels are sufficient to cover debt payments.[cvi] Other methods to contain the amount of the loan used for retrofits is provided by offering other options such as equipment rentals through program partners and incentives to lower project costs.

In terms of impacts on home sales, although the new homeowner would benefit from the energy savings achieved with the retrofits, the lien attached to the property may be perceived as a disincentive to attracting prospective purchasers. Flexibility within the repayment plan for programs will need to enable homeowners who choose to pay off the LIC loan in full at any time particularly if they intend to sell their home. This could simply be included by the seller as a condition where the LIC loan would be paid off by the homeowner selling the property upon their acceptance of a purchase offer. It is also noteworthy that research has shown there can be an increase in resale value with residential buildings that contain energy and environmental performance features.[cvii]

There is a temporary risk or constraint for the homeowner as they commit to retrofit projects with contractors who may often require a deposit upfront. This has created a need for bridge financing between receipt of the full loan amount from the municipality and when a deposit payment is required by contractors. While some homeowners may have access to funds to cover project deposits, it may be beneficial to allow for an early disbursement of a portion of the retrofit loan before they are completed to alleviate this temporary financial constraint. For example, 30% of the retrofit cost could potentially be provided upfront where contractors require an initial installment payment.

Flexibility in program financing will have to accommodate the need for contractors and auditors to be paid in a timely manner as past energy efficiency and conservation incentive programs have involved long transaction delays which deter program participation by these critical stakeholders. Establishing project cost maximums should also be considered to prevent contractors from artificially elevating prices as has been seen by utilities in delivering these programs in the past. Utilizing pre-qualified contractors who accept program terms and conditions considering the issues may help solve some of these challenges moving forward.

4.9.2 Market risk

Canadian loan-based home retrofit programs have not yet achieved the volume of uptake experienced in the U.S. where the market has had longer to mature and includes widespread support from state legislation as well as private sector involvement. In general, Canadian loan-based residential retrofit programs to date have not exceeded 50 retrofits per year on average which indicates a market resistance perhaps pertaining to other risks acknowledged within this section. This is excluding the exceptional case of the early success achieved within Halifax's Solar City program.

The risk of KHERP not successfully engaging enough participants to sustain a long-term program can be in part lowered by sound program design that address know barriers. Marketing approaches have become more sophisticated using social media tools and digital market intelligence which can build on the lessons learned from earlier pioneers of home retrofit programs in other municipalities. While it is difficult to assess the probability of low program uptake, the involvement of area utility providers and other marketing channel partners can potentially improve participation rates. Furthermore, the inclusion of a multi-layered education and outreach program, as outlined in section 4.2, will help drive demand.

The historical count of pre and post retrofit energy audits in Kingston included within in section 3.4.1 showed an average of almost 350 retrofits completed annually since 2007 which were largely influenced by the availability of incentives and rebates. The audit data obtained for the home archetype analysis indicates an even higher annual number of retrofits achieved. The added complexity of using financing does bring in issues such as homeowner debt capacity and emphasizes the need for energy savings to match or exceed borrowing costs. However, projected participation rates in KHERP are relatively conservative when comparing to similar programs currently under development in other municipalities.

On the other hand, if demand outstrips supply, it could cause elevated costs for labour and/or equipment. As demand is stimulated incrementally by KHERP, relationships can be established with the supply chain for related retrofit products and equipment. Economies of scale and security of supply may also be realized through buying some common items in bulk volume to help keep costs stable for participating homeowners particularly if incentives are phased out over time.

Development of the final marketing and outreach plan in collaboration with identified stakeholders will be critical to ensure effective engagement of the target markets. This will need to be balanced with the allowance of the local labour pool to be developed to meet the increased demand as addressed in the next sub-section.

4.9.3 Human Resource Risk

In any venture involving consumers, there is a risk of demand outstripping the supply of goods or services as marketed or hinder sustained consumer interest significantly – a risk known in business as the paradox of success. If marketing efforts are so successful, consumer interest in the program could exceed the labour pool capacity to conduct the audits and complete the retrofits. This can result in damaging the reputation of the program and ultimately impair reaching the implementation targets. This is a possible outcome given the increase in home improvement projects since the pandemic was declared in March 2020.[cviii] Yet even prior to this, there was acknowledgement in late 2019 of the need to recruit more trades professionals to address a shortage in skilled workers from retirements within a provincial funding announcement for associated training.[cix]

It will be important to collaborate with St. Lawrence College and other training institutions to provide apprenticeship and related opportunities to incrementally grow the skilled trade workforce. In addition, working through pre-qualified contractor networks of channel partners and encouraging membership in related trades associations will help ensure homeowners regarding the quality of workmanship associated with the retrofits performed on their home. KHERP will also include a dispute resolution process to protect the reputation of the program which is important for consumer confidence. As the program aims to stimulate a market transformation over the long-term, potentially over-time, more skilled tradespeople will be attracted to the Kingston area to fill the incremental growth in demand for related services.

During the period where partnerships are formally established and the administrative structure is developed leading into program launch, it will be important to incrementally build implementation capacity to meet demand. For example, it may be prudent to be more strategic rather than aggressive in planning marketing of the retrofit program in the initial months to allow for testing of systems, tools and approaches. This can be achieved by using soft launches or beta testing within certain target neighbourhoods to help avoid newly established administrative systems and contractors getting overwhelmed with new demand. Staging soft launches will help manage program demand so that it does not outstrip the availability of program services, which is important to avoid negative experiences for homeowners including extended wait times for getting application or financing approvals as well as delays in completing retrofit projects. This approach simultaneously allows program capacity to be progressively developed while providing administrators an opportunity to address any problematic issues causing delays in the retrofit process prior to a full city-wide launch

4.9.4 Technical Risks

Many retrofits will include several different energy efficiency upgrades and installations with the intent of lowering overall energy use and emissions. However, if these energy savings are not achieved, participating homeowners will be justifiably concerned given the time, expense, and inconvenience of proceeding with the retrofits.

Assuming equipment and other measures such as insulation were installed properly, as quality of workmanship was already discussed above regarding the availability of skilled workers, the probability of a mechanical system such as an air sourced heat pump not working properly are likely quite low. In the case of equipment malfunctions, extended warranties and maintenance packages may be a worthwhile consideration for the homeowner and could be considered an eligible cost of the program. In practice, this means that one year of maintenance and initial equipment commissioning would be incorporated into KHERP financing to minimize risk of retrofit performance failure.

Commissioning of new equipment is an additional step to help ensure the more complex equipment is working as expected following installation. The Home Energy Coach will also be able to assist participating homeowners choose the right package of retrofits such as improving the building envelope which is necessary to optimize the effectiveness of any heating system as an example. These risk management measures will be more fully explored with program and channel partners when the retrofit program is fully established in 2021.

In addition to the risk mitigation approaches outlined above, the following list summarizes how each element of the program addresses the potential barriers to homeowners implementing energy retrofits as identified in section 2:

- Affordability of upfront retrofit costs – low-interest financing for up to 20 years;
- Duration of the business case for retrofits in relation to residents' ownership of the home – transferrable lien and incentives to improve the business case;
- Level of homeowner understanding of energy efficiency and conservation opportunities and benefits – Subsidized energy audits, Energy Coach, mobile apps to support decision-making process
- Concerns from mortgage lenders or third-party financiers – loan loss reserve
- Having an adequately sized, engaged and skilled local workforce – partnerships with colleges, training of tradespeople, engagement of utility contractor networks
- Participation of low-income households – use of KHERP and other income-dependent incentives, Energy Coach (retrofit plans) and equipment rentals

5.0 MONITORING, EVALUATION AND CONTINUOUS IMPROVEMENT

In order to measure progress of program implementation against the program goal and objectives, the following key progress indicators (KPIs) are proposed to be monitored:

Output indicators:

- Number of home energy assessments completed as part of retrofit program
- Total GHG (Tonnes) and energy reduction opportunities (GJ) identified within the assessments
- Financing allocated to retrofit projects (Total $)
- Number of contractors and auditors trained to support KHERP

Outcome indicators:

- % of household energy (GJ) and GHG emissions (Tonnes) reduced via retrofits on average per home
- Total CO2e (Tonnes) reduced per year for all program participants
- Ratio of incentive cost vs. cumulative GHG reduction during life of equipment ($/Tonne)
- Average annual utility cost savings per household ($)
- Savings to Investment Ratio (SIR) of retrofits implemented ($ invested: $ of all energy related savings including capital cost avoidance for longer lasting equipment)
- Total dollars invested in retrofits ($)
- High level of customer satisfaction with service (through survey)
- Loan defaults/arrears (% of the number of loans and total $ borrowed)

These progress indicators can be linked to the drivers of performance in a simplified program Logic Model as illustrated in Appendix K. After the initial three-year period of implementing retrofits, an evaluation of KHERP will be conducted using the KPI's to help enable continuous improvement of the program. Revisions in programming and retrofit targets will be considered to continue KHERP's scale-up over the long-term with a focus on the following improvements:

- Program impact such as the quantity of energy and emissions reduced as well as qualitative measures pertaining to the level of customer satisfaction;
- Uptake or participation levels such as the number of retrofits completed compared homes engaged through different marketing approaches;
- Effective use of resources which refers to the KPIs addressing $/Tonne GHG reduced and low loan default rates as examples; and,

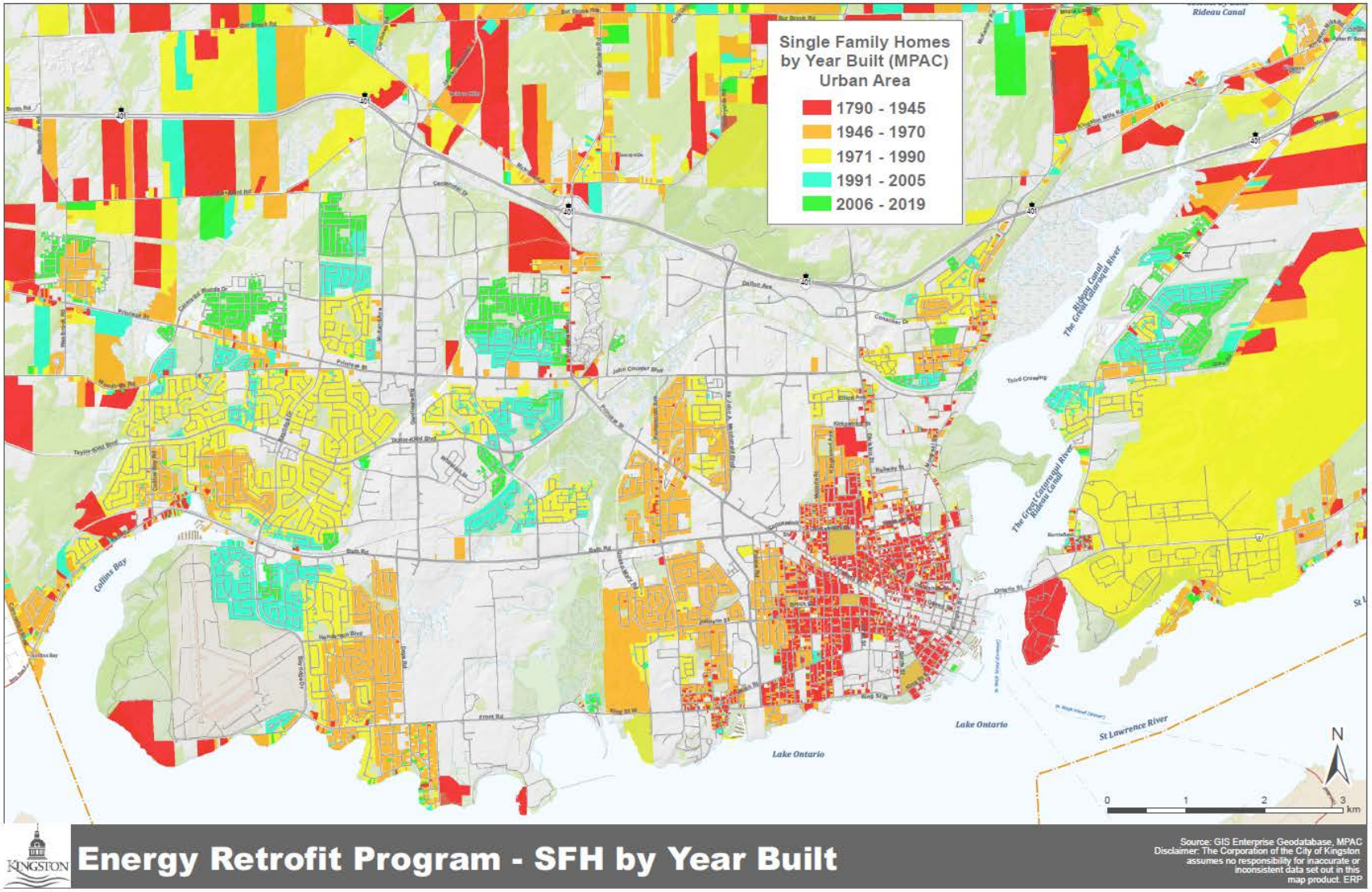
- Financial sustainability of the program including managing administration costs and utilizing alternative sources of sustainable and competitive financing.

Following the first few years of KHERP that could potentially have FCM funding support, different funding models will need to be considered to achieve long-term targets regarding the scaled impact of the program. This could include adding an administrative fee for each retrofit application, adding an interest rate rider to the LIC loan as well as accessing alternative sources of financing for the loans such as Canadian Infrastructure Bank, Infrastructure Ontario, Municipal debentures and exploring the possibility of the private sector taking on full program responsibility as has occurred in the U.S..[cx]

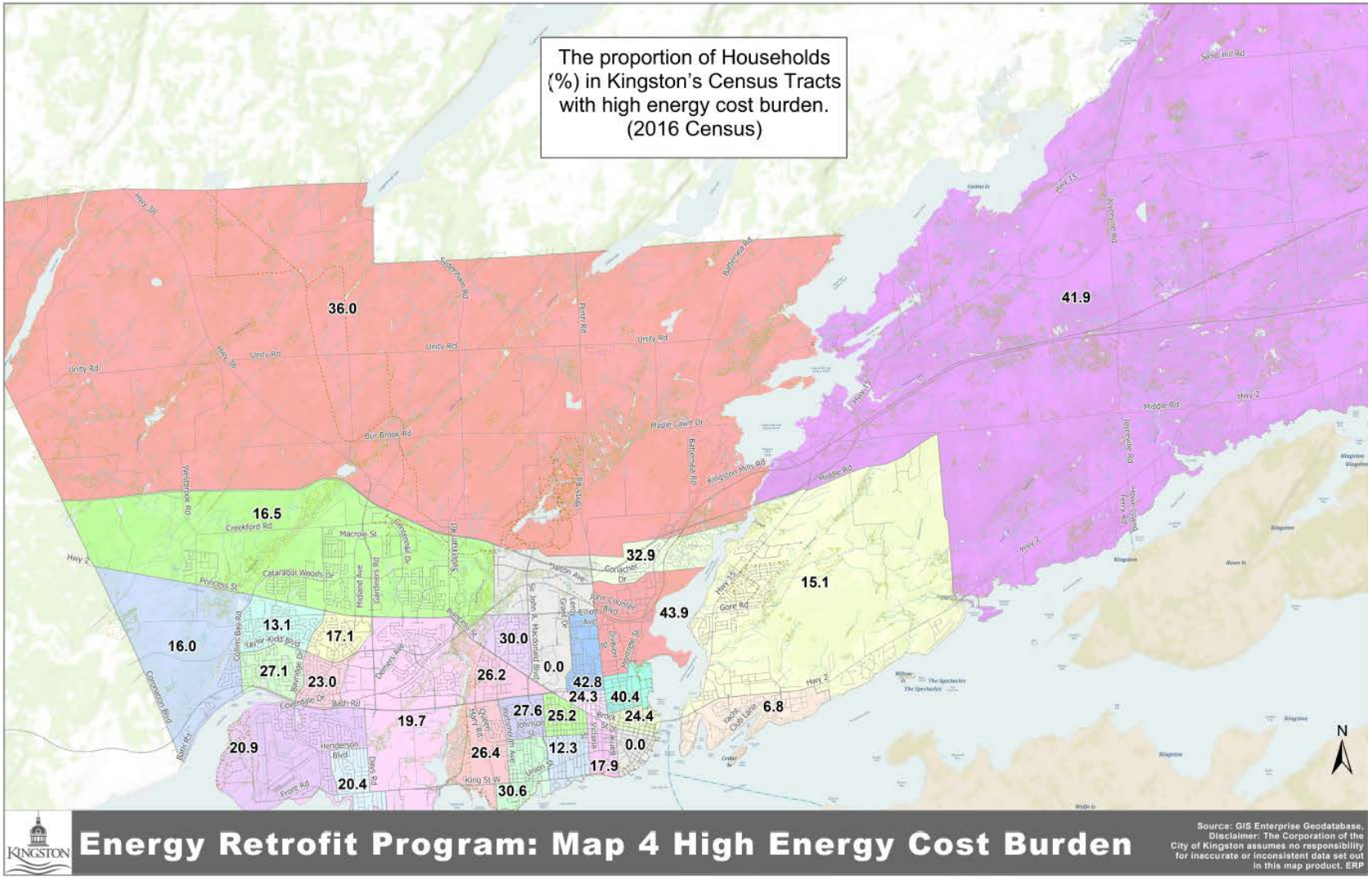
Consideration of expanding the program scope may occur following the initial KHERP launch and ramp-up stages as part of implementing the Climate Leadership Plan which will be completed in late 2021. Scope expansions could include multi-residential and commercial buildings, adding more water conservation and waste reduction measures as well as resiliency improvements that reduce climate risk within the community from changing climate conditions. Multi-residential buildings reached with Toronto's High-rise Retrofit Improvement Support Program showed a higher level of program uptake per household and total emission reductions compared to their single-family Home Energy Loan Program, although with lower energy and GHG reductions per household.[cxi] Retrofits in multi-residential apartment buildings in Kingston would also enable renters to benefit from the energy savings achieved by the program.

City staff will also continue to share lessons learned with other municipalities as part of a broader community of practice that exists amongst local government agencies. This has been facilitated in the past by organizations such as the Clean Air Partnership, FCM IESO and QUEST. The ongoing support from these organizations enables municipalities to continue the collaboration on determining how to effectively develop and deliver retrofit programs intended for the existing housing stock.

APPENDIX A - Location of Homes by Age of Construction



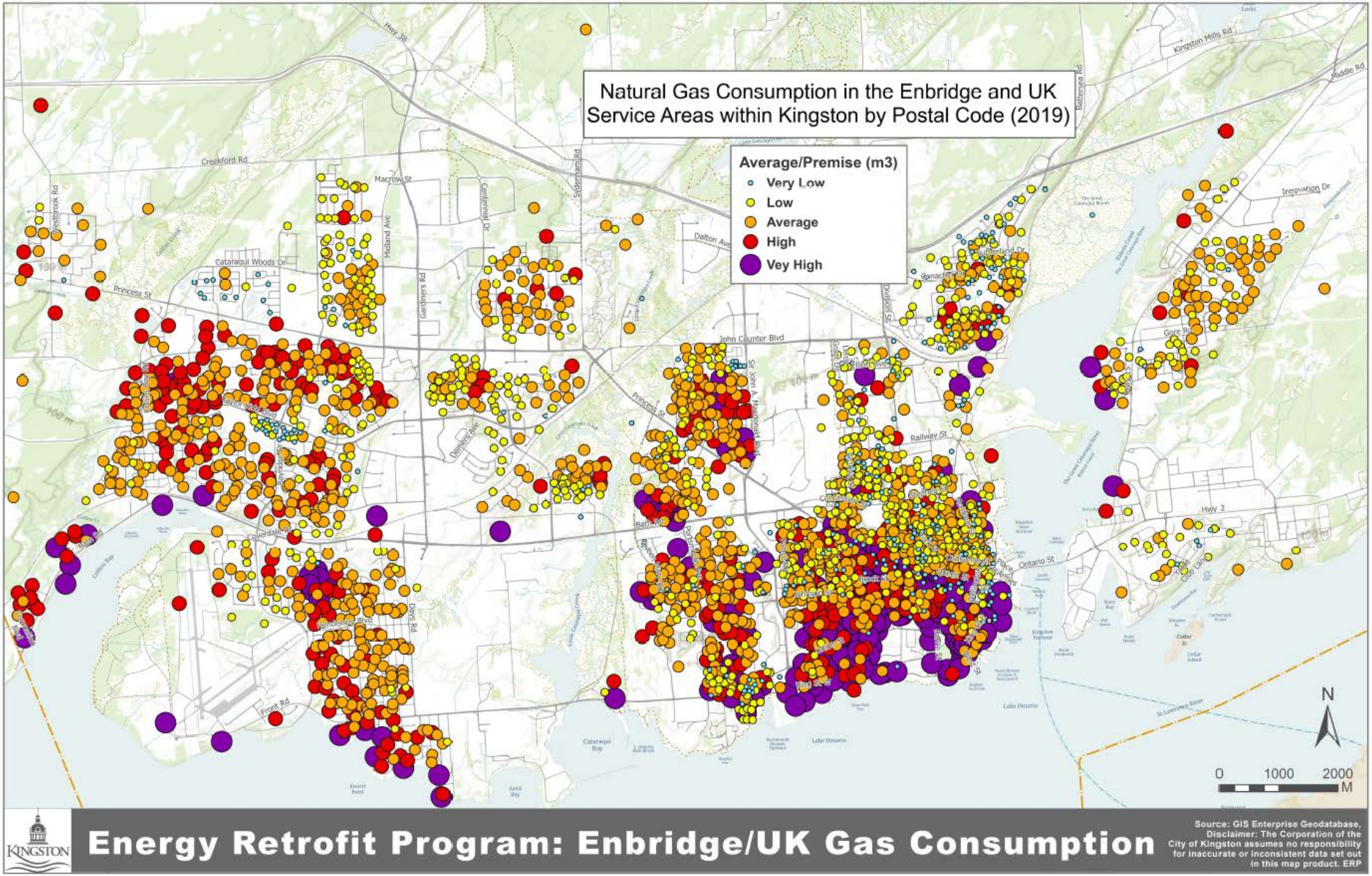
APPENDIX B - Census Tracts with A High Energy Cost Burden Within Kingston.

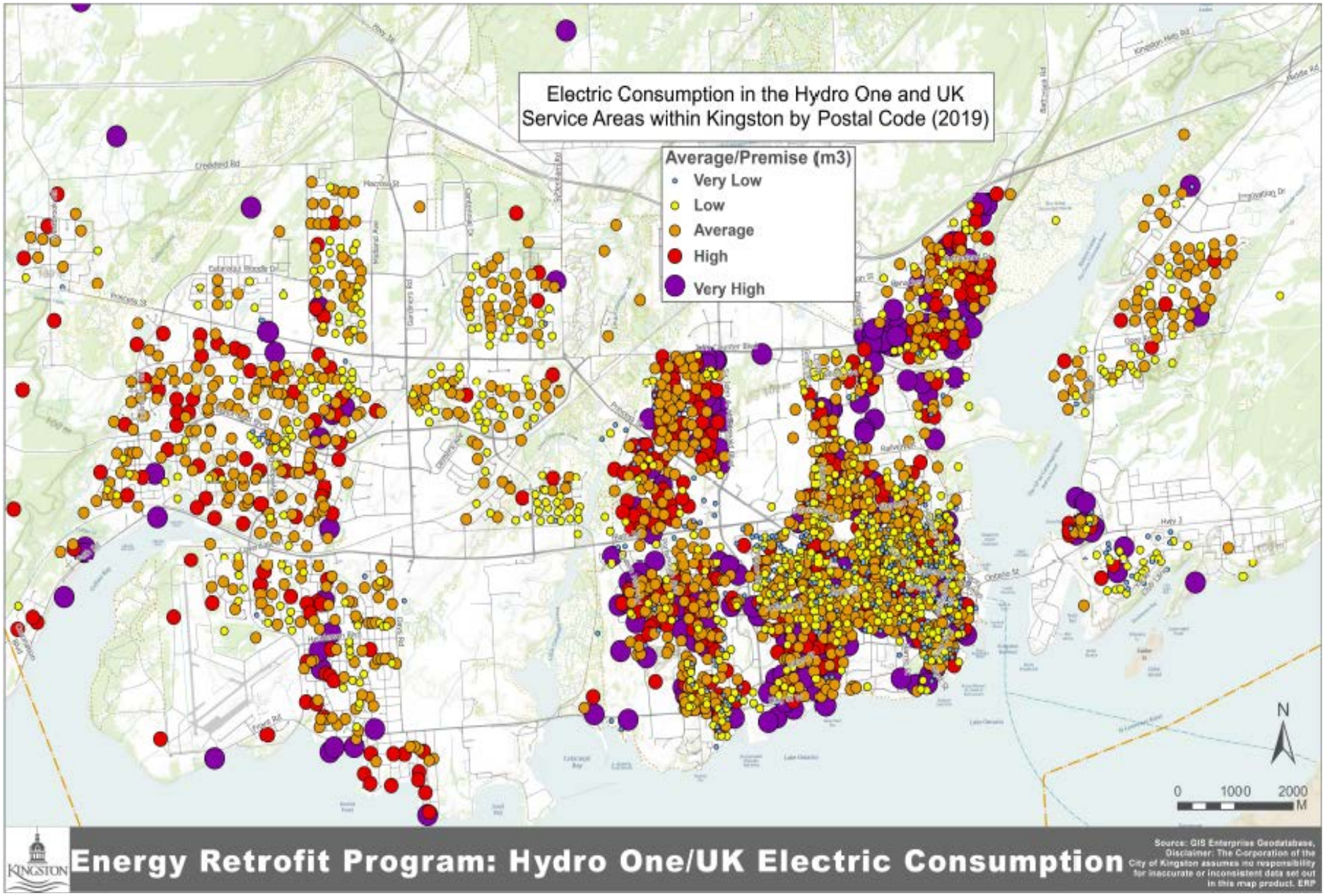


APPENDIX C - Summary Attributes of Other Retrofit Programs in North America [cxii]

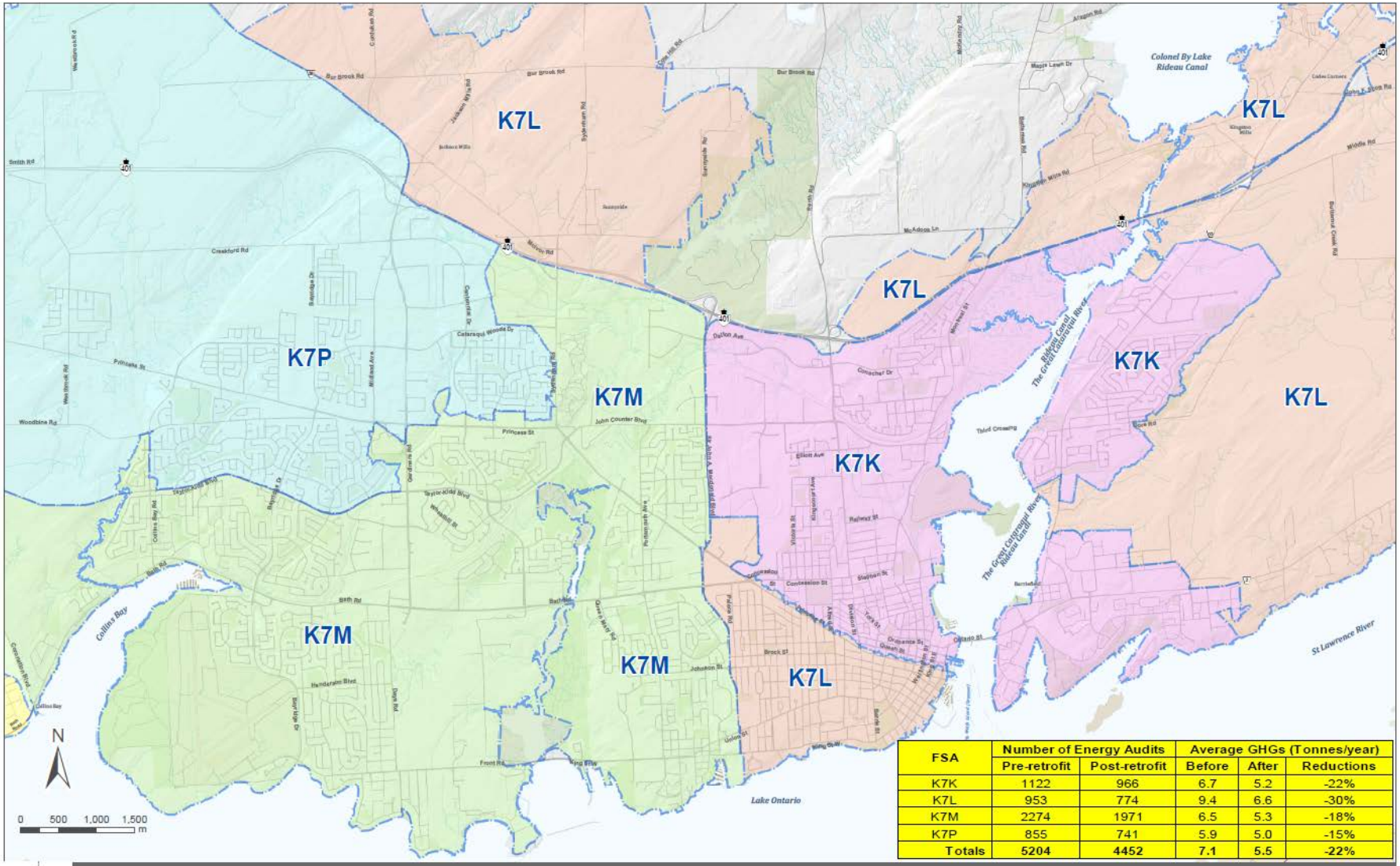
	Toronto HELP program (Ontario)	**Clean Energy Financing program (Nova Scotia)**	**Town of Berwick (Nova Scotia)**	**My Energy Improvement Plan (Nova Scotia)**	**Halifax Solar City Program (Nova Scotia)**	**Quebec [Inactive]**	**US HERO** (California, Missouri, Florida)
Max financing (% home value or $)	10% up to $75K	$10K-$20K	15%	$10K	75%	$10K-$20K	≤ 15-20%
Interest rate	3.7-4.3%	4-4.18%	4%	3.7-3.95%	4.75%	1%	2.75-8.35%
Term (years)	5-20	10	10	10	10	≤20	5-30
Admin/application fees	2% +	$550	5%	$199		$72.46	varies
Early payoff option	✔	✔	✔	✔	✔	✔	✔
Mortgage lender approval	✔	✘	✘	✔	✘	✘	varies
Home energy audit	✔	✔	✘	✔	N/A	✔	✘
Contractor payor	homeowner	PDA	town	PDA		homeowner	PDA
Pre-qualified contractors	✘	✘	✔	✘	✘	✘	✔
List of approved retrofits	✘	✘	✔	✘	✔	✘	✔
Administrator type	Municipality	Non-profit	Municipality/ Private company	Non-profit	Municipality	Non-profit	Private company
Budget surpluses for financing	✔	✔	✔			✔	✘
Other financing sources	Green bonds	loans				grant	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	$7,000 - $10,000	$6000	$8,000		$13,000	$19,000
Overall program budget	$2.7 million	40 projects/year		10 projects/year		$500,000	$3 billion
Average energy reduction	30%					29%	

APPENDIX D - Average Energy Use per Home by Postal Code – Kingston 2019




Electric Consumption in the Hydro One and UK Service Areas within Kingston by Postal Code (2019)
Average/Premise (m3)
Very Low
Low
Average
High
Very High
N
0
1000
2000
M
KINGSTON
Energy Retrofit Program: Hydro One/UK Electric Consumption
Source: GIS Enterprise Geodatabase.
Disclaimer: The Corporation of the City of Kingston assumes no responsibility for inaccurate or inconsistent data set out in this map product. ERP

APPENDIX E - Home Energy Retrofits Completed in Kingston by FSA: 2007 – 2020 [cxiii]



FSA	Number of Energy Audits		Average GHGs (Tonnes/year)		
	Pre-retrofit	Post-retrofit	Before	After	Reductions
K7K	1122	966	6.7	5.2	-22%
K7L	953	774	9.4	6.6	-30%
K7M	2274	1971	6.5	5.3	-18%
K7P	855	741	5.9	5.0	-15%
Totals	5204	4452	7.1	5.5	-22%

Energy Retrofit Program - Energuide history in Kingston

Source: GIS Enterprise Geodatabase, MPAC
Green Communities Canada, EnerGuide
Disclaimer: The Corporation of the City of Kingston assumes no responsibility for inaccurate or inconsistent data set out in this map product. ERP

APPENDIX F - Archetypes for Single Family Residential Buildings

Archetype A

01

Multi-storey homes, built between 1790 and 1945. These homes are natural gas heated with moderate efficiency furnaces and natural gas hot water systems. They have poor insulation in the ceiling, walls and foundation and a poor air tightness rating.

Average annual electricity costs:	$1,355
Average annual natural gas costs:	$1,049
Average annual energy costs:	**$2,403**

Client Implications:

These homes consume **154 GJ** (0.73GJ/m2) of natural gas and electricity on average and produce **6.27 tCO2e** (0.030 tCO2e/m2) on average. They represent **10.9% of the housing stock** and 14.8% of dwellings that have been audited in the City of Kingston

Variable	Archetype A
Vintage	1790-1945
Floor Area (m2)	209.2
Primary Heat Source	Condensing Furnace
Primary Fuel Type	Natural Gas
Primary Efficiency (%)	87.6
Heat Pump	No
Hot Water System	Conventional Tank
Hot Water Fuel Type	Natural Gas
Hot Water Energy Factor	0.68
Ventilation Type	None
Ceiling Insulation (RSI)	3.33
Wall Insulation (RSI)	1.53
Foundation Insulation (RSI)	0.99
Windows (RSI)	0.37
Doors (RSI)	0.39
Number of Windows	18
Number of Doors	3
Electricity Consumption (GJ)	38.1 GJ (10583.6 kWh)
Natural Gas Consumption	115.4 GJ (3,093.7 m3)
Energy Score (GJ)	153.5
Carbon Score (tCO2e)	6.27
Air Tightness (ACH50P)	9.12

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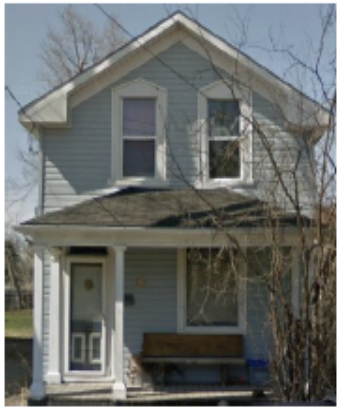
Archetype B

02



Multi-storey homes, built between 1946 and 1970. These homes are Natural Gas heated with moderately efficient natural gas furnaces and hot water systems. They have slightly better levels of insulation in the ceilings and foundation but worse wall insulation than the Archetype A dwellings.

Average annual electricity costs:	$1,307
Average annual natural gas costs:	$794
Average annual energy costs:	**$2,100**

Client Implications:

These homes consume **123 GJ** (0.60 GJ/m2) of natural gas and electricity and produce **4.75 tCO2e** (0.023 tCO2e/m2) on average. They represent **18.8% of the housing stock** and 31.3% of dwellings that have been audited in the City of Kingston.

Variable	Archetype B
Vintage	1946-1970
Floor Area (m2)	204.2
Primary Heat Source	Condensing Furnace
Primary Fuel Type	Natural Gas
Primary Efficiency (%)	88.9
Heat Pump	No
Hot Water System	Conventional Tank
Hot Water Fuel Type	Natural Gas
Hot Water Energy Factor	0.66
Ventilation Type	None
Ceiling Insulation (RSI)	4.09
Wall Insulation (RSI)	1.11
Foundation Insulation (RSI)	1.91
Windows (RSI)	0.38
Doors (RSI)	0.59
Number of Windows	16
Number of Doors	3
Electricity Consumption (GJ)	36.7 GJ (10208.2 kWh)
Natural Gas Consumption	86.2 GJ (2,311.6 m3)
Energy Score (GJ)	123.0
Carbon Score (tCO2e)	4.75
Air Tightness (ACH50P)	6.04

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Archetype C

03

Small single to 1.5 storey homes, built between 1971 and 1990. These homes are natural gas heated with moderate efficiency furnaces and conventional natural gas hot water systems. They have moderate levels of insulation in the ceiling, walls and foundation.

Average annual electricity costs:	$1,234
Average annual natural gas costs:	$854
Average annual energy costs:	**$2,087**

Client Implications:

These homes consume **128 GJ** (0.52 GJ/m2) of natural gas and electricity and produce **5.09tCO2e** (0.021 tCO2e/m2) on average. They **represent 27.5% of the housing stock** and **34.3% of dwellings that have been audited** in the City of Kingston.

Variable	Archetype C
Decade Built	1971-1990
Floor Area (m2)	246.9
Primary Heat Source	Condensing Furnace
Primary Fuel Type	Natural Gas
Primary Efficiency (%)	89.6
Heat Pump	No
Hot Water System	Conventional Tank
Hot Water Fuel Type	Natural Gas
Hot Water Energy Factor	0.61
Ventilation Type	None
Ceiling Insulation (RSI)	4.64
Wall Insulation (RSI)	2.17
Foundation Insulation (RSI)	1.52
Windows (RSI)	0.37
Doors (RSI)	0.70
Number of Windows	16
Number of Doors	3
Electricity Consumption (GJ)	34.7 GJ (9,638.5 kWh)
Natural Gas Consumption (GJ)	93.1 GJ (2,495.6 m3)
Energy Score (GJ)	127.8
Carbon Score (tCO2e)	5.09
Air Tightness (ACH50P)	4.55

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Archetype D

04

Small single to 1.5 storey homes, built between 1991 and 2005. These homes are natural gas heated with moderate efficiency furnaces and conventional natural gas hot water systems. They have moderate levels of insulation in the ceiling, walls and foundation.

Average annual electricity costs: $1,178
Average annual natural gas costs: $ 797
Average annual energy costs: $1,975

Client Implications:

These homes consume **120 GJ** (0.46 GJ/m2) of natural gas and electricity and produce **4.74 tCO2e** (0.018 tCO2e/m2) on average. They **represent 15.2% of the housing stock** and **9.7% of dwellings that have been audited** in the City of Kingston.

Variable	Archetype D
Decade Built	1991-2005
Floor Area (m2)	263.1
Primary Heat Source	Condensing Furnace
Primary Fuel Type	Natural Gas
Primary Efficiency (%)	92.5
Heat Pump	No
Hot Water System	Induced Draft Fan
Hot Water Fuel Type	Natural Gas
Hot Water Energy Factor	0.63
Ventilation Type	Heat Recovery Ventilator
Ceiling Insulation (RSI)	5.23
Wall Insulation (RSI)	2.50
Foundation Insulation (RSI)	1.84
Windows (RSI)	0.37
Doors (RSI)	0.74
Number of Windows	18
Number of Doors	3
Electricity Consumption (GJ)	33.1 GJ (9,203.0 kWh)
Natural Gas Consumption	86.6 GJ (2,322.4 m3)
Energy Score (GJ)	119.8
Carbon Score (tCO2e)	4.74
Air Tightness (ACH50P)	3.04

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Archetype E

05

Large multi- storey homes, built between 2006 and 2019. These homes are natural gas heated with high efficiency furnaces and conventional natural gas hot water systems. They have good levels of insulation in the ceiling, walls and foundation with best in class air tightness.

Average annual electricity costs:	$1,219
Average annual natural gas costs:	$776
Average annual energy costs:	**$1,995**

Client Implications:

These homes consume **118 GJ** (0.39 GJ/m2) of natural gas and electricity and produce **4.62 tCO2e** (0.015 tCO2e/m2) on average. They **represent 13.0% of the housing stock** and **0.4% of dwellings that have been audited** in the City of Kingston.

Variable	Archetype E
Decade Built	2006-2019
Floor Area (m2)	300
Primary Heat Source	Condensing Furnace
Primary Fuel Type	Natural Gas
Primary Efficiency (%)	94.1
Heat Pump	No
Hot Water System	Induced Draft Fan
Hot Water Fuel Type	Natural Gas
Hot Water Energy Factor	0.64
Ventilation Type	Heat Recovery Ventilator
Ceiling Insulation (RSI)	6.36
Wall Insulation (RSI)	2.86
Foundation Insulation (RSI)	1.90
Windows (RSI)	0.40
Doors (RSI)	1.06
Number of Windows	18
Number of Doors	3
Electricity Consumption (GJ)	34.3 GJ (9,522.8 kWh)
Natural Gas Consumption (GJ)	84.2 GJ (2,256.1 m3)
Energy Score (GJ)	118.4
Carbon Score (tCO2e)	4.62
Air Tightness (ACH50P)	2.20

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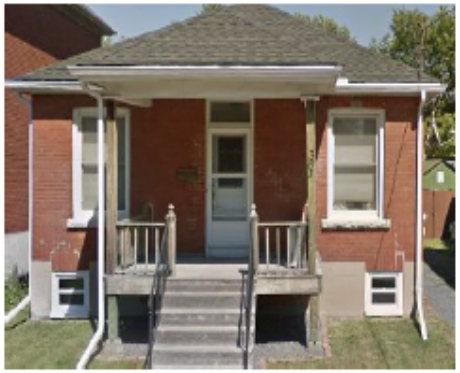
Archetype F

06



Single to 1.5 storey homes, built between 1790 and 1945. These homes are electrically heated with high efficiency baseboards/hydronic/plenum and electric conventional tank hot water systems. They have poor levels of insulation in the ceiling, walls and are the leakiest in terms of air tightness.

Average annual electricity costs:	$4,067
Average annual natural gas costs:	$0
Average annual energy costs:	**$4,067**

Client Implications:

These homes consume **114 GJ** (0.49 GJ/m2) of electricity but produce only **0.92 tCO2e** (0.004 tCO2e/m2) on average. They represent **1.3% of the housing stock** and **1.0% of dwellings that have been audited** in the City of Kingston

Variable	Archetype F
Decade Built	1790-1945
Floor Area (m2)	231.3
Primary Heat Source	Baseboard/Hydronic/Plenum
Primary Fuel Type	Electricity
Primary Efficiency (%)	96.6
Heat Pump	No
Hot Water System	Conventional Tank
Hot Water Fuel Type	Electricity
Hot Water Energy Factor	0.72
Ventilation Type	None
Ceiling Insulation (RSI)	3.17
Wall Insulation (RSI)	1.53
Foundation Insulation (RSI)	1.16
Windows (RSI)	0.36
Doors (RSI)	0.39
Number of Windows	19
Number of Doors	3
Electricity Consumption (GJ)	114.4 GJ (31,776.1kWh)
Natural Gas Consumption (GJ)	0.00
Energy Score (GJ)	114.4
Carbon Score (tCO2e)	0.92
Air Tightness (ACH50P)	9.59

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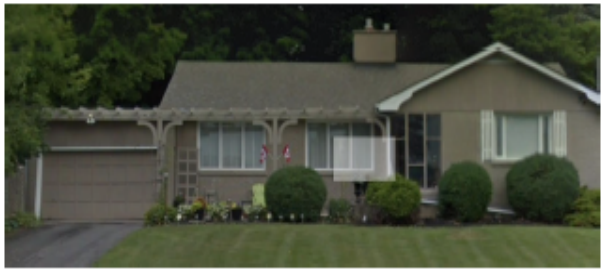
Archetype G

07



Single to 1.5 storey homes, built between 1946 and 1990. These homes are electrically heated with high efficiency baseboards/hydronic/plenum and electric conventional tank hot water systems. They have moderate levels of insulation in the ceiling, walls and foundations.

Average annual electricity costs: $3,432
Average annual energy costs: $3,432

Client Implications:
These homes consume **97 GJ** (0.35 GJ/m2) of electricity and produce only **0.78tCO2e** (0.003 tCO2e/m2) on average. They represent **3.6% of the housing stock** and **2.9% of dwellings that have been audited** in the City of Kingston.

Variable	Archetype G
Decade Built	1946-1990
Floor Area (m2)	272.5
Primary Heat Source	Baseboard/Hydronic/Plenum
Primary Fuel Type	Electricity
Primary Efficiency (%)	98.1
Heat Pump	No
Hot Water System	Conventional Tank
Hot Water Fuel Type	Electricity
Hot Water Energy Factor	0.75
Ventilation Type	None
Ceiling Insulation (RSI)	4.49
Wall Insulation (RSI)	2.18
Foundation Insulation (RSI)	1.55
Windows (RSI)	0.39
Doors (RSI)	0.64
Number of Windows	19
Number of Doors	3
Electricity Consumption (GJ)	96.5 GJ (26,814.0 kWh)
Natural Gas Consumption (GJ)	0.00
Energy Score (GJ)	96.5
Carbon Score (tCO2e)	0.78
Air Tightness (ACH50P)	5.69

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Archetype H

08

Large multi-storey homes, built between 1991 and 2019. These homes have high efficiency electric furnaces and electric hot water systems. They have high levels of insulation in the ceiling, walls and foundation with a good air tightness rating.

Average annual electricity costs: $3,121
Average annual energy costs: $3,121

Client Implications:

These homes are consume **88 GJ (0.22 GJ/m2) of electricity** and produce **0.71 tCO2e** (0.002 tCO2e/m2) on average. They represent 2.0% of the housing stock and 0.3% of dwellings that have been audited in the City of Kingston.

Variable	Archetype H
Decade Built	1991-2019
Floor Area (m2)	398
Primary Heat Source	Forced Air Furnace
Primary Fuel Type	Electricity
Primary Efficiency (%)	95.9
Heat Pump	No
Hot Water System	Conventional Tank
Hot Water Fuel Type	Electricity
Hot Water Energy Factor	0.63
Ventilation Type	Heat Recovery Ventilator
Ceiling Insulation (RSI)	5.20
Wall Insulation (RSI)	2.83
Foundation Insulation (RSI)	2.29
Windows (RSI)	0.39
Doors (RSI)	0.9
Number of Windows	24
Number of Doors	4
Electricity Consumption (kWh)	87.8 GJ (24,379.6 kWh)
Natural Gas Consumption (GJ)	0.00 GJ
Energy Score (GJ)	87.8
Carbon Score (tCO2e)	0.71
Air Tightness (ACH50P)	2.89

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Archetype I

09

Small single to 1.5 storey homes built prior to 1990. These homes are heated with poor efficiency oil furnaces with electricity hot water systems. They have low levels of insulation in the ceiling, walls and foundation and a poor air tightness rating.

Average annual electricity costs:	$1,825
Average annual oil costs:	$4,465
Average annual energy costs:	**$6,289**

Client Implications:

These homes consume produce **179 GJ** (0.90 GJ/m2) of oil and electricity and **10 tCO2e** (0.05 tCO2e/m2) on average. This Archetype is the most carbon intensive and a top priority for retrofits. They represent **5.3% of the housing stock** and 3.1% of dwellings that have been audited and in the City of Kingston.

Variable	Archetype I
Decade Built	Pre-1990
Floor Area (m2)	200.0
Primary Heat Source	Furnace With Flame Retention Head
Primary Fuel Type	Oil
Primary Efficiency (%)	81.9
Heat Pump	No
Hot Water System	Conventional Tank
Hot Water Fuel Type	Electricity
Hot Water Energy Factor	0.75
Ventilation Type	None
Ceiling Insulation (RSI)	3.72
Wall Insulation (RSI)	1.94
Foundation Insulation (RSI)	1.16
Windows (RSI)	0.37
Doors (RSI)	0.55
Number of Windows	18
Number of Doors	3
Electricity Consumption (GJ)	51.3 GJ (14,255.0 kWh)
Oil Consumption (GJ)	127.7 GJ (3,479.0 L)
Energy Score (GJ)	179.0
Carbon Score (tCO2e)	10.0
Air Tightness (ACH50P)	7.71

Lightspark

Archetype J

10

These bungalow-style homes, built between on and after 1990. These homes are heated with poor efficiency oil furnaces with oil-powered conventional tank hot water systems. They have moderate to high levels of insulation in the ceiling, walls and foundation with a good air tightness rating.

Average annual electricity costs:	$2,103
Average annual oil costs:	$3,859
Average annual energy costs:	**$5,962**

Client Implications:

These homes consume **169 GJ** (0.45GJ/m2) of oil and electricity produce **8.8 tCO2e (0.023 tCO2e/m2)** on average. They represent **0.05% of the housing stock** and 0.25% of dwellings that have been audited and in the City of Kingston.

Variable	Archetype J
Decade Built	Post-1990
Floor Area (m2)	375.1
Primary Heat Source	Furnace With Flame Retention Head
Primary Fuel Type	Oil
Primary Efficiency (%)	84.8
Heat Pump	No
Hot Water System	Conventional Tank
Hot Water Fuel Type	Oil
Hot Water Energy Factor	0.61
Ventilation Type	None
Ceiling Insulation (RSI)	5.57
Wall Insulation (RSI)	2.89
Foundation Insulation (RSI)	2.78
Windows (RSI)	0.42
Doors (RSI)	0.90
Number of Windows	24
Number of Doors	3
Electricity Consumption (kWh)	59.1 GJ (16,427.9 kWh)
Oil Consumption (L)	110.4 GJ (3,007.0 L)
Energy Score (GJ)	169.4
Carbon Score (tCO2e)	8.8
Air Tightness (ACH50P)	3.15

Lightspark

Archetype K

11

Bungalow-style homes built in the 1960s. These homes are propane heated with moderate efficiency furnaces and conventional electric hot water systems. They have moderate levels of insulation in the ceiling, walls and foundation.

Average annual electricity costs:	$1,747
Average annual propane costs:	$2,166
Average annual energy costs:	**$3,913**

Client Implications:

These homes consume **111 GJ** (0.43 GJ/m2) of propane and electricity and only produce **4.12 tCO2e (0.016 tCO2e/m2) o**n average. They **represent 1.4% of the housing stock** and 1.5% of dwellings that have been audited and only in the City of Kingston.

Variable	Archetype K
Decade Built	Pre-1990
Floor Area (m2)	256.8
Primary Heat Source	Condensing Furnace
Primary Fuel Type	Propane
Primary Efficiency (%)	90.0
Heat Pump	No
Hot Water System	Conventional Tank
Hot Water Fuel Type	Electricity
Hot Water Energy Factor	0.78
Ventilation Type	None
Ceiling Insulation (RSI)	4.11
Wall Insulation (RSI)	1.95
Foundation Insulation (RSI)	1.30
Windows (RSI)	0.37
Doors (RSI)	0.55
Number of Windows	20
Number of Doors	4
Electricity Consumption (GJ)	50.1 GJ (13905.9 kWh)
Propane Consumption (GJ)	61.3 GJ (2,421.0 L)
Energy Score (GJ)	111
Carbon Score (tCO2e)	4.12
Air Tightness (ACH50P)	7.18

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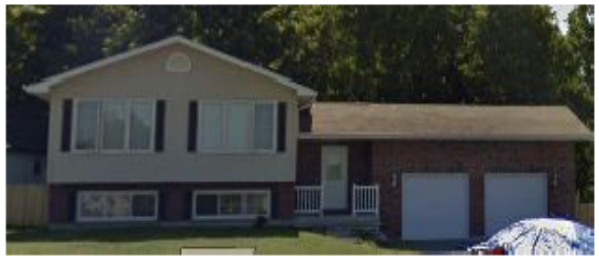
Archetype L

12



Large multi-storey homes, built prior to 1990. These homes are heated with moderate efficiency propane-fueled furnaces and conventional electric hot water systems. They have moderate to high levels of insulation in the ceiling, walls and foundation with a good air tightness rating.

Average annual electricity costs:	$1,715
Average annual propane costs:	$2,555
Average annual energy costs:	**$4,270**

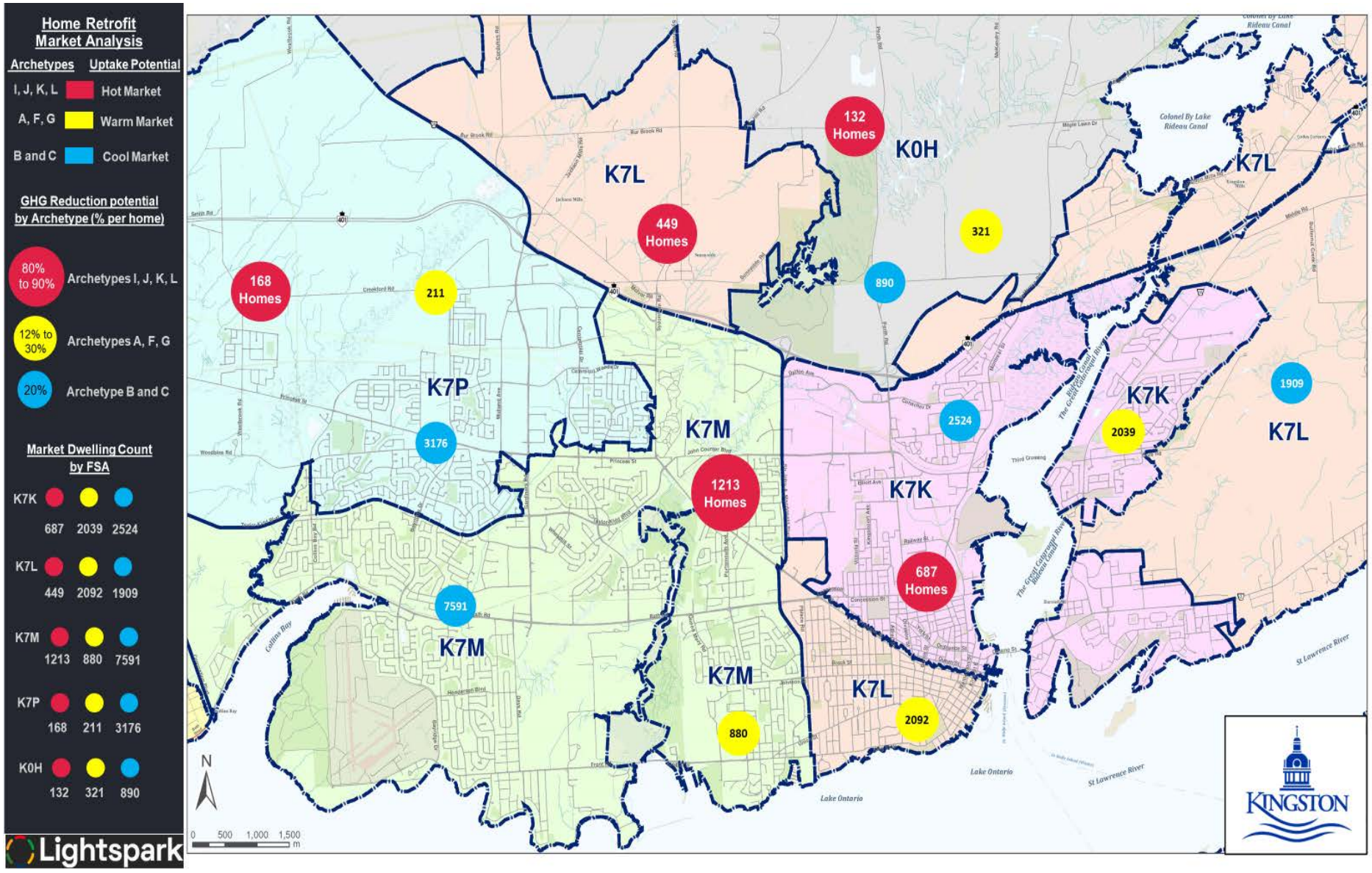
Client Implications:

These homes consume **120.5 GJ (0.38 GJ/m2) of propane and electricity** and produce **4.78 tCO2e (0.015 tCO2e/m2)** on average. They **represent 0.9% of the housing stock** and 0.3% of dwellings that have been audited in the City of Kingston.

Variable	Archetype L
Decade Built	Post-1990
Floor Area (m2)	320.0
Primary Heat Source	Condensing Furnace
Primary Fuel Type	Propane
Primary Efficiency (%)	93.6
Heat Pump	No
Hot Water System	Conventional Tank
Hot Water Fuel Type	Electricity
Hot Water Energy Factor	0.70
Ventilation Type	None
Ceiling Insulation (RSI)	5.40
Wall Insulation (RSI)	2.73
Foundation Insulation (RSI)	1.62
Windows (RSI)	0.41
Doors (RSI)	0.90
Number of Windows	25
Number of Doors	4
Electricity Consumption (GJ)	48.2 GJ (13,399.0 kWh)
Propane Consumption (L)	72.3 GJ (2,855.3 L)
Energy Score (GJ)	120.5
Carbon Score (tCO2e)	4.78
Air Tightness (ACH50P)	3.46

Lightspark

APPENDIX G - Priority Home Archetypes by Program Uptake and Impact Potential



APPENDIX H - Sample Customer Profiles of Potential Retrofit Program Participants [cxiv]

The Home Improvement Personas

Loughborough University

This set of personas represents archetypal owner-occupier families that live in solid wall (hard to treat) UK homes.

- The primary purpose of the persona set is to inform the design of retrofit energy saving measures by providing insight into the everyday domestic contexts within which these measures will need to fit.
- The personas represent:
    - The attitudes & motivations of homeowners related to making improvements to their homes
    - how they go about making these improvements
    - how these attitudes, motivations & behaviours result in opportunities & barriers to retrofit.
- The work formed part of the CALEBRE Project (Consumer-Appealing Low Energy Technologies for Building Retrofitting) [grant number EP/G000387/1], funded by the Research Councils UK's Energy Programme and E.ON.

The process to create these personas is described in:

Haines, V and Mitchell, V, 2014. A persona-based approach to domestic energy retrofit. Building Research & Information, Special Issue: Energy retrofits of owner-occupied homes, Volume 42, Issue 4, 462-476.

http://dx.doi.org/10.1080/09613218.2014.893161

For more information, please contact: Prof. Victoria Haines, School of Design & Creative Arts, Loughborough University, LE11 3TU, UK v.j.haines@lboro.ac.uk

The Idealist Restorer – the property is a project

"If you're going to do a job, you might as well do it well"

John & Shena brought their house in a run down condition 5 years ago. They are seeking to achieve an **aesthetic, tasteful** home of **character** that exudes both **individuality & quality**. John likes to carry out work himself as he enjoys **mastering practical skills** but also wants to ensure a **quality job**. He is the dominant decision maker regarding home improvement & has a **grand plan** for the property. He likes to ensure that underlying structural issues are sorted before more cosmetic improvements are made.

John Silverstone age 43

Lives with his wife Shena & 2 children in a terraced 4 bed Victorian villa in a North London suburb. He is an IT manager for a large firm of accountants.

Attitudes & Motivations

- Motivated to **live in an older property** because of the character & the opportunity it provides for restoration & improvement. Values the aesthetic period features & space afforded by older homes
- John wants to **restore as many original features** within the home as possible but not at the expense of aesthetics, comfort & convenience. Although he wishes to keep the sash windows, he has replaced the quarry tile floor in the hallway with laminate flooring
- Motivated to learn new DIY skills & **wants to do things thoroughly**
- **Energy efficiency** is perceived as a construct of **quality** but aesthetics & comfort are valued more highly

Pain Points

- Shoddy workmanship
- Lack of professionals with specialist knowledge of older properties
- Poor quality products or materials
- His own lack of time

Opportunities for Retrofit

- Very open to retrofitting energy efficiency measures & in an **optimal order** if the aesthetics of the home are respected
- Interested in '**clever**' energy saving technologies but only if the character of the home can be maintained

Key Variables

Loughborough University

The Functional Pragmatist – the property is a place to live

"To be honest I don't think we'd do it until something went wrong"

Robert & Suzanne have lived together for 18 years and have two teenage children. They chose an older property as it was close to the town centre and because it was more **spacious & roomy** than an equivalently priced newer home. They enjoy socialising at home and often have friends around. They are a little **daunted by the maintenance issues** and consider some problems (e.g. damp) to be unsolvable. Without a master plan for their property, they undertake **only basic DIY**, relying on recommendations from friends & family for larger jobs. They may respond to unsolicited approaches from professionals if they coincide with having some money available.

Suzanne Miller age 47

Suzanne & Robert live in a Victorian villa-style house near the centre of Lincoln, with their 2 children. Suzanne works at the local health centre and Robert is a Sales Manager.

Attitudes & Motivations

- Motivated to live in an older property because of the **layout and room size** that accommodates a full and active family life
- **Home improvements are seen as a hassle** rather than a hobby; they take time away from more important things - hobbies & family time
- They are **not particularly interested in keeping older features** of the house, but place greater value on convenience
- They are concerned about the environment and climate change, as a result of their **family values**

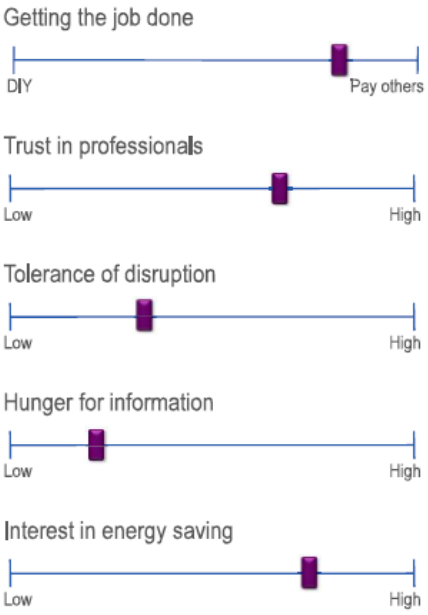
Pain Points

- Finding time getting quotes & finding professionals to do work
- Professionals who provide a poor service
- Jobs taking longer than anticipated
- Having to do home improvements at all

Opportunities for Retrofit

- When things wear out or go wrong
- At the time of purchasing the house
- When re-purposing a space or extending the home
- When finance becomes available

Key Variables



The Property Ladder Climber – the property is a step up

"We like the older kinds of properties, we wanted a place that needed work doing"

Reece & Emily chose their house as it needed considerable work in order to 'do it up.' They **intend to sell at a profit** as a step towards a bigger property. Older properties that have undergone little or no renovation are particularly attractive although the age of the property was not one of their main concerns. Following an **overall plan**, they have addressed the structural problems, replaced all the windows and put in a new heating system. Once the kitchen, bathroom and redecoration are finished, they will sell the house, **buy another and start again.**

Reece Martin age 31

Reece & Emily have been together for 7 years, living in 4 Midlands properties in that time, each of which they have renovated. They both work full time and so use all of their spare time on the house.

Attitudes & Motivations

- They are motivated to live in an older property by the **potential it offers to add value** to its resale value through renovation
- **Happy to borrow money** in the short term to finance home improvements, paying these back when the house is sold
- They enjoy developing their DIY skills as the projects get bigger with each house they buy
- Open to consequential improvements as they are thinking at a **whole house level** but these improvements must lead to financial gain at the point of resale
- Energy saving beyond current building regulations is not a priority

Pain Points

- Professionals who do not turn up on time or job takes longer than anticipated
- Delays in work starting may have knock on effects for other jobs that are planned
- Having to spend time getting quotes & finding professionals to do work

Opportunities for Retrofit

- Open to the use of finance schemes if these are cost effective within the context of 'improving to sell'
- Unlikely to consider technologies with long payback times unless the cost of installation is passed on

Key Variables

Getting the job done

Trust in professionals

Tolerance of disruption

Hunger for information

Interest in energy saving

The Affluent Service Seeker – the property is a pleasure

"It's not just that you've got more money , its also that your time becomes more precious so that its worth paying others"

Deniz & Azra brought their house 23 years ago when their 3 children still lived at home. Now it's rather large for 2 people but they **value the comfort**, location, mature garden & space for entertaining. They view their home as a **substantial financial asset** & are therefore alert to opportunities to add value to their home. Deniz employs **specialist professionals** to carry out work on his home & **highly values the recommendations** of friends & neighbours with similar properties. He has recently had solar PV installed at the rear of his house & is pleased with the **financial payback.**

Deniz Ablak age 64

Deniz lives with his wife Azra in a detached 19th century property in rural Hampshire. He owns a car dealership & service centre.

Attitudes & Motivations

- Motivated to **live in an older property** because of the character, idyllic **rural location** large garden & useful outbuildings
- Deniz accepts that older properties are **expensive to maintain** and views spending on the property as a way to preserve & add value to his investment
- He seeks **luxury & quality** but also **value for money.** Known to be **financially savvy**
- **Carries out very little DIY** through choice but he is also less **physically fit** than when he was a younger man
- **Energy efficiency** is perceived as difficult to achieve in a large old property but Deniz is keen to take advantage of any **grants or incentive schemes** available. Values comfort over financial saving

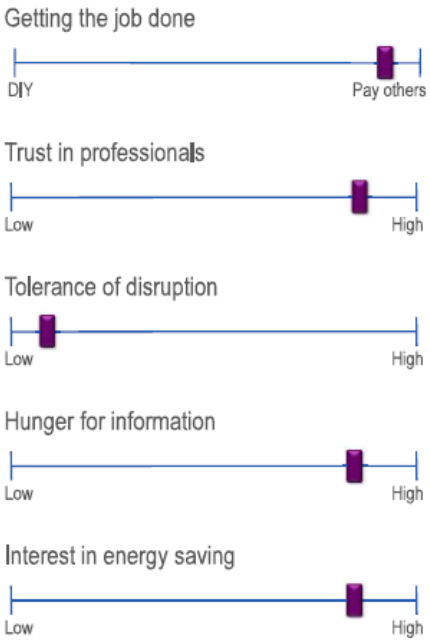
Pain Points

- Lack of professionals with specialist knowledge of older properties
- Poor customer service
- Jobs not completed to schedule
- Poor information about available grants & incentive schemes

Opportunities for Retrofit

- Open to incentive schemes & polices that generate income for the homeowner or add value to the property
- Will choose to use specialist professionals to ensure a quality job

Key Variables



The Aesthetic Pragmatist – the property is a home

"I'd like to keep the windows as traditional as possible because it's a traditional house"

Over the years, Ben & Eleanor have created a home that meets their **practical needs** as well as being **full of character** and charm. Eleanor loves home-making and carries out most of the minor decorating and **small repair jobs**, but they rely on professionals for everything else. Ben & Eleanor love **restoring the older features** in their home and will preserve these where cost allows. They **redecorate regularly** and so are not particularly concerned about durability.

Ben Dixon age 56

Ben lives with his wife Eleanor in a stone cottage outside Bristol. Ben is an accountant and Eleanor works part time as an Occupational Therapist.

Attitudes & Motivations

- Motivated to live in an older property because of the **character & space** it offers
- Enjoy having a project on the go but **improving or updating the decor**, furniture & appliances within the home will be of higher priority than repurposing of space or non-essential maintenance
- Likely to **cover up some issues** like damp through frequent redecoration
- Value 'off the shelf' solutions, preferring to finance these from savings or windfalls rather than loans. Want a **neat and tidy job** to be done, with a good quality finish

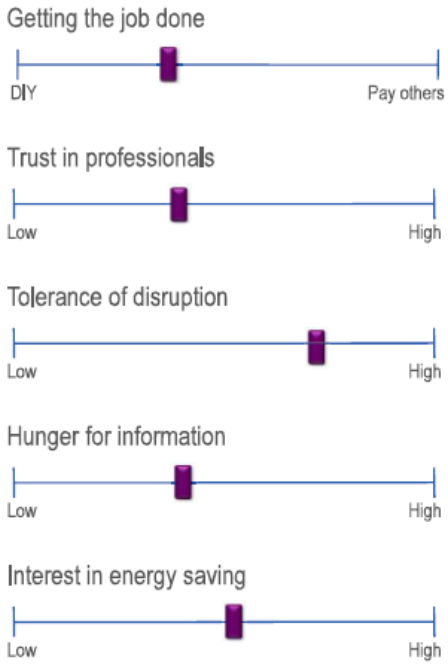
Pain Points

- Having to spend time getting quotes & finding professionals to do work
- Professionals who do not turn up on time or job takes longer than anticipated (unplanned disruption)
- Only being able to afford options that detract from the character of the property

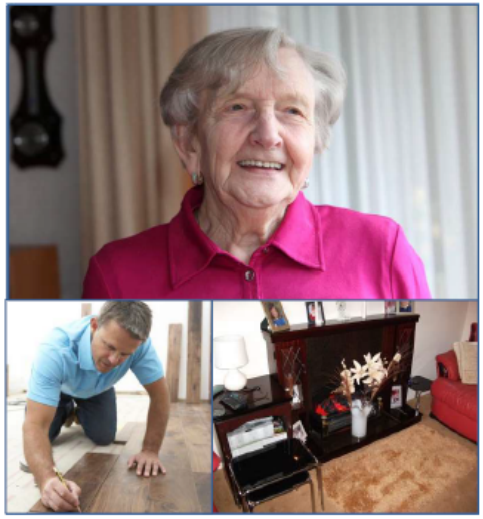
Opportunities for Retrofit

- When they first purchase the house or within the regular cycle of decorating and refurbishment
- The order of retrofit will be driven by aesthetic priorities, e.g. the desire for new kitchen may lead to a new boiler

Key Variables



The Stalled (Lack of Finance) – the property is a shelter



"You know, there's not much money left. So it's a case of having to do it yourself"

Brenda has lived in her house for 34 years. Now divorced, she used most of her savings to buy sole ownership of the house. She wants her home to be a **pleasant, warm and secure place to live.** She likes the original features of the house but is happy to sacrifice these for comfort and security. She undertakes **only basic maintenance** unless work is funded by up-front grants or is supported by friends & family. She relies heavily on information and **advice from family and close friends**.

Brenda Stirling, age 72

Brenda lives alone in her Victorian mid-terrace property in Leeds. She is divorced and relies on a small pension as her sole income.

Attitudes & Motivations

- Brenda wants a warm, comfortable home, but is **not extravagant** in her requirements
- She wants to **feel safe and secure** in her home and be assured that any work undertaken is not ripping her off or putting her in danger
- Brenda is **frugal** and is interested in saving energy primarily to save money. She is positive towards opportunities to improve the warmth and security of her home.
- Its not uncommon for Brenda to leave parts of the house **unheated** through the winter, but uses **draughtproofing** to increase comfort

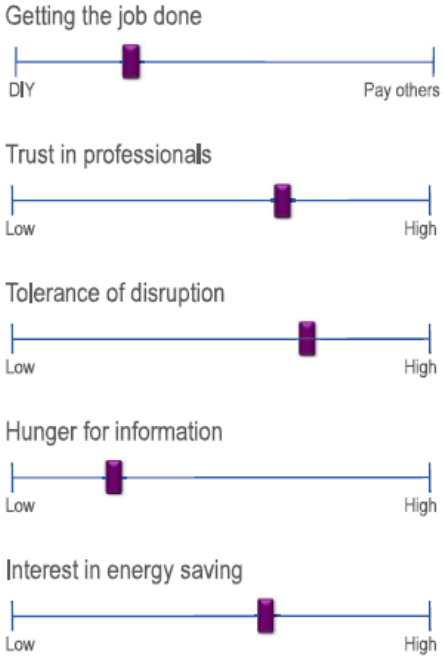
Pain Points

- Worry about being unable to afford repairs and renovations that are needed for a reasonable standard of living
- Limited capacity in old age for change or disruption
- Unfriendly or impolite workers

Opportunities for Retrofit

- Limited to when grants are available
- Will undertake consequential improvements if dictated by grant scheme

Key Variables



The Stalled (Pressures of Life) – the property is a necessity

"I'm frustrated a little bit because I'd like it to be more efficient, but the kind of things I would need to do to make it are big things"

Callum & Maria chose an older house because they liked the **style and character, at an affordable price.** Since having a baby, Maria has given up work as she hasn't been well and their **focus of attention has turned to health and family matters.** They undertake only essential repairs on their house, to make a problem go away, at least temporarily, but recognise they will need to deal with it eventually. This **could be years away**, once they gain control over their lives again.

Callum Peacock, age 33

Callum lives with his wife, Maria and their baby, Melissa, in a 1910s semi-detached house in Newcastle. Callum works as a secondary school teacher.

Attitudes & Motivations

- Callum do**es not have the time, emotional energy or financial resource** to undertake home improvements at present
- He will use a trusted, known professional to help with any **essential jobs** around the house but won't undertake any major projects
- Callum & Maria may consider taking a **loan** to fund essential maintenance but they prefer to wait and use **savings** when they can afford

Pain Points

- Having to find time getting quotes & finding professionals to do work
- Professionals who do not turn up on time or job takes longer than anticipated (unplanned for disruption)

Opportunities for Retrofit

- Almost none at present

Key Variables

Getting the job done

Trust in professionals

Tolerance of disruption

Hunger for information

Interest in energy saving

APPENDIX I - Sample Measures and Estimated Costs [cxv]

Retrofit Measure	Estimated Cost	Existing Utility/Provincial Rebates
Building Envelope		
Air Sealing	$200 – $1,500	Enbridge Gas or Home Assistance Program (HAP)* for electrically heated homes
Cool roof surfacing	$150 to $450/m²	
Doors	$200 + per door	Enbridge
Insulation: Attic	$1.50 to $3.50/ft²	Enbridge, HAP*
Insulation: Basement	$6,500 to $18,000	Enbridge, HAP*
Insulation: Walls	$150 to $3,000, plus installation	Enbridge, HAP*
Windows	$300 to $700+ per window, plus installation	Enbridge
HVAC/DHW		
Air Source Heat Pumps	$2,500 to $5,000 incl. installation	
Ductless (min-split) Air Source Heat Pumps	$2,500 to $5,000+ per unit, incl. installation	In-store retailer rebate (expires 2021),
Furnaces: electric	Average $4800	Hydro One – thru installation partners
Electric Thermal Storage		
Ground Source Heat Pumps	$20,000 – $40,000, incl. installation	Future Enbridge Gas retrofit program
Solar Water heaters	$6,000 – $10,000 incl. installation	
Tankless Water Heaters	$1,000 to $2,800	Enbridge, retailer rebate (expires 2021), rentals through Utilities Kingston
Drain-Water Heat Recovery	$550 - $1,700 + installation	Enbridge,
Heat Recovery Ventilators	$350 - $1500	
Other retrofits		
Solar PV Panels	$25,000 to $30,000 incl. installation	
Battery Energy Storage	$6,000 to $30,000 per system, incl. installation	
Electric Vehicle Chargers	$1,700 to $4,000 incl. installation	retailer rebate (expires 2021)

* indicates low- income eligibility requirements

APPENDIX J - Retrofit Program Uptake Scenarios (Market Penetration Rates)

Market penetration rates

Type of home and heating	**Program Uptake**	**Program Driver**	**# of Homes to Retrofit** (no previous energy audit)	**% of single-family homes**	**65%**	**45%**	**25%**	**10%**
All oil and propane	Hot market	Highest emissions	2,232	7%	1,451	1,004	558	
Oldest electric	Warm market	High energy costs	1,380	4%	897	621	345	
Oldest natural gas		High emissions and above average costs	2,561	8%	1,665	1,152	640	
1946 - 1990 natural gas	Cool Market	Moderate emissions	10,663	31%	6,931	4,798	2,666	1,066
		TOTALS	**16,836**	**50%**	10,943	7,576	4,209	
				65% Hot market	1,451		1,004	45% hot
				45% Warm market	1,773		985	25% warm
				25% Cool market	2,666		1,066	10% cool
				TOTAL	**5,890**		**3,056**	

market penetration rates

Type of home/heating	Program Uptake	Program Driver	# of homes audited	no audits	total	with % of audits*	65%	45%	25%	10%
All oil and propane	Hot market	Highest emissions	434	2,232	2666	2341	1,521	1,053	585	
Oldest electric	Warm market	High energy costs	325	1,380	1705	1413	918	636	353	
Oldest natural gas	Warm market	high emissions and above average costs	1232	2,561	3793	2684	1,745	1,208	671	
1946 - 1990 natural gas	Cool	Moderate emissions	5451	10663	16114	11208	7,285	5,044	2,802	1,121
		TOTALS (rounded)	**7,442**	**16,836**	**24,278**	**17,694**	**11,469**	**7,940**	**4,411**	
					* include 25% of hot market homes and 10% of warm/cool market homes already audited					
						65% hot market	1,521		1,053	45% hot market
						45% Warm market	1,844		1,024	25% warm market
						25% cool market	2,802		1,121	10% cool market
						TOTAL	**6,167**		**3,198**	

APPENDIX K - Simplified Program Logic Model

Performance Need - from City Council's Strategic Plan 2019-2022 Climate Leadership Focus Area:

- 1.5 Develop and promote incentives for residents to reduce their energy use and become part of city-wide solutions to meet Kingston's carbon neutral target.
- Action 1.5.1 - Develop an energy retrofit program that targets specific appliances with high capital cost and high carbon reduction impact for property owners.

Underlying Need to be Addressed (Drivers of Performance)	**Intervention** (Actions to address underlying needs)	**Indicator** (Measure of progress)
Deep residential energy retrofits are often expensive and have long financial paybacks which may be cost prohibitive for some residents. Many retrofits no longer have incentive or rebate programs available.	Develop and deliver a program that incentivizes home energy retrofits and encourages homeowners to implement projects that significantly reduce GHGs through fuel switching, conservation or energy efficiency improvements.	❖ % of household energy/GHG reduced via retrofits (average in gigajoules (GJ) and tonnes (T)) ❖ Total GHG (T) reduced per year (all participants) ❖ Ratio of incentive cost vs. cumulative GHG reduction ($/T)
Residents may require guidance on how to cost-effectively reduce their energy consumption and need support to identify where the best opportunities for reductions within their home.	Provide subsidized or free home energy assessments to participants of the retrofit program which identify the specific options in each household to optimize GHGs/energy reductions.	**o** Number of home energy assessments completed as part of retrofit program **o** Total GHG (T) & energy reduction opportunities (GJ) identified within assessment
Residents in low-income households may have difficulty accessing financing to pay for upfront costs of energy retrofits that could save them money on their utility bills.	Provide low-interest financing options to homeowners that support the implementation of the eligible retrofits identified within the home energy assessments.	**o** Financing allocated to retrofit projects (Total $) ❖ Average annual utility cost savings per household ❖ 0.75 – 1.25 Savings to investment ratio
Common barriers to residential energy retrofit financing programs include lack of awareness of programs, complicated application process and default concerns of lenders.	Provide a one-window Energy Concierge service to promote & deliver the program. Establish a loan loss reserve to address lender concerns.	❖ High level of customer satisfaction with service (through survey) ❖ 0 - 1% loan defaults/arrears

❖ = Outcome indicator **o** = Output indicator

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[iv] http://docs.assets.eco.on.ca/reports/other-publications/Reducing-My-Footprint-Factsheet.pdf

[v] https://www.wri.org/our-work/project/science-based-targets-initiative

[vi] National Research Council. (2017). Build smart - Canada's buildings strategy. Retrieved from https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/emmc/pdf/Building_Smart_en.pdf

[vii] Navius Research, A Plan for Climate Leadership in British Columbia, 2015. http://cleanenergycanada.org/wpcontent/uploads/2015/10/A-Plan-for-Climate-Leadership-in-BC-Final-Oct-27-12pm-2015.pdf

[viii] The 2018 Kingston community GHG emissions inventory is available at the following URL: https://www.cityofkingston.ca/documents/10180/2304312/Environment_2018-Community-Greenhouse-Gas-Inventory.pdf/c0973e68-e51f-7cde-48dd-42d0bad650bf?t=1596047262191

[ix] Generation Energy Council Report, June 2018, “Canada's Energy Transition: Getting to Our Future, Together” https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/CoucilReport_july4_EN_Web.pdf

[x] https://www.scorecard.efficiencycanada.org/2020

[xi] Environmental Commissioner of Ontario, “Every Joule Counts: Ontario’s Energy Use and Conservation Year in Review” Annual Energy Conservation Progress Report 2016/2017 (Volume Two).

[xii] Environmental Commissioner of Ontario 2019 Energy Conservation Progress Report, A Healthy, Happy, Prosperous Ontario: Why we need more energy conservation, https://docs.assets.eco.on.ca/reports/energy/2019/why-energy-conservation-01.pdf

[xiii] https://theenergymix.com/2019/03/25/ontario-slashes-energy-efficiency-programs-delays-promise-to-cut-hydro-rates/

[xiv] https://www.newswire.ca/news-releases/canada-announces-new-energy-savings-rebate-program-to-help-ontarians-save-money-and-fight-climate-change-889485009.html

[xv] The most robust existing residential energy programs in Ontario are for natural gas users although a new integrated electricity and natural gas conservation framework for Ontario during 2021-2024 has been proposed by the province at time of writing this document. However, it appears that the new provincial program will focus on the commercial, industrial and institutional sectors.

[xvi] Fraser Institute 2017, Evaluating electricity price growth in Ontario, https://www.fraserinstitute.org/sites/default/files/evaluating-electicity-price-growth-in-ontario.pdf

[xvii] Statistics Canada. Table: 18-10-0004-01 (formerly CANSIM 326-0020) - Consumer Price Index, monthly, not seasonally adjusted. 2002=100. Canada. Energy includes: "electricity", "natural gas", "fuel oil and other fuels", "gasoline", and "fuel, parts and accessories for recreational vehicles".

[xviii] The Kingston 2018 Community GHG Inventory estimates 14% of GHGs from residential sector which is suspected to exclude multi-residential buildings that use bulk utility meters. Consequently, the emissions associated with multi-residential energy consumption get aggregated in with the Industrial, Commercial and Institutional sectors energy and emissions data.

[xix] https://www.cityofkingston.ca/residents/environment-sustainability/climate-change-energy/climate-action-plan

[xx] Aaron Gillich, Minna Sunikka-Blank & Andy Ford (2017): Designing an ‘optimal’ domestic retrofit programme, Building Research & Information, https://doi.org/10.1080/09613218.2017.1368235 .

[xxi] Statistics Canada, Residential Sector - Ontario, Table 2: Secondary Energy Use and GHG Emissions by End-Use, https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=res&juris=on&rn=2&page=0.

[xxii] https://betterhomesto.ca/wp-content/uploads/2019/11/BHTO-Whole-House-Guide-Nov19.pd

[xxiii] https://buildingknowledge.ca/services/builder-evaluation-services/residential-building-code-energy-compliance/

[xxiv] Clean Air Partnership 2020, Accelerating Home Energy Efficiency Retrofits Through Local Improvement Charge Programs – A Toolkit for Municipalities.

[xxv] Accessed though Community Data Program, sourced from Statistics Canada 2016 Census - Dwelling Condition (4), Tenure (4), Period of Construction (12), Structural Type of Dwelling (10) and Condominium Status (3) for Private Households of Canada, Provinces and Territories, Census Metropolitan Areas, Census Agglomerations (Tracted and Untracted) and Census Tracts, 2016 Census - 25% Sample Data - based on Statistics Canada table 98-400-X2016221.

[xxvi] https://energypoverty.ca/#s2

[xxvii] Ibid.

[xxviii] https://energypoverty.ca/mappingtool/

[xxix] https://energypoverty.ca/mappingtool/ based on Statistics Canada 2016 Census data.

[xxx] Clean Air Partnership 2020.

[xxxi] Gillich, Sunikka-Blank and Ford (2017) .

[xxxii] https://www.cityofkingston.ca/residents/environment-sustainability/climate-change-energy/climate-action-plan

[xxxiii] City of Kingston Municipal Energy Study, June 2018: https://www.cityofkingston.ca/residents/environment-sustainability/climate-change-energy/community-energy-plan

[xxxiv] City of Kingston Corporate Strategic Plan 2019-2022: https://www.cityofkingston.ca/apps/councilpriorities/

[xxxv] Dunsky Energy Consulting 2018, The Economic Impact of Improved

Energy Efficiency in Canada: Employment and Other Economic Outcomes from the

Pan-Canadian Framework's Energy Efficiency Measures, prepared for Clean Energy Canada.

[xxxvi] Dunsky 2018.

[xxxvii] https://www.electricalindustry.ca/latest-news/919-acadia-center-releases-comprehensive-report-energy-efficiency-engine-of-economic-growth-in-canada

[xxxviii] Efficiency Canada, :Why Doug Ford Needs an Energy Efficiency Strategy – Updated and Expanded" https://www.efficiencycanada.org/why-ford-government-needs-energy-efficiency-expanded/

[xxxix] For example, see the economic impact of 13 actions assessed within A Climate Action Plan For Waterloo Region http://www.climateactionwr.ca/wp-content/uploads/2015/10/ClimateActionPlanWaterlooRegion_Full_Nov2013.pdf

[xl] Environmental Commissioner of Ontario. (2019). *2019 energy conservation progress report. Environmental Commissioner of Ontario.*

Retrieved from https://docs.assets.eco.on.ca/reports/energy/2019/why-energy-conservation.pdf

[xli] Winfield, Mark, Peter Love, James Gaede and Scott Harbinson, February 2020, "Unpacking the Climate Potential of Energy Efficiency" Studies in Ontario Energy Policy Series No. 7, York University.

[xlii] Clean Air Partnership 2020

[xliii] City of Toronto 2019, report IE6.5 to the Infrastructure and Environment Committee entitled: Extending Successful Energy Retrofitting Programs, June 13, 2019.

[xliv] Clean Air Partnership 2020

[xlv] https://fcm.ca/en/resources/gmf/case-study-2015-fcm-sustainable-communities-award-energy-program

[xlvi] https://www.scorecard.efficiencycanada.org/2020

[xlvii] Clean Air Partnership 2020.

[xlviii] Clean Air Partnership 2020.

[xlix] See "Building Energy Retrofit Bundling Programs: Report & Recommendations for the City of Vancouver" prepared by CALP and the Integral Group with support from Natural Resources Canada, April 2019.

[l] Clean Air Partnership 2020.

[li] https://www.edmonton.ca/programs_services/documents/PDF/BERA-ProgramManual.pdf

[lii] City of Toronto 2019.

[liii] City of Toronto 2019.

[liv] For example, in Waterloo Region, a survey of residents showed that only 40% of homeowners saw energy efficiency of their residence as their responsibility siting governments and utilities as more responsible. *Community Energy Investment Strategy for Waterloo Region,* February 2018, pg. 27: https://www.regionofwaterloo.ca/en/resources/Community-Energy-Investment-Strategy---For-Web---access.pdf

[lv] https://www.uniongas.com/residential/save-money-energy/home-rebate/ngop

[lvi] Navigant 2019, Integrated Ontario Electricity and Natural Gas Achievable Potential Study, prepared for IESO.

[lvii] Winfield et al 2020.

[lviii] https://www.cityofkingston.ca/residents/community-services/housing/programs/kingston-frontenac-renovates

[lix] https://www.yellowpages.ca/search/si/2/Heating+Contractors/Kingston+ON

[lx] Clean Air Partnership 2020.

[lxi] https://www.ontario.ca/laws/regulation/060586#BK43

[lxii] O. Reg. 586/06

[lxiii] Diagram courtesy of Clean Air Partnership

[lxiv] IESO Year End reports 2019 and 2017: http://www.ieso.ca/en/Corporate-IESO/Media/Year-End-Data, http://www.ieso.ca/Power-Data/Conservation-Overview/Conservation-Reports

[lxv] Navigant 2019.

[lxvi] Navigant 2019.

[lxvii] Navigant 2019.

[lxviii] See https://www.ivey.uwo.ca/energycentre/blog/2019/06/a-closer-look-at-hydro-quebecs-electricity-price-advantage-over-ontario/ , https://energyrates.ca/residential-electricity-natural-gas/ and https://www.oeb.ca/sites/default/files/uploads/Report_Defining_Typical_Elec_Customer_20160414.pdf

[lxix] https://www.fao-on.org/en/Blog/media/MR_Home_Energy_2020

[lxx] Unpublished memo from Green Communities Canada to Red Squirrel Conservation Services, dated July 19, 2020.

[lxxi] Green Communities Canada 2000.

[lxxii] REEP Green Solutions 20 Year Anniversary report https://reepgreen.ca/wp-content/uploads/2019/10/20th%20Anniversary%20Report.pdf

[lxxiii] Green Communities Canada 2000

[lxxiv] This is the initial focus of the retrofit program as multi-residential rental units will require a modified program design due to larger buildings and scale of retrofits, challenges in engaging off-site building owners and much greater resources needed to accommodate increased demand for financing.

[lxxv] Acacia Consulting & Research and Focus Consulting Inc. prepared for the City of Kingston, September, 2019: 10-Year Municipal Housing and Homelessness Plan for the City of Kingston and County of Frontenac – Five-Year Review Environmental Scan and Needs Assessment.

[lxxvi] https://www.engineeringtoolbox.com/co2-emission-fuels-d_1085.html

[lxxvii] Monthly average cost for Kingston in 2019 retrieved from: https://www2.nrcan.gc.ca/eneene/sources/pripri/prices_bycity_e.cfm?productID=7&locationID=66&locationID=72&frequency=M&priceYear=2019&Redisplay=

[lxxviii] Average weekly prices in 2019 for nearest major city to Kingston (Ottawa): retrieved from: https://www2.nrcan.gc.ca/eneene/sources/pripri/prices_bycity_e.cfm?productID=6&locationID=66&locationID=18&frequency=W&priceYear=2019&Redisplay= then converted to gigajoules.

[lxxix] Utilities Kingston 2019 natural gas prices including all variable charges derived from: https://www.cityofkingston.ca/documents/10180/32016310/Committee-of-the-Whole_Meeting-01-2019_Report_19-043-Approval-of-Local-Dist-Rate-Change-and-Federal-Carbon-Charge-for-Natural-Gas.pdf/f3fa15fd-48bc-4807-8cc9-090a723cb576 then converted to gigajoules.

[lxxx] Based on a conversion of the consumption emission factor from Environment Canada 2020, National Inventory Report 1990 – 2018, Appendix 3, Electricity Emission Intensity for Ontario.

[lxxxi] Total variable costs including blended Time of Use Rates for 2019 retrieved from: https://www.oeb.ca/rates-and-your-bill/electricity-rates/historical-electricity-rates then converted to $ per Gigajoule.

[lxxxii] See https://www.npr.org/2020/02/21/808016558/as-solar-energys-price-has-dropped-more-companies-get-onboard , https://www.forbes.com/sites/jamesellsmoor/2019/06/15/renewable-energy-is-now-the-cheapest-option-even-without-subsidies/#5cae4d0e5a6b and https://science.sciencemag.org/content/365/6449/108

[lxxxiii] Statistics Canada 2016 Census - Dwelling Condition (4), Structural Type of Dwelling (10) and Condominium Status (3) for Private Households of Canada, Provinces and Territories, Kingston Census Metropolitan Areas - based on Statistics Canada table 98-400-X2016221

[lxxxiv] https://homestars.com/reno-report-2019/

[lxxxv] H. Pettifor a,n, C.Wilson a, G.Chryssochoidis, “The appeal of the green deal: Empirical evidence for the influence of energy efficiency policy on renovating homeowners.” Energy Policy79(2015)161–176

[lxxxvi] Informed by resources prepared by the Federation of Canadian Municipalities available at: https://fcm.ca/en/resources/gmf/factsheets-community-efficiency-financing

[lxxxvii] Victoria Haines & Val Mitchell (2014) A persona-based approach to domestic energy retrofit, Building Research & Information, 42:4, 462-476, DOI: 10.1080/09613218.2014.893161

[lxxxviii] Haines and Mitchell 2014.

[lxxxix] FCM Webinar June 29, 2020 for their GMF Community Energy Financing funding program

[xc] Cost savings are estimated based on the assumptions noted within Hydro One’s website and will vary widely based on individual homes. A calculator is provided on the following website to make more specific estimates based on user inputs https://www.hydroone.com/saving-money-and-energy/residential/fuel-switching.

[xci] More details on the benefits of home energy disclosure can be found in chapter 12 of the Clean Air Partnership (2020) LIC Guide as previously referenced. Energy disclosure was previously piloted as a voluntary program and was proposed to become mandatory in Ontario as part of the Green Energy Act but that aspect of the act was repealed in the Fall of 2018 shortly after the new government came in to power following the summer election. (Also see Environmental Commissioner of Ontario Annual Energy Conservation Progress Report 2016/2017 (Volume Two): Every Joule Counts: Ontario’s Energy Use and Conservation Year in Review).

[xcii] See: Naima Canada. (2017, November 2). Home Energy Rating and disclosure Guide. Retrieved from: http://www.naimacanada.ca/home-energy-rating-disclosure-guide; and, Goodman, L., & Zhu, J. (2016). PACE loans: Does sale value reflect improvements? New York: doi:10.3905/jsf.2016.21.4.006 .

[xciii] https://www.nrcan.gc.ca/energy-efficiency/energuide-canada/energuide-energy-efficiency-home/after-your-energuide-home-evaluation/20572

[xciv] Gillich, Sunikka-Blank and Ford (2017) .

[xcv] Clean Air Partnership 2020.

[xcvi] Excerpt from 2016 Reep Green Solutions Annual Report: https://reepgreen.ca/2016/09/coaching-home-energy-upgrades/.

[xcvii] Frappe-Seneclauze, T., Heerema D., Wu, K. (2017). Deep emissions reduction in the existing building stock. The Pembina Institute.

[xcviii] See: Energy Efficiency Alberta. Retrieved from: https://www.efficiencyalberta.ca and GreenUp, (2016, April 8), Green Business Program will provide One-Stop-Shopping for Energy Efficiency, Retrieved from: https://www.greenup.on.ca/green-business-program-will-provide-one-stop-shopping-energy-efficiency

[xcix] Such as: https://www.nrcan.gc.ca/energy-efficiency-homes/20546 , https://www.energystar.gov/campaign/home and https://saveonenergy.ca/en

[c] Many electricity and natural gas utilities have established these non-regulated affiliates which expands the scope of what projects and programs they invest in and deliver and also allows them to operate outside of their distribution service territory.

[ci] https://www.hrai.ca/

[cii] The reference to this multiplier within the report is from a blog (https://www.efficiencycanada.org/covid-19-part-2-energy-efficiencys-role-in-canadas-economic-recovery/) which is based on a more detailed economic impact study published in May 2018: https://www.efficiencycanada.org/wp-content/uploads/2018/05/Report_LessIsMore_EconomicImpactStudy-2018-05-01.pdf

[ciii] Clean Air Partnership 2020.

[civ] Mezzanotte, C., Weilamann, C., & Gutierrez, L. (2018). Residential PACE delinquency trends. ().DBRS. Retrieved from

https://pacenation.us/wp-content/uploads/2018/04/DBRS-Residential-PACE-Delinquency-Trends.pdf

[cv] California State Treasurer. (2019). Property assessed clean energy (PACE) loan loss reserve program. Retrieved from https://www.treasurer.ca.gov/caeatfa/pace/activity.asp

[cvi] Clean Air Partnership 2020.

[cvii] https://www.td.com/document/PDF/economics/special/GreenCondos.pdf

[cviii] https://www.cbc.ca/news/canada/toronto/covid-home-renovation-soar-along-with-sales-and-calls-to-contractors-1.5704816

[cix] https://news.ontario.ca/en/release/54538/ontario-increasing-investments-in-skilled-trades

[cx] Clean Air Partnership 2020.

[cxi] City of Toronto 2019.

[cxii] Modified with permission from Clean Air Partnership 2020.

[cxiii] Green Communities Canada 2000.

[cxiv] Based on the research by Haines and Mitchell 2014 as it appeared in Appendix H of the City of Windsor's Residential Deep Home Energy Retrofit Program Business Case, December 2019: https://www.citywindsor.ca/cityhall/committeesofcouncil/Standing-Committees/Environment-Transportation-and-Public-Safety-Standing-Committee/Documents/S%201_2020%20appendix%20B%20-%20Feb%2019%202020.pdf.

[cxv] https://betterhomesto.ca/upgrades/

By-Law Number 2021-XX

A By-Law to Authorize the Undertaking of Energy Efficiency and Water Conservation Works on Private Residential Property as Local Improvements under the Kingston Home Energy Retrofit Program (KHERP)

Passed: [Meeting Date]

Whereas Part III of Ontario Regulation 586/06, Local Improvement Charges - Priority Lien Status, enacted under the *Municipal Act, 2001*, S.O. 2001, c. 25 ("O. Reg. 586/06"), authorizes a municipality to pass a by-law to undertake work on private property as a local improvement for the purpose of raising all or any part of the cost of the work by imposing special charges on lots upon which all or some part of the local improvement is or will be located; and

Whereas Section 36.5(2) of O. Reg. 586/06 states that the by-law may authorize the undertaking of works which satisfy the requirements of a municipal program for which the municipality has given notice under Section 36.6(2)(b) of O. Reg. 586/06; and

Whereas at its meeting of January XX, 2021, City Council received the Kingston Home Energy Retrofit Program Rationale and Design Study;

Therefore, be it resolved that the Council of The Corporation of the City of Kingston hereby enacts as follows:

1. Council authorizes the undertaking of energy efficiency and water conservation works on private residential property as local improvements under the Kingston Home Energy Retrofit Program (KHERP), as set out in Schedule "A" to this By-Law, subject to amendments made by the Commissioner, Business, Environment & Projects from time to time, for the purpose of raising all or any part of the cost of the work by imposing special charges on lots upon which all or some part of the local improvement is or will be located.

2. This By-Law shall come into force and take effect on the date of its passing.

Given First and Second Readings [Meeting Date]

Given Third Reading and Passed [Meeting Date]

John Bolognone
City Clerk

Bryan Paterson
Mayor

Schedule "A"
Kingston Home Energy Retrofit Program (KHERP)

1.0. Overview (One-Family Housing Program Stream)

The KHERP is designed to extend municipal financing to participating homeowners for the installation of qualifying building envelope, thermal, power, and water improvements and related energy assessments, and to secure payment by imposing a local improvement charge ("**LIC**") on the property, as authorized by Ontario Regulation 586/06, Local Improvement Charges – Priority Lien Status, enacted under the *Municipal Act, 2001*, S.O. 2001, c. 25 (the "**Regulation**"). This program may be administered by the City of Kingston (the "**City**") alone, or in conjunction with a third-party program administrator to be selected at a later date.

1.1. Program Eligibility

The following residential building types are eligible for the KHERP: detached houses, semi-detached houses, and row houses.

All registered owner(s) of the property must consent to participation in the KHERP.

The property must have a property tax account with the City and all property taxes, utility bills and other payment obligations to the City must be in good standing.

The homeowner must notify its mortgage lender (if applicable) of its intention to participate in the KHERP using the City's prescribed form.

1.2. Geographic Scope

Registered owners of eligible properties within the geographic boundaries of the City of Kingston can participate in the KHERP.

1.3. Home Energy Assessments

The KHERP will utilize a version of the EnerGuide Rating System (the **"ERS"**) that provides a standard measure of a home's energy and greenhouse gas ("**GHG**") emissions performance. The ERS provides a standardized tool and process to assess home energy efficiency and can model energy savings projects in measurable performance improvement.

The homeowner must have their pre- and post-retrofit home 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 that does not require an in-house visit, provided that it follows the ERS.

Upon completion of the pre-retrofit home energy assessment, a report will be provided to the homeowner with the NRCan EnerGuide rating for the home and

recommendations for energy improvements to potentially increase that rating. A copy of this report must be provided to the City in order to access the LIC financing. The City may also require access to a minimum of 24 months of utility bills via the applicable fuel and power utility service providers and authorized by the homeowner (12 months prior to the retrofit and 12 months following the retrofit), and up to five years thereafter, for performance verification.

After the retrofit is complete, a post-retrofit home energy assessment is performed by the CEA and a report will be provided to the homeowner with the updated EnerGuide rating and confirmation that the improvements have been completed. When the improvements have been completed, and if the EnerGuide rating has increased to the minimum thresholds as described in Section 1.9. - Access to Utility Rebates & KHERP Incentives, then any applicable incentives will be confirmed, and the City will issue the final disbursement of funds.

The cost of the home energy assessments is initially paid by the homeowner, but may be eligible for a rebate if the homeowner either:

a) participates in a utility or senior government energy retrofit incentive program(s); or

b) achieves a minimum 20% reduction of GHG emissions, and or equivalent reduction in energy consumption for electrically heated homes, as verified by a post-retrofit home energy assessment. Any potential rebate under this subsection (b) is expressly subject to the City securing funding for same from the Federation of Canadian Municipalities (the "**FCM Funding**").

1.4. Qualifying Energy Efficiency and Conservation Measures

The home energy assessment must demonstrate the potential to achieve effective energy reductions in order to qualify for LIC financing. Financing is designated for capital costs (not maintenance costs) with an expected useful life of 5-20 years and for measures that are permanently affixed to a property. The average expected useful life of the retrofit measures implemented within a participating property shall not be less than the LIC financing term of the loan extended to the homeowner. The following is a non-exhaustive list of the categories of eligible measures:

i. 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.

ii. 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-pellet heaters, heat distribution systems, duct sealing, fans, associated electrical equipment as required.

iii. Mechanical systems (water heating): high-efficiency water heaters (i.e. heat pump, electric water tanks, etc.), drain water heat recovery systems, solar hot water systems.

iv. Renewable energy, energy storage and EV chargers: solar photovoltaic systems, electric vehicle charging stations (Level 2), battery storage devices, associated electrical and load management equipment, including but not limited to, electric thermal storage.

v. Health and safety measures, such as electrical wiring and panel upgrades that are required undertakings to permit energy improvements.

vi. Climate adaptation improvements, such as back-flow prevention valves, sump pumps and basement waterproofing.

vii. Other: Permanently affixed lighting, lighting controls, new energy efficient (certified) products will be considered as additional eligible technologies.

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

Retrofit costs up to the lesser of 10% of the current value assessment of the property (as determined by the Municipal Property Assessment Corporation), or $40,000, are eligible for the KHERP.

1.5. Completing the Retrofit through Contractor Engagement

The City will provide LIC financing to homeowners for eligible measures covered by the KHERP that have been:

- recommended or identified by the CEA;
- verified by the City or the assigned program administrator; and
- installed by contractors hired by the homeowner.

The City will not pre-qualify contractors or procure contractors to perform home 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 to pay

contractors directly. Where contractors require an upfront deposit prior to completing the retrofit, up to 30% of the total LIC financing may be released by the City prior to the homeowner completing the post-retrofit home energy assessment, provided that the pre-retrofit home energy assessment and the contractor's scope of work demonstrate that the minimum GHG emission thresholds of the KHERP will be met, as set out in Section 1.9. - Access to Utility Rebates & KHERP Incentives.

The City is not responsible for the work quality of any contractors hired in connection with the KHERP and assumes no liability for the works undertaken. All retrofit improvements and renovations must adhere to applicable permitting requirements, codes, laws 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 must be dealt with between the homeowner and the contractor.

1.6. Energy Coach

Subject to the City securing the FCM Funding, the KHERP may include access to an energy coach who will provide guidance to the homeowner throughout the process to help expedite the retrofits and to improve overall satisfaction with program effectiveness.

1.7. Application Process

The application process is set out below. City staff will periodically review this process to ensure effective program implementation and, where deemed appropriate, the City may make changes to this process, in its sole discretion.

Step 1: Pre-qualifications

Homeowners must complete and submit the City's standard application form, which will include the following:

- Property address;
- Property assessment roll number to confirm that all property tax payments are in good standing; and
- Proof of approval by all registered owner(s).

If a homeowner has one or more outstanding mortgage(s) associated with the property, then the homeowner must inform the mortgage lender(s) of its intention to participate in the KHERP (which may include a maximum approved dollar amount based on the City's requirements for the KHERP) using the City's prescribed form, and the homeowner must provide proof of delivery to the City.

Once the homeowner has been prequalified by the City based on the above criteria, the City will provide the homeowner with notice to proceed with the pre-retrofit home energy assessment.

Step 2: Identifying Energy Retrofit Improvements
A. Home Energy Assessment

The homeowner will complete the pre-retrofit home energy assessment in accordance with Section 1.3 - Home Energy Assessments and submit a copy of the CEA's home energy assessment report to the City.

The home energy assessment report must include:

- The current NRCan EnerGuide rating for the home, including the rated energy consumption in gigajoules per year (GJ/yr.) and GHG emissions in tonnes per year (GHG(T)/yr.);

- Recommended improvements that have been customized for the home based on existing conditions, which are projected to improve its NRCan EnerGuide rating, including a reduction in energy consumption and/or GHG emissions; and

- Potential eligibility for utility rebates and incentives offered by Enbridge Gas, Hydro One, Utilities Kingston, the IESO's Save On Energy program or other incentive programs available to Kingston residents.

B. Report Review
Prequalified KHERP applicants may wish to review the home energy assessment report with the energy coach provided by the City, if any. This step may help homeowners choose which retrofit improvements to make based on estimated energy cost savings that may be realized after installing the recommended improvements, as well as the estimated useful life of the proposed improvements. If this information is not readily available, the homeowner can request it as part of obtaining contractor quotes.

C. Obtaining Contractor Quotes
The homeowner will engage qualified contractors selected by the homeowner to implement the retrofit measures identified in the report. Contractor quotes must include the estimated cost of the retrofits for inclusion in the Funding Request Form, and must itemize costs for all labour, parts and equipment, relevant permit fees, if applicable, and applicable taxes.

Step 3: Funding Request Form
Together with the home energy assessment report, the homeowner will submit a Funding Request Form that includes:

- the improvements that the homeowner intends to install based on the home energy assessment report;

- a copy of the contractor's quote containing the items set out in Step 2(C) above; and

- the amount of contractor prepayment (as indicated in Section 1.5. - Completing the Retrofit through Contractor Engagement) being requested from the City upon signing the Property Owner Agreement referred to in Step 4 below.

Following receipt of the Funding Request Form, the City or its program administrator, will:

- confirm the eligibility of the works in accordance with the criteria set out in Section 1.4. - Qualifying Energy Efficiency and Conservation Measures;

- verify the reasonableness of retrofit costs and labour costs by consulting manufacturer pricing and prevailing labour rates; and

- review estimates of all eligible utility rebates and incentives for the homeowner, as identified in the pre-retrofit home energy assessment, including those from the KHERP.

in order to derive the funding amount, up to the maximum amount specified in Section 1.4. - Qualifying Energy Efficiency and Conservation Measures.

Step 4: Property Owner Agreement (the "POA")
Following the City's review and approval of the home energy assessment and the Funding Request Form, the homeowner will be required to execute the City's standard POA in the form attached as Appendix B. The form of POA is subject to change from time to time, in the City's sole discretion.

Step 5: Completing Improvements
A. Initial Funding Disbursement
Following execution of the POA, the City will provide the homeowner with the initial disbursement agreed upon in the POA, up to a maximum of 30% of the estimated cost of the work, which will be used by the homeowner to pay any upfront deposits required by the contractor. Pursuant to the terms of the POA, the homeowner will be obligated to repay the initial disbursement to the City if the homeowner does not complete the improvements within the time specified in the POA.

The homeowner will then proceed with hiring contractor(s) and performing the approved energy improvements to the property within the time specified in the POA.

B. Final Funding Disbursement
As detailed in the POA, the City will provide the final disbursement after the homeowner has provided a copy of the final invoice from the contractor and post-retrofit home energy assessment report from the CEA that:

- confirms that the approved retrofit measures have been installed and are in good operational order;

- provides a new NRCan EnerGuide energy (GJ/yr.) and GHG (Tonnes/yr.) rating of the home, and such rating is greater than the NRCan EnerGuide rating noted on the pre-retrofit home energy assessment report from the CEA; and

- indicates the actual costs and useful life for all the works, as evidenced by receipts and invoices, where applicable.

Step 6: LIC Repayment
Following the City 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), a by-law will be presented to City Council pursuant to Section 36.14 of the Regulation that imposes the special charges on the participating properties, in the form attached as Appendix A (the "**Special Charge By-Law**"). The form of Special Charge By-Law is subject to change from time to time, in the City's sole discretion.

For each property included in the Special Charge By-Law, the Treasurer will then enter the amount of each annual payment in the local improvement roll.

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. Failure to make payments of the LIC is treated in the same manner as uncollected property taxes and would be subject to the imposition of penalty and interest charges.

1.8. LIC Disclosure
As stated in the Regulation, the special charge imposed on the homeowner's property constitutes a special lien that is binding on all future owners. As such, in addition to any notice requirements contained the Regulation, the City will take the following steps to ensure greater transparency of the LIC to interested parties:

- posting on the City's website notice of the Special Charge By-Law; and

- updating the tax certificate to include the full LIC amount, the amount payable in the current year, the start and end year, and a note referencing the Special Charge By-Law. the name of the local or local by-law number, annual amount, start year and the end year.

The steps will be completed as a courtesy only, and the City may, in its sole discretion, elect to discontinue any or all such steps.

1.9. Access to Utility Rebates and KHERP Incentives

The City encourages applicants to review third-party energy savings programs offered by utilities and agencies such as Enbridge Gas, Utilities Kingston, Hydro One and the IESO's Save On Energy program. Energy efficiency measures that are eligible under KHERP may also be eligible for rebates from utilities. The applicant can decide whether the financing advanced by the City will be net of any third-party rebates or other incentives received by the homeowner.

Subject to the City securing the FCM Funding, KHERP will offer the first 500 eligible applicants' incentives for emission reductions. The incentive levels are aligned with performance improvement levels achieved with the retrofits and installation of the fuel switching technology in terms of reductions of GHG emission or energy consumption for electrically heated homes.

The following are the incentive levels based on the post-retrofit home energy assessment results of a home (decimal values to be rounded to nearest whole number):

- 20% – 25% reduction in emissions or energy consumption = $1,000
- 26% – 30% reduction in emissions or energy consumption = $3,000
- >30% reduction in emissions or energy consumption = $5,000

It is expected that in most cases, higher retrofit costs will typically lead to a greater reduction in emissions/energy, and therefore to a greater incentive amount. However, the total applicable incentives from all sources cannot exceed the total project cost and the KHERP incentives will be adjusted accordingly. Retrofit projects eligible for KHERP incentives will have the applicable incentive dollar value deducted from the total financing amount provided by the City. The KHERP incentives will be a non-repayable disbursement to the eligible homeowner upon project completion as outlined in Step 5 of the Application Process (see Section 1.7 – Application Process).

1.10. Quality Control

As a means of additional oversight to confirm that the funded improvements have been completed, the POA will indicate that the City reserves the right to have a City official or third-party contractor inspect the property. The homeowner is also responsible for keeping original copies of contractor invoices and photos of installed measures (particularly for measures that are difficult to inspect, such as insulation), and shall disclose this information to the City upon request.

1.11. Measurement and Verification

Pursuant to the POA, the homeowner must agree to provide the City with access to the property's utility usage data in order to monitor results and evaluate the program's effectiveness for a period of up to five years after completion of the retrofit. Also, the

homeowner must agree to participate in surveys and other follow-up activities to help the City evaluate the program.

Appendix A
Form of Special Charge By-Law
By-Law Number 20XX-XX
A By-Law to Authorize the Imposition of Special Charges on [Insert Property Address] (the "Benefitting Property")

Passed: [Meeting Date]

Whereas at its meeting on January XX, 2021, Kingston City Council enacted By-Law 2021-XX, A By-Law to Authorize the Undertaking of Energy Efficiency and Water Conservation Works on Private Residential Property as Local Improvements under the Kingston Home Energy Retrofit Program (KHERP), in accordance with Part III of Ontario Regulation 586/06, Local Improvement Charges - Priority Lien Status, enacted under the *Municipal Act, 2001*, S.O. 2001, c. 25 ("O. Reg. 586/06"); and

Whereas the owner(s) of the Benefitting Property and the City of Kingston (the "City") have entered into a Property Owner Agreement (the "POA") pursuant to Section 36.2 of O. Reg. 586/06 for the City to undertake work as a local improvement (the "Work") on the Benefitting Property and to raise the cost of the Work (the "Cost") by imposing a special charge on the Benefitting Property; and

Whereas the City Clerk has certified the POA pursuant to Section 36.4 of O. Reg. 586/06; and

Whereas the Work has been completed; and

Whereas a local improvement roll was prepared in accordance with Section 36.10 of O. Reg. 586/06, setting out the Cost, the proposed special charges to be imposed on the Benefitting Property, when the special charges are to be paid, and the lifetime of the Work; and

Whereas the City has given notice of the proposed local improvement roll to the owner(s) of the Benefitting Property pursuant to Section 36.11 of O. Reg. 586/06; and

Whereas the City Treasurer has certified the proposed local improvement roll in accordance with Section 36.11(2) of O. Reg. 586/06; and

Whereas Section 36.14 of O. Reg. 586/06 provides that after the Treasurer has certified the local improvement roll, the City shall by by-law provide that the amount specially charged on the lot set out in the roll shall be sufficient to raise the lot's share of the cost by a number of equal annual payments and that a special charge shall be imposed in each year on the lot equal to the amount of the payment payable in that year;

Therefore be it resolved that the Council of The Corporation of the City of Kingston hereby enacts as follows:

1. The provisions of Section 36.14 of O. Reg. 586/06 apply to the Benefitting Property as a result of the completion of the Work pursuant to the POA.

2. The amounts specially charged on the lot as set out in the certified local improvement roll attached as Schedule “A” to this By-Law (the “Special Charge”) is sufficient to raise the lot’s share of the Cost and shall be imposed on and collected by annually adding the annual amount payable as set out in Schedule “A” to this By-Law (the “Annual Payments”) to the tax roll of the lot.

3. The Annual Payments as set out in certified local improvement roll attached as Schedule “A” do not extend beyond the lifetime of the Work.

4. The amount of each payment made in respect of the Special Charge shall be entered in the local improvement roll by the Treasurer.

5. This By-Law shall come into force and take effect on the date of its passing and shall be deemed repealed on the date on which the Treasurer certifies that the Special Charge has been paid in full.

Given First and Second Readings [Meeting Date]

Given Third Reading and Passed [Meeting Date]

John Bolognone
City Clerk

Bryan Paterson
Mayor

SCHEDULE A

SAMPLE

CITY OF TORONTO - Home Energy Loan Program
Local Improvement Charges Added to Taxes

Roll Number	Roll Type	Tenant Number	Site Address	Lot	Property Owner(s)
----	Residential	0			

Local Improvement Charge								
Cost of Work	Funding Amount	Interest Charge	Admin Charge	Special Charge (total amount owing)	When Special Charge to Be Paid	Lifetime of the Work	Annual Payment	Detail Description
								Home Energy Loan Program - Local Improvement Charges added to taxes

Certified as sufficient, in accordance with O.Reg. 596/06.

xxxxxxxxxx xxxxxxxxxx, Deputy Treasurer

Approved as to Form

xxxxxxxxxx xxxxxxxxxx, Director, Revenue Services