

COUNCIL INNOVATION FUND – AFFORDABLE HOUSING ENERGY EFFICIENCY RETROFIT DEMONSTRATION PROJECT UPDATE

EXECUTIVE SUMMARY

On 2013 July 24, Council approved a City of Calgary Council Innovation Fund grant of \$124,000 for the Affordable Housing Energy Efficiency Retrofit Project. The project focused on the affordable housing sector in Calgary, with the objective of better understanding the value of return on investment, interdependencies, and hierarchy of changes to improve the energy use of tenant-occupied, affordable housing buildings. Modelling the benefits of investments in energy efficiency in this sector has never been conducted in Alberta despite the significant impact on community greenhouse gas (GHG) emissions of older stock, multi-residential buildings, qualifying this project as innovative in the Calgary market.

The project was initiated by the All One Sky Foundation, had Council sponsorship from previous Alderman Gael Macleod, and received administrative sponsorship from Environmental and Safety Management (ESM). As part of a collaborative effort, ESM partnered with Calgary Housing Corporation (CHC), and received an endorsement from the Affordable Housing Group in the Office of Land Servicing and Housing (OLSH). The Infrastructure and Information Systems (IIS) business unit provided oversight for the technical elements of the work.

A CHC-owned and operated building, Bankview 1, was selected for the pilot building. A financial assessment tool was developed to assess the return on investment of possible energy efficiency and renewable energy upgrades to Bankview 1, beyond what was already planned as part of the building's capital renewal plan (Attachment 1). The modelled return on investment of possible upgrades considered economic, environmental and social perspectives. The recommended portfolio included measures that have a positive economic return on investment, as well as measures that reflect the financial benefit of avoided GHG emissions. These measures include upgrades such as updating all windows to achieve a higher insulation value, upgrading all lighting in apartments and common areas to LED, and installing a solar photovoltaic (PV) system. The predicted incremental cost of the recommended portfolio (beyond what is already planned in the CHC capital renewal plan) is \$197,000. However, this expenditure is expected to produce benefits outweighing the investment such as a 28 per cent energy use reduction, operating costs savings of about \$14,800 per year (\$11,900 for energy bill savings and \$2,900 savings on the water bill), a 31 per cent reduction in GHG emissions, and reduction of other related air pollutants. The results of the energy and financial modelling were summarized in an Integrated Energy Master Plan for Bankview 1 (Attachment 2).

A third deliverable of the project was a tenant engagement guide (attachment 3). Tenant engagement will help to realize the full potential of increased energy (cost) savings from any installed energy efficiency measures, and previous research on these kinds of programs have demonstrated that tenants also benefit from new knowledge, improved relationships, increased confidence and empowerment, and strengthened communities. At Bankview 1, tenants pay for their own electricity use, and therefore will also financially benefit from the lower utility bills.

ADMINISTRATION RECOMMENDATION(S)

Administration recommends that the Priorities and Finance Committee recommend that Council:

- 1) Receive this report for information

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PREVIOUS COUNCIL DIRECTION / POLICY

On 2013 July 24, Council approved the application to fund the Affordable Housing Energy Efficiency Retrofit Demonstration Project, PFC2013-0468, in the amount of \$124,000 from The City of Calgary Council Innovation Fund.

On 2011 November 7, Council approved the report UE2011-24 to approve the Calgary Community Greenhouse Gas Reduction Plan.

BACKGROUND

The City of Calgary has committed to reducing community greenhouse gas (GHG) emissions by 20 per cent and 80 per cent below 2005 levels by 2020 and 2050, respectively. Improving energy efficiency in buildings is one of the most cost-effective means to reduce GHG emissions, and it is one of four significant opportunities to reduce GHGs identified in Calgary's Community-wide GHG Reduction Plan.

The majority of affordable housing buildings, particularly privately owned buildings, are some of the oldest and least energy efficient properties in Calgary.¹ The extent to which large energy savings and GHG emission reductions could be realized in this sector is thus significant.

Energy poverty is prevalent in the city of Calgary. Many households are concerned about paying their utility bills.² In 2011 the poorest 20 per cent of households in Alberta spent approximately 58 per cent of their after-tax income on shelter (i.e., rent, mortgage, utilities); twice that of the average household. The disproportionate 'energy burdens' on low-income households often force difficult choices about how to spend limited income – necessitating trade-offs between shelter costs, groceries and other basic necessities. Even a relatively small reduction in energy costs can be significant for low-income households. Improving the energy efficiency of homes and helping occupants reduce energy use are the most cost-effective ways to make sustained decreases in energy burdens.

In addition, influencing tenant behaviour can also increase the likelihood of realizing projected savings from the energy efficiency measures installed as part of a capital renewal project of a building or even for buildings where there have been no or minimal upgrades performed.

This demonstration project was initiated with three key benefits in mind:

1. Opportunity to partner with CHC to improve the energy efficiency of the pilot building (Phase 1);
2. Opportunity to demonstrate the triple bottom line benefits of investing in GHG reduction projects (Phase 1); and
3. Potential to apply the modelling process and the tenant engagement toolkits in other CHC buildings and at the community scale (Phase 2).

¹The vast majority of the nearly 600 non-market rental buildings in Calgary are over 20 years old ; only 9 per cent of affordable housing units are in buildings built within the last 20 years (City of Calgary, 2012). Average buildings constructed before 1983 use 75-100 per cent more energy per square meter than homes built recently.

² Recent surveys have shown that one-in-three Calgarians are concerned about not having enough money for housing, and 80 per cent of Calgarians are concerned about the cost of their natural gas and electricity bills (United Way and City of Calgary, 2011 and C3, 2011).

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INVESTIGATION: ALTERNATIVES AND ANALYSIS

Overall, there were three key deliverables of this project:

1. **A Financial Decision Support Tool** (See example output in Attachment 1)– a Microsoft Excel-based spreadsheet tool designed to assist the CHC and other public and private multi-unit housing providers assess the incremental costs, benefits and GHG emission savings of implementing individual or portfolios of energy saving measures.
2. **An Integrated Energy Master Plan** (See the executive summary in Attachment 2)– presents the recommended energy efficiency, conservation, and renewable energy projects for consideration by the CHC for inclusion within a modified capital renewal program for the pilot building; and documents the process used so that it can be replicated for other low-cost or affordable housing buildings.
3. **A Tenant Engagement Guide** (see the executive summary in Attachment 3)– helps the CHC, other social housing providers, and landlords of low-cost housing to meaningfully engage their residents in behavioural change for energy conservation, particularly recognizing the potential barriers of vulnerable populations.

For the pilot building, a CHC property (Bankview 1) was chosen that is typical of the affordable housing stock in Calgary. The building is a low-rise apartment block constructed in 1982. There are 26 separate apartments, including three in the basement level, each with street-level entry, and 23 units in the three above-ground storeys. Residents pay their own electricity bills, and heating is provided by CHC. The building is in reasonably good condition for its age and the energy consumption is in the middle of the range when compared to similar building types of this vintage. The building was also selected as it was slated for upgrades in 2014, and already had a defined capital renewal plan. The results of this pilot would serve to enhance the plans already in place for building improvements.

An energy assessment was performed on Bankview 1, which included thermal imaging. During the assessment, 22 potential energy efficiency upgrades and two renewable energy projects were identified and then modelled. The energy efficiency measures included such things as weather-stripping, programmable thermostats, LED lighting, and enhanced insulation. Renewable energy initiatives such as solar photovoltaic (PV) and solar hot water systems were also considered.

Further to modelling the energy reduction potentials, the options were assessed using the Financial Decision Support Tool, which evaluates each potential energy efficiency or renewable energy upgrade using various profitability measures. The options were evaluated primarily on the basis of Net Present Value (NPV), although a number of other standard financial decision criteria were calculated to add value to the investment decision: Discounted return on investment (ROI); Benefit-cost ratio (BCR); and Simple (undiscounted) payback (SPB) were all considered.

The profitability of each option was evaluated from both a public policy perspective and the perspective of the private property owner or manager. The difference between the two perspectives is that the public policy perspective applies a financial value to the environmental

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and social benefits of investments in energy efficiency and renewable energy³. The private perspective only evaluates the options based on standard profitability.

Once the options were evaluated with this tool they were ranked on the basis of the profitability measures. By ranking the options, property owners or building managers can maximize the value of their investment in energy saving measures by working down the list until either (a) the cumulative costs exhausts the available budget or (b) the cost of the next best option outweighs the benefits.

Four portfolios of energy saving upgrades were developed for Bankview 1:

1. Maximum energy reduction - all measures considered;
2. Private-owner perspective (economic) - only measures that were profitable to the private owner or manager were considered;
3. Public benefits perspective (economic and environment) - all measures that were profitable from the public policy perspective were considered.
4. Social benefits perspective (economic, environmental, and social) - all measures where the Benefit to Cost Ratio (BCR) was ≥ 0.7 .⁴

See Attachment 1 for the results of the financial modelling for Bankview 1.

Based on the analysis of the portfolios, to balance private profitability with lifetime GHG emission savings, the consultant recommended implementing the Public benefits portfolio for Bankview 1 (i.e., portfolio 3). In this portfolio, ten measures have a positive return on investment from *both* a private and public perspective. These measures include upgrades such as updating all windows to achieve a higher insulation value, upgrading all lighting in apartments and common areas to LED, and installing a solar PV system. Two additional measures that have a positive return on investment from a public policy perspective were recommended in the public portfolio:

- Upgrading hot water heaters from existing tanks to condensing units to improve the efficiency by 30 per cent; and
- Upgrading all patio doors to Energy Star in-swing French doors.

The modelling results have been provided to CHC for consideration in the tender for Bankview 1. Since the existing capital renewal plan is already making upgrades to the building envelope, any envelope-related recommended upgrades will be considered as part of the current building

³ Applying a value to avoided GHG emissions is often referred to as the social cost of carbon (SCC). The SCC is an aggregate measure of the impacts of climate change. It is defined as the incremental social cost of emitting one more tonne of carbon into the atmosphere at any point in time. The social cost of carbon takes into account, for example, costs such as changes in net agricultural productivity, human health, and property damages from increased flood risk. Ideally, to minimize overall costs, governments would invest in all activities that reduce greenhouse gas emissions at a price per tonne that is less than or equal to the social cost of carbon.

⁴ To reflect the wider social benefits of low-income energy assistance programs offered by utilities, regulators tend to relax the cost-effectiveness criteria. The Ontario Energy Board uses a threshold equivalent to a BCR of 0.7 for low-income housing projects. Governments may choose to compensate private building owners for the incremental cost of energy efficiency upgrades that pass the public or social threshold, but do not have a positive private NPV.

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renovation. All non-envelope recommendations will be considered as part of the next phase of the project.

Stakeholder Engagement, Research and Communication

This project was a collective effort between All One Sky, Calgary Housing Company (CHC) and Environmental & Safety Management (ESM) with support from the Infrastructure and Information Systems (IIS). The Affordable Housing Group in the Office of Land Servicing and Housing (OLSH) endorsed the project at the proposal stage.

CHC facilities staff and on-site support workers were also engaged as part of the research for both the Energy Master Plan and the Tenant Engagement Toolkit.

Strategic Alignment

This report supports UEP 2012-2014 Business Plan action 3P4.1 Deliver brownfield redevelopment, Corporate waste management, greenhouse gas and air quality programs that align to environmental goals.

This report also supports UEP 2012-2014 Business Plan action 1C4.1 Leverage relationships with partners, stakeholders and The Corporation to deliver programs and services.

This project aligns with the Council Innovation Fund purpose of “one-time start up or “seed” funds for initiatives or programs which will support or contribute to Council’s priorities.”

It aligns with CHC’s mandate to deliver safe and affordable housing solutions to meet the needs of Calgarians not served by the marketplace through advocacy and coordinating support services, fostering community inclusion and pride of home and creating an environment that fosters opportunities for residents to realize their full potential.

Social, Environmental, Economic (External)

In addition to a reduction in greenhouse gas emissions, reducing energy consumption stands to improve the affordability of shelter and other basic necessities for the city’s poorest households, and can contribute to poverty relief in the city. The degree to which environmental, economic, or social benefits are realized will depend directly on how the information learned through this process is applied and adopted across the city.

Investing in recommended energy efficiency measures is estimated to have an incremental capital cost of \$197,000 for the Bankview 1 building. This expenditure would produce multiple benefits:

- Lifetime GHG emission reduction of about 31 per cent (savings of 1,955 t CO₂-eq);
- Lifetime reductions in other air emissions of NO_x, PM, and SO₂ of 3.3 t, 0.3t, and 3.4t, respectively;
- Lifetime energy savings of about 28 per cent (or 27,480 GJ); and

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- Average operating cost savings of about \$14,800 per year (\$11,900 in energy cost savings and \$2,900 in water bill savings).

Energy efficiency retrofits and tenant engagement programs can also improve the quality of life of low-income residents by increasing the comfort and liveability of the upgraded building, and by empowering residents to take control of their own energy use.

Financial Capacity

Current and Future Capital and Operating Budget:

The Affordable Housing Energy Efficiency Retrofit project was managed within the approved total budget of \$124,000.

In the current tender for Bankview 1, CHC is including the option for contractors to bid on the recommended envelope upgrades, to be included if possible as part of the existing capital renewal budget. For all other recommended upgrades, ESM and CHC will collaborate to identify possible sources of funding to complete the recommended upgrades at Bankview 1 as part of Phase 2. Possible sources of funding may include provincial or federal funding sources such as FCM's Green Municipal Fund. If funding is not identified for Phase 2, the additional energy efficiency and renewable energy upgrades will not be completed for Bankview 1.

In the future, if all of the recommended measures are implemented, the expected operating cost savings for the building is about \$14,800 per year.

Risk Assessment

There is a risk that the modelling results over estimate the potential for energy reduction or cost savings, or that some of the assumptions used in the modelling are incorrect. This risk was mitigated through the selection of modelling contractor and using internal technical expertise.

There is also a risk that there will be low uptake of the process and tools developed as part of this project by CHC or other affordable housing providers in Calgary. For Phase 2 of the pilot project, ESM will continue to collaborate with CHC to ensure the implementation of the project meets their needs. Key learnings from the pilot will be applied if the program is rolled out to other affordable housing providers in Calgary.

REASON(S) FOR RECOMMENDATION(S):

The scope of the project has been completed and delivered within the one year timeframe and within the Council Innovation Fund allocated budget. For these reasons Environmental and Safety Management (ESM) recommends that this report be received for information as the final deliverable for the project.

ATTACHMENT(S)

1. Sample Output from Financial Decision Support Tool
2. Executive Summary of the Integrated Energy Master Plan
3. Executive Summary of the Tenant Engagement Toolkit