ULI British Columbia

Technical Assistance Panel Report | MAY 28–29, 2024

OPPORTUNITIES & CHALLENGES OF RETROFITS

LEARNINGS FROM LOW INCOME SENIORS RESIDENCE ALEXANDER HOUSE

Net Zero Imperative Vancouver, British Columbia

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ON THE COVER: Image showing the TAP panelists presenting their findings and suggestions at the end of Day Two *(Graham Handford)*.

Executive Summary

The ULI Technical Advisory Panel (TAP) convened in May 2024 to develop strategies for scaling up retrofits in Vancouver, British Columbia, focusing on affordable housing as a pathway to achieving net-zero targets. Alexander House, an 81-unit seniors' residence, served as the case study for addressing the challenges and opportunities of building retrofits.

Context and Objectives

Buildings in Metro Vancouver account for 25% of greenhouse gas (GHG) emissions in the area. 80% of the buildings that will exist in 2050 are already built, and to meet Canada's 2050 net zero emission goals, 600,000 homes must be retrofitted each year. While retrofits can enhance energy efficiency and tenant comfort, barriers such as high costs, complex permitting, and limited organizational capacity persist. The TAP sought to develop a roadmap to overcome these challenges and scale retrofit adoption.

Benefits and Challenges

Despite advancements in building systems, technology, and energy modeling, key obstacles remain. Many funding and regulatory structures are not aligned with retrofit needs; therefore, the TAP has generated recommendations for stakeholders to implement.

Recommendations

- Develop a streamlined retrofit roadmap, as demonstrated in the Alexander House case study.
- Simplify funding and permitting processes by consolidating application requirements and timelines.
- Expand municipally approved emission reduction strategies and incorporate both relative and absolute baselines for GHG improvements.
- Develop a standardized occupant survey template.
- Develop a Universal Energy Modeling Approach.
- Map electrical capacity across British Columbia.

The TAP findings highlight the transformative potential for retrofits, specifically affordable housing, to reduce emissions and improve tenant well-being. By addressing these barriers and fostering collaboration, Vancouver can accelerate retrofit adoption to achieve climate and housing goals while creating resilient, low-carbon communities.

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About the Urban Land Institute

The Urban Land Institute is a global, member-driven organization comprising more than 45,000 real estate and urban development professionals dedicated to advancing the Institute's mission of providing leadership in the responsible use of land and in creating and sustaining thriving communities worldwide.

ULI's interdisciplinary membership represents all aspects of the industry, including developers, property owners, investors, architects, urban planners, public officials, real estate brokers, appraisers, attorneys, engineers, financiers, and academics. Established in 1936, the Institute has a presence in the Americas, Europe, and the Asia Pacific region, with members in 81 countries.

ULI's extraordinary impact on land use decision making is based on its members' sharing expertise on a variety of factors affecting the built environment, including urbanization, demographic and population changes, new economic drivers, technology advancements, and environmental concerns.

Peer-to-peer learning is achieved through the knowledge shared by members at thousands of convenings each year that reinforce ULI's position as a global authority on land use and real estate. In 2019 alone, more than 2,400 events were held in about 330 cities around the world.

Drawing on the work of its members, the Institute recognizes and shares best practices in urban design and development for the benefit of communities around the globe.

More information is available at uli.org. Follow ULI on Twitter, Facebook, LinkedIn, and Instagram

Net Zero Imperative

Thanks to a generous gift from Owen Thomas, ULI has launched the Net Zero Imperative – a multi-year initiative to accelerate decarbonization in the built environment. Additional gifts from Lynn Thurber, Joe Azrack, Franz Colloredo-Mansfeld, and Dan Cashdan further support and bolster the NZI program's scale and impact. To advance the initiative, the Net Zero Imperative work includes technical assistance panels in five global cities each year, designed to help developers, building owners, cities, and other relevant constituents reduce carbon emissions associated with buildings, communities, and cities. The fundamental goal of the effort

Distinct from Advisory Services panels, TAPs leverage local expertise through a two-day workshop.

is to provide concrete ideas and strategies to real estate owners, public sector leaders, and the general public to eliminate carbon emissions from the built environment to reach net zero. Through its work, like the technical assistance panel in Vancouver, the initiative will create global resources (research, toolkits, and other tools) to help all ULI members accelerate decarbonization in their real estate operations and in their cities. During the Net Zero Imperative's time in Vancouver, the committee held virtual and in-person educational events, a two-day technical assistance workshop, and produced this report.

Message from the Co-Chairs

This report intends to contribute to the important mission of supporting adoption of deep energy retrofits in the non-profit housing sector. The non-profit housing sector is fragmented and the Lower Mainland's many non-profit housing providers are focused on delivering essential services to their customers in need. Buildings in need of retrofits date back as far as the 1950's and because of this, non-profits often lack accurate and up-to-date building information. Without up-to-date building information and without open-source access to utility information through BC Hydro, it is challenging to complete the necessary and costly energy models required to start the retrofit process. This ultimately means that the various public funding programs are out of reach – the hurdles are just too high. As the retrofit planning process takes months or even years, construction costs rise, delaying improved comfort and health outcomes for residents. Older buildings reach the end of their useful life and redevelopment becomes the more feasible scenario – even though we know that the most sustainable building is the one that already exists.

The report's target audience is the real estate industry at large; municipal, provincial and federal levels of government; public, private, and nonprofit owners; and other groups whom could benefit from a streamlined retrofit industry. While the report includes a retrofit roadmap for Alexander House, the key recommendations and policy actions to improve retrofit adoption and outcomes in British Columbia are important in improving efficiency within the retrofit space.

– ULI NZI Vancouver Co-Chairs: Zoe Brook & Vincent Delfaud

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ULI Advisory Services: National and Global Programs

Since 1947, the ULI Advisory Services program has assembled well over 700 ULI-member teams to help sponsors find creative, practical solutions for complex land use challenges. A wide variety of public, private, and nonprofit organizations have contracted for ULI's advisory services. National and international panelists are specifically recruited to form a panel of independent and objective volunteer ULI member experts with the skills needed to address the identified land use challenge. The program is designed to help break through obstacles, jump-start conversations, and solve tough challenges that need an outside, independent perspective. Three- and five-day engagements are offered to ensure thorough consideration of relevant topics.

An additional national offering is the project analysis session (PAS) offered at ULI's Fall and Spring Meetings, through which specific land use challenges are evaluated by a panel of volunteer experts selected from ULI's membership. This is a conversational format that lends itself to an open exchange of ideas among diverse industry practitioners with distinct points of view. From the streamlined two-hour session to the "deeper dive" eight-hour session, this intimate conversational format encourages creative thinking and problem solving.

Learn more at americas.uli.org/programs/advisory-services/.

ULI Advisory Services: Vancouver

The goal of the ULI Advisory Services program is to bring the finest expertise in the real estate field to bear on complex land use planning and development projects, programs, and policies. Drawing from its local membership base, ULI NZI Vancouver conducted a two-day TAP offering objective and responsible advice to local decision-makers on a wide variety of land use and real estate issues ranging from site-specific projects to public policy questions. The TAP program is intentionally flexible to provide a customized approach to specific land use and real estate issues.

Each panel team is composed of highly qualified professionals who volunteer their time to ULI. They are chosen for their knowledge of the panel topic and screened to ensure their objectivity.

ULI BC NZI is graciously sponsored by PCI, Pinchin, and Warrington PCI Management.

ULI's interdisciplinary panel teams provide a holistic look at development problems. A respected ULI member who has previous panel experience chairs each panel.

The agenda for a two-day panel assignment is intensive. It includes an in-depth briefing day composed of a tour of the site and meetings with sponsor representatives; hour-long interviews; and one day of formulating recommendations. On the final day on site, the panel makes an oral presentation of its findings and conclusions to the sponsor. This report is a summary of the TAP's recommendations and findings. In fulfillment of the mission of the Urban Land Institute, this report is intended to provide objective advice that will promote the responsible use of land to enhance the environment.

Significant preparation is required by the sponsoring entities before the panel's visit, including sending extensive briefing materials to each member and arranging for the panel to meet with key local community members and stakeholders in the project under consideration. This allows for TAP participants to make accurate assessments of a sponsor's issues to provide recommendations in a compressed amount of time.

Acknowledgments

On behalf of the Urban Land Institute, the panel would like to thank its hosts: the City of Vancouver, Canadian Affordable Housing Society, Alexander House, and ULI Vancouver. Thank you for providing us with all the necessary information to execute the TAP. Thank you to Wendy Waters, who was instrumental in securing the grant funding. Thank you, Shannon Paterson, at ULI BC for your continuous guidance and support in making the TAP happen. The TAP would like to thank Inform Projects for hosting the two-day workshop in their beautiful office space. Thank you to Uplift for your help in preparing for the TAP and facilitating the two-day panel. Thank you to Lazy Gourmet for keeping the group well-fed and hydrated during our collaboration sessions, and to Belgard Kitchen for hosting the group for a family-style dinner. The panel would also like to thank the ULI Foundation, which provided significant financial support for this panel. Lastly, thank you to the ULI BC NZI sponsors, PCI, Pinchin and Warrington PCI Management. This would not have happened without you. A special thank-you goes to the advisors and panelists of the TAP for your time and dedication.

The TAP would not have been possible without the panelists, advisors, organizers and sponsors.

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Image showing the ULI NZI Chairs & TAP Support Team.

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PANEL MISSION

Why

Metro Vancouver's 500,000 buildings generate 4 million tonnes of greenhouse gases annually, accounting for 25% of the area's emissions. Deep retrofits can cut energy use by 50%-70% and GHG emissions by 80%-100%, while also improving climate resiliency, occupant quality of life, and housing affordability. Many affordable housing units in BC need retrofits, but non-profit operators lack resources. Leveraging local expertise from the ULI network in BC can ensure successful retrofit projects.

What

The purpose of the TAP is to identify a roadmap to scaling up the retrofit of affordable housing stock: identifying the hurdles, recommending effective solutions, necessary supports and incentives for retrofit adoption. Alexander House was chosen as a notional subject property for the retrofit case study.

How

In preparation for the TAP, the ULI BC Co-Chairs and Support Team identified and interviewed key experts & stakeholders from BC Hydro, Brightside Homes, Pembina Institute, Evoke Buildings, AME Consulting, Aboriginal Housing Management Association, BC Non-Profit Housing Association, City of Vancouver, OPENTech, Metro Vancouver, and Efficiency Capital, and asked the following questions:

1. *What is your experience with and relationship to retrofits?*
2. *What are the top 5 things you want the panellists to know for the case study?*
3. *What improvements would you suggest for the retrofit process/ costs/outcomes?*
4. *What critical changes are needed to advance retrofit adoption in Vancouver?*

The Briefing Book provided panelists with interview notes, key takeaways, and additional context for developing a retrofit roadmap for Alexander House (see Appendix C). It included building characteristics, energy models, a retrofit pro forma, relevant policies, funding programs, industry initiatives, resources, and questions for the panelists

The TAP Panelists were given an indepth Briefing Book on Alexander House prior to the workshop, including interviews from local key experts and stakeholders

TAP SUMMARY

The TAP was a structured, two-day event held on May 28th and 29th, 2024. On Day One, panelists began by touring Alexander House and participated in a question-and-answer period with previously engaged stakeholders and advisors, discussing the details of Alexander House, the retrofit space at large, and the interview outcomes and insights.

On Day Two, the panelists participated in a facilitated workshop to recommend a specific roadmap to achieve a CMHC's Canada Greener Affordable Housing Program (CGAH) funded retrofit. Panelists were broken out into small groups, and asked to answer the following questions:

Panel Questions

1. *What stood out and what resonated from the Advisor Interviews and Alexander House tour?*
2. *What is currently working well in the larger retrofit space?*
3. *How do we apply what's working in the larger retrofit space to non-profit-operated affordable housing retrofits?*
4. *What key interventions would most help create success for non-profit-operated affordable housing retrofits?*
5. *How can we create a simplified retrofit planning process that reduces time and cost but delivers acceptable and equivalent outcomes?*
6. *How do we measure impact and define success (KPIs) in the retrofit space over the short, medium and long term?*
7. *What is the roadmap for deep carbon retrofit? Design it.*

The answers to these questions informed the recommendations for the Alexander House Retrofit and highlighted key challenges and opportunities in the retrofit space, outlined in this report.

The TAP Panelists developed a CGAH-funded retrofit roadmap (CMHC).

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Image showing the TAP Panelists outlining their findings from Day One.

Insights from the two-day workshop generated recommendations for government, financial institutions, and building owners.

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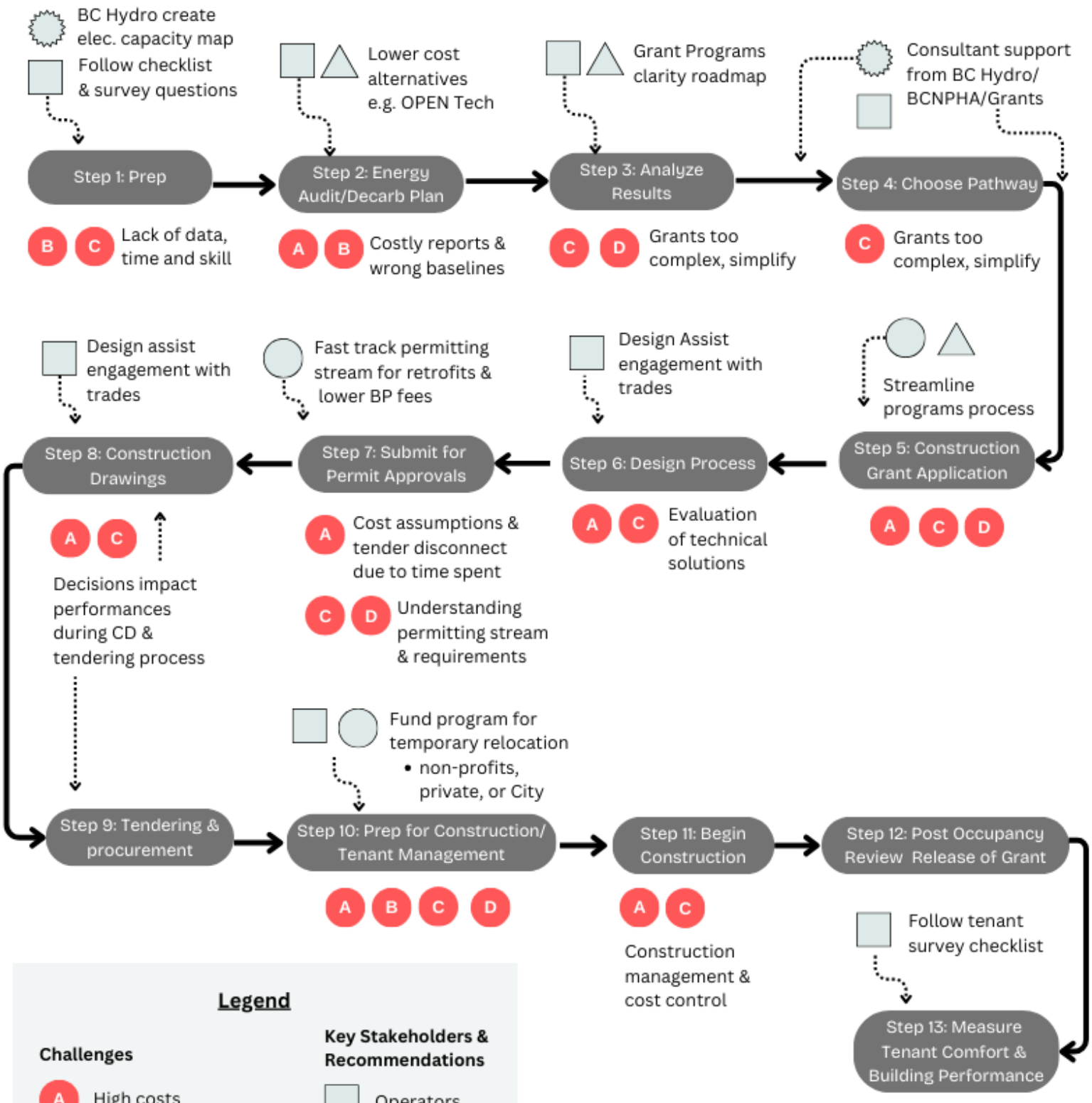
Image showing TAP Panelist creating retrofit roadmap.

Retrofit Roadmap

Challenges and Key Stakeholders



Legend

Challenges

- A High costs
- B Building info quality
- C Lack of resources (time/skill)
- D Complexity of process

Key Stakeholders & Recommendations

- Operators
- Funders
- Municipalities
- Utilities

Insights

"Contractors who self proforma mech./elec. can have cost & coordination benefits."

"GHGI fine in the City of Vancouver should not apply to non-profits, but the funds should be allocated to fund non-profit retrofits."

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Image showing TAP Panelists creating the retrofit roadmap.

TAP OUTCOMES

The outcome of the TAP is outlined in the following four sections:

1. Recommendations for Government, Funders & Operators (pg. 16)
2. Key Challenges & Improvements (pg. 19)
3. Key Benefits & Opportunities in the Retrofit Space (pg. 21)
4. Recommendations for Alexander House Retrofit (pg. 22)

The Greenhouse Gas Intensity fines in Vancouver are too financially insignificant to justify and outweigh the high upfront retrofit costs.

Part 1 - Recommendations for Government, Funders & Operators

GOVERNMENT

Expand the scope of approved emission reduction strategies: We recommend the City of Vancouver expands its current approach to measuring building emissions by incorporating additional factors that could contribute to overall greenhouse gas (GHG) reductions. This could include evaluating the impact of electric vehicle (EV) infrastructure, urban farming, and other carbon sequestration measures. By broadening the types of interventions and actions that contribute to emission reductions beyond mechanical or facade retrofits, the City of Vancouver can better support housing operators, developers, and asset managers in their decarbonization efforts.

Exclude non-profits from GHGI fines: We recommend that GHGI fines collected by the City of Vancouver are partly allocated to a new fund or program designed to incentivize and support retrofits of eligible non-profit owned buildings in the City of Vancouver.

FUNDERS

Incorporate both relative and absolute baselines for GHG improvements: We recommend combining relative percentage reductions and absolute baselines to make funding more accessible to buildings at different decarbonization stages. Stakeholders noted that stringent funding requirements often hinder progress despite strong GHG reduction goals. Leveraging tools like GRID (North America's benchmarking and performance tool by OPEN Technologies) can establish accurate baselines, providing clearer targets and improving consistency and impact measurement across retrofit projects.

- Absolute carbon/energy intensity thresholds allow more buildings to qualify for smaller, incremental improvements at lower capital cost, which could better foster action, growth in the industry, and building of capacity for larger projects.

Streamline funding application processes: To enhance efficiency and support retrofit adoption, funders like CMHC could combine the application processes for programs such as CMHC Seed Funding and CGAH into a single streamlined application. This approach would save time and resources, encourage retrofit uptake, and allow non-profit housing providers to preserve their contingency reserves for other essential needs.

Develop a coordinated checklist for grant requirements: BCNPHA or a similar organization could coordinate various funding program requirements into a checklist to help applicants navigate the requirements across multiple grant programs. To create the checklist, BCNPHA could utilize AI to complete the follow the following steps:

Step 1: Identify relevant programs.

Step 2: Streamline submission by consolidating data entry and pre-funding requirements.

Step 3: Identify shared and unique requirements across programs.

Step 4: Summarize each program's scope and coverage to clarify eligibility and benefits for applicants.

Non-profits and organizations with limited resources require more streamlined funding application processes to assist the retrofit process.

A standardized occupant survey template would assist operators in gathering the critical data on occupant health, comfort, and other measurable retrofit impacts.

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TAP Panelists inspecting Alexander House's facade.

OPERATORS

Develop a standardized occupant survey template: BC affordable housing landlord associations could create a comprehensive, standardized survey template for building occupants to collect data on key factors such as occupant health, comfort, and other measurable outcomes related to retrofit impacts. This template could be developed in consultation with stakeholders like Metro Vancouver Housing, BC Housing, and BCNPHA ensuring that it captures a wide range of information needed to assess retrofit effectiveness and occupant satisfaction. See the appendix for tenant survey question examples.

ADDITIONAL RECOMMENDATIONS

Universal Energy Modeling Approach: A standardized energy modeling approach would provide consistency, reduce redundancies, and make it easier to compare and evaluate energy efficiency improvements across various projects. While the BC Non-Profit Housing Association (BCNPHA) has initiated this work, it would be beneficial to secure

additional funding to advance and complete this initiative.

Electrical Capacity Mapping and Coordination with BC Hydro: BC Hydro could play a crucial role in facilitating retrofits by providing publicly accessible maps of electrical capacity throughout BC. Such maps would allow building owners, developers, and retrofit project teams to better understand the electrical limitations and potential upgrades required for their properties. Moreover, BC Hydro could improve the coordination of information sharing on electrical capacity with industry stakeholders. Streamlining communication channels and making critical data on electrical infrastructure readily available would enable more efficient planning and execution of retrofit projects, particularly when considering upgrades for EV charging and other energy-intensive improvements.

Key projects like Universal Energy Modeling and Electrical Capacity Mapping are critical to scaling retrofit projects.

Part 2 - Challenges & Improvements

Challenges within the retrofit space were summarized by the TAP into four critical areas:

- High costs
- Electrical capacity
- Lack of specialized talent
- The complexity of permit and funding applications approvals

The strongest consensus among TAP participants was that the financial viability of retrofits is largely dependent on the balance of high energy costs and carbon taxation, which in BC is currently too financially insignificant to justify the high upfront investment required. With little financial savings, this makes retrofits expensive, and many studies indicate a negative net present value (CAGBC, 2021) for projects in British Columbia, unless substantial grant funding or reduced borrowing costs

TAP Advisor Micah Lang sharing policy insights with TAP Panelists.

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are secured. Additionally, affordable housing operators have very limited capacity for debt servicing, further complicating financial feasibility.

While multiple barriers contribute to high retrofit costs, a shortage of specialized professionals compounds the problem. Retrofitting requires project management expertise, but the niche is less attractive than new construction or larger commercial projects, leading to a limited pool of qualified individuals.

A significant site-specific challenge during the retrofit process is electrical capacity, as both building and off-site electrical upgrades are extremely costly and can cause major disruptions. Upgrade requirements are sometimes not fully understood until deep into project planning, which can delay or derail retrofit initiatives.

Lastly, the permitting and funding approval processes for retrofits were identified by the TAP as highly, and unnecessarily, complex. Through permitting and approval processes, retrofits are treated similarly to new construction, despite being fundamentally different. This results in unnecessary design reviews and underwriting, creating additional hurdles for project success.

Technology and funding sources have drastically changed the retrofit landscape, but not enough to meet decarbonization goals.

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Image showing TAP Panelists brainstorming.

Image showing TAP Panelists & ULI Support Team brainstorming.

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The social impact rationale of retrofits is significant and should not be overlooked in the decision-making process.

Part 3 - Key Benefits & Opportunities

The TAP identified four key benefits and opportunities within the retrofit space. Firstly, there has been a rapid improvement in the technology landscape, including advancements in heat pumps, building envelopes, energy modeling, and clean energy sources like wind and solar. Furthermore, the use of artificial intelligence for building performance analysis, predictive maintenance, retrofit prioritization, and cost optimization has recently dramatically advanced (see Appendix D for AI applications). These advancements, combined with the availability of clean energy in our region, provide more ways to reduce energy consumption and greenhouse gas emissions than ever before.

Secondly, there are multiple funding sources available for reducing greenhouse gas emissions, energy consumption, and improving resiliency. These funding sources help reduce both the financial burden of retrofits and the upfront costs. There is also an opportunity to consolidate funding sources and streamline the application and fund release processes, which would save significant time and resources

Thirdly, there is an opportunity to streamline permit approvals by limiting drawing submissions and building permit fees for retrofits, making the process more efficient.

Lastly, the social impact of retrofits is significant. Retrofits support at-risk populations, such as seniors, children, and low-income tenants, by maintaining affordable housing and improving tenant comfort during extreme heating and cooling events. Using the tenant survey questions in Appendix B can help minimize tenant relocation, enhancing tenant wellbeing during these upgrades.

Part 4 - Recommendations for Alexander House Retrofit

Built in 1990, Alexander House is an 81-unit seniors residence in Gastown. The building features two amenity rooms, a large rooftop deck, and covers approximately 15,500 square feet with soft landscaping and pedestrian walkways. It is an 8-storey concrete structure over a concrete parkade, clad in stucco, split face block, and aluminum siding. The exterior walls lack rainscreen technology, so a Building Envelope Condition Assessment is recommended. The domestic water system includes two gas water heaters from 2011 and 2016, suggested for replacement in 2021 and 2026. All suites and common areas have electric baseboard heaters. The building has a make-up air unit (MAUs) on the roof to pressurize the hallways. There is a single electrical room in the parkade with a 400A main switch and several sub panels, with breaker panels in each suite.

Accessing essential building details and up-to-date documentation for retrofit analysis can be challenging. Not all building owners have the necessary information available, and gathering utility information can take significant time if not properly tracked. At the time of the TAP, the following documentation was available:

- Building Audit
- Condition Assessment
- Drawings and Floorplans (partial)
- Maintenance Report (partial)
- Insurance Appraisals
- Decarbonization Report
- Utility Bills (partial)

During the TAP, participants noted the need for an updated envelope assessment due to potential moisture in the walls, roof, and insulation, which could affect retrofit success. They also highlighted the significant parking and roof space, raising questions about better utilization. Lastly, they observed occupant behavior such as open windows, portable air conditioning units, and the timing of space usage.

RELEVANT POLICIES

Retrofit permitting varies widely depending on the scale of the retrofit and the municipality. There are important code and administrative elements, but also much ambiguity and discretion by the building and permitting departments. TAP panelists were asked to consider pathways to minimize required approvals which adhere to building code and regulatory standards.

176 Alexander Street

Operator: Affordable Housing Societies

Housing Type: Below Market Seniors Residence

Units: 81

Amenities: Two Amenity Rooms and a Large Rooftop Deck

Year Built: 1990

Construction Type: Concrete

Storeys: 8

Parking: 19 stalls

OPEN TECH DECARBONIZATION RESULTS & PLAN

After the initial building information is collected, it is important to understand what retrofit opportunities present the best carbon reduction, energy savings and low capital costs. The traditional approach would be to hire a consultant to conduct an energy audit, which is typically costly, time-consuming, and resource intensive. While incentives for such studies exist to bring costs down, the TAP did not have 1-3 months to wait for the results of a typical energy audit. OPEN Tech provides a solution that utilizes AI to deliver virtual energy audits and decarbonization plans in 1-2 weeks. The full decarbonization report for Alexander House can be found in Appendix B, and a summary can be found in the table below.

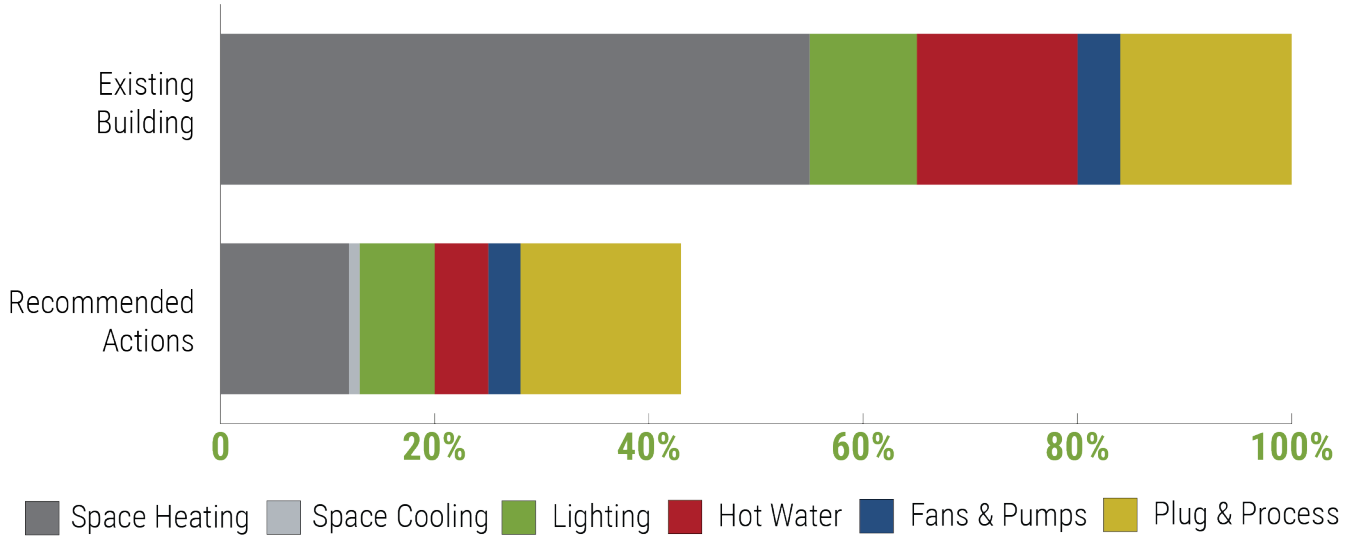
Table: Recommended Actions From Decarbonization Report

Recommended Actions	Cumulative GHG Savings	Energy Savings	Capital Costs	Payback Period	Energy Cost Savings
Common Area Lighting Retrofit	1% 1 tonne	5% 55,249 kWh	$135,000	22 years	$6,077/year
Window Re-placement: Triple Glaze	3% 3 tonnes	16% 186,982 kWh	$1.045 million	14 years	$14,034/year
Heat Pumps - Suites & Make-Up Air Units	58% 61 tonnes	45% 529527 kWh	$1.011 million	31 years	$20,121/year
Heat Pump Domestic Hot Water Heaters	95% 100 tonnes	58% 681,572 kWh	$243,000	42 years	$4,369/year
Total	**95% 100 tonnes**	**58% 681,572 kWh**	**$2.434 million**	**54 years**	**$44,601**

ENERGY USE BREAKDOWN

The energy use breakdown of Alexander House was derived from 2 years of electricity and gas consumption data. By utilizing such data, OPEN Tech was able to generate retrofit solutions for the building, and compare the energy use of the existing building to the projected energy use if the recommended retrofit actions were taken.

Graph: Energy Use from Existing Building vs Implementing Recommended Actions



FUNDING PLAN & SCENARIO ANALYSIS

The decarbonization report gives an order of magnitude to the retrofit opportunities, and approaching a quantity surveyor for class D estimate would be the next step in developing a more accurate funding plan. At the time of the TAP, this part of the exercise had not been completed, but would be the best next step for BCNPHA, following the retrofit roadmap outlined in the following pages.

A high-level draft retrofit pro forma was developed for Alexander House, based on actual retrofit projects at the time, with sensitivities for per-unit retrofit costs ranging from $100,000 to $200,000 per door. The grant and loan programs assume CMHC's Canada Greener Affordable Housing Program, using indicative rate from CMHC (May 17, 2024), and it is assumed that there is no existing mortgage to factor into debt service requirements.

CRF definition: Capital reserve fund

CGAH Indicative Rate: 4.10%

Pro forma analysis shows that Alexander House can afford retrofit financing of approximately $2.55M, while contributions could be another $6.9M, for total funding sources of $9.45M. Based on active and completed retrofit projects, a benchmark per unit cost for the proposed scope would be $125,000/unit or $10.125M, leaving a capital gap of $690,000 ($8,500/unit). If project costs came in higher, at $150,000/unit, still well below the $170,000 maximum funding amount for CGAH retrofits, there would be no ability to take on a larger loan to cover the difference, increasing the cash

Image showing TAP Panelists touring Alexander House.

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required to $2.7M.

An increase of net operating income of $142/unit/month (+21% to average rents) would be needed to close the funding gap to $0, however the tenants are fixed income seniors with no ability to pay for additional retrofit financing so this would not be a viable option.

Finally, if funding sources were secured and the project completed, the additional loan payments would reduce cash flow from Alexander House to just $10,000-50,000/year depending on actual realized energy savings (or not). The longterm risk here is that even after making such substantial building improvements, there may not be sufficient remaining cash flow to continue adequately maintaining the facility for another 10-20 years, especially if the retrofit loan is renewed at a higher interest rate than 4% in 10 years.

In summary, deep energy retrofits can be financially very risky and uncertain for Societies with limited resources, especially when considering that the retrofit activities will substantially disrupt tenants, potentially requiring full relocation, which is a huge administrative and social burden for operators. CMHC's CGAH program comes the close to creating viable retrofits, by providing such a large contribution per unit, however the high performance requirements are challenging to achieve with tenanted buildings, and require up to a year or more of preplanning without certainty of success.

Two modifications to the retrofit funding could ease the financial planning aspect of retrofits:

1. Funding to be the lower of $150,000 or Class B cost estimate project costs with sufficient contingency allocation.
2. Loan amount to be determined by available property cash flow, with adequate ongoing maintenance reserve factored in ($75-100/unit/m), with balance of $150,000/unit funding to be forgiveable loan.

Retrofit funding can then be prioritized by $/unit factored against absolute GHG and energy intensity targets, and then by depth of affordability. Smaller projects with less tenant disruption, lower capital cost, and high GHG reduction outcomes, could be funded at the same time as deeper energy retrofits for the occasional un-tenanted building.

Cost Sensitivities	CGAH Retrofit			
Total Cost $/unit	**$200,000**	**$150,000**	**$125,000**	**$100,000**
INCOME				
Avg Rent	$650	$650	$650	$650
Vacancy	1.0%	1.0%	1.0%	1.0%
Avg Opex	($450)	($450)	($450)	($450)
CRF contribution	($60)	($60)	($60)	($60)
Net Income /un/m	$134	$134	$134	$134
	20.5%	20.5%	20.5%	20.5%
CAPITAL STACK				
Indicative Rate	4.10%	4.10%	4.10%	4.10%
Amortization	40	40	40	40
Debt Service	1.0	1.0	1.0	1.0
Max Loan	$31,473	$31,473	$31,473	$31,473
Max Grant	$85,000	$85,000	$85,000	$85,000
Equity Gap /un	$83,527	$33,527	$8,527	($16,473)
	41.8%	22.4%	6.8%	-16.5%
NET CASH FLOW				
Interest Buffer	0.50%	0.50%	0.50%	0.50%
Stabilized Rate	3.60%	3.60%	3.60%	3.60%
Actual Pmt	($124)	($124)	($124)	($124)
Energy Savings	$45	$45	$45	$45
Net Cash Flow /un/m	$55	$55	$55	$55
	8.4%	8.4%	8.4%	8.4%
TOTAL PROJECT				
Units	81	81	81	81
Total Capital Req'd	$16,200,000	$12,150,000	$10,125,000	$8,100,000
Total CGAH Loan	$2,549,276	$2,549,276	$2,549,276	$2,549,276
Total CGAH Grant	$6,885,000	$6,885,000	$6,885,000	$6,885,000
Total Equity Gap	$6,765,724	$2,715,724	$690,724	($1,334,276)
Net Income	$129,762	$129,762	$129,762	$129,762
Total Debt Service	($120,350)	($120,350)	($120,350)	($120,350)
Energy Savings	$43,740	$43,740	$43,740	$43,740
Net Cash Flow	$53,152	$53,152	$53,152	$53,152
Yield on Equity Invested	0.79%	1.96%	7.70%	-3.98%

Summary

By evaluating retrofit opportunities for Alexander House as a case study, the TAP highlights the significant opportunities in advancing retrofit adoption across affordable housing, underscoring the environmental, economic, and social benefits of retrofits. Key recommendations center around aligning policies and funding, simplifying application processes, and improving electrical infrastructure to enable more efficient retrofits.

The main takeaway from the TAP is the need for comprehensive attention to the retrofit space. The report encourages policymakers to streamline funding and permitting, while advocating for more resources to support non-profit operators navigating complex retrofit projects. The panel also notes that retrofits not only improve energy efficiency but enhance occupant comfort, especially for vulnerable populations. By addressing high upfront costs, electrical limitations, and regulatory hurdles, this TAP report highlights a path toward scalable retrofit practices that can meet both immediate housing needs and long-term climate goals in Vancouver and beyond. In conclusion, the TAP report states that cohesive, well-supported retrofit programs could transform communities and preserve the affordable housing stock available today.

RECOMMENDATIONS

- Develop a streamlined retrofit roadmap, as demonstrated in the Alexander House case study (page
- Simplify funding and permitting processes by consolidating application requirements and timelines.
- Expand municipal approved emission reduction strategies and incorporate both relative and absolute baselines for GHG improvements.
- Develop a standardized occupant survey template.
- Develop a universal energy modelling approach.
- Map electrical capacity across British Columbia.

Appendix A: Resource Library

FUNDING PROGRAMS

Below is a summary of some relevant funding programs available for retrofits.

CMHC

- National Housing Co-Investment Fund offers loans below market rates with favorable conditions for non-profits and Indigenous groups. The Co-Investment Fund has struggled with uptake due to additional accessibility requirements, and low contribution amounts (2.5% of budget typical contribution).
- Canada Greener Affordable Housing Program is CMHC's new flagship funding program for non-profit energy retrofits, launched in 2023. CGAH focuses on two main criteria: 60-70% energy efficiency improvement from baseline performance, and 80% reduction of operational GHGs, based on ASHRAE level 3 audit and energy model reports. CGAH has been criticized for not mandating any affordability requirements either at application or through covenant or loan agreement; however, the streamlined requirements allow for an accelerated approvals process with reduced application materials, and rapid turnaround of Loan Agreement by CMHC. CGAH has two funding opportunities:
    - Pre-retrofit activities: $130,000 maximum contribution per project, and typical funding amounts much lower. Difficult to secure due to oversubscription.
    - Retrofit Funding: CMHC will fund 100% of eligible retrofit costs, up to $170,000 per unit. Forgivable loans will be the lesser of: $85,000 per unit, or 80% of eligible retrofit costs. Low-interest loans are required to finance the rest, the lower of 20% of eligible costs or per project debt service capacity at 1.0x indicative rate and 30-40 year amortization.

CleanBC

- The Building Innovation Fund offers a maximum incentive amount of $1,000,000 per project.
- The Communities Fund Provides provincial and federal funding for community infrastructure projects that reduce reliance on fossil fuels, with funding up to 65% of the eligible project costs.
- The Social Housing Incentive Program provides incentives for electrical

- load analysis ($7,000 up to 100%), energy studies (up to $5,000), project implementation support (up to $7,000), retrofit incentives (up to $200,000 up to 75%), and electrical system upgrades (top up, up to 100%).
- Free energy coaching services to assist building owners and operators reduce GHGs through fuel-switching and other electrification measures and take advantage of CleanBC's Custom-Lite and CleanBC Commercial Express incentive offerings.
- Energy Conservation Assistance Program (ECAP) Incentives: Free installation of energy-saving measures and potentially ENERGY STAR appliances and high-efficiency gas furnaces, depending on eligibility.
- Social Housing Retrofit Support Program (SHRSP) Incentives: $8,000 for energy studies, $11,000 for project implementation support, and rebates for various energy-saving measures.

Other

- FortisBC has a wide range of incentives, from boiler rebates to insulation, with the Deep Energy Retrofit Pilot Program emerging as a highlight, potentially covering 60%-80% of total project costs.
- The City of Vancouver's Non-Profit Resilient Retrofit Grant Program: Up to 100% of incremental consultant, capital, and replacement costs for retrofits, including heat pump installation, after applying other grants/ funds.
- Vancity's Non-Profit Housing Retrofit Program: Grants up to $80,000 for planning deep energy and carbon retrofit projects.
- BC Housing:
    - Energy Efficiency Retrofit Program (EERP): Retrofits for boilers, domestic hot water tanks, lighting, some MUA units, heat pumps, and furnaces. BC Housing provides EERP funding via capital grants to eligible and approved projects to cover the gap between approved project costs and the utility incentive program contributions, up to a maximum of $100,000.
    - Capital Renewal Fund (CRF): Funding for building remediation, including seismic, fire safety, or energy performance improvements. Eligibility: Minimum funding of $250,000 per building, remortgage required, BC Housing Operating Agreement (OA) or recently ended OA.
- Funded by the City of Vancouver in partnership with CleanBC and BCHydro, and administered through LandlordBC, the RARA program has $3.5 million

in grant funds available for owners of market rental buildings to undertake critical energy retrofit upgrades, including building electrification and fuel-switching using new heat pump technology – this would be interesting when retrofitting projects that combine below and at market rental units.

- Based on the Energy performance achieved, the owner/operator can claim a tax credit corresponding to the cost of retrofit through the Clean Building Tax Credit Act in grant funds available for owners of market rental buildings to undertake critical energy retrofit upgrades, including building electrification and fuel-switching using new heat pump technology.
- Based on the Energy performance achieved, the owner/operator can claim a tax credit corresponding to the cost of retrofit through the Clean Building Tax Credit Act

INDUSTRY INITIATIVES & RESOURCES

City of Vancouver - Green Energy Resources and Programs for Multi Family Buildings

BC Housing - Energy Efficiency Program

BC Nonprofit Housing Association - Retrofit and Maintenance Projects

Pembina Institute - Reframed Initiative Case Studies and Reframed Initiative Report

Fresco & BC Hydro - Concept Framework to Electrifying Multi-Unit Residential Buildings

Zero Emissions Building Exchange - Retrofit Resources

APPENDIX B: ADVISOR INTERVIEW NOTES

A group of advisors were interviewed in preparation for the TAP, and on Day 1, the TAP had an opportunity to ask further questions from the attending advisors in a panel-like format.

Disclaimer: the interview summaries are based off transcripts and meeting notes, and do not necessarily represent the views of the individuals or organizations and should not be taken as quotes by media without explicit written permission from the advisor.

Documents references by the Advisors

- BC Hydro - Presentation on Low Carbon Electrification Funding Programs
- Brightside Homes - Net Zero Strategy
- Pembina Institute - Summary of Recent Reports
- Metro Vancouver - Best Practices in Energy and Emissions Benchmarking and Reporting for Existing Large Buildings
- Efficiency Capital - Presentation & Sample Case Study

List of Advisors

- Patrick Caraher & Atoine Archie, Aboriginal Housing Management Association
- Mike Kasuya, AME Consulting Group
- Victoria Richards, BC Hydro
- Jackie Kanyuk & Brian Jung, BC Non-Profit Housing Association
- William Azaroff & Wesley Everaars, Brightside Homes
- Micah Lang, City of Vancouver
- Erin Ellis, Efficiency Capital
- Patrick Roppel, Evoke Buildings
- Michael Epp & Jeff Sevold, Metro Vancouver
- Donovan Woollard & Christian Cianfrone, Open Tech
- Betsy Agar, Pembina Reframed Initiative

Key themes to develop informed recommendations:

1. Simplification: Streamline funding and permitting.
2. Incentivization: Expand financial support for energy-saving measures.
3. Collaboration: Foster partnerships across stakeholders and governments.
4. Education: Build knowledge through case studies, training, and resource sharing.
5. Tenant-Centric: Prioritize minimal disruption and improved quality of life for tenants.

Advisor Insights

1. What is your experience with and relationship to retrofits?

- *"Retrofitting is central to our work, focusing on upgrading building envelopes, heating systems, and integrating renewables like solar panels."* – Patrick Caraher, Aboriginal Housing Management Association (AHMA)
- *"We lead energy retrofits, major equipment replacement projects, and energy studies to optimize performance and reduce costs."* – Mike Kasuya, AME Consulting Group
- *"Our projects range from mechanical upgrades to net-zero strategy retrofits, emphasizing energy efficiency and tenant engagement."* – William Azaroff, Brightside Community Homes
- *"We provide turnkey decarbonization solutions, funding multi-measure retrofits to achieve energy savings and improved occupant health."* – Erin Ellis, Efficiency Capital
- *"Policy work on decarbonizing large buildings is key, from setting performance targets to improving mechanical systems."* – Micah Lang,

City of Vancouver

2. What are the top 5 things you want the panelists to know for the case study?

Prioritize Energy Studies:

- *"Energy studies are essential for identifying cost-effective measures, like high-performance windows and heat pump installations."* – Patrick Caraher, AHMA
- *"Start with a decarbonization plan integrated into a capital plan to balance short-term needs like tenant comfort with long-term goals."* – Micah Lang, City of Vancouver

Align Projects with Funding Opportunities:

- *"Plan retrofits around available funding streams, such as BC Hydro and CleanBC incentives."* – Victoria Richards, BC Hydro
- *"Explore portfolio-wide bundling to achieve economies of scale and attract funders."* – William Azaroff, Brightside Community Homes

Consider Electrical Capacity:

- *"Evaluate electrical load and plan upgrades early to avoid costly service disruptions."* – Victoria Richards, BC Hydro
- *"Look for opportunities to reduce electrical demand with envelope improvements and efficient systems."* – Micah Lang, City of Vancouver

Engage Stakeholders Early:

- *"Involve owners, consultants, and contractors early to streamline coordination and avoid costly delays."* – Patrick Caraher, AHMA
- *"BC Non-Profit Housing Association (BCNPHA) offers resources to guide operators through planning and funding processes."* – Jackie Kanyuk, BCNPHA

Focus on Tenant Needs:

- *"Retrofits should prioritize tenant well-being, minimizing disruption while improving thermal comfort and indoor air quality."* – Erin Ellis, Efficiency Capital

3. What improvements would you suggest for the retrofit process, costs, and outcomes?

Simplify Funding and Permitting:

- *"Consolidate funding requirements across agencies and streamline permitting processes to reduce administrative burdens."* – Mike Kasuya, AME Consulting Group
- *"Introduce a single-window application system to make retrofits accessible to smaller operators."* – Victoria Richards, BC Hydro

Expand Incentives:

- *"Increase funding for electrical upgrades and expand rebates for envelope improvements."* – Erin Ellis, Efficiency Capital
- *"Provide tax credits for retrofits and extend support for energy audits and project management."* – Betsy Agar, Pembina Institute

Enhance Collaboration:

- *"Encourage partnerships between municipal and provincial governments to align retrofit goals and streamline processes."* – Antoine Archie, AHMA
- *"Aggregators can help smaller operators pool resources and access larger funding opportunities."* – Patrick Caraher, AHMA

4. What critical changes are needed to advance retrofit adoption in Vancouver?

Policy Adjustments:

- "Introduce retrofit-specific regulations to fast-track permitting and incentivize deep retrofits." – Micah Lang, City of Vancouver
- "Clarify long-term decarbonization targets to help operators plan their projects strategically." – Michael Epp, Metro Vancouver

Utility Support:

- *"BC Hydro should publish public capacity maps and improve support for electrical upgrades."* – Victoria Richards, BC Hydro
- *"Integrate renewable energy sources like solar and wind to reduce reliance on hydroelectricity."* – William Azaroff, Brightside Community Homes

Expand Knowledge Sharing:

- *"Document successful retrofit projects and provide case studies to guide operators."* – Erin Ellis, Efficiency Capital
- *"Enhance training for tradespeople and project managers to address capacity shortages."* – Patrick Roppel, Evoke Buildings

Improve Tenant Engagement:

- *"Develop tenant communication strategies to ensure clarity about retrofit timelines and benefits."* – Jackie Kanyuk, BCNPHA
- *"Offer relocation and support services during disruptive retrofit phases."* – Patrick Caraher, AHMA

Appendix C: TENANT SURVEY QUESTIONS

Before asking any questions to tenants, it is important to outline the following information regarding building upgrades:

- The purpose of the upgrades
- The upgrades being considered
- Importance of tenant input/opportunities to provide input
- How the upgrades impact tenants

Comfort Questions:

- Overall, how comfortable is the temperature of your unit in the summer?
- How would you describe the temperature in your unit during the summer?
- How often is your home at a comfortable temperature in the summer?
- Which of the following actions do you take when the temperature in your unit is too hot in the summer (please check all that apply)?
    a. Open windows
    b. Turn on AC
    c. Turn on fans
    d. Lower thermostat setting
    e. Move to a different part of the apartment
    f. Eat or drink something cold
    g. Call the property manager
    h. Put on lighter clothes
    i. Take a cold
    j. Shower do nothing
    k. Other, please specify:
- How satisfied are you with your ability to control the temperature in your unit in the summer?
- Do you ever use an Air Conditioning (AC) unit in the summer?
- Do you have any comments about the comfort of your unit in the summer?
- Overall, how comfortable is the temperature of your unit in the winter?
- How would you describe the temperature in your unit during the winter?
- How often is your home at a comfortable temperature in the winter?
- Which of the following actions do you take when the temperature in your unit is too cold in the winter (please check all that apply)?

    a. Turn up the thermostat
    b. Turn on a plug-in heater
    c. Dress warmer
    d. Eat or drink something warm
    e. Move to a different part of the apartment
    f. Turn on the oven
    g. Call the property manager
    h. Put on a blanket
    i. Take a hot shower or bath
    j. Use an electric blanket
    k. Do nothing
    l. Other, please specify:
- How satisfied are you with your ability to control the temperature in your unit in the winter?
- Do you ever use a plug-in heater in the winter?
- Do you have any comments about the comfort of your unit in the winter?

Air Quality Questions:

- How would you describe the air-flow in your unit?
- How satisfied are you with the freshness of the air in your unit?
- Do you regularly use your…
    a. Bathroom fan
    b. Kitchen fan
- Do you have any of the following issues in your unit?
    a. Condensation on windows
    b. Drafts near walls or windows when your windows are closed
    c. Do you have comments about the air quality in your unit?

Lighting Questions:

- Overall, how satisfied are you with the lighting conditions in your unit?
- How would you describe the amount of natural light in your unit?
- How satisfied are you with the artificial/electrical lights in your unit?
- Do you have comments about the lighting conditions in your unit?

APPENDIX C

Noise Questions:

- Overall, how satisfied are you with the noise levels in your unit?
- How would you describe the noise from your neighbours inside the building?
- How would you describe the noise from outside the building (vehicles, passers-by, nearby buildings, etc)?
- How would you describe the noise from fans and other appliances in your unit?
- Do you have comments about noise levels in your unit?

Common Space Questions:

- Overall, how satisfied are you with the temperature in the common spaces of your building?
- How would you describe the temperature in the common spaces of your building?
- How would you describe the amount of light in the common spaces of your building?
- How satisfied are you with the availability of common spaces for socializing with neighbours?
- How satisfied are you with landscaping and green space around the building?
- Do you have comments about common spaces in your building?

Overall Experience:

- Overall, how satisfied are you with your building?
- How would you say the building appears to visitors, overall?
- How often do you talk to any of your neighbours?
- To what extent are your electricity (BC Hydro) bills a financial burden to you?

Retrofit Questions:

- Overall, what is your satisfaction level with the building rehabilitation project?
- Overall, how comfortable has the temperature been in your unit over the winter?
- Have you noticed a change in your electrical (BC Hydro) heating bill?
    a. If yes, did it increase or decrease?

   b. By how much $_____ over _____ month period
- Have you noticed any changes in noise levels in your unit?
- How satisfied are you with the temperature in common spaces in the building?
- How satisfied are you with the lobby update?
- How satisfied are you with the building's exterior appearance?
- Any additional comments related to the building rehabilitation project (construction team, project management, results in energy efficiency and/or cost reductions, esthetics, or additional comments to the above questions)?

About the Tenant Questions:

- How old are you?
- How do you identify your gender?
- What language do you speak most often at home?
- Do you identify as any of the following?
   a. an Indigenous person
   b. a Black person
   c. a person of colour or visible minority
   d. an immigrant
   e. a person with mobility challenges (uses scooter, wheelchair, cane, etc.)
   f. a person with other disabilities (not including mobility ones)
   g. a person with multiple chronic health conditions
- How many adults live in your unit?
- How many children live in your unit?
- Unit #:_____

Appendix D: AI Application for Retrofits

About the Tenant Questions:

1. AI for Building Performance Analysis & Benchmarking

Purpose: Analyze your building's energy use and compare it to similar properties to identify inefficiencies and prioritize improvements.

Recommended Tools:

- PathFinder by OPEN Technologies: An intuitive tool that leverages whole-building energy modeling to educate users on the implications of building design on performance metrics such as energy use and greenhouse gas emissions.
- Cost: Information not specified; please contact OPEN Technologies for details.

Additional Options:

- Energy Star Portfolio Manager: A free tool that helps you track and assess energy and water consumption across your building portfolio. Cost: Free
- RETScreen: Developed by the Government of Canada, this free software assists in evaluating energy production, savings, costs, emission reductions, and financial viability for various energy-efficient and renewable energy technologies. Cost: Free

2. AI for Predictive Maintenance & Fault Detection

Purpose: Predict equipment failures before they occur, allowing for proactive maintenance and reducing unexpected repair costs.

Recommended Tools:

- Smart Thermostats (e.g., Nest, Ecobee): These devices learn your building's heating and cooling patterns to optimize energy use and can alert you to potential issues. Cost: Approximately $150–$250 per device.

Additional Options:

- Energy Conservation Assistance Program (ECAP) by BC Hydro and FortisBC: For income-qualified households, this program provides an in-home visit with free energy-saving product installations, including LED light bulbs, high-efficiency showerheads, and weather-stripping to reduce drafts. Some homes may also qualify for an ENERGY STAR® refrigerator and insulation upgrades. Cost: Free for eligible participants

3. AI for Retrofit Prioritization & Cost Optimization

Purpose: Analyze various retrofit options to recommend the most cost-effective energy-saving measures within your budget.

Recommended Tools:

- Affordable Housing Navigator by OPEN Technologies: Helps housing development managers quickly determine the financial feasibility of a development project by integrating all Canadian funding requirements into one comprehensive tool. Cost: Information not specified; please contact OPEN Technologies for details.

Additional Options:

- Energy Efficiency Retrofit Program by BC Housing: Provides funds for non-profit housing providers to make electric and gas energy upgrades. Cost: Funding program; application required

4. AI for Automating Energy Audits & Compliance

Purpose: Streamline the energy audit process and ensure compliance with energy efficiency standards and regulations.

Recommended Tools:

- Virtual Energy Score for Homes by OPEN Technologies: Allows homeowners and municipalities to understand the Net-Zero-readiness of their residential buildings, providing detailed insights for ground-oriented homes and large-scale insights for communities. Cost: Information not specified; please contact OPEN Technologies for details.

Additional Options:

- Energy Conservation Assistance Program (ECAP) by BC Hydro and FortisBC: As mentioned above, this program offers free energy evaluations and installations to help ensure homes meet energy efficiency standards. Cost: Free for eligible participants

5. AI for Tenant Engagement & Behavioral Insights

Purpose: Encourage tenants to adopt energy-saving behaviors through personalized insights and engagement strategies.

Recommended Tools:

Empower Me: A BC-based program that educates and supports diverse communities in energy efficiency practices. Cost: Free for participants

Additional Options:

Energy Saving Kit by BC Hydro: Provides free energy-saving products and advice to help lower-income customers save energy and money. Cost: Free for eligible participants

6. AI for Funding & Grant Application Support

Purpose: Identify relevant funding opportunities and assist in the application process for energy retrofit projects.

Recommended Tools:

- Social Housing Retrofit Support Program by FortisBC and BC Hydro: Offers energy study funding, implementation support funding, and incentives on various high-efficiency natural gas and electric upgrades for renovation projects undertaken by charities and non-profit housing providers. Cost: Funding program; application required

Additional Options:

- Energy Efficiency Programs by the Province of British Columbia: Offers financial incentives, information, and support to help households and businesses save energy and reduce greenhouse gas emissions by switching to high-efficiency heating equipment and making building-envelope improvements. Cost: Varies by program; application required

By leveraging these BC-based and free programs, non-profit housing operators can effectively plan and implement deep energy retrofits, leading to cost savings and enhanced tenant comfort.

British Columbia
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britishcolumbia.uli.org

Panelist Briefing Book

Urban Land Institute Net Zero Initiative- Affordable Housing Retrofits

Event: ULI NZI TAP
Date: May 28 and 29 2024
Location: 411 Railway Street (Inform Projects)

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10. Donovan Woollard & Christian Cianfrone, Open Tech
11. Betsy Agar, Pembina Reframed Initiative

Introduction

Existing buildings represent 25% of GHGs in the region and represent the highest potential for GHG reduction over the next 25 years. Improving existing buildings results through retrofits drives positive outcomes including climate resiliency, occupant quality of life, and preserving housing affordability. However, there are many hurdles to energy retrofits in the current status quo, and non-profit building operators are not always resourced to navigate retrofit planning and implementation.

The purpose of the TAP is to identify a roadmap to scaling up retrofit of affordable housing stock: identifying the hurdles, recommending effective solutions, and recommending necessary supports and creating incentives for retrofit adoption.

How do we get there? We have chosen a notional subject property for a retrofit case study. Building-specific information is included on page 4. During the TAP, panelists will tour the building on Day one, and participate in facilitated workshops on Day 2 to recommend a specific roadmap to achieve a CGAH-funded retrofit.

TAP OUTCOMES

The outcome of the TAP will be a report published in the Fall 2024. The report's target audience includes the industry at large; municipal, provincial and federal levels of government; public, private, and nonprofit owners; and other groups who could benefit from a streamlined retrofit industry.

The report will include the retrofit roadmap for the subject property. It will also include key recommendations and policy actions to improve retrofit adoption and outcomes.

QUESTIONS TO BE ADDRESSED BY THE PANEL

1. What is currently working well in the larger retrofit space? How do we apply what's working to non-profit operated affordable housing retrofits?
2. What key interventions would most help create success for non-profit operated affordable housing retrofits? For example, recommended changes to municipal policy and funding requirements.
3. How can we create a simplified retrofit planning process that reduces time and cost but delivers acceptable and equivalent outcomes?
4. How do we measure impact and define success (KPIs) in the retrofit space over the short, medium, and long term?

Consider these aspects of a retrofit during the workshop:

- Energy Modelling
- Design & Engineering
- City Policy & Permitting
- Funding Programs
- Procurement & Construction
- Support and Resources for Non-Profits
- Industry Capacity and Business Models
- Climate Resilience & Occupant Wellbeing

Host Property Information

ALEXANDER HOUSE

Address: 176 Alexander Street
Operator: Affordable Housing Societies
Housing Type: Below Market Seniors
Units: 81
Amenities: Two Amenity Rooms and a Large Rooftop Deck
Year Built: 1990
Construction Type: Concrete
Storeys: 8

BUILDING INFORMATION

Please visit this link to download the following building information for Alexander House provided by Affordable Housing Societies (expires May 28 2024). The link includes all available property information:

- Building Audit
- Condition Assessment
- Drawings and Floorplans
- Maintenance Report
- Insurance Appraisals
- Utility Bills.

RETROFIT PRO FORMA

Below is a draft retrofit pro forma for Alexander House, with sensitivities for per-unit retrofit costs ranging from $100,000 to $200,000 per door. The grant and loan programs assume CMHC's Canada Greener Affordable Housing Program (see page 6), using indicative rate from CMHC (May 17, 2024):

Cost Sensitivities	CGAH Retrofit			
Total Cost $/unit	**$200,000**	**$150,000**	**$125,000**	**$100,000**
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Energy Savings	$43,740	$43,740	$43,740	$43,740
Net Cash Flow	$53,152	$53,152	$53,152	$53,152
Yield on Equity Invested	0.79%	1.96%	7.70%	-3.98%

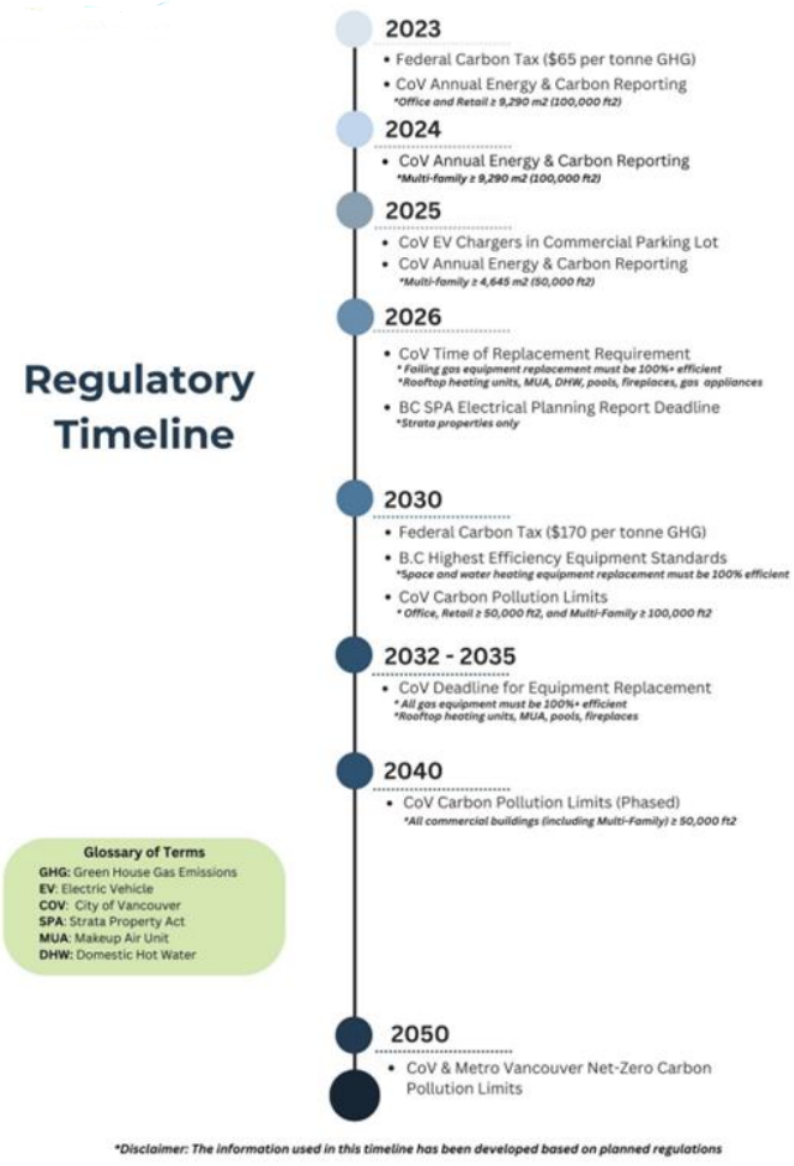
Download Link to the pro forma excel document with additional sensitivities (expires May 28).

Retrofit Market Information

POLICIES

Retrofit permitting currently varies widely depending on the scale of the retrofit and the municipality. There are important code and administrative elements, but also much ambiguity and discretion by the building and permitting departments. As a TAP panelist, consider pathways to minimize required approvals which adhere to building code and regulatory standards.

Below is a timeline published by FRESCo that details upcoming carbon-related regulatory milestones from Federal Government, Provincial Government, and City of Vancouver.



FUNDING PROGRAMS

Below is a summary of some relevant funding programs available for retrofits.

- **CMHC**
  - **National Housing Co-Investment Fund** offers loans below market rates with favorable conditions for non-profits and Indigenous groups. The Co-Investment Fund has struggled with uptake due to additional accessibility requirements, and low contribution amounts (2.5% of budget typical contribution).
  - **Canada Greener Affordable Housing Program** is CMHC's new flagship funding program for non-profit energy retrofits, launched in 2023. CGAH focuses on two main criteria: 60-70% energy efficiency improvement from baseline performance, and 80% reduction of operational GHGs, based on ASHRAE level 3 audit and energy model reports. CGAH has been criticized for not mandating any affordability requirements either at application or through covenant or loan agreement; however, the streamlined requirements allow for an accelerated approvals process with reduced application materials, and rapid turnaround of Loan Agreement by CMHC. CGAH has two funding opportunities:
    - Pre-retrofit activities: $130,000 maximum contribution per project, and typical funding amounts much lower. Difficult to secure due to oversubscription.
    - Retrofit Funding: CMHC will fund 100% of eligible retrofit costs, up to $170,000 per unit. Forgivable loans will be the lesser of: $85,000 per unit, or 80% of eligible retrofit costs. Low-interest loans are required to finance the rest, the lower of 20% of eligible costs or per project debt service capacity at 1.0x indicative rate and 30-40 year amortization.
- **CleanBC:**
  - The **Building Innovation Fund** offers a maximum incentive amount of $1,000,000 per project.
  - The **Communities Fund** Provides provincial and federal funding for community infrastructure projects that reduce reliance on fossil fuels, with funding up to 65% of the eligible project costs.
  - The **Social Housing Incentive Program** provides incentives for electrical load analysis ($7,000 up to 100%), energy studies (up to $5,000), project implementation support (up to $7,000), retrofit incentives (up to $200,000 up to 75%), and electrical system upgrades (top up, up to 100%).
  - Free energy coaching services to assist building owners and operators reduce GHGs through fuel-switching and other electrification measures and take advantage of CleanBC's Custom-Lite and CleanBC Commercial Express incentive offerings.
  - **Energy Conservation Assistance Program** (ECAP) Incentives: Free installation of energy-saving measures and potentially ENERGY STAR appliances and high-efficiency gas furnaces, depending on eligibility.
  - **Social Housing Retrofit Support Program** **(SHRSP)** Incentives: $8,000 for energy

studies, $11,000 for project implementation support, and rebates for various energy-saving measures.

- **FortisBC** has a wide range of incentives, from boiler rebates to insulation, with the Deep Energy Retrofit Pilot Program emerging as a highlight, potentially covering 60%-80% of total project costs.
- **The City of Vancouver's Non-Profit Resilient Retrofit Grant Program:** Up to 100% of incremental consultant, capital, and replacement costs for retrofits, including heat pump installation, after applying other grants/funds.
- **Vancity's Non-Profit Housing Retrofit Program**: Grants up to $80,000 for planning deep energy and carbon retrofit projects.
- **BC Housing:**
    - **Energy Efficiency Retrofit Program (EERP)**: Retrofits for boilers, domestic hot water tanks, lighting, some MUA units, heat pumps, and furnaces. BC Housing provides EERP funding via capital grants to eligible and approved projects to cover the gap between approved project costs and the utility incentive program contributions, up to a maximum of $100,000.
    - **Capital Renewal Fund (CRF)**: Funding for building remediation, including seismic, fire safety, or energy performance improvements.
      Eligibility: Minimum funding of $250,000 per building, remortgage required, BC Housing Operating Agreement (OA) or recently ended OA.
- Funded by the City of Vancouver in partnership with CleanBC and BCHydro, and administered through LandlordBC, the **RARA program** has $3.5 million in grant funds available for owners of market rental buildings to undertake critical energy retrofit upgrades, including building electrification and fuel-switching using new heat pump technology – this would be interesting when retrofitting projects that combine below and at market rental units.
- Based on the Energy performance achieved, the owner/operator can claim a tax credit corresponding to the cost of retrofit through the **Clean Building Tax Credit Act**

INDUSTRY INITIATIVES & RESOURCES

- **City of Vancouver - Green Energy Resources and Programs for Multi Family Buildings**
- **BC Housing - Energy Efficiency Program**:
- **BC Nonprofit Housing Association - Retrofit and Maintenance Projects**
- **Pembina Institute - Reframed Initiative Case Studies and Reframed Initiative Report**
- **Fresco & BC Hydro - Concept Framework to Electrifying Multi-Unit Residential Buildings**
- **Zero Emissions Building Exchange - Retrofit Resources**

Advisor Interviews

A group of advisors were interviewed in preparation for the TAP. Please read the interview summaries on the following pages. On Day 1 of the TAP, you will have an opportunity to ask further questions from attending advisors in a panel-like format.

Disclaimer: the interview summaries are based off transcripts and meeting notes, and do not necessarily represent the views of the individuals or organizations and should not be taken as quotes by media without explicit written permission from the advisor.

Please download associated appendices provided by the Advisors here (expires May 28). The link includes the following files:

- BC Hydro - Presentation on Low Carbon Electrification Funding Programs
- Brightside Homes - Net Zero Strategy
- Pembina Institute - Summary of Recent Reports
- Metro Vancouver - Best Practices in Energy and Emissions Benchmarking and Reporting for Existing Large Buildings
- Efficiency Capital - Presentation & Sample Case Study

LIST OF QUESTIONS

1. What is your experience with and relationship to retrofits?
2. What are the top 5 things you want the panellists to know for the case study?
3. What improvements would you suggest for the retrofit process/costs/outcomes?
4. What critical changes are needed to advance retrofit adoption in Vancouver?

LIST OF ADVISORS

1. Patrick Caraher & Atoine Archie, Aboriginal Housing Management Association
2. Mike Kasuya, AME Consulting Group
3. Victoria Richards, BC Hydro
4. Jackie Kanyuk & Brian Jung, BC Non-Profit Housing Association
5. William Azaroff & Wesley Everaars, Brightside Homes
6. Micah Lang, City of Vancouver
7. Erin Ellis, Efficiency Capital
8. Patrick Roppel, Evoke Buildings
9. Michael Epp & Jeff Sevold, Metro Vancouver
10. Donovan Woollard & Christian Cianfrone, Open Tech
11. Betsy Agar, Pembina Reframed Initiative

ADVISOR INTERVIEWS

Organization: Aboriginal Housing Management Association (AHMA)

Advisor: Patrick Caraher, Portfolio Planning & Development Specialist

Interview Synopsis

1. **What is your experience with and relationship to retrofits?**

- Navigating various funding sources including BC Housing, CMHC, utility funding, and potential federal funding. Obtaining funding has become increasingly challenging due to inflated construction costs and longer approval timelines. Previously BC Housing would approve retrofits budgets in 1-2 years, now BC Housing often won't look at the proposal for a couple of years. CMHC has provided AHMA with $1M retrofit assessment funding, mostly for single-family homes in poor condition. AHMA received $29M from the Province for two MURB retrofits and some other small projects. Utility funding has not been as helpful for MURBs but is changing – AHMA is anticipating increased funding from BC Hydro in the future.
- Estimating project costs, which has been difficult to do accurately for projects, leading to delays in project approvals and increased timelines. AHMA uses Asset Planner which has a retrofit pricing tool but are using Quantity Surveyors more often for better accuracy. Tenders for projects are often much higher than estimated due to inflationary pressures on building materials. These challenges are impacting our ability to complete deep carbon retrofit projects and meet electrification goals in the province.
- Involvement in committees for building electrification and high-performance, resilient housing design to address these funding challenges and ensure targeted spending for deep carbon retrofits. Engineers express confidence in their ability to conduct retrofits, but funding remains a significant hurdle, especially with inflation and budget constraints. Prioritizing spending through energy studies and understanding the knock-on effects of building envelope renewal are critical aspects of our approach to retrofits.

2. **What are the top 5 things you want the panellists to know for the case study?**
- Retrofits should use energy studies to prioritize cost-effective, high impact measures, like upgrading high-performance windows and electrifying heating systems. Replacing the building envelope is not always worth it.
- Electrical load assessment is a critical first step. Solar cladding is an exciting innovation that may help ease electrical load, but careful consideration is needed, as its effectiveness can vary depending on factors like building orientation and location.
- There are examples of projects chasing green certifications which resulted in negative consequences, like Passive House buildings become excessively warm through excessively thickening walls around windows, hindering ventilation and causing overheating.
- Challenges may arise in retrofitting larger buildings, such as finding suitable placements for external units for heat pumps on tower roofs, although utilizing parking garages could offer a solution.

3. **What improvements would you suggest for the retrofit process/costs/outcomes?**
- Deeper incentives are needed for retrofitting buildings, as current incentives like Clean BC's $50,000 offer may not adequately support nonprofit housing societies.
- A concierge service or organization offering low or no-cost guidance on stacking funding sources would greatly benefit nonprofit housing societies navigating the retrofit process.
- Government agencies should take greater ownership in helping organizations navigate efficiency targets and policy changes, ensuring equity and avoiding financial strain.
- Recommendations should focus on facilitating conversations and building public consensus to influence policy changes towards more equitable retrofit processes.
- Prioritizing equity in electrification and retrofit efforts is crucial to prevent nonprofit housing societies from facing deeper financial challenges.

4. **What critical changes are needed to advance retrofit adoption in Vancouver?**
- Improved education and awareness among nonprofit housing providers about impending regulations and retrofit opportunities, as many nonprofits may overlook these due to other priorities.
- Assistance programs or concierge services should be established to help nonprofit housing societies navigate funding sources and retrofit processes effectively.
- Government agencies should take greater responsibility in supporting nonprofit housing providers with deeper funding and guidance to ensure equitable access to retrofit initiatives.
- Focus on aggregating smaller housing providers to increase their borrowing and negotiating power, potentially through a funding guidebook that streamlines the process.
- Enhancing resiliency in retrofit projects is crucial, especially in response to extreme weather events like heatwaves and floods, to prevent further vulnerabilities in housing.

Organization: Aboriginal Housing Management Association (AHMA)
Advisor: Atoine Archie, Capital Projects Manager

1. What is your experience with and relationship to retrofits?

- Atoine Archie holds a three-year diploma in architecture/engineering/technology from TRU and has previous experience building First Nations health centers.
- AHMA primarily utilizes the BC Housing Capital Renewal Fund for AMHA member renovations and renewals of off-reserve Indigenous housing. Retrofit activities include building envelopes, siding, insulation, windows, doors, elevators and installing heat pumps. Projects range from single-family homes to concrete buildings.
- Thermal comfort and heat wave resilience are integrated with AHMA's member retrofits, including solar panels, greywater technology, and heat recovery ventilation.
- AHMA works directly with Provincial ministry of housing to get grants, so they are not limited to BC Housing's programs. Getting the ministry involved gives AHMA more leverage with the Federal government, who provide financing for on-reserve initiatives.
- AHMA also collaborates with on-reserve housing managers - for instance they are helping First Nations Housing and Infrastructure Council (FNHIC) to input various nations' on-reserve buildings in the Asset Planner program. Asset Manager helps extract all energy usage information, building information, operations information into reports. It helps with portfolio analysis, and energy studies.
- AHMA is looking at creating their own energy calculator based on Ashrae Level 2 requirements. The intent is to help meet CMHC Co-Investment requirements which is a 20-25% reduction. Doing full energy studies on each asset is not feasible, so they are looking at solutions for more efficient portfolio level analysis.

2. What are the top 5 things you want the panellists to know for the case study?

- Conduct your energy studies.
- Identify all the different people who would be involved (owners/consultants/advocates) and engage them early.
- Do all the planning upfront - think of all the alternatives to avoid change orders and coordination issues.
- Consider supply chain diversity - consider experience with first nations, first nations staff, women in trades training, programs like Bladerunner

3. What improvements would you suggest for the retrofit process/costs/outcomes?

- More collaboration between provincial and federal government as it relates to Indigenous housing. There is a gap between on- and off-reserve housing. On-reserve housing is federal crown land and funded as such, but when it comes to off-reserve housing (which is most urban Indigenous populations), the federal government points fingers at province/municipality to support.
- Let's bring more retrofit projects forward as a sector, and voice what the projects need to be successful and feasible.

4. What critical changes are needed to advance retrofit adoption in Vancouver?

- Diverse energy sources are necessary but can be limited by electrical loads, requiring BC Hydro's support.
- Municipalities need to reduce hurdles to retrofits through incentives.

Organization: AME Group

Advisor: Mike Kasuya, Principal

Interview Synopsis

1. **What is your experience with and relationship to retrofits?**
   - I lead a team of nine at a mechanical consulting firm, specializing in energy retrofits, major equipment replacement, energy studies, and incentive programs primarily for existing commercial buildings. They have also participated in residential retrofit initiatives such as Pembina Institute's Reframed projects.

2. **What are the top 5 things you want the panellists to know for the case study?**
   - Navigating funding opportunities for both planning and execution is crucial for nonprofits undertaking retrofits, but the process is complex and can be scattered. It's often worth hiring someone to help navigate funding.
   - A centralized database or platform for funding opportunities would greatly benefit nonprofits navigating retrofit projects. Better Buildings BC (https://www.betterbuildingsbc.ca/) is a useful resource for accessing incentives for commercial buildings and could serve as a model for a similar platform tailored to nonprofits.
   - The Pembina Reframed retrofit case studies are helpful, if you are undertaking a retrofit find a Reframed case study building with a similar typology.

3. **What improvements would you suggest for the retrofit process/costs/outcomes?**
   - Funding availability is a key factor in advancing retrofit projects. Coordination between different funding programs could incentivize more retrofits and make the process easier.
   - A more holistic approach to project planning and an integrated project team can help housing operators understand the bigger picture and set effective goals for their assets.
   - The retrofit process could benefit from a more integrated team approach, with consultants collaborating from the outset to prioritize goals and identify the most effective strategies.
   - Establishing a repository of retrofit success stories and best practices could help nonprofits navigate the complexities of the retrofit process and make informed decisions.
   - Education and training programs tailored to the needs of nonprofit organizations could further support capacity building and knowledge sharing in the retrofit sector.

4. **What critical changes are needed to advance retrofit adoption in Vancouver?**
   - Policy changes are crucial to drive retrofit adoption. The City of Vancouver is targeting large commercial buildings first, then later rolling out policies for smaller buildings. They are taking a stick approach rather than incentive-based approach.
   - Municipalities could incentivize retrofit projects by offering reduced permit fees or fast-track permit review processes based on retrofit performance metrics.
   - Municipalities could benefit from creating a pre-approved list of consultants or engineers to expedite the permit process and ease the burden on staff.

Organization: BC Non-Profit Housing Association

Advisors: Jackie Kanyuk, Senior Program Delivery Manager, Asset Management; Brian Jung, Senior Program Delivery Manager, Asset Management


Interview Synopsis

1. **What is your experience with and relationship to retrofits?**
   - Focus on overcoming the barrier of limited resources and effort in the retrofit market to help building owners understand retrofit requirements before major investments are made.

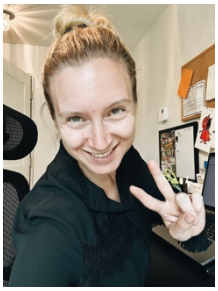
2. **What are the top 5 things you want the panellists to know for the case study?**
   - Maintaining a knowledgeable advocate throughout the retrofit project is crucial to ensure that the original objectives of the study are met and that solutions are implemented effectively.
   - The level of interactivity on a platform providing retrofit solutions should be carefully considered to balance the value of feedback from professionals in the construction industry with the need to guide the next steps in the retrofit process.

3. **What improvements would you suggest for the retrofit process/costs/outcomes?**
   - Technology can help streamline the process of analyzing potential retrofit options and quantifying pathways for building improvements, reducing the need for constant back-and-forth meetings and analysis by consultants.
   - The CMHC Interim Affordable Homes Housing Program offers substantial grants and financing for energy-saving retrofits, driving activity in the market. However, there is debate around the necessity of meeting strict energy savings thresholds and the potential optimization of such programs to make them more accessible and beneficial for a wider range of projects.

4. **What critical changes are needed to advance retrofit adoption in Vancouver?**
   - Offer a solution to streamline the initial cost and time of energy studies for affordable housing sectors by providing multiple opportunities for funding studies rather than a single shot approach.

Organization: BC Hydro

Advisor: Victoria Richards, Key Account Manager



Interview Synopsis

1. **What is your experience with and relationship to retrofits?**
- BC Hydro collaborates closely with BC Housing and BC Non-Profit Housing Association (BCNPHA). Energy managers at these organizations assist nonprofits with retrofits and low carbon electrification.
- Most customers approach BC Hydro through BC Housing or BCNPHA. BCNPHA's energy team aligns various funding streams for retrofit projects.
- BC Hydro's support and funding requirements are integrated into this collaborative framework. This coordination streamlines the process for social housing operators and ensures effective implementation of retrofit initiatives in the social housing sector.

2. **What are the top 5 things you want the panellists to know for the case study?**
- Complexity and misalignment of grants' requirements: Numerous grant streams and funding providers each with unique requirements. This complexity can be overwhelming for social housing providers.
- Role of BC Housing and BC Non-Profit Housing Association: BC Hydro collaborates closely with these organizations. Energy managers are embedded within these organizations to assist with retrofits. These organizations help navigate funding and project management.
- Programs and Support:
    - CleanBC Social Housing Incentive Program: Focuses on fuel switching (e.g., gas to electric for heating and hot water).
    - BC Hydro's Low Carbon Electrification: Includes electrical load analysis and incentives for electrical upgrades.
    - Social Housing Retrofit Support Program: Co-funded by BC Hydro and FortisBC, focuses on energy efficiency.
    - New funding program coming in the fall of 2024 focusing on MURBs
- Project Management and Expertise: Importance of having experts and project managers due to the complexity of aligning grants and managing projects. Funding available for project management to assist housing providers.

- Implementation and Execution: Studies and implementation can be pursued simultaneously for efficiency and fuel switching. Electrical upgrades require BC Hydro alliance members, ensuring qualified professionals handle the work. Coordination needed for both BC Hydro and FortisBC requirements for trades and contractors.
- Electrical upgrades are not just important on the MURBs side but could also have implication on BC Hydro's side. Service upgrades are expensive and time consuming – it has been flagged in the past as a major challenge for the previous case studies (Pembina Reframed). Understanding the required capacity is something that should come as early as possible.

3. **What improvements would you suggest for the retrofit process/costs/outcomes?**

- Simplify and align grant streams and funding provider requirements to reduce complexity and overwhelming social housing providers.
- Strengthen partnerships with BC Housing and BC Non-Profit Housing Association to improve funding navigation and project management support.
- Expand CleanBC Social Housing Incentive Program for broader fuel-switching opportunities.
- Increase funding and support in BC Hydro's Low Carbon Electrification program for electrical load analysis and upgrades.
- Enhance the Social Housing Retrofit Support Program's focus on energy efficiency through co-funding with FortisBC.
- Provide more resources and funding for expert project managers to help align grants and manage complex retrofit projects.
- Allow simultaneous pursuit of efficiency and fuel-switching studies and implementations.
- Ensure electrical upgrades are handled by qualified BC Hydro alliance members and coordinate requirements with FortisBC.

4. **What improvements would you suggest for the retrofit process/costs/outcomes?**

- Regulation and policy changes are needed at provincial and local government levels.
- Development of a comprehensive low carbon electrification roadmap.
- Collaboration with partners like FortisBC to reduce carbon without completely removing gas.
- Emphasis on achieving net zero rather than just near zero emissions.
- Recognition of the challenge of full building retrofits, especially in the social housing sector.
- Consideration of staggered approaches for gradual electrification and efficiency improvements.
- Support for visionary planning and strategic prioritization of housing stock for retrofits.

Organization: Brightside Community Homes

Advisors: William Azaroff, CEO; Wesely Everaars, Director of Community Real Estate

Interview Synopsis

1. **What is your experience with and relationship to retrofits?**
   - Brightside is a housing operator with retrofit experience ranging from minor retrofits to envelope sealing, fuel switching, introducing cooling, re-piping and even elevator replacements. Our focus has shifted towards net-zero portfolio strategies, bundling retrofit work across the portfolio, and reducing retrofit timelines.
   - We work on understanding consumption, conversion rates, costing the retrofit and taking it to a funder – usually with a consultant like Affine. Then comes tenant management. Coordination with tenant and building maintenance teams is crucial, especially for larger retrofits involving tenant relocation.

2. **What are the top 5 things you want the panellists to know for the case study?**
   - Understanding your housing portfolio is crucial, including building age, type, and depth of pre-retrofit studies. When we launched the net zero strategy we aimed to do all 24 buildings. We realized a retrofit isn't always the best option. Now we look at absolute emissions and absolute intensity (per sqm), prioritizing the buildings that are the worst offenders. In our strategy, if we take care of the 50% worst offending buildings, we could make more than a 50% positive impact.
   - Aligning your plan with government funding opportunities is important. If you have a BC Housing Operating Agreement, discuss opportunities and creative solutions with BC Housing and be specific in your objectives.
   - Scope management and avoiding a “while we’re at it” mentality is critical to prevent scope creep during retrofits and ensure the project stays focused on GHG and net zero.
   - BCNPHA is a very helpful resource, particularly with Energy Star and working with Hydro to get all buildings into the tool. BCNPHA staff study retrofit processes and bring forward suggestions for best practices for asset management and project planning.
   - Strategic goals should align with both net-zero initiatives and redevelopment plans, considering the cost implications and technological advancements in retrofitting versus redevelopment. If

redevelopment is more feasible than retrofit, we will build for net zero from the start including utilizing available grants to test new technologies – ex. solar cladding.

3. **What improvements would you suggest for the retrofit process/costs/outcomes?**
- Roadblocks mainly stem from varying funding requirements and lack of alignment among different funders. It has gotten better over the years but there is still a need for coordination and alignment in government funding at the municipal, provincial and federal levels.
- The process could benefit from a streamlined capital stacking framework for retrofits, particularly on a portfolio/sector basis.
- There's a need for funders to prioritize GHG reduction over just energy reduction, especially considering the implications of fuel switching on net energy consumption.

4. **What critical changes are needed to advance retrofit adoption in Vancouver?**
- Concerns arise regarding load capacity in neighborhoods, potentially hindering fuel-switching efforts in future retrofit projects. Dialogue with Hydro indicates openness to exploring alternative energy sources like solar panels and cladding to alleviate this issue.
- There's a need to move beyond heavy reliance on hydroelectricity and explore diverse green energy options like solar, geothermal, and wind power. When you look at other jurisdictions they prioritize diversity of energy sources. Reticence from municipalities towards adopting these technologies poses a challenge that needs addressing.
- With predictions of a potential 30% decrease in hydroelectric output in the next decade, coupled with water shortages and prolonged heatwaves, the risk of blackouts and brownouts becomes a pressing concern. Planning for neighborhood energy generation and load distribution is crucial to mitigate these risks.
- Many smaller non-market housing organizations survive on operating agreements and often lack the capacity and resources to undertake retrofit projects independently. Initiatives like aggregators or support mechanisms are needed to help them navigate the retrofit process effectively and participate in broader sustainability efforts.

Organization: City of Vancouver

Advisors: Micah Lang, Team Lead, Large Existing Buildings

Interview Synopsis

1. **What is your experience with and relationship to retrofits?**
   - I am a policy maker for retrofits - policy regulations and support programs to help large buildings reduce their greenhouse gas emissions. This mostly pertains to performance elements of buildings, but more recently has involved prescriptive requirements for building systems and components. I interact with people in industry: building owners, industry associations, contractors and engineers who work on retrofit projects. 10 years in this role at the City. Prior to that I did private consulting in a similar space.

2. **What are the top 5 things you want the panellists to know for the case study?**
   - Create a decarbonization plan that is integrated with a capital plan in one document.
   - Start with the end in mind but do some work to clarify the short-term priorities. For example, if you know you want to decarbonize the building, but the short-term priority is the comfort of residents and cooling, then that should be reflected through planning.
   - Don't let perfect be the enemy of the good. When we think about decarbonizing existing buildings, people get stuck because 100% decarbonization is very challenging. Getting 80% of the way there is often good enough for now - technology is advancing rapidly and future solutions may help you get to 100%. In these cases, plan to get your final reductions in the future as technology improves. For instance, it's often okay to keep gas for back up emergency uses knowing that when it comes time to replace that equipment in the future, the technology will be there to do it.
   - Specific to the non-market sector, take advantage of the growing and knowledgeable community of practice in the non-market sector. BCNPHA Retrofit Grant program is the innovation incubator in terms of retrofitting existing nonmarket housing and provides free technical assistance and grant money for capital upgrades.

3. **What improvements would you suggest for the retrofit process/costs/outcomes?**
   - Don't let perfect be the enemy of the good. 80% is still a good result.

- Try to identify solutions that work within existing electrical capacity. Avoiding electrical service upgrades keeps costs down. Look for creative load management/demand management solutions on site.
- BCNPHA plays an important coordinator role and it would be good to see this type of activity expanded to support retrofits. I see an opportunity to improve the process with BC Hydro to produce a transparent, turnkey retrofit process.
- Equipment incentives are important and there has been a historic underinvestment in this area. There has been money available for detached home and large commercial buildings, but multi-family buildings have not been targeted in the same way. Incentives are required to spur voluntary action in the form of rebates, tax incentives, clear pricing.
- The City of Vancouver are doing several things right now to streamline the process. When a building is just looking at changing its mechanical equipment for instance, contractors can take out trade permits online. We are currently doing an overhaul of electrical permits to require electrical planning reports as a condition for getting a permit. This is because many buildings are not doing due diligence up front before submitting for permit. We are also thinking about and working on improving coordination between the City and BC Hydro related to capacity at certain sites and the ability to get permits on those sites. There are city wide goals in Vancouver for net zero retrofits, but they are not yet fully translated into regulations, and the sooner the City can clarify that, the easier it will be for building owners to plan those projects. We expect to go to council in about a years' time with the next set of regulations.

4. **What critical changes are needed to advance retrofit adoption in Vancouver?**

- More streamlined process and access to information from BC Hydro.
- The Province putting equipment standards into legislation.
- The City putting implementing overarching policy to decarbonize all existing buildings.
- For the multifamily building sector, expanding the current retrofit support pilot programs to include more buildings and understand the barriers to identify and put into place the solutions necessary to scale. For instance, there are currently very few examples of buildings who have switched from gas to heat pump for domestic hot water, so we need more pilot buildings to do this before we can effectively scale.
- Expanded Provincial and Federal government incentives through funding, rebates, tax incentives.
- The City of Vancouver has approximately 10,000 larger buildings, with 25 years to decarbonize them. That means 400 buildings a year undertaking some sort of retrofit. We're currently at about 20 buildings a year undertaking the types of retrofits necessary to get to the end state. Larger buildings defined as within Part 3 of the building code (4 storeys and up).
- It would be good to create a tool for easily identifying priority buildings for retrofitting across the city, including identifying which ones will probably be redeveloped instead.
- Ensuring there is minimal dissonance between City and Provincial legislation, improving alignment of retrofit and redevelopment policy.
- City of Vancouver is trying to scale virtualization and will be issuing an RFP soon.

Organization: Efficiency Capital

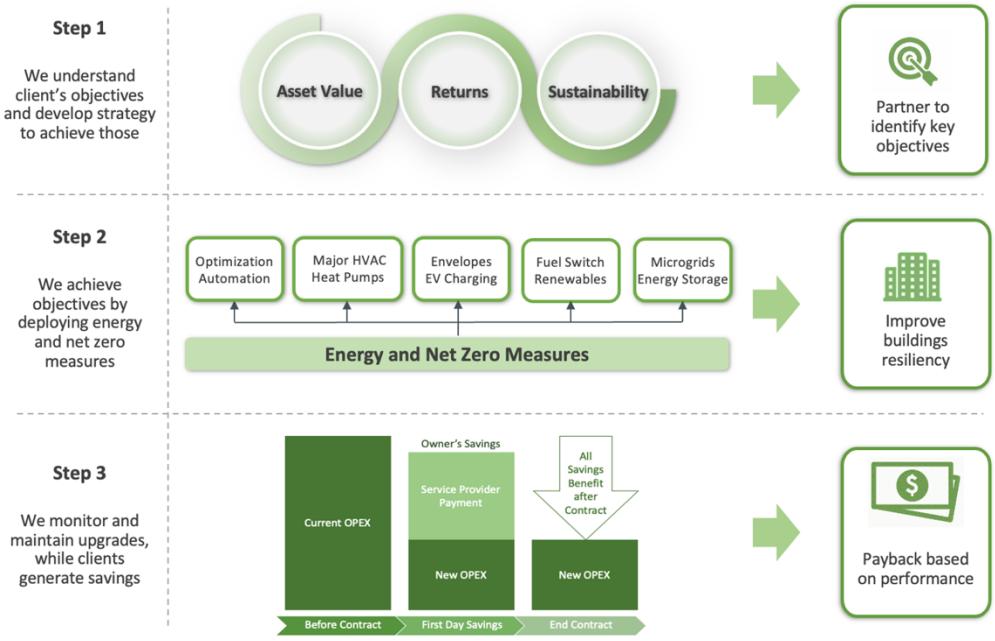
Advisors: Erin Ellis, Director of Development

Interview Synopsis

1. **What is your experience with and relationship to retrofits?**
   - Efficiency Capital (EC) is Canada's first Energy-as-a-Service (EaaS) company that develops, funds and manages net-zero projects in the built environment. Incubated in 2012 by The Atmospheric Fund (TAF) – a regional climate agency that is the Toronto and Hamilton area hub of the LC3 network – EC seeks to increase the flow of third-party capital into such projects by leveraging strategic partnerships with various banks, impact investors, community foundations and other organizations to enable the transition to a low-carbon economy.
   - EC uses the approaches and lessons learned from the infrastructure development and renewable energy industries but simplifies it and offers it 'as-a-service' at the building level. Now building owners can partner with EC to upgrade their energy infrastructure, get the benefit of an expanded capital pool, increased valuations, and improved productivity and occupant health - all upfront capital costs being funded by EC on behalf of the building owner, and payback over time.
   - EC delivers on its model by aggregating projects to sufficient size so institutional lenders and impact investors can help fund the transition to the low-carbon economy while enabling businesses and asset owners to remain competitive with best-in-class modern low-carbon building infrastructure.
   - Currently, EC has access to over $120M in low-cost project funding to deliver fully-funded, turnkey and de-risked decarbonization solutions across Canada. EC is supported by the Canada Infrastructure Bank's (CIB) Commercial Building Retrofit Initiative (EC is recognized as one of a handful of esteemed "Retrofit Aggregators" under this program), several LC3 network organizations, various Canadian foundations, and other impact investors. In 2021 EC was named to the Globe and Mail's "Fastest Growing Companies" and in 2023 was awarded "Best ESG Solution" by Global Financial Markets Review.
   - The challenge for affordable housing providers is that every dollar they spend is a choice between delivering critical services to their community or replacing aging infrastructure. By always putting people first, social housing providers are often in the difficult financial position of having a substantial backlog of deferred maintenance and much needed asset renewals while also lacking the capital required to pay for it all.
   - EC's interests are aligned with those of affordable housing providers – ensuring savings are achieved and sustained – because EC develops, invests in and manages building infrastructure renewals in order to generate energy and water savings over time, which are then shared between the partners. Savings are protected by performance insurance, ongoing monitoring and

verification, preventative maintenance and equipment guarantees. This allows owners and operators to focus on their core operations while enjoying multi-measure upgrades across their building portfolio, within a single budget cycle.

EC's Retrofit Process (Simplified)



2. **What are the top 5 things you want the panellists to know for the case study?**

The five most critical value drivers for affordable housing providers in their consideration of asset renewal projects include the following:

- **Financial Health**
  - A 'deep' approach to building upgrades encompassing multiple energy conservations measures (ECMS) in a single retrofit allows for lower cost/faster payback ECMs (i.e. low flow toilets) to 'pay for' higher cost/longer payback ECMs (i.e. heat pumps) while ensuring that efficiency savings from the combined ECMs cover 100% of repayments though overall energy savings
  - Leveraging existing reserves to generate future net benefits to their reserve fund
- **Strategic Relationships**
  - Long-term investment partnerships required to fulfill the providers asset stewardship mandate while limiting pressure on reserves and reducing the need for internal capacity development, thereby allowing the housing provider to focus on core business functions and not the technical and/or project management components of the retrofit process
  - Support identifying and securing any available investment tax credits, incentives, grants, efficiency loans and rebates in the market to integrate into the overall funding stack)
- **Operational Optimization**
  - Modernization of controls, systems, maintenance protocols and energy management practices leading to an improved Facilities Condition Index
  - Drives organizational culture change to a more data-driven housing agency

- **Tenant Health & Comfort**
  - Better indoor environmental quality (IEQ) and improved thermal comfort in areas that were too hot or cold delivers superior health outcomes
  - The overall sense of wellbeing is improved for those who reside in buildings and communities they take pride in being a part of.
- **Long Term Resilience**
  - More responsive buildings and operations with real time alerts to help prevent and quickly manage issues as they arise
  - Improved sustainability correlates to lower total cost of ownership (avoided carbon taxes, lower insurance premiums, etc.)

3. **What critical changes are needed to advance retrofit adoption in Vancouver?**

To advance energy retrofit adoption in Vancouver, several critical changes are necessary:

- **Policy and Regulatory Support**
  - Implement and enforce stricter building codes that mandate energy efficiency standards
  - Provide clear guidelines and streamlined permitting processes for retrofitting projects
- **Financial Incentives and Funding**
  - Offer regionally catered subsidies, tax credits, and efficiency loans to reduce the financial burden on property owners
  - Establish public-private partnerships to fund large-scale retrofit initiatives
- **Awareness and Education**
  - Launch awareness campaigns to inform property owners and businesses about the benefits of energy retrofits
  - Provide training programs for contractors and builders on the latest retrofit technologies and practices
- **Technical Support and Resources**
  - Create a centralized resource hub offering technical advice, case studies, and best practices
  - Offer energy audits and assessments at reduced or no cost to help property owners identify retrofit opportunities
- **Market Development**
  - Support the development and growth of local markets for energy-efficient products and services
  - Encourage innovation and adoption of new technologies through grants and research funding
- **Community Engagement**
  - Involve local communities in planning and decision-making processes to ensure retrofitting projects meet local needs and preferences
  - Foster collaborations between municipalities, utilities, and community organizations

Organization: Evoke Buildings

Advisor: Patrick Roppel, Managing Principal, Building Science Specialist

Interview Synopsis

CONTINUED ON FOLLOWING PAGES

EVOKE
Sensible building solutions

Evoke Buildings Engineering Inc.
250-997 Seymour Street
Vancouver, BC V6B 3M1

May 2, 2024 24-00234

Vincent Delfaud
Vice President, Design & Sustainability
Bosa Properties Inc.
email@domain.com

Re: ULI NZI - Near Zero Residential Retrofit

Dear Vincent:

You asked us to prepare a brief document with our key insights, lessons learned, and best practices regarding retrofits in our field. This letter summarizes our key insight and recommendations.

Information is Fundamental to Informed Decisions and Meeting Objectives

The key goals for deep carbon retrofits for affordable rental stock should be:

1. Pursue cost effective solutions that make a big impact, but do not chase diminishing returns and add unnecessary costs.
2. Seek synergies between carbon reducing measures, structural upgrades, and occupant comfort.
3. Seek solutions that minimize occupant disruption.

Finding optimal solutions that meet these collective goals typically requires more than is done by looking at the building at the surface and doing a high-level assessment. Some insights follow.

- Canadian multi-unit residential buildings vary broadly in construction, architecture, and climate. These differences must be considered for each building.
- Examples of challenges and questions that need to be addressed are:
    - Cantilevered balconies:
        - deteriorated wood balconies can be disruptive and costly to repair.
        - concrete balconies are difficult to address thermal bridging, but there are ways of addressing and get to NZR.
    - Structural capacity:
        - Assess if there is structural capacity to hang panels and/or support new cladding, windows, and insulation.
        - Assess if there is structural capacity for the roof to add weight or change how the roof is insulated.
        - Determine if you want to voluntary upgrade to current code requirements.
    - Windows:
        - Need to determine how are the windows installed.
        - Flange mounted windows may require the cladding to be cut back or removed.
    - Roofs:
        - How will adding insulation affect the height of parapets and doors thresholds.
    - Articulating façade and site constraints:
        - Consider if prefabrication is an option.

        - Determine if there are site or access constraints that make renewals difficult.
        - Assess constraints related to setbacks and property lines.
    - Other needs
        - Do a needs assessment at the beginning of process to identify other needs, such accessibility, sprinklers, compartmentation of units, acoustics, and noise.
        - Occupant surveys are used to help identify other needs.
        - Determine if funding is dependent on satisfying needs other than related to reducing energy or carbon emissions.
- The timing of renewals should be evaluated holistically for all the project objectives and requirements.
    - Assess if costly and disruptive electrical upgrades be avoided if mechanical and building envelope solutions are done in-conjunction to reduce loads.
    - Have renewals been done recently that are conducive to phasing the work? For example, an upgrade to a roof can likely be done after a major renewal to the walls, windows, mechanical, and electrical if the roof has recently been renewed.
- The level of airtightness is a big unknown for specific buildings and is an important consideration if not doing a wholesale improvement to entire building envelope air barrier. Testing can reduce the level of uncertainty and might be justified to enable some solutions.
- Asbestos. The presence of asbestos needs to be evaluated in-conjunction with work done to the interior, such as window renewal, new ducting, or installing new electrical cables.
- Embodied carbon considerations for retrofits are primarily the building envelope.
    - The best way to minimize embodied carbon is to select a level of insulation and glazing performance that make sense from an energy efficiency and occupant comfort perspective.
    - Adding more than is needed to make a significant impact will add capital costs and embodied carbon that might not be justified by operational energy savings.
    - More insulation might be justified to avoid electrical upgrades, depending on the overall retrofit strategy.

Seek Synergies

- Are there synergies with a seismic upgrade? Determine what level of seismic upgrade makes sense in-conjunction with the required building envelope retrofit.
- Are there ways to reduce interior disruptions and costs through the retrofit strategy? For example, evaluate if re-piping, running cable, and ducting ca be avoided by equipment selection, strategy, and/or by making use of unique building features.
- There are synergies of doing required re-piping, electrical upgrades, and ventilation at the same time if the same interior spaces will be disrupted and require similar repairs.

Cooling and Electrification

- Full electrification has the biggest impact on reducing GHGs.
- Active cooling and ventilation are highly recommended given indoor air quality considerations and extreme weather.

- Active cooling has synergies with electrification.
- Full electrification might trigger electrical service upgrades that should be considered in-conjunction with assessing energy and carbon savings.
- Think holistically. Assess why building envelope retrofits are necessary and not just do ad hoc renewals with more efficient boilers, lighting, and other cost-effective renewals of existing equipment.
- Provide examples of what it takes to electrify a building in the roadmap.
    - Electrical capacity, loads, and equipment selection.

Additional Building Envelope Design and Construction Considerations

Conventional rehab

- Industry well able to deliver.
- Least overall risk.
- Usually most cost effective and best value.

Prefabrication

Advantages

- Speed of construction,
- Minimize occupant disruption,
- synergies with seismic upgrades,
- minimize waste.

Challenges

- Not ideal for wood-framed MURBs (this is a lot of buildings that will need to be done).
- Structural support to hang prefabricated panels.
- Cost.
- Supply chain and market readiness.
- Existing building tolerances.
- Competitive bids, performance specifications, and testing.

Closing

I look forward to participating in the panel and being part of the upcoming workshop. Please do not hesitate to contact me with any questions regarding this document. I will follow up separately with additional resources related to deep carbon retrofits for multi-unit residential buildings.

Evoke Buildings Engineering Inc.

Patrick Roppel, P.Eng.
Building Science Specialist

Organization: Metro Vancouver

Advisors: Michael Epp, Director of Housing Planning & Development; Jeff Sevold, Project Engineer


Interview Synopsis

1. **What is your experience with and relationship to retrofits?**

- Metro Vancouver has a multi-year strategy because of their portfolio approach. 5-year capital plans generate funding available for retrofits and development. From there the funding is allocated to individual projects and those projects go through their individual permitting schedules. We also have annual access to funds for retrofits.
- Metro is undertaking "lite" retrofits for mech/elec systems but not necessarily seismic or complete envelope. Targeting a 20-30% reduction in overall energy usage, and up to 98% reduction in some cases.
- Several projects from Pembina's Reframed Initiative are moving into implementation:
    - 2 projects in detailed design submitting for permit shortly.
    - 1 under construction finishing in September.
    - All are 1960's - 1970's, some 80's, asbestos in most of them. Limiting interfacing with asbestos but not eliminating it.
    - Envelope upgrades
    - Seismic upgrades (Metro Vancouver internal funded)
    - Significant mech upgrades from gas fired hydronic, upgrading some buildings to in-suite heating cooling with heat pumps.
    - Switching from central heating to suite-metered heating using existing meters. Bill payment responsibility switches from Metrovan to new tenant upon turnover.
- We take an approach of no tenant relocation – this often drives retrofit scope and plan.

2. **What are the top 5 things you want the panellists to know for the case study?**

- Every retrofit is different but there is commonality in the process and the effective solutions.
- Using builders with mech/elec in house can reduce trade margins and control cost.
- Consider procurement approaches to realize economies of scale.
- Share lessons learned with your network so mistakes aren't being made more than once.

3. **What improvements would you suggest for the retrofit process/costs/outcomes?**
   - Coordination and Improvement of Funding Programs. CMHC Co-Investment Fund does not always make up for negative NPV and the strings attached can cost too much. It often does not pencil for retrofits.
   - Many funding programs are set up for new construction, some requirements are irrelevant and draw schedules can be inefficient.

4. **What critical changes are needed to advance retrofit adoption in Vancouver?**
   - The value of a retrofit often triggers the requirements of a new build adding significant time and cost. How can we get municipalities and councils to consider varying those requirements?
   - CMHC programs often have requirements for energy reductions that are not possible to meet or have other unintended consequences. What is the right target to aim for?

Organization: OPENTech

Advisors: Donovan Woollard, Co-Founder and CEO; Christian Cianfrone, Co-founder and Chief Decarbonization Officer


Interview Synopsis

1. What is your experience with and relationship to retrofits?

- Donovan Cianfrone: Oversees product development at OPEN
- Christian Woollard: has a background in GC & commercial/residential real estate consulting

2. What are the top 5 things you want the panellists to know for the case study?

- OPEN's Virtual Decarbonization Platform offers a quick and cost-effective way for building owners to assess their properties' decarbonization potential. It leverages AI and real building data to generate tailored Virtual Decarbonization Plans, providing recommended actions and their associated analysis. This approach is faster, cheaper, and more comprehensive than traditional energy audits, freeing up resources for actual retrofit projects.
- OPEN's Virtual Decarbonization Platform is intended to advance buildings down the retrofit funnel, providing "easy, early, and enough" information to owners and capital providers. The goal is to identify high quality candidate buildings that warrant the time, effort, and budget for securing capital on the way to detailed design and implementation. Specific site conditions may lead to variations on the platform's proposed recommendations, including variations on implementation costs. The technology is limited in its understanding of site conditions as it balances speed, cost-effectiveness, and low-friction data collection with high confidence recommendations.
- The virtual energy audit will produce a report like the sample in the Appendix.
- CMHC funding structure: CMHC is rigid in their contributions and may not allow for the reallocation of funds from new construction to retrofit projects. This could impact the ability to secure additional funding for retrofitting existing buildings.
- The level of experience and support from building owners varies greatly, depending on factors such as the size of their portfolio, their relationship with organizations like BC Housing, and their individual expertise. This can impact the level of involvement and support needed from the team.

3. What improvements would you suggest for the retrofit process/costs/outcomes?

- Retrofitting buildings with passive measures such as shading and filtration can help reduce the need for mechanical cooling and improve indoor air quality, especially in the face of climate-related challenges like intense heat and smoke inhalation.
- Deep energy retrofits may require extensive documentation and coordination with the city of Vancouver for building permits, structural requirements, and noise and fire safety regulations.

4. What critical changes are needed to advance retrofit adoption in Vancouver?

- General contractors need to understand the project goals to maintain the GHG/energy objectives.

SEE VIRTUALIZATION REPORT FOR ALEXANDER HOUSE ON FOLLOWING PAGES

176 Alexander Street

Overview

CITY	OWNER	ANNUAL EMISSIONS
Vancouver, BC	-	105 Tonnes
USE	**GROSS FLOOR AREA**	**ENERGY USE INTENSITY**
Multi-unit Residential	6,236 m²	190 kWh/m²/yr

Current Performance

- GOOD — Hot Water Load
- FAIR — Building Envelope
- FAIR — Light & Plug Load
- FAIR — Heating System
- N/A — Cooling System

Decarbonization Plan

OPTIMIZED FOR 80% GHG REDUCTION

Recommended Actions

	Cumulative GHG Savings	Cumulative Energy Savings	Measure Capital Cost	Measure Incr. Capital Cost*	Payback Period	Individual Measure Energy Cost Savings
★ Common Area Lighting Retrofit	1% 1 tonne	5% 55,249 KWH	$135,000	$135,000	22 years	$6,077
★ Window Replacement - Triple Glazed	3% 3 tonnes	16% 186,982 KWH	$1,045,000	$194,000	14 years	$14,034
★ Heat Pumps - Make-Up Air and Suites	58% 61 tonnes	45% 529,527 KWH	$1,011,000	$628,000	31 years	$20,121
★ Heat Pump Domestic Hot Water Heaters	95% 100 tonnes	58% 681,572 KWH	$243,000	$182,000	42 years	$4,369
All Recommended Actions	95% 100 tonnes	58% 681,572 KWH	$2,435,000	$1,139,000	26 years	$44,601

RECOMMENDED ACTIONS

95% GHG savings

100 tonnes of GHG saved per year

-$ $78 cost per tonne of GHG saved

Other Actions

	Cumulative GHG Savings	Cumulative Energy Savings	Measure Capital Cost	Measure Incr. Capital Cost*	Payback Period	Individual Measure Energy Cost Savings
+ Recladding + R10 Insulation	95% 100 tonnes	61% 717,473 KWH	$3,718,000	$1,239,000	>99 years	$3,949
+ Suite Heat Recovery Ventilators	96% 101 tonnes	65% 773,191 KWH	$405,000	$405,000	66 years	$6,129
+ Suite Lighting and Appliances	96% 101 tonnes	68% 805,972 KWH	$250,000	$250,000	69 years	$3,606
All Recommended and Other Actions	96% 101 tonnes	68% 805,972 KWH	$6,808,000	$3,033,000	52 years	$58,285

ALL ACTIONS

96% GHG Savings

101 tonnes of GHG saved per year

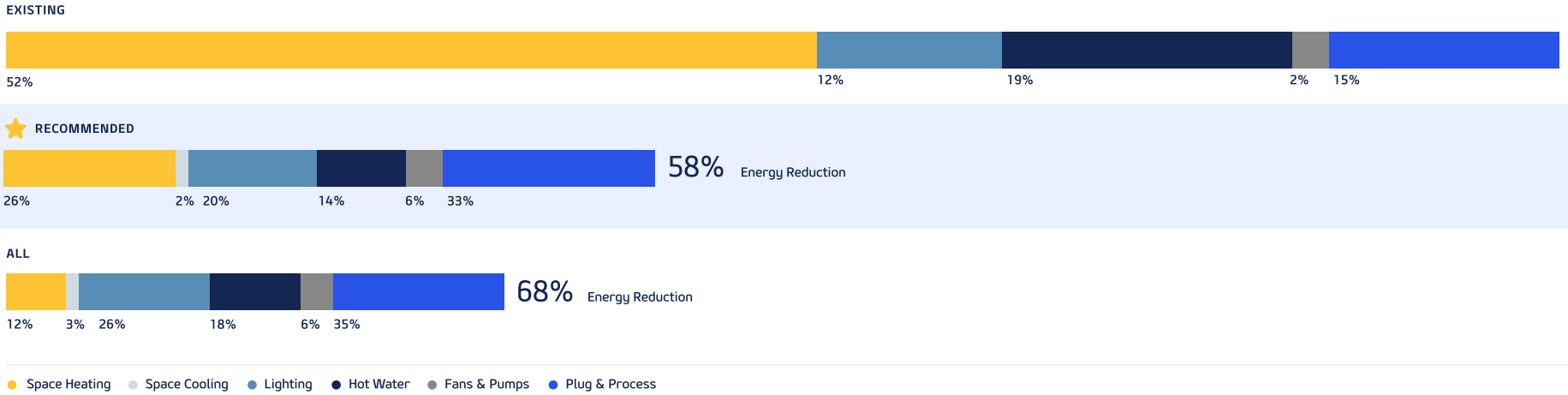
-$ $129 cost per tonne of GHG

This plan was developed by calibrating OPEN's AI model with the building's utility bills to create a credible baseline from which building specific decarbonization measures were assessed.

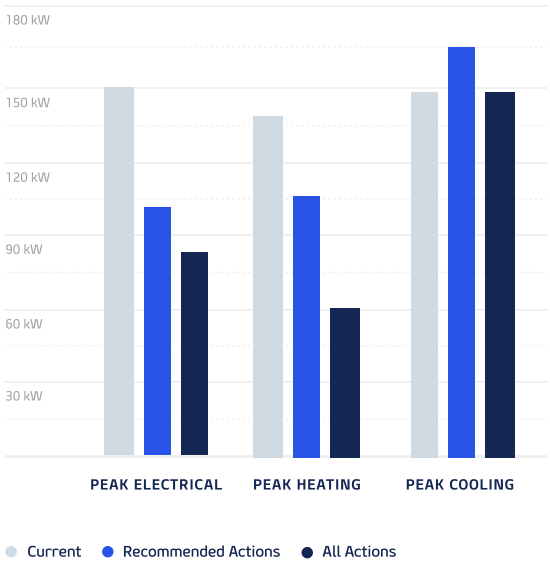
**The incremental capital cost is the difference between the total project cost for an ECM and a "like-for like" replacement cost before incentives. Costs do not include other infrastructure upgrades that may be required (e.g. structural, electrical, etc).*

176 Alexander Street

Energy Use Breakdown



Peak Load Analysis



Multifamily Residential Specific Strategies

The recommended actions in the decarbonization plan also contribute to other climate strategies as indicated below.

CLIMATE RISK MITIGATION

Cooling Included

The Recommended Actions include adding or improving cooling to residential suites.

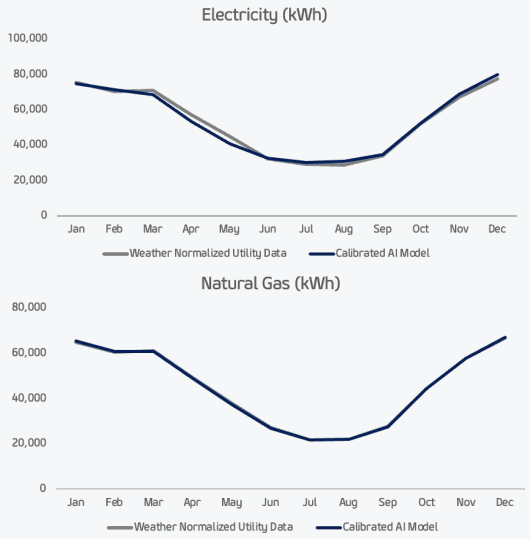
EV CHARGING

8 EV Charging Stations

An estimated 8 Level 2 EV charging stations could be added without upgrading the electrical service.

Model Accuracy

OPEN's AI model has produced a baseline energy model that matches your submitted monthly utility data to within ASHRAE Guideline 14 tolerances.



Organization: Pembina Institute
Advisor: Betsy Agar, Program Director, Buildings

Interview Synopsis

1. **What is your experience with and relationship to retrofits?**
- Retrofit design for reducing energy consumption & GHG emissions.
- Studied six, low-rise MURBS in Victoria, Vancouver, New Westminster, Coquitlam, North Vancouver, and Kamloops.
    - 11-50 units each
    - 4 wood framed and one hybrid concrete/wood and one steel-framed
    - Built between 1963 and 1994
    - Boilers for space heating (mid-efficiency between 80-88%). Domestic hot water efficiency varied.
    - Energy consumption is 309 kWh/m2/yr, 50% higher than the B.C. average for similar buildings.
    - Roof insulation values in five buildings were between RSI-1.41 to RSI-2.82.
    - Wall insulation ranges from RSI-1.05 to RSI-1.97, indicating low thermal resistance.
    - Air leakage for all buildings suggests infiltration rates exceeding the typical assumed rate of 0.25 L/s/m2 at 5 Pa7 (very drafty and allows heat to escape through the envelope).

2. **What are the top 5 things you want the panellists to know for the case study?**
- Create a like-for-like baseline retrofit (ie. The measures needed to keep the facility maintenance and repair up to date – which can be used to help isolate the costs and benefits in the analysis of ambitious energy and carbon reduction in study).
- Partial electrification of space heating systems occurs when boilers are recently replaced, but significant GHG emissions reductions could also be achieved through a diversified natural gas pathway (helps avoid potential challenges with e.g. the need for electrical panel capacity upgrades).
- This graph:

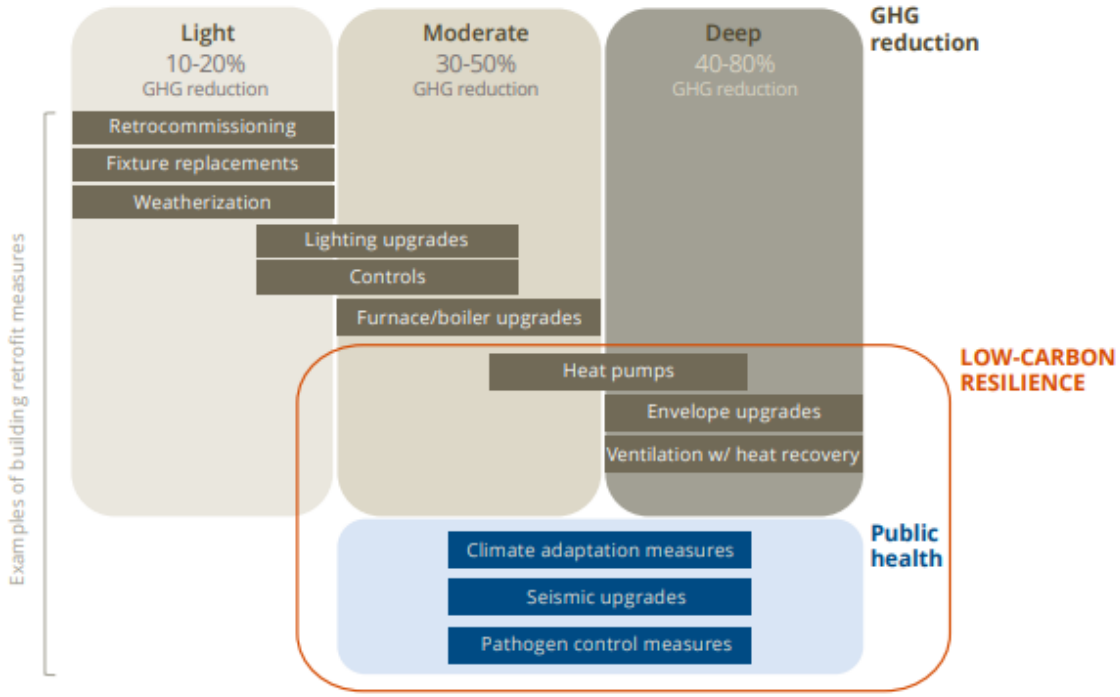


Figure 2. Building retrofit measures for GHG reduction and resilience

- Proposed deep retrofit schematic designs show deep carbon reduction is feasible, but energy cost savings and the avoided cost of carbon alone cannot recover the full retrofit costs. Furthermore, there is no correlation between net present value and carbon reduction, meaning deep carbon reduction does not necessarily equate to high retrofit costs. The median capital cost per dwelling unit is $63,000 for baseline and $138,000 for deep retrofits, while per CFA, it is $1,000 for baseline and $2,000 for deep retrofits (utility escalation rates included). Under the current federal carbon pollution pricing system, the regulatory charge for carbon emissions from fossil fuels is benchmarked at $65/tonne carbon dioxide equivalent (tCO2e) and is scheduled to climb to $170/tonne by 2030.
- Capital costs: (median) ~ $138,000 per housing unit, which falls within the grant limit of the Canada Mortgage and Housing Corporation of up to $170,000/unit to cover the full cost of deep retrofits, available through the Canada Greener Affordable Housing – Retrofit Funding program. The median incremental NPV is estimated at $68,000, which represents the cost gap that needs to be closed to make the financial case for deep retrofits. Based on median NPV estimates, the deep retrofits add a premium of approximately 60% on top of baseline retrofit cost

3. **What improvements would you suggest for the retrofit process/costs/outcomes?**

- For market rental units, government needs to develop a cost-sharing mechanism that allows landlords to recuperate costs without increasing rents.

- Access to funding (see below for list this study used).

Table 13. NPVs by dwelling unit – Reference rate scenario, with incentives

Building	Funding programs	Incentive	Incentive proportion of incremental capital (from Table 10)	NPV per unit with incentives	
				Deep retrofit	Incremental
Medewiwin*	CleanBC Communities Fund Investing in Canada Infrastructure Program	$1,410,000	89%	-$85,000	+$18,000
Manor House	FortisBC Deep Energy Retrofit Pilot Program	$6,075,000	129%	-$63,000	+$13,000
Crown Manor**	CleanBC Social Housing Incentive Program (SHIP)	$112,000	4%	-$161,000	-$92,000
Le Chateau	CleanBC Social Housing Incentive Program (SHIP)	$200,000	6%	-$288,000	-$87,000

* Includes solar PV

**Includes additional rental revenue of $37,200 from two new housing units

- Adding solar PV to help reduce utility costs.
- Enhancing insulation with over cladding to minimize tenant disruption.
- Adding heat recovery ventilators to reduce heat loss while bringing in fresh, filtered air.
- Thoughtful design decisions can reduce the need for costlier and more complex actions, such as electrical upgrades, if prioritized at the outset of the design process.
- FortisBC offers the most significant rebates for envelope upgrades, such as through its Deep Energy Retrofit Pilot Program.
- Certify the building/align it with a certification!
- Utilize Design Thinking when developing a deep retrofit plan. When everyone understands/communications re the common goal, there is a stronger collective understanding of project. This process is very different from traditional design approaches where each team member solves one problem at a time, passing the project along to the next specialist.

4. **What critical changes are needed to advance retrofit adoption in Vancouver?**

- The business case needs further research: Calculate the opportunity cost of doing nothing to adapt buildings to future climate extremes and risks, to reduce energy demand for heating and cooling energy costs, and to incorporate preventative health measures.
- Access to grants & funding.