Town of Banff

HIGH PERFORMANCE BUILDINGS IN MOUNTAIN COMMUNITIES

RESIDENTIAL BUILDINGS

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Abbreviations and Glossary

Abbreviations

Abbreviation	Description
AC	Air Conditioning
ACH	Air Changes Per Hour at a given pressure differential
ACP	Alternative Compliance Path
AHJ	Authority Having Jurisdiction
ASHP	Air-Source Heat Pump
CMHC	Canadian Mortgage and Housing Corporation
COP (COPc / COPh)	Coefficient of Performance (for Cooling / Heating)
DCV	Demand-Controlled Ventilation
DHW	Domestic Hot Water
ECCC	Environment and Climate Change Canada
EER	Energy Efficiency Ratio
EPD	Electrical Plug Density
ERV	Energy Recovery Ventilator
EUI	Energy Use Intensity
EUI_{adj}	Adjusted Energy Use Intensity complying with the requirements in Part 9 of the National Building Code – Alberta Edition
EV	Electric Vehicle
FCU	Fan Coil Unit
FDWR	Fenestration-and-Door-to-Wall Ratio
GHG	Greenhouse Gas Emissions
GHGI	Greenhouse Gas Emissions Intensity
GSHP	Ground-Source Heat Pump
GSHX	Ground-Source Heat Exchange
HRV	Heat Recovery Ventilator
HVAC	Heating, Ventilation, and Air Conditioning

Abbreviation	Description
ILCC	Incremental Life-Cycle Cost
ILCC/Tonne	Incremental Life-Cycle Cost per Tonne of Carbon Saved
LCC	Life-Cycle Cost
LCCA	Life-Cycle Cost Analysis
LEED	Leadership in Energy and Environmental Design
LPD	Lighting Plug Density
MURB	Multi-Unit Residential Building
NBC	National Building Code
NBC AE	National Building Code – Alberta Edition
NECB	National Energy Code of Canada for Buildings
NPV	Net Present Value
NRC	National Research Council
OA	Outdoor Air
Pa	Pascal, unit of pressure
PV	Photovoltaic
R – value (SI/IP)	Thermal resistance
REC	Renewable Energy Certificates
RNG	Renewable Natural Gas
sCOP	Seasonal Coefficient of Performance
SHGC	Solar Heat Gain Coefficient
TEDI	Total Energy Demand Intensity
TEUI	Total Energy Use Intensity
ToB	Town of Banff
U-value (SI/IP)	Thermal transmittance (inverse of R-value)
VRF	Variable Refrigerant Flow
WSHP	Water-Source Heat Pump
WWR	Window-to-Wall Ratio

Glossary of Terms

Term	Explanation
Archetypes	A typical building with a set of features (including size, form, construction assemblies and mechanical system) that is meant to represent all buildings of that type.
Capital Cost	The hard construction cost to implement a specific design strategy at a building. Hard costs in building capital costs refer to the direct expenses associated with the physical construction of a building. In this study, hard costs have been quantified for construction related costs including construction labor, building materials and design and construction contingences.
Cost Effective	Cost effective for this study was defined by the Town of Banff as the lowest upfront construction cost, or the lowest capital cost expense to the owner/developer to build. Construction cost considers estimated hard costs, or costs associated with physical construction of the building (materials, labor, equipment, etc.).
Design Strategies	A package of building retrofit measures focused on reducing energy and greenhouse gas intensity of a building. In this study, several design strategies have been defined for each archetype to comply with selected energy performance Tiers.
Energy Performance Tier	A code compliance pathway for achieving higher levels of energy efficiency in buildings. It requires demonstrating achievement of pre-defined energy performance levels through the use of energy simulations.
Estimated % Of Total Capital Building Cost	The ratio between the capital cost (specific design strategy) and the total building capital cost.
Greenhouse Gas Intensity (GHGi)	GHGI measures the greenhouse gas emissions associated with the operational energy for a building. GHGI is expressed in kilograms of carbon dioxide equivalent per square meter per year ($kgCO_2e/m^2/y$).
Incremental Abatement Rate	The life-cycle cost to reduce one tonne of greenhouse gas emissions. A measure of the “cost effectiveness” of the investment in reducing greenhouse gas emissions. A positive value means a net cost to reduce a tonne of GHGs whereas negative value suggests a net savings.
Incremental Capital Cost	Incremental net capital cost between scenarios (e.g. incremental net costs between Tier 1 vs. Tier 2 vs. Tier 4).
Incremental Energy Cost	Incremental net yearly energy costs in 2025$ between scenarios (e.g. incremental net costs between Tier 1 vs. Tier 2 vs. Tier 4).

Term	Explanation
Incremental Net Present Value	The life-cycle cost compared to a baseline or reference case. This references the incremental net cost between scenarios (e.g. incremental net costs between Tier 1 vs Tier 2 vs Tier 4 etc). When positive it indicates a favourable business case over the baseline scenario (indicating smaller total life-cycle costs compared to baseline).
Life-Cycle Cost	The initial and recurring capital costs, operating costs (utility costs), and residual value over a study period. The study period for this project is 40 years.
Life-Cycle Cost Per Tonne	The life-cycle cost to reduce one tonne of greenhouse gas emissions.
Total Building Capital Cost	The estimated hard construction cost (as defined above) for the total building construction (including energy items associated to the design strategy and non-energy items).
Total Energy Use Intensity (TEUI)	The total energy consumed by the building on-site in one year divided by the total gross floor area of the building.

Executive Summary

Project Context

The Town of Banff applied for funding through the Code Acceleration Fund (CAF) to advance the adoption and implementation of high-performance energy codes. This initiative is a response to Banff's growing momentum in housing development and reflects the Town's commitment to empowering private developers to construct buildings that are both efficient and sustainable. It reinforces alignment with Banff's Renewable Energy Transition Roadmap—an Environmental Master Plan that outlines ambitious community-wide objectives, including a 30% reduction in greenhouse gas emissions by 2030 and an 80% reduction by 2050 (based on 2016 levels), alongside a goal of achieving 100% renewable energy by 2050. While Banff's current regulatory framework mandates higher efficiency standards for all new municipal buildings, the Town does not have the agency to enforce a specific building code.

Despite lacking regulatory authority to enforce energy codes for residential construction, the Town aims to understand how builders can voluntarily adopt high energy performance Tiers under the National Building Code - 2023 Alberta Edition (NBC AE 2023) and, more broadly, achieve the energy requirements set out for Part 9 buildings (under NBC AE 2023 part 9.36) and other buildings (under NECB 2020).

This study was commissioned to evaluate possible cost-effective pathways to achieve different Tiers of energy performance for four residential archetypes expected to be a majority of future development in the Town and surrounding area. The four building archetypes selected as the focus of the study by the Town of Banff are shown below in Figure 1, with a summary of building characteristics assumed for the study.

1 Fourplex

- Low-rise MURB
- Four dwelling units
- 844 m^2, three floors
- 112 m^2 unconditioned parking
- Subject to Part 9 requirements

2 Garage Suite

- Accessory dwelling
- One dwelling unit
- 111 m^2, two floors
- 81 m^2 unconditioned parking
- Subject to Part 9 requirements

3 Apartment

- Low-rise MURB
- 36 dwelling units
- 2,135 m^2, three floors
- 562 m^2 unconditioned parking
- 144 m^2 unconditioned storage
- Subject to Part 3 requirements

4 Mixed-Use

- Mixed-use MURB with street-level restaurant, retail, and office space
- 24 dwelling units
- 2,370 m^2, three floors
- Subject to Part 3 requirements

Figure 1: Summary of Archetypes

The study also explores potential cost premiums specific to Banff and other mountain communities, identifies design strategies to improve new build performance aligned with Banff's energy and emissions goals, and provides guidance for municipal staff, builders and developers.

The methodology proposed for this project included characterizing representative archetypes, analyzing existing building designs, modeling energy performance, estimating costs, and conducting life-cycle cost analyses with the purpose of identifying practical design strategies suitable for Banff's climate zone (7A). The study considered the current in force requirements for Alberta (Tier 1) as well as 'mid Tier' (Tier 2 for NECB, Tier 3 for NBC AE-9.36) and 'upper' Tier requirements (Tier 4 for NECB, Tier 5 for NBC AE-9.36) to illustrate the incremental level of effort to achieve higher performance. In addition, the study presents a number of sensitivity analyses addressing variables like fuel cost ratios, grid emission factor projections and capital cost escalation as well as consideration for potential differences between current and upcoming proposed code versions.

Summary of Study Results

Key study results, presented as normalized by archetype floor area, are presented below.

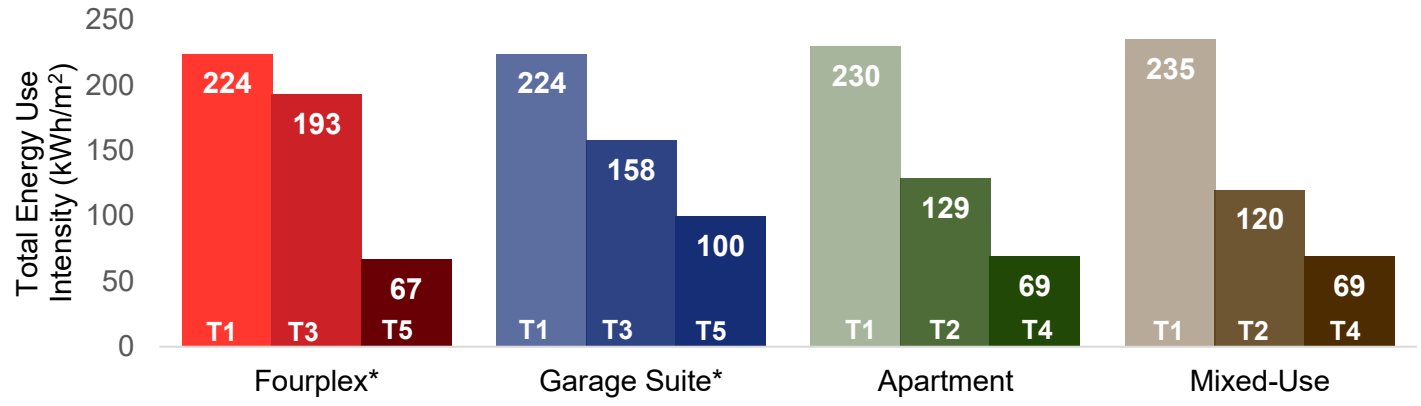

Figure 2: Total Energy Use Intensity of Modelled Archetype Tiers

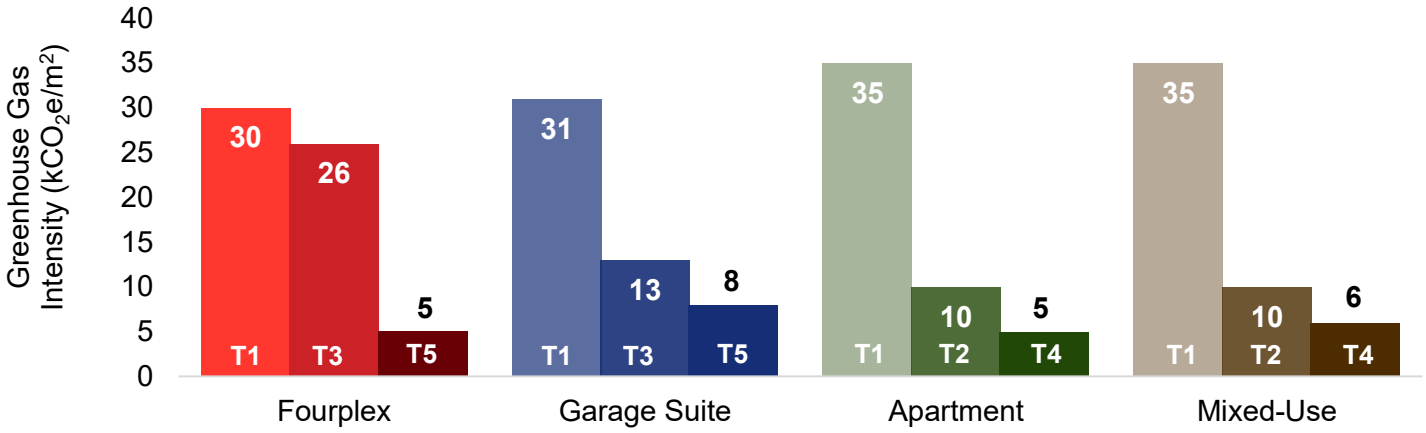

Figure 3: Greenhouse Gas Emission Intensity of Modelled Archetype Tiers

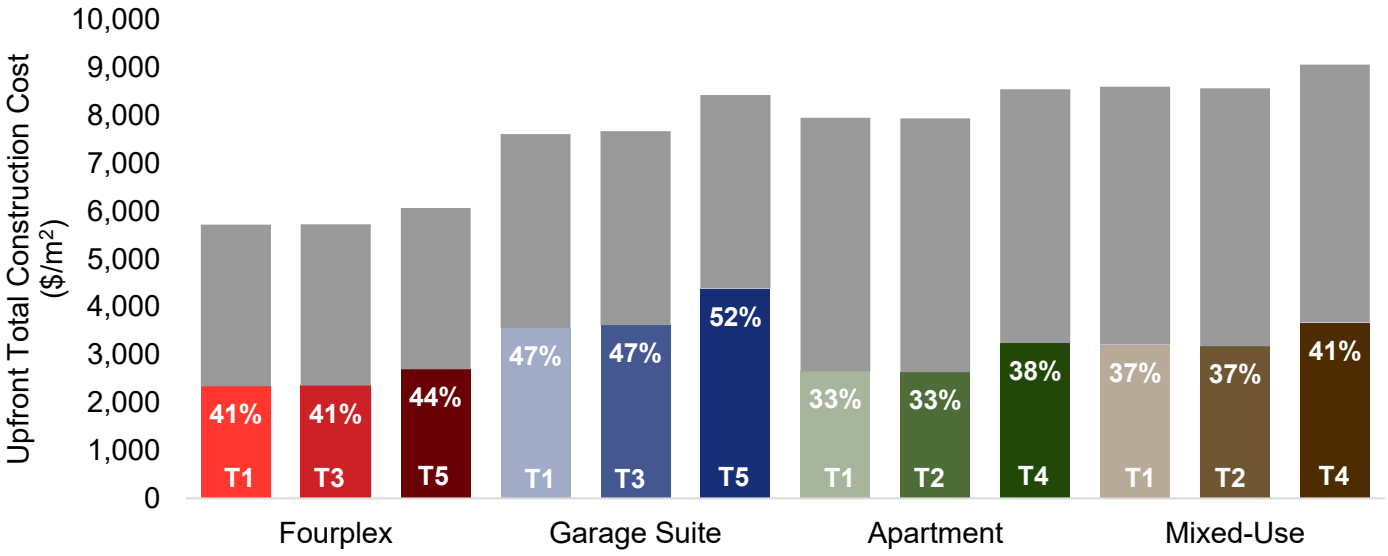

Figure 4: Est. Construction Cost for Design Strategies (% of Est. Total Construction Cost of Modelled Archetype Tiers)

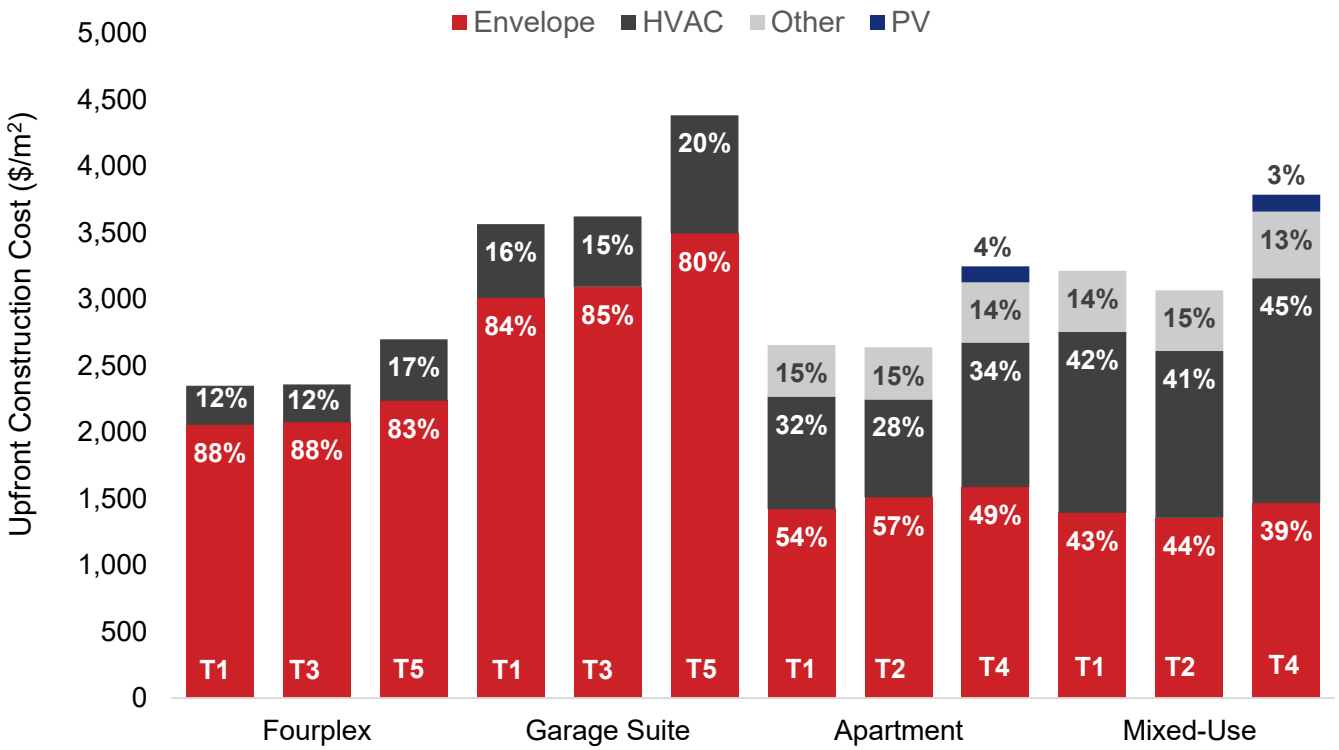

Figure 5: Est. Construction Cost for Design Strategies by Primary System of Modelled Archetype Tiers

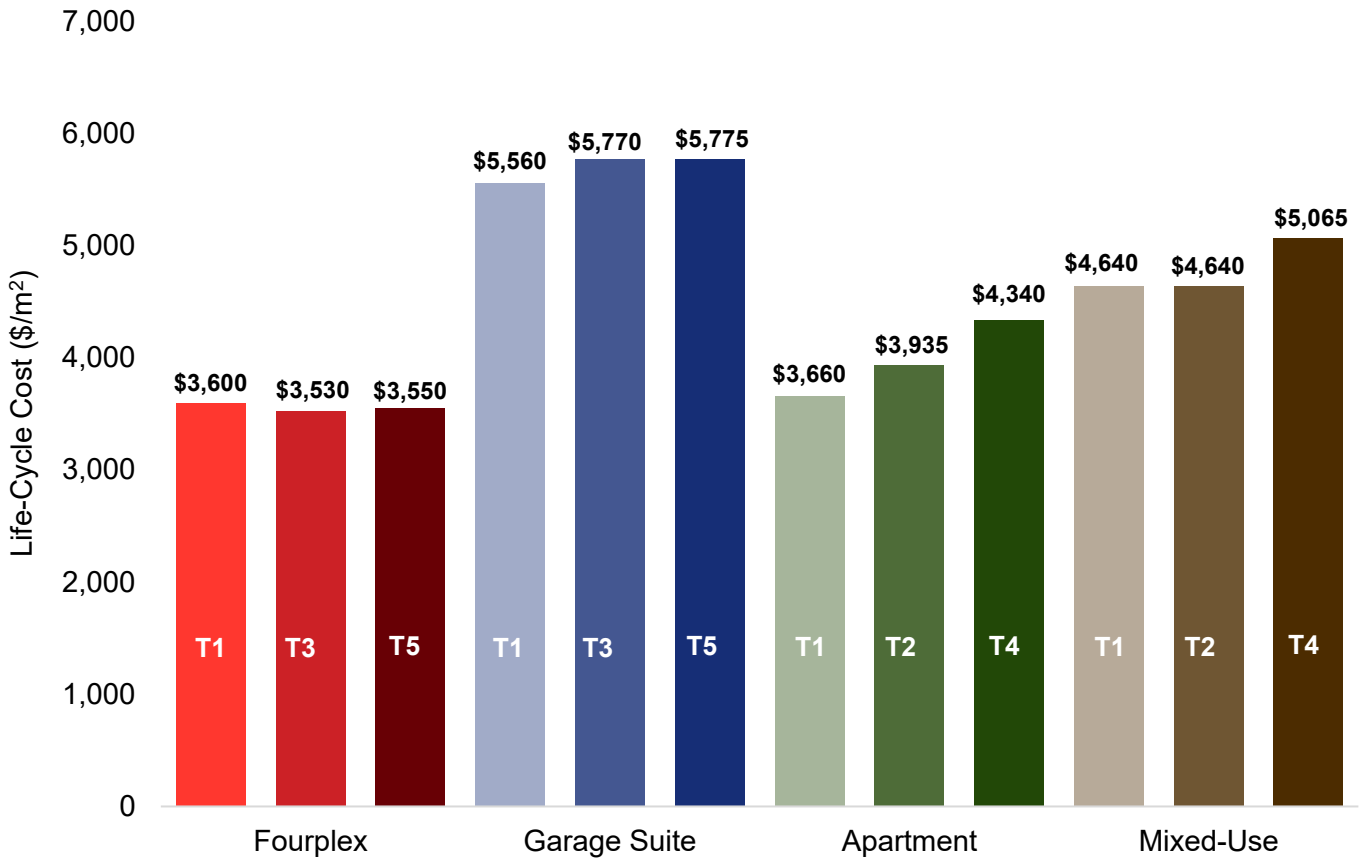

Figure 6: Life-Cycle Cost Performance of Modelled Archetype Tiers

The results above are presented on a per unit basis. Key results present as absolute values (i.e. results not normalized by floor area) for each archetype and Tier can be seen below in Table 1.

Table 1: Summary of Key Financial Results

		Total Construction Cost ($M)			Operational Costs ($/m²/yr)			Life-Cycle Costs ($M)			40-year GHG Reductions (tCO_2e)		
	Archetype	Tier 1	Mid Tier	Upper Tier	Tier 1	Mid Tier	Upper Tier	Tier 1	Mid Tier	Upper Tier	Tier 1	Mid Tier	Upper Tier
Part 9	Fourplex	$4.8	$4.8	$5.1	$0.2	$0.2	$0.1	$3.0	$2.9	$2.8	-	140	830
	Garage Suite	$0.84	$0.85	$0.93	$0.3	$0.4	$0.2	$0.6	$0.6	$0.6	-	80	100
Part 3	Apartment	$17.0	$17.0	$18.3	$0.6	$0.8	$0.5	$7.8	$8.4	$9.2	-	2,090	2,500
	Mixed-Use	$20.4	$20.3	$21.5	$0.6	$0.7	$0.4	$11.0	$11.0	$12.0	-	2,360	2,750

Key Findings

Key findings from the energy modelling analysis included:

- There are technically feasible design pathways to achieve the mid and upper Tier performance for all archetypes, although complying with the upper Tiers is anticipated to be challenging for each of the residential archetypes explored.
- For mid and upper Tiers, fuel switching with air source or ground source systems are essential design strategies. As Alberta's electricity continues to reduce in carbon intensity, emissions from these fuel-switched buildings would more closely align with Banff's community goals for buildings by 2050.
- Achieving higher levels of air tightness called for at higher Tiers is relatively simple to model but can be significantly challenging in practice, making it challenging to estimate potential costs. Achieving extremely airtight buildings requires careful attention and coordination through all phases of design and construction by multiple disciplines, and often performance is only evident after on-site testing.
- Showing compliance with higher Tiers may be more accessible in the upcoming revision to the NBC and NECB (i.e. as part of the planned 2025 release) which are expected to credit fuel switching more readily than in the current code.

Furthermore, key findings from the financial analysis are summarized below.

- For the mid Tiers, the capital cost premium was estimated to be negligible compared to the lowest Tier (Tier 1). In other words, mid Tier performance may be able to be achieved for similar or even slightly lower capital costs as Tier 1. However, annual utility costs are expected to be higher in the mid Tier buildings compared to Tier 1, due to the relatively higher cost of electricity. This trade-off will need to be carefully considered by owners/developers.
- For the upper Tiers, the cost premium compared to total estimated construction cost was estimated to range between 5-11% compared to the lowest Tier (Tier 1). A majority of the cost premium can be attributed to the need for high-performing enclosure and geo-exchange systems at these upper Tiers.
- Focusing on only lowest upfront construction cost does not adequately incorporate other benefits of building to higher performance. Life-cycle cost and abatement rate are two complementary metrics that can be used to evaluate the cost effectiveness of investment into higher performance buildings. The life-cycle cost analysis suggests more attractive results for mid and upper Tiers for the smaller Part 9 archetypes than for the larger, Part 3 ones. This result is mainly driven by higher operational savings offered by energy efficiency and geo-exchange technologies compared to the larger Part 3 buildings. For Part 3 buildings, the mid Tiers show the most cost-effective scenario, due to the lower capital costs per square meter offered by design trade-offs and the project scale and operational cost savings offered by fuel switching strategies.
- Emission abatement rates are much more attractive for higher performing Tiers compared to abatement rates for retrofit projects (i.e. retrofitting buildings to reduce emissions down the road will be more expensive than investing in higher performing buildings in the first place).

Next Steps / Future Work

The Town can play a key role to educate, support and catalyze change in the new building sector. Potential areas for future work raised in this study include:

- Encourage/support builders with guidelines, information and programs specific to meeting higher performance Tiers. Cost effective strategies examined included improving air infiltration, air source and ground source heat pump systems and high performance enclosure systems. The Town can help to accelerate change by developing bespoke guides or connecting builders to training/resources, especially the local workforce.
- Given estimated cost premiums and poor traditional business case performance, starting or continuing to advocate for regulatory change and/or providing performance incentives/rebates will be another avenue to accelerate higher performance buildings in the Town and broader community. While some provinces have published timelines for adopting higher Tiers, Alberta has yet to do so. Advocating for a clear schedule for Tier adoption remains important, even without formal regulations. Furthermore, consideration for a voluntary approach to higher performance development, such as through Community Improvement Incentives, may be beneficial, as it would offer a framework towards guiding builders to achieve higher levels of performance.
- Convene an industry working group of engaged building industry members willing to provide their time and insights to help the Town of Banff move towards its goals. The Town should consider convening a working group following the completion of this report to hold a deeper conversation on the types of policies, programs and/or other supports necessary to enable higher performance buildings.
- GHG emissions considered in this study are primarily operational emissions related to energy consumption, other sources of emissions, such as embodied carbon are another potential area for further exploration.

The primary objective of this project is to initiate a dialogue regarding the advantages of higher performance buildings for mountain communities, as well as to identify potential opportunities and challenges for owners, developers, occupants, and the broader community. This study does not serve as a prescriptive manual for builders, nor does it define a singular pathway to achieving enhanced building performance or specify exact costs. The outcomes and expenses associated with new construction are significantly affected by project-specific variables. However, lessons from this study offer valuable insights for other mountain communities with similar climate and architectural contexts, but differing regulatory environments.

1 Introduction

1.1 Background

In 2019, Banff Town Council adopted an Environmental Master plan that included community wide goals of achieving 30% greenhouse gas (GHG) emissions reductions over 2016 levels by 2030 and 80% by 2050. The accompanying energy transition roadmap sets out the long-term pathway to achieve these ambitious targets. One of the key areas of focus is Energy Efficient buildings. Typically, the easiest pathway for an efficient building is at its initial construction since retrofits of existing buildings can be more complex, disruptive to occupants and (as a result) more costly.

Because municipalities in Alberta lack the jurisdictional authority to modify the provincial building codes, the Town of Banff is exploring ways to encourage residents, developers and builders to invest in the upfront cost of building high performing buildings. To support this initiative, the Town applied and received funding under the Code Acceleration Fund (CAF) managed by Natural Resources Canada (NRCan).

As part of the research project titled “High Performance Buildings in Mountain Communities”, the Town aims to provide clarity to the cost implications of fulfilling stricter energy performance Tiers for buildings that are specifically relevant for the Bow Valley and other mountain communities.

1.2 Project Purpose

The purpose of this project is to perform a technical analysis, capital cost analysis, and evaluate the life-cycle cost impacts of homes built to comply with increasingly stringent performance Tiers as outlined in both the National Building Code – Alberta Edition (NBC AE) and the National Energy Code for Buildings (NECB). The project aims to provides a deep understanding on:

- Energy-related features and characteristics of four residential archetypes that are expected to make up a significant portion of new development in the Town of Banff, the Bow Valley, and similar mountain communities (Archetypes to be studied included: Fourplex, Garage Suite, Low-Rise Apartment and Mixed-Use Buildings);
- Potential design strategies that are practical for the different archetypes, and can also achieve the energy performance Tiers in a cost-effective way;
- The greenhouse gas emissions, energy consumption, and financial impacts of different energy performance Tiers for each archetype; and
- The impacts of uncertainty on key inputs such as utility costs, upfront construction costs, and non-energy benefits (e.g. maintenance cost savings) to the estimated financial return on investment.

Ultimately, the project is meant to support the discussion on the challenges and benefits of high performance buildings for Alberta mountain communities. The goal is to provide useful data and discuss the potential

opportunities and barriers for owners/developers, occupants, and the broader community in making investments beyond minimum code performance.

This study is not intended to be a prescriptive guide for builders, define the only pathway to achieving higher performance in new builds, or indicate what the exact costs will be to each project. The performance and cost of new buildings is heavily influenced by build-specific factors, and this report is intended to support (and ideally simplify and accelerate) the decision-making process for investment, particularly in the early stages.

Findings and conclusions from this report will be further enhanced through engagement with industry leaders and with comparison to real-world data as local projects pursue a beyond-code mandate.

Key Study Terms

Design Strategies: A package of building measures focused on reducing energy and greenhouse gas intensity of a building. In this study, several design strategies have been defined for each building type to comply with selected energy performance Tiers.

Cost Effective: Defined for this study as the lowest construction cost, or the lowest upfront expense to the owner/developer to build. Construction cost considers estimated hard costs, or costs associated with physical construction of the building (materials, labor, equipment, etc.), as well as associated soft costs (contingencies related to permit, engineering and design costs).

1.3 Current State of Energy Efficiency

1.3.1 Current Energy Code Requirements for New Buildings

There are two energy codes in Alberta that pertain to energy use in new construction and major renovation of buildings (i.e. new builds, NC): the National Building Code – 2023 Alberta Edition (NBC AE 2023) and the National Energy Code for Buildings 2020 (NECB 2020).

Houses that are three storeys or less and with an area less than 600 m^2 are referred to as Part 9 buildings and typically follow energy requirements set out in Part 9 of the NBC AE. Residential buildings exceeding three storeys or having an area more than 600 m^2 are referred to as Part 3 buildings and typically follow energy requirements set out in the NECB. Detailed compliance requirements can be found in NBC AE Div. A Section 1.3.

The NBC AE 2023 and NECB 2020 have introduced Energy Performance Tiers as a pathway towards reducing operational GHG emissions across Canada to be net-zero by 2050. The Tiers represent a stepped increase in energy performance versus an equivalent home built to minimum requirements defined in the Code. The performance targets needed to achieve the Tiers for Part 9 and Part 3 buildings are shown in Table 2 and Table 3 below, respectively.

At present, the minimum performance for Alberta is Tier 1 for new buildings subject to NBC AE 2023 and NECB 2020.

Table 2: Current Part 9 (NBC AE 2023) Energy Performance Requirements

Energy Performance Metric	T1	T2	T3	T4	T5
Min. Energy Improvement[1]	≥ 0%	≥ 10%	≥ 20%	≥ 40%	≥ 70%
Min. Heat Loss Reduction[2]	≥ 0%	≥ 5%	≥ 10%	≥ 20%	≥ 40%
Max. Peak Cooling Load[3]	≤ 0%	≤ 0%	≤ 0%	≤ 0%	≤ 0%

Table 3: Current Part 3 (NECB 2020) Energy Performance Requirements

Energy Performance Metric	T1	T2	T3	T4
Min. Energy Improvement	≥ 0%	≥ 25%	≥ 50%	≥ 60%

Compliance with the codes can generally be achieved with one of three alternative paths: Prescriptive Path, Trade-Off Path, and Performance Path. The Performance Path tends to offer the most flexibility and was therefore selected as the primary pathway to use for this study; allowing for a balance between costs and energy efficiency.

1.3.2 Considerations for Future Code Updates

The Canadian Board for Harmonized Construction Codes (CBHCC), supported by the National Research Council (NRC), is updating the NBC and NECB to 2025 versions, which are expected to be released in 2025[4]. These updated versions will address evolving needs in building safety, energy efficiency, and environmental sustainability, and will significantly advance the construction of *low-carbon* buildings in Canada.

Notably, the current Performance Path of NECB 2020 focuses on compliance by assessing relative percent savings for energy (vs. a reference building). It is anticipated that future versions of the Code will support the use of absolute targets and will have Greenhouse Gas (GHG) emissions reduction pathways as well as energy savings pathways.

Absolute Energy Targets

Relative percent savings is impacted not only by performance improvements due to design decisions, but also by corresponding changes to the reference building under standardized modeling rules. Consequently, reference building modeling rules can sometimes demotivate a development team from pursuing a more efficient or sustainable approach. For example, NECB 2020 modeling rules state that if heat pumps are used in the proposed building then they must also be used in the reference building. This requirement for a fuel-source and system-type agnostic approach negates some of the benefit achieved in a relative performance pathway that could be realized in an absolute performance pathway.

At present there are no absolute energy targets in the Alberta building code and the schedule for adoption of 2025 NBC/NECB updates by Alberta is unknown. Requirements for the next version of the national harmonized

[1] The calculated Energy Improvement for Part 9 buildings differs from Part 3 buildings in that it includes only certain end-uses as defined in NBC AE 9.36.5.4.
[2] The calculated Heat Loss is similar to Total Energy Demand Intensity (TEDI), except that it includes only certain loads, as defined in NBC AE 9.36.7.3.
[3] The proposed house peak cooling load shall not be greater than the reference house peak cooling load.
[4] CBHCC-Current Codes

codes have not been finalized; however, proposed changes for the new national standards have been issued for public review. The expected absolute building energy targets indicated in the Proposed Change for a Part 3 low-rise MURB and Office are shown under Tier 1 in Table 4 below[5]. All other targets have been assumed as follows:

- The Mixed-Use building energy target was calculated using a blend of the MURB and Office targets, following the methodology described in the Proposed Change
- The Tier 2 to Tier 4 building energy targets have not been specified in the Proposed Change; for this study, they have been assumed to match the current levels of Tiers with the same percent improvement requirements (as per NECB 2020)

Table 4: Anticipated Future Part 3 (NECB 2025) Energy Performance Requirements

	TEUI (ekWh/m²/yr)			
Part 3 Archetype	**T1**	**T2**	**T3**	**T4**
Assumed % Improvement vs. Tier 1	n/a	25%	50%	60%
Apartment (MURB, not more than 6 storeys)	**225**	169	113	90
Office	**175**	131	57	36
Mixed-Use (Blend of 2/3 MURB and 1/3 Office)	208	156	104	83

GHG Emissions Targets

In addition to energy requirements, the new version of the NBC/NECB (2025) is also expected to include voluntary Greenhouse Gas Emissions Intensity (GHGI) targets that allow for buildings to achieve baseline and higher Tiers based on their GHG emissions[6] savings. The proposed GHG Emissions Performance Levels are summarized in Table 5 below.

Table 5: Anticipated Future Part 3 (NECB 2025) GHG Performance Levels

GHG Emissions Performance Level	Percent Improvement
A	≥ 90%
B	≥ 75%
C	≥ 50%
D	≥ 25%
E	≥ 10%
F	≥ 0%

[5] These requirements are summarized from publicly available version of NBC and NECB that were released for public comment. As the 2025 NBC and NECB updated versions were not released at the time of this analysis, WSP acknowledges that these requirements may be different between the public comment versions. The draft revisions can be obtained from https://cbhcc-cchcc.ca/eng/public-review/2024_1/pcfs/necb20_divb_01.01.02.01._001868.html.
[6] Similar to revised energy requirements, draft GHG targets can be obtained from https://cbhcc-cchcc.ca/eng/public-review/2024_1/pcfs/necb20_divb_11_002003.html.

In its current form, the GHG Emissions Performance Levels aren't a compliance requirement; however, they do provide an opportunity for provinces and/or municipalities to adopt them as mandatory requirements in the future, by requiring new Part 3 buildings of certain type or size to achieve a certain letter grade, for example.

Future Code Focus for this Study

For this study, Design Strategies are primarily selected to achieve compliance with the currently enforced codes (NBC AE 2023 for Part 9 and NECB 2020 for Part 3). Compliance with the anticipated performance requirements in the future NECB 2025 have been analysed for the Part 3 buildings with results in Sections 3.3 and 3.4 and discussion in Section 4.4.

For Part 9 buildings, it is anticipated that a similar labelling approach will be adopted for carbon emission compliance, and that GHG emission threshold levels will be tied to a required minimum energy performance level. For the purpose of this study, WSP focused on evaluating compliance with the current code, as the complexity of the upcoming changes will require a deeper study of the final code version.

1.3.3 Municipal Building Requirements, Guidelines, and Programs

Beyond NBC AE 2023 and NECB 2020, there are no other requirements that directly outline energy performance requirements. The Town's existing Banff Design Guidelines focus on ensuring that the built environment reflects the aesthetic of Banff's natural surroundings and the Town's unique character; it does not have any explicit energy related requirements. There are some implicit considerations (and benefits) based on acceptable building materials, roof style/shape, desirable window form, and desirable functional aspects - including providing direct access/connection to exterior spaces - but the reason to include these features is not directly related to energy savings criteria.

The Town does support energy efficiency in buildings through incentive programs, including a Deep Retrofit program[7] designed to incentivize large retrofit projects in residential homes, a Property Assessed Clean Energy (PACE) style program, incentives for solar photovoltaic (PV), and a post-purchase rebate program that covers a wide variety of products including heat pumps, efficient appliances and water fixtures, Energy Star-rated enclosure replacements (windows, doors), and other building components. However, these programs are focused on supporting efficiency and greenhouse gas reductions in existing buildings, so their relevance to new construction is also indirect.

As previously outlined, The Town does not have the ability to regulate/mandate more stringent Tiers of performance through the code authority (as seen in other jurisdictions across Canada, such as in B.C.). Because municipalities in Alberta lack the power to modify the provincial building codes, any private sector building development pursuing higher Tiers of performance will be voluntary.

1.3.4 The Current Housing Crisis

The Town of Banff's housing crisis is another key piece of context: it has been facing a significant housing shortage for decades. The Town's limited area and strict development regulations have resulted in a shortage

[7] Deep Retrofit Program | Banff, AB - Official Website

of housing, particularly affecting short-term workers, families, and young adults. Currently, the vacancy rate for rental dwellings is less than 1%, and the Town estimates it has a shortage of approximately 700 to 1,000 homes for a population of 10,944 people (2024)[8]. Any future housing will be via redevelopment and through increased density. The Town, in consultation with other Bow Valley Communities, has identified four types of residential buildings that are expected to be a majority of any future residential redevelopment. The residential buildings identified are Garage Suites, fourplexes, low-rise apartment buildings, and low-rise mixed-use buildings. The features of these archetypes are discussed and elaborated on further throughout this report.

1.3.5 Community Strategic Environmental Goals

The Town of Banff has several environmental strategies in place, primarily guided by their Environmental Master Plan and the Renewable Energy Transition Roadmap which are detailed below.

- **Environmental Master Plan**: This plan sets a 10-year strategic vision for a sustainable future. It includes initiatives to reduce greenhouse gas emissions, improve energy efficiency, and promote sustainable practices across the community.
- **Renewable Energy Transition Roadmap**: This roadmap outlines a pathway to achieve Banff's ambitious climate goals set under the Environmental Master Plan. A key focus area of the roadmap includes "Energy Efficient Buildings" and outlines strategic actions to improve energy efficiency in new and renewed residential and commercial buildings starting in 2030 as well as the implementation of a community-wide solar PV program and seeing a majority of buildings install heat pumps.

As outlined across these two strategic documents, the Town has set ambitious community targets for greenhouse gas emissions and renewable energy, including achieving 30% emissions reductions by 2030, and 80% by 2050 (relative to 2016 emissions levels) and achieving 100% renewable energy for all buildings by 2050.

A net zero goal applies, implicitly, to the existing building inventory (i.e. all buildings operating in 2016). This means that plans to grow the current stock would result in net emissions increase. Given this fact, it is important to integrate sustainability considerations into planning and design of new constructions. Thankfully, new buildings represent the cheapest place to invest in decarbonization, since the upgraded investment align 100% with planned capital investment. Retrofitting existing buildings often involves complex logistics, disruptions to occupants, and higher labor costs and investing at the new construction (or major renovation) stage avoids these hurdles.

A key metric for the study that will be important to understand is how compliance with different Tiers impact operational greenhouse gas emissions in the identified archetypes.

1.3.6 Additional Considerations

It should be noted that additional regulatory compliance might be required to implement some of the design strategies explored within this study and should therefore be further investigated at a later implementation stage. An example of such broader considerations is the acquisition of drilling permits from Parks Canada when seeking

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to implement a geo-exchange system as well as additional complexity arising from drilling depth limitations and soil usage.

Another example are the evolving requirements of available provincial and federal funding and financing opportunities which may or may not align with Tiered code requirements (either current or anticipated). Further discussion on the incentive and financing landscape for new buildings is provided in Chapter 4.

1.4 Project Team and Roles

This project was completed by WSP, with support of a costing sub-consultant, A.W. Hooker. The primary roles and responsibilities of each firm in the project are summarized below:

Table 6: Team Roles

WSP	■ Overall Project Management and Coordination with Town of Banff ■ Archetype Development and Characterization ■ Archetype Design Strategy Development ■ Archetype Energy Modelling Analysis ■ Life-Cycle Cost Analysis ■ Co-Benefits Analysis ■ Final Report Development
A.W. HOOKER QUANTITY SURVEYORS	■ Capital Cost Estimating

2 Methodology

2.1 Summary of Analysis Approach

A summary of the methodology for this project is presented in Figure 7, with key tasks highlighted for each step in the analysis. Additional details on methodology are provided in Appendix A.

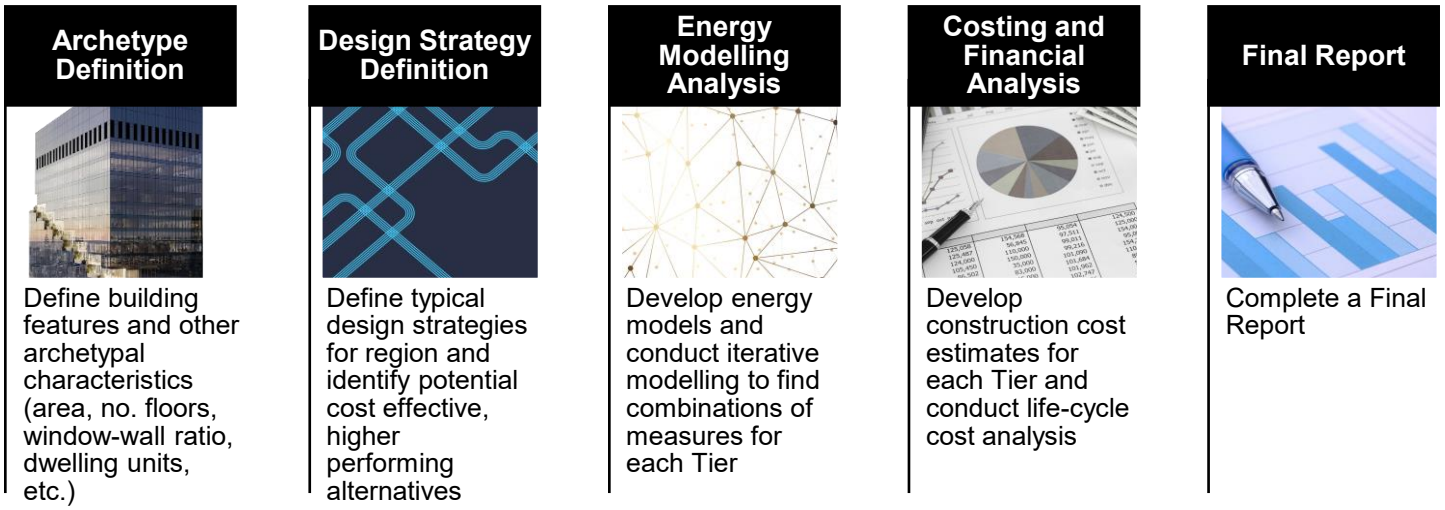

Figure 7: Project Methodology

2.2 Archetypes and their Key Features

Four archetypes were selected for this study, which are expected to represent most of the new residential development in Banff and in the Bow Valley Area. A summary description of the archetypes is provided below in Figure 8. For a complete description of the archetypes and their building features, see Section 3.

1 Fourplex

- Low-rise MURB
- Four dwelling units
- 844 m^2, three floors
- 112 m^2 unconditioned parking
- Subject to Part 9 requirements

2 Garage Suite

- Accessory dwelling
- One dwelling unit
- 111 m^2, two floors
- 81 m^2 unconditioned parking
- Subject to Part 9 requirements

3 Apartment

- Low-rise MURB
- 36 dwelling units
- 2,135 m^2, three floors
- 562 m^2 unconditioned parking
- 144 m² unconditioned storage
- Subject to Part 3 requirements

4 Mixed-Use

- Mixed-use MURB with street-level restaurant, retail, and office space
- 24 dwelling units
- 2,370 m^2, three floors
- Subject to Part 3 requirements

Figure 8: Summary of Archetypes Studied

2.3 Design Strategy Considerations

Achieving a high-performance building design requires a holistic approach that maximizes energy efficiency as well as carbon reductions and typically requires improvements beyond what is prescribed by current standards. Best practices consider main categories when designing high-performance buildings, as listed in Table 7 below. Category descriptions and their influence on being able to meet compliance targets are also shown in Table 7. Out of these six categories, some have a higher potential on the meeting the compliance targets than others. For example, Occupant-Connected Systems & Equipment have a low impact on the targets because, for the most part, these loads are prescribed by the NBC AE and NECB and there is limited improvement that can be made beyond what is specified in the Code. Enclosure Systems, on the other hand, have a significant impact on the thermal demands and energy use of the building, and therefore have a high impact on reaching the compliance targets. Therefore, placing a large focus on identifying potential cost-effective strategies in categories that have a high impact will be key to finding cost effective options.

Table 7: Design Strategy Descriptions

	DESCRIPTION	INFLUENCE ON MEETING TARGETS
Occupant-Connected Systems & Equipment	For residential buildings, this category typically includes lighting systems (fixtures, controls) and plug loads (kitchen equipment and other home appliances).	**LOW:** Occupant-Connected Systems & Equipment has a limited influence towards meeting high-performance compliance targets because most of these the loads are prescribed by the Codes; however, some energy efficiency strategies were evaluated for Part 3 buildings, where applicable.
Enclosure Systems	Enclosure systems include components separating the interior and the exterior environments of a building (e.g. exterior walls, windows, doors, roof, foundation, and slabs-on-grade).	**HIGH:** Enclosure systems can contribute significantly to a high-performance building when strategies are put in place to reduce heat-loss and improve air tightness. Design strategies were evaluated for all performance Tiers and all archetypes.

 HVAC Delivery Systems	This category includes HVAC distribution systems throughout the building. It includes hydronic, air or refrigerant-based systems for distribution of fresh air, heating and cooling energy.	**HIGH:** HVAC delivery systems contribute greatly to the building energy consumption. Adoption of energy efficiency/proper design strategies in this category can reduce effectively the associated energy use.
 Optimal Fuel-Switching	This category focuses on switching from fuel-fired heating and domestic hot water systems to cleaner and more efficient energy generation sources.	**HIGH:** Optimal Fuel-Switching has the highest potential in achieving an energy efficient, low-carbon design and is therefore explored for the majority of the Tiers in all archetypes.
 Alternative Energy Generation	Includes exploring opportunities for clean energy generation through renewable sources (typically solar photovoltaic panels).	**MEDIUM:** Alternative Energy Generation has good potential to reduce carbon emissions as well as utility costs. Implementation is explored for all archetypes in the study.
 Grid Stewardship	This category evaluates strategies aimed at reducing the impact on the local electrical grid (e.g. solar PV, battery energy storage, and potential synergies with EV chargers).	**MEDIUM:** Grid Stewardship measures, especially proven technologies like solar PV, can significantly reduce a building's energy and carbon emissions, given the right conditions (e.g. roof space, orientation, loading capacity).

2.4 Cost Estimates and Life-Cycle Costing

For this study, a cost consultant was retained by the study team. The cost consultant developed two cost estimates for use for this study:

- Total Construction Cost - The estimated total cost to build a new version of the facility archetype, including all capital and construction-related soft costs (e.g. design services), but not including other soft costs (e.g. financing, real estate services, etc.)
- Design Strategy Construction Costs - Only the Construction Costs associated with implemented strategies (i.e. Enclosure, HVAC, lighting, Domestic Hot Water & Renewable Energy Systems).

Class C capital cost estimates for the design strategies were prepared by A.W. Hooker, based on building features, equipment selection, and assembly information provided by WSP for each design strategy meeting the NBC AE/NECB performance Tiers of each archetype. The summary of all capital cost estimates by archetype is included in Appendix D of this report. A.W. Hooker developed detailed pricing for the buildings specific to the Town of Banff, but also developed cost factors to estimate the potential cost premium of construction in the Town of Banff compared to urban regions such as the City of Calgary and City of Edmonton. To provide additional context to the study, A.W. Hooker also developed high-level elemental cost estimates for the total construction cost to build similar buildings in the Town of Banff.

Beyond upfront capital construction costs, life-cycle costs were assessed over 40 years, a typical timeframe roughly representing a typical building renewal cycle for major re-investment in building infrastructure and components. Recapitalization (building system and equipment replacement costs) was included in the analysis, as well as consideration of the residual value for the building systems at the end of the 40-year period. Utility costs consider estimated consumption rates, distribution and transmission charges, and other miscellaneous

fixed costs (e.g. administrative) for buildings located in the Town of Banff; escalation factors were applied to these energy costs for future years. A detailed description of financial assumptions and the life-cycle costing process is included in Appendix C of this report.

2.5 Emissions, Energy, and Financial Metrics

Several key metrics were used to describe and evaluate the performance of the building archetypes, which are summarized in Table 8 below.

Table 8: Compliance and Financial Analysis Metrics

	Metric	Unit	Definition
Part 3 Compliance Metrics	Total Energy Use Intensity (TEUI)	ekWh/m^2/y	The total energy consumed by the building on-site in one year divided by the total gross floor area of the building.
	Energy Improvement	%	The Total Energy Use Intensity (TEUI) savings for the proposed building design vs. the reference building design defined in the Code.
Part 9 Compliance Metrics	Adjusted Energy Use Intensity (EUI_{adj})	ekWh/m^2/y	The energy only for space heating, ventilation, service water heating, and space cooling consumed by the building on-site in one year divided by the total gross floor area of the building, as per NBC AE 9.36.5.4.(1); this is the energy used for the Energy Improvement compliance calculation (slightly different from a typical EUI calculation which includes all building energy).
	Heat Loss Intensity	ekWh/m^2/y	The annual gross space heat loss from the building envelope, infiltration, and ventilation, divided by the total gross floor area of the building, as per NBC AE 9.36.7.3.(5); this is the heat loss used for the Heat Loss Reduction compliance calculation (slightly different from a typical TEDI calculation which includes all heating loads).
	Peak Cooling Load	kW	The maximum building cooling load occurring within a year.
	Energy Improvement	%	Adjusted Energy Use Intensity savings for the proposed building design vs. the reference building design defined in the Code.
	Heat Loss Reduction	%	Heat Loss Intensity savings for the proposed building design vs. the reference building design defined in the Code.

	Metric	Unit	Definition
Other Energy Metrics	Thermal Energy Demand Intensity	ekWh/m^2/y	The total energy consumed by the building for heating and ventilation in one year divided by the total gross floor area of the building.
	Peak Electricity Demand	kW	The maximum building electrical load occurring within a year.
	Greenhouse Gas Intensity (GHGI)	kgCO_2e/m^2/y	The amount of GHGs emitted per unit of floor area.
Financial Metrics	Upfront Capital Cost	$2025	The nominal initial capital (hard) cost of an identified measure/bundle of measures.
	Energy Cost Change	$2025	The energy cost change resulting from reductions in electricity and fossil fuel consumption. Energy cost escalation factors are applied each year to the current base energy rates.
	Life-Cycle Cost	$2025	Sum of all cash flows over the project study-period, including measure capital costs, replacement costs, residual value, energy cost change discounted to present dollars.
	Abatement Rate	$2025/t$CO_2$e	Life-cycle cost divided by the sum of emission change over the project- study period, relative to an emission baseline consisting of current energy use and emission factor forecasts for each energy type.

Key assumptions for calculating metrics above are summarized in Table 9. Refer to Appendix B and C for additional details

Table 9: Key Financial and GHG Factor Assumptions

	Parameter	Value
Key Financial Assumptions	Capital Cost Escalation	2.0%
	Discount Rate	5.2%
	Study Period	40 years
	Electricity and Natural Gas Utility Costs	Varies by Archetype, includes retailer and distributor (FortisAlberta / ATCO Gas South) costs
	Energy Rate Cost Escalation	2.0%
	Capital Cost Escalation	2.0%

	Parameter	Value
Emission Factors	Natural Gas	190 kgCO2e/kWh (all years)
	Grid Electricity	271 $kgCO_2e/kWh$ (2025) and decreasing over time to down to 0 $kgCO_2e/kWh$ (2050)
	Solar PV	0 kgCO2e/kWh (all years)

2.6 Sensitivity Analyses

A key outcome of this research study for the Town is a better understanding of financial implications for stricter Tiers and the potential cost/benefits. Therefore, developing a range of financial scenarios and studying the associated impact to financial performance (payback, incremental cost savings, etc.) can provide beneficial insights on the research analysis. The sensitivity analyses involved changing one variable at a time for a selected archetype to determine the magnitude of impact.

3 Summary of Archetypal Design Approaches

This section summarizes the design approaches selected for each archetype, as well as results from the energy, emissions, and cost analysis.

Each archetype is presented as its own sub-section which is organized as follows:

- Archetype Building Features: A summary of key building features and characteristics used to inform the modelling and costing processes.
- Summary of Key Design Strategies: A summary of design strategies considered for each Tier to meet compliance with the current enforced energy related requirements (under NBC AE 2023 for Part 9 or NECB 2020 for Part 3), as well as potential changes to the strategies considering expected requirements outlined in the upcoming NBC 2025 and NECB 2025 update.
- Current Code Compliance Energy Results: A summary of the energy and emissions results, including the metrics used to assess compliance, as well as other energy and emission related metrics that can be output from the energy analysis.
- Construction Cost and Life-Cycle Cost Analysis Results: A summary of the construction cost estimate results as well as the life-cycle cost analysis, including potential electricity and natural gas utility cost implications.
- Key Observations: A summary of key observations from the results and data presented.

3.1 Fourplex

3.1.1 Archetype Features

A summary of the archetype's features used for the energy and costing analysis is presented Table 10 below. Note that the summary is meant to represent the current typical construction features for this specific archetype in Banff and based on a review of the documentation provided by the Town. Figure 9 provides a visual presentation of what could be considered as a typical Fourplex building; however, analysis and other insights are not necessarily based on the specific building shown here. Figure 10 shows the energy model generated by WSP for this archetype.

Table 10: Archetype Features Summary – Fourplex

General Features	→ Residential building with four separate dwelling units → 4 bedrooms, 4 bathrooms per dwelling unit, separate HVAC systems → Attached single-car garage
Floor Area	→ 844 m² total conditioned area (211 m² per dwelling unit) → 112 m² unconditioned area (parking garage)
No. Floors	→ 4 floors including basement dwelling unit
Envelope	→ Structure: concrete slab floor (uninsulated), concrete foundation, wood-framed above-grade structure → Walls: fiber cement siding or stone veneer, fibreglass batt insulation → Roof: pitched roof w/ batt insulation, asphalt singles → Windows: 10% WWR, double-glazed windows, Argon-filled, vinyl frames → Doors: opaque entrance doors, glass patio doors
Lighting	→ Interior: LED pot or surface mounted lighting → Exterior: LED wall sconce lighting
Plugs, Appliances, Fixtures	→ Suite: electric kitchen range, refrigerator, and in-suite laundry → Plumbing fixtures: shower heads, toilets, kitchen and bathroom faucets.
HVAC	→ Central forced-air furnaces with DX cooling → Gas-fired, storage DHW heaters → No ventilation energy recovery

Figure 9: Fourplex Example

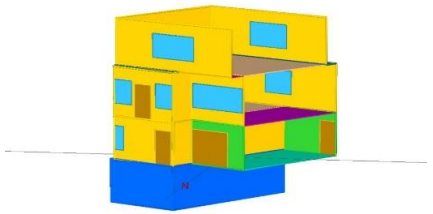

Figure 10: Fourplex Model View

3.1.2 Summary of Key Design Strategies

A summary of the key design strategies and technologies analysed for this archetype are shown in Table 11 below. The table details the building systems that are required to achieve compliance for each of the Tiers, moving from a typical design (Tier 1) to a high-performance design (Tier 5).

Table 11: Design Strategies Summary – Fourplex

	Tier 1	Tier 3	Tier 5
Above-Grade Walls	Wood-framed wall with int. batt insulation (R-3.1 SI / R-17.5 IP eff.)	Wood-framed wall with int. batt insulation + ext. semi-rigid insulation with strapping for cladding support (R-3.52 SI / R-20 IP eff.)	Wood-framed wall with int. batt insulation + increased ext. semi-rigid insulation with thermally broken clips for cladding support (R-7.0 SI / R-40 IP eff.)
Below-Grade Walls	Concrete, interior batt insulation in offset framing (R-3.52 SI / R-20 IP eff.)	Match Tier 1	Match Tier 1
Slab-on-Grade Floors	n/a	n/a	n/a
Floors Over Unheated Spaces	Interior batt (R-5.0 SI / R-28 IP eff.)	Interior batt (R-5.3 SI / R-30 IP eff.)	Interior batt + foam board below (R-8.8 SI / R-50 IP eff.)
Roofs	Wood-framed, blown-in / batt insulation (R-10.4 SI / R-59 IP eff.)	Wood-framed, blown-in / batt insulation (R-12.3 SI / R-70 IP eff.)	Wood-framed, blown-in / batt insulation (R-14.1 SI / R-80 IP eff.)
Windows	Double-glazed, vinyl frames, thermally broken spacer, low-e coating (U-1.59 SI / U-0.28 IP eff., SHGC-0.26)	Match Tier 1	Triple-glazed, fibreglass frames, insulating spacer, double low-e coating (U-0.85 SI / U-0.15 IP eff., SHGC-0.26)

	Tier 1	Tier 3	Tier 5
WWR	WWR: 10% FDWR: 16%	Match Tier 1	Match Tier 1
Doors	Swing: Non-thermally broken (U-1.61 SI / U-0.28 IP eff.) Garage: Non-thermally broken (U-1.61 SI / U-0.28 IP eff.)	Match Tier 1	Swing: Thermally broken (U-1.13 SI / U-0.20 IP) Garage: Thermally broken (U-0.57 SI / U-0.10 IP)
Infiltration	2.5 ACH @ 50 Pa (0.53 ACH @ 5 Pa)	2.1 ACH @ 50 Pa (0.45 ACH @ 5 Pa)	1.3 ACH @ 50 Pa (0.28 ACH @ 5 Pa)
Lighting	Included in 'Misc. Equipment' below	Match Tier 1	Match Tier 1
Lighting Control (Daylighting)	None	Match Tier 1	Match Tier 1
Misc. Equipment	1,305 W-peak	Match Tier 1	Match Tier 1
HVAC	Central forced-air system per dwelling unit Natural gas furnace (95% eff.) DX cooling (11.5 EER)	Match Tier 1	Central GSHP per dwelling unit, vertical boreholes, electric back-up, multi-speed fans (5.0 GSHP sCOP)
Ventilation	No ERV, OA: 32 L/s (68 cfm) per dwelling unit	Match Tier 1	Match Tier 1
DHW Equipment	Natural gas storage heater per dwelling unit (54% eff.)	Electric storage heater per dwelling unit (100% eff.)	Instantaneous electric heater per dwelling unit (100% eff.)
DHW Load	0.24 kW (0.018 gpm)	Match Tier 1	Match Tier 1
Solar PV	None	Match Tier 1	Match Tier 1

3.1.3 Current Energy Code Compliance

Part 9 Compliance Targets

Tier 1

- 0% energy improvement vs. NBC AE 2023
  - 212 ekWh/m²/y energy target for this archetype
- 0% heat loss reduction vs. NBC AE 2023
  - 162 ekWh/m²/y heat loss target for this archetype

Tier 3

- 20% energy improvement vs. NBC AE 2023
  - 179 ekWh/m²/y energy target for this archetype
- 10% heat loss reduction vs. NBC AE 2023
  - 146 ekWh/m²/y heat loss target for this archetype

Tier 5

- 70% energy improvement vs. NBC AE 2023
  - 58 ekWh/m²/y energy target for this archetype
- 40% heat loss reduction vs. NBC AE 2023
  - 97 ekWh/m²/y heat loss target for this archetype

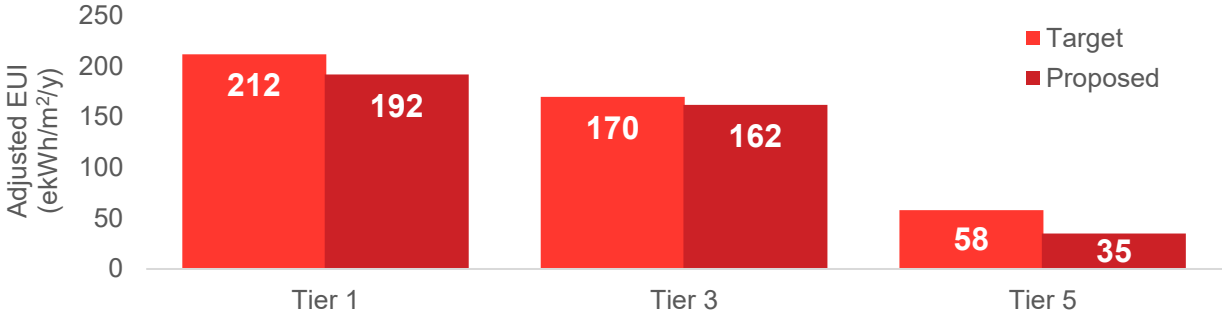

Figure 11: Adjusted EUI Results – Fourplex

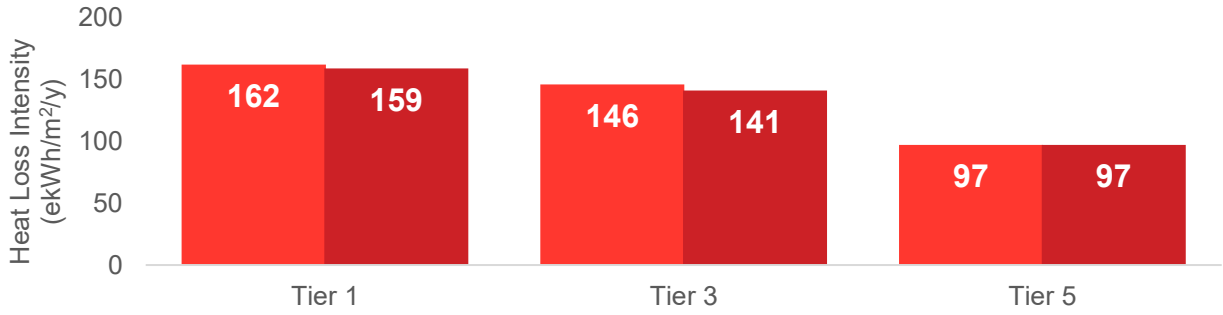

Figure 12: Heat Loss Intensity Results – Fourplex

Figure 11 and Figure 12 show the comparison of the Fourplex model compared to the NBC AE 2023 performance compliance requirements for each Tier.

The requirements also include ensuring that peak cooling demand does not exceed the reference model (which is not shown in here but is the case for each of the energy models developed). Notably, the percent improvement shown excludes plug/process loads (as allowed by NBC). Other secondary energy and

Table 12: Secondary Energy Metrics – Fourplex

Tier	TEUI (kWh/m²/y)	GHGI (kgCO₂/m²/y)	TEDI (kWh/m²/y)	Peak Demand (W/m²)
Tier 1	224	30	162	23
Tier 3	193	26	136	19
Tier 5	67	5	60	17

3.1.4 Construction Costs and LCCA Results

Figure 13 shows the upfront capital costs estimates for the design strategies summarized above for each Tier performance results. A similar comparison is shown for energy costs in Figure 14, which includes both fixed costs, and variable costs (i.e. energy costs that vary by energy use). Note that the cost estimates presented below only consider costs for implementing the design strategies. Analysis results relative to total construction cost and incremental return on investment is shown on the following page.

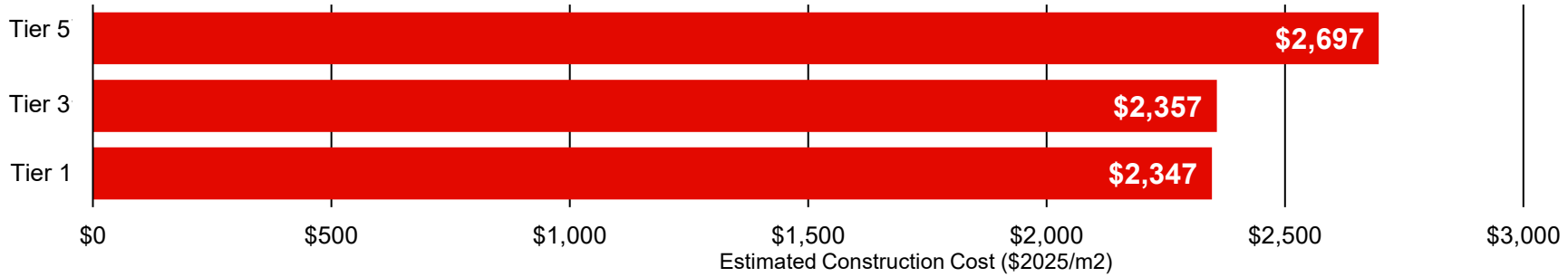

Figure 13: Capital Costs – Fourplex

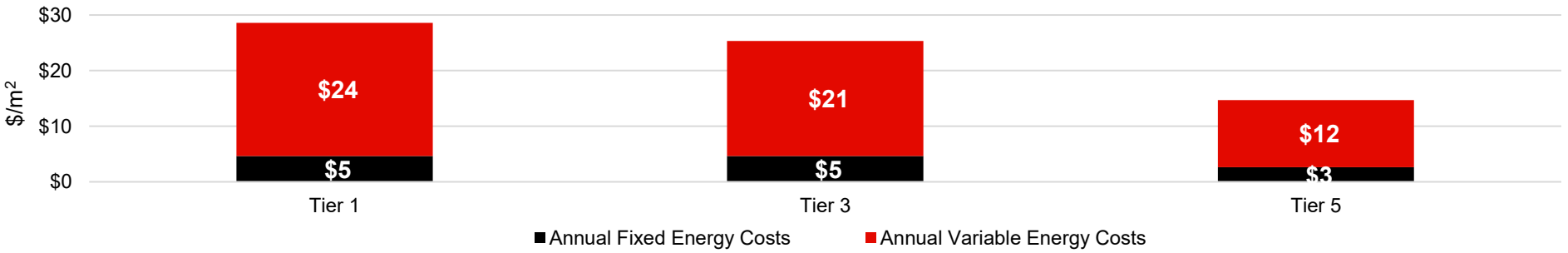

Figure 14: Estimated Annual Energy Costs – Fourplex

Table 13 and Table 14 include additional results of the financial analysis. AW Hooker provided preliminary estimates of total upfront capital costs for each archetype. These are presented in Table 13 for context of the upfront capital costs to implement design strategies identified for each Tier compared to illustrate the incremental cost in the context of the total cost for construction of the entire building. To understand the relative benefit of incremental investment in design strategies/technologies to achieve the higher Tier of performance, WSP considered the return on investment - as shown in the Net Present Value (NPV) - of incremental capital cost in terms of energy and emissions cost savings between the minimum Tier (Tier 1) and the higher Tiers (Tiers 3 and 5). A second metric - the incremental abatement rate - provides insight into how efficient the capital investment was in reducing operational GHG emissions. This metric is important when NPV's are negative (i.e. there is no return on investment), since it allows for relative comparison of different levels and kinds of investment to support the goal of GHG reduction.

Table 13: Construction Costs - Fourplex

	Upfront Capital Cost ($2025/m^2)	Total Upfront Building Capital Cost ($2025/m^2)	Estimated % of Total Building Capital Cost	Incremental Capital Cost ($2025/m^2)	Capital Cost ($2025/ft^2)	Total Building Capital Cost ($2025/ft^2)
Tier 1	$2,350	$5,720	41%	-	$220	$530
Tier 3	$2,360	$5,730	41%	$10	$220	$530
Tier 5	$2,700	$6,070	44%	$350	$250	$560

Table 14: Financial Metrics - Fourplex

	Incremental Energy Cost ($2025/m^2)	Life-Cycle Costs ($M)	Incremental Net Present Value ($M)	Incremental Abatement Rate ($/Tonne)
Tier 1	-	$3.0	-	-
Tier 3	-$3.3	$2.9	$0.1	-$430
Tier 5	-$13.9	$2.8	$0.2	-$250

KEY OBSERVATIONS

- In terms of carbon emission footprint, Tier 5 offers the best potential to meet the Town's decarbonization targets.
- The electricity peak load (i.e. Grid Stewardship benefit) of both the Tier 3 and Tier 5 designs are reduced vs. the Tier 1 pathway. The Tier 5 design is improved, even beyond the Tier 3 design, while still being 100% fuel-switched to electrified systems.
- From a total building capital cost perspective, Tier 3 costs are comparable to those of Tier 1, while Tier 5 shows a modest increase of 6% due to higher performing enclosure measures.
- On the operational cost side, Tier 5 offers better energy cost savings due to the significant improvement in efficiency introduced by the geo-exchange system.
- In terms of Life-Cycle costs, both Tier 3 and 5 offer returns on the investment. Tier 3 offers a better percentage return, while Tier 5 offers a better absolute return.
- The Incremental Abatement Rate is not as important (or meaningful) a metric when both upgraded packages achieve NPV-positive results. Abatement is a more useful metric, as discussed below, when life-cycle costs are increased over the study period, but GHG reductions are still meaningful.
- It should be noted that although not a primary compliance metric, there is a requirement in the NBC AE 2023 that the peak cooling load in the proposed building must be less than that in the reference building, for each Tier. Modeling results showed that the peak cooling loads were comparable between the proposed and reference buildings, though in some instances they were slightly higher in the proposed. Despite not being the primary focus for this study, this peak cooling load requirement should be considered and appropriately addressed through site selection (e.g. orientation), building massing (e.g. WWR), and load reduction measures (e.g. shading devices) throughout the design of a building.

3.2 Garage Suite

3.2.1 Archetype Features

A summary of the archetype's features used for the energy and costing analysis is presented in Table 15. Note that the summary is meant to represent the current typical construction features for this specific archetype in Banff and based on a review of the documentation provided by the Town. Figure 15 provides a visual presentation of what a Garage Suite building may look like; however, analysis and other insights are not necessarily based on the specific building shown here. Figure 16 shows the energy model generated by WSP for this archetype.

Table 15: Archetype Features Summary – Garage Suite

General Features	→ Residential dwelling unit above of a double-car garage → Above-garage single suite, three bedrooms, three bathrooms
Floor Area	→ 111 m² total conditioned area → 81 m² unconditioned area (parking garage)
No. Floors	→ 2 floors
Envelope	→ Structure: concrete slab floor (uninsulated), concrete foundation, wood framed above-grade structure → Walls: fiber cement siding (Hardie) or stone veneer, fibreglass batt insulation → Roof: pitched roof with batt insulation, asphalt singles → Windows: 15% WWR, double-glazed windows, Argon-filled, vinyl frames → Doors: opaque entrance doors, glass patio doors
Lighting	→ Interior: LED pot or surface mounted lighting → Exterior: LED wall sconce lighting
Plugs, Appliances, Fixtures	→ Suite: electric kitchen range, refrigerator, and in-suite laundry → Plumbing fixtures: shower heads, toilets, kitchen and bathroom faucets.
HVAC	→ Central forced-air furnaces with DX cooling → Gas-fired, storage DHW heaters → No ventilation energy recovery

Figure 15: Garage Suite Example

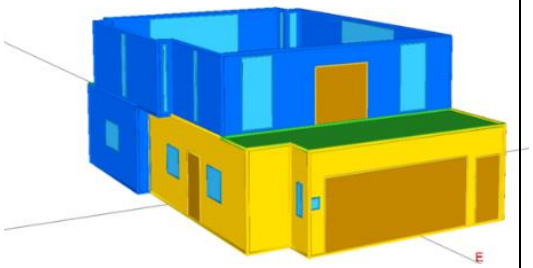

Figure 16: Garage Suite Model View

3.2.2 Summary of Key Design Strategies

A summary of the key design strategies and technologies analysed for this archetype are shown in Table 16 below. The table details the building systems that are required to achieve compliance for each of the Tiers, moving from a typical design (Tier 1) to a high-performance design (Tier 5).

Table 16: Design Strategies Summary – Garage Suite

	Tier 1	Tier 3	Tier 5
Above-Grade Walls	Wood-framed wall with int. batt insulation (R-3.5 SI / R-20 IP eff.)	Wood-framed wall with int. batt insulation + ext. semi-rigid insulation with strapping for cladding support (R-3.9 SI / R-22 IP eff.)	Wood-framed wall with int. batt insulation + increased ext. semi-rigid insulation with thermally-broken clips for cladding support (R-7.0 SI / R-40 IP eff.)
Below-Grade Walls	n/a	n/a	n/a
Slab-on-Grade Floors	50 mm XPS insulation below (R-1.9 SI / R-11 IP eff.)	Match Tier 1	200 mm polyiso. insulation below (R-8.8 SI / R-50 IP eff.)
Floors Over Unheated Spaces	Interior batt (R-5.0 SI / R-28 IP eff.)	Match Tier 1	Interior batt + foam board below (R-8.8 SI / R-50 IP eff.)
Roofs	Wood-framed, blown-in / batt insulation (R-10.4 SI / R-59 IP eff.)	Wood-framed, blown-in / batt insulation (R-10.6 SI / R-60 IP eff.)	Wood-framed, blown-in / batt insulation (R-14.1 SI, R-80 IP eff.)
Windows	Double-glazed, vinyl frames, thermally broken spacer, low-e coating (U-1.59 SI / U-0.28 IP eff., SHGC-0.26)	Double-glazed, fibreglass frames, insulating spacer, low-e coating (U-1.24 SI / U-0.22 IP, SHGC-0.26)	Triple-glazed, fibreglass frames, insulating spacer, double low-e coating (U-0.85 SI / U-0.15 IP eff., SHGC-0.26)

	Tier 1	Tier 3	Tier 5
Window-to-Wall Ratio	WWR: 15% FDWR: 25%	Match Tier 1	Match Tier 1
Doors	Swing: Non-thermally broken (U-1.61 SI / U-0.28 IP eff.) Garage: Non-thermally broken (U-1.61 SI / U-0.28 IP eff.)	Match Tier 1	Swing: Thermally broken (U-1.13 SI / U-0.2 IP eff.) Garage: Thermally broken (U-0.57 SI / U-0.1 IP eff.)
Infiltration	2.5 ACH @ 50 Pa (0.53 @ 5 Pa)	Match Tier 1	2.3 ACH @ 50 Pa (0.49 @ 5 Pa)
Lighting	Included in 'Equipment' below	Match Tier 1	Match Tier 1
Lighting Control (Daylighting)	None	Match Tier 1	Match Tier 1
Misc. Equipment	1,305 W peak	Match Tier 1	Match Tier 1
HVAC	Central forced-air system Natural gas furnace (95% eff.) DX cooling (11.5 rated EER)	Central cold-climate ASHP, natural gas back-up, multi-speed fans (3.0 rated COPh, 3.0 rated COPc)	Central GSHP, vertical boreholes, electric back-up, multi-speed fans. (5.0 GSHP sCOP)
Ventilation	No ERV OA: 27 L/s (57 cfm)	Match Tier 1	Match Tier 1
DHW Equipment	Natural gas storage heater (55% rated eff.)	Electric storage heater (100% rated eff.)	Instantaneous electric heater (100% rated eff.)
DHW Load	0.24 kW (0.018 gpm)	Match Tier 1	Match Tier 1
Solar PV	None	Match Tier 1	Match Tier 1

3.2.3 Current Energy Code Compliance

Part 9 Compliance Targets

Tier 1

- 0% energy improvement vs. NBC AE 2023 ref.
  - 168 ekWh/m²/y TEUI target for this archetype
- 0% reduction in heat loss reduction vs. NBC AE 2023
  - 156 ekWh/m2/y heat loss target for this archetype

Tier 3

- 20% energy improvement vs. NBC AE 2023 ref.
  - 135 ekWh/m2/y TEUI target for this archetype
- 10% reduction in heat loss reduction vs. NBC AE 2023
  - 140 ekWh/m2/y heat loss target for this archetype

Tier 5

- 70% energy improvement vs. NBC AE 2023 ref.
  - 45 ekWh/m2/y TEUI target for this archetype
- 40% reduction in heat loss reduction vs. NBC AE 2023
  - 93 ekWh/m2/y heat loss target for this archetype

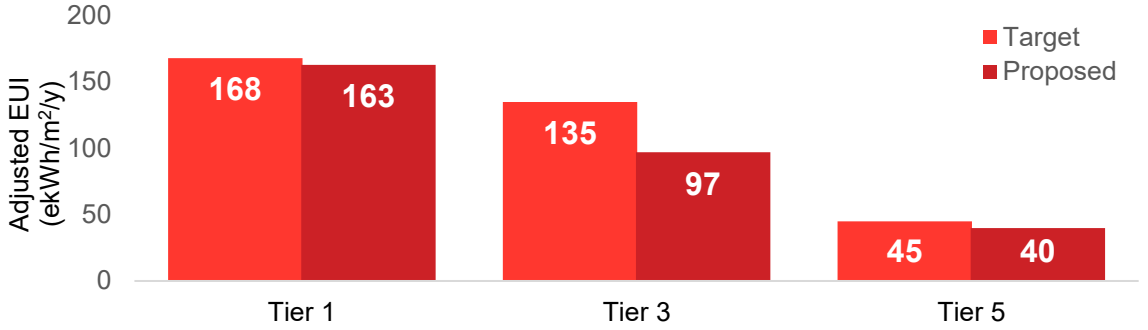

Figure 17: Adjusted EUI Results – Garage Suite

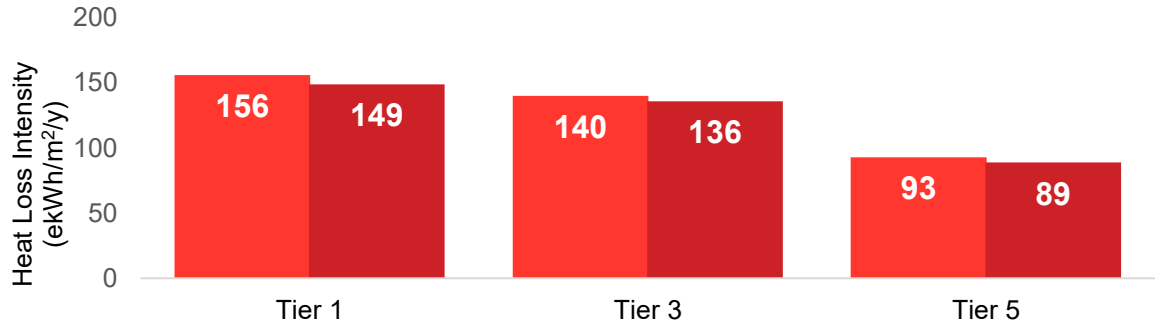

Figure 18: Heat Loss Intensity Results – Garage Suite

Figure 17 and Figure 18 show the comparison of the Garage Suite model compared to the NBC AE 2023 performance compliance requirements for each Tier.

The requirements also include ensuring that peak cooling demand does not exceed the reference model (which is not shown in here but is the case for each of the energy models developed). Notably, the percent improvement shown excludes plug/process loads (as allowed by NBC). Other secondary energy and emissions related metrics are shown in Table 17.

Table 17: Secondary Energy Metrics – Garage Suite

Tier	TEUI (kWh/m²/y)	GHGI (kgCO₂/m²/y)	TEDI (kWh/m²/y)	Peak Demand (W/m²)
Tier 1	224	31	122	28
Tier 3	158	13	104	36
Tier 5	100	8	48	24

3.2.4 Construction Costs and LCCA Results

Figure 19 below shows the capital costs between different Tiered performance results. A similar comparison is shown for energy costs in Figure 20. Note that the cost estimates presented below only consider costs for implementing the design strategies. Analysis results relative to total construction cost and incremental return on investment is shown on the following page.

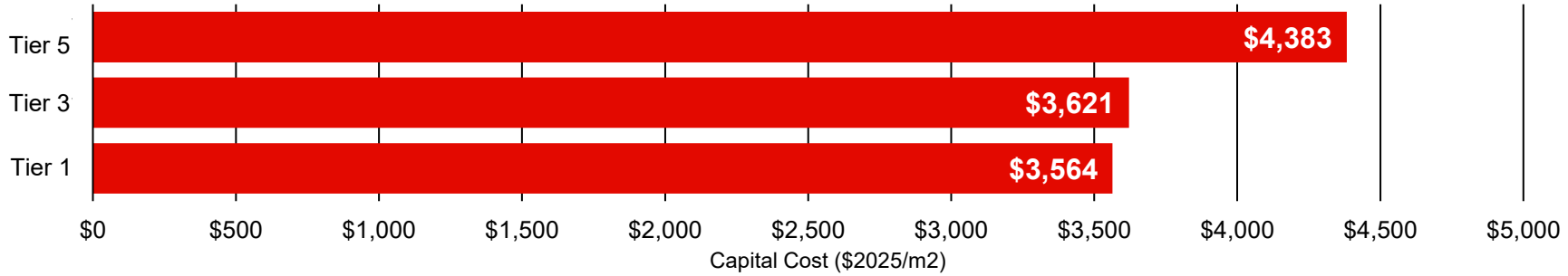

Figure 19: Capital Costs – Garage Suite

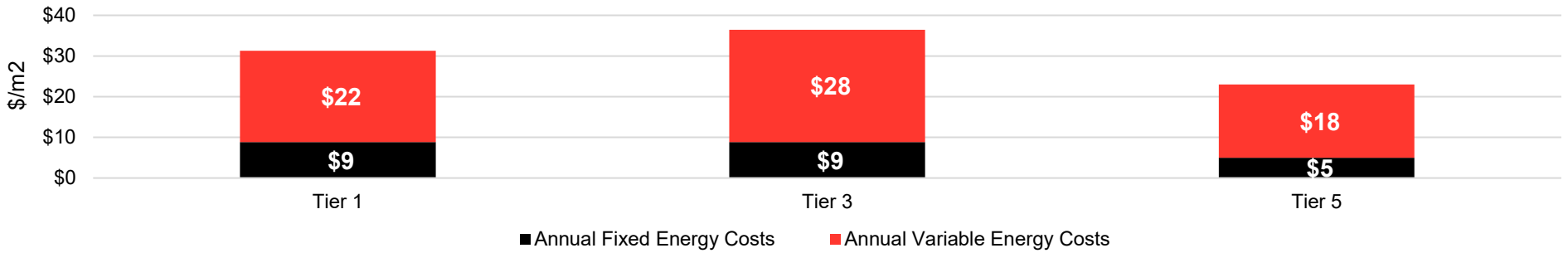

Figure 20: Estimated Annual Energy Costs - Garage Suite

Table 18 and Table 19 include additional results of the financial analysis. To understand the relative benefit of incremental investment in design strategies/technologies to achieve the higher Tier of performance, WSP considered what the return on investment was with respect to the additional capital investment required compared to the additional energy and emissions savings between the minimum Tier (Tier 1) and the higher Tiers (Tiers 3 and 5). The incremental net present value metric provides insight into to return on investment relative to the additional energy savings achieved for the additional capital investment to improve energy performance. The incremental abatement rate metric provides insight into how "efficient" the capital investment was in reducing operational emissions.

Table 18: Construction Costs – Garage Suite

	Capital Cost ($2025/m^2)	Total Building Capital Cost ($2025/m^2)	Estimated % of Total Building Capital Cost	Incremental Capital Cost ($2025/m^2)	Capital Cost ($2025/ft^2)	Total Building Capital Cost ($2025/ft^2)
Tier 1	$3,560	$7,620	47%	-	$330	$710
Tier 3	$3,620	$7,670	47%	$60	$340	$710
Tier 5	$4,380	$8,430	52%	$820	$410	$780

Table 19: Financial Metrics – Garage Suite

	Incremental Energy Cost ($2025/m^2)	Life-Cycle Costs ($K)	Incremental Net Present Value ($M)	Incremental Abatement Rate ($/Tonne)
Tier 1	-	$620	-	-
Tier 3	$5.2	$640	-$0.02	$250
Tier 5	-$8.3	$640	-$0.02	$180

KEY OBSERVATIONS

- Unlike the fourplex archetype, the efficiency of heat pumps was required for the Garage Suite in both Tier 3 and 5 to meet the targeted performance with the lowest up-front cost. This reason is potentially due to the absence of a below-grade floor, which is typically conducive to a reduction of heat loss through the envelope due to the added insulation from the ground. A higher FDWR for the garage archetype might also contribute to higher losses. Electrification in Part 9 buildings is discussed more exhaustively in section 4.
- From a total building capital cost perspective, Tier 3 costs are comparable to those of Tier 1, while Tier 5 shows a cost premium increase of 10% due to a higher performing envelope design as well as introduction of geothermal system.
- The energy cost of the Tier 3 design is increased compared to the Tier 1 due to the use of electricity as a primary source of heating. Though the Tier 5 design also uses electricity for heating, its improvements in energy-efficiency flip the energy cost result, offering net savings.
- The life-cycle cost performance of both Tier 3 and 5 is identical (as studied) and only slightly higher than the Tier 1 scenario. However, while Tier 3 performance is driven by a comparable up-front cost and higher energy cost, operational savings are the main driver for the Tier 5 financial performance, due to a significant improvement in energy efficiency.
- For Tier 3 and Tier 5, there is a net cost per tonne of emission reduced (ranging between $180/T and $250/T). Tier 5 performs better than Tier 3 due to enhanced GHG reductions. Also, as discussed further in Chapter 4, this range of abatement performance is much better than what has been observed for *retrofits* of similar building types (5x-10x less).
- Similar to the Fourplex, there is a requirement in the NBC AE 2023 that the peak cooling load in the proposed building must be less than that in the reference building, for each Tier. For the Garage Suite, modeling results showed that the peak cooling loads were comparable between the proposed and reference buildings, though in some instances they were slightly higher in the proposed. Despite not being the primary focus for this study, this peak cooling load requirement should be considered and appropriately addressed through site selection (e.g. orientation), building massing (e.g. WWR), and load reduction measures (e.g. shading devices) throughout the design of a building.

3.3 Apartment

3.3.1 Archetype Features

A summary of the archetype's features used for the energy and costing analysis is presented Table 20 below. Note that the summary is meant to represent the current typical construction features for this specific archetype in Banff and based on a review of the documentation provided by the Town. Figure 21 provides a visual presentation of what an Apartment building may look like; however, analysis and other insights are not necessarily based on the specific building shown here. Figure 22 shows the energy model generated by WSP for this archetype.

Table 20: Archetype Features Summary – Apartment

General Features	→ Residential building with 12 dwelling units per floor (36 units total) → 1-2 bedrooms, 1 bathroom per dwelling unit, central HVAC systems and exterior access to units
Floor Area	→ 2,135 m² total conditioned area → 706 m² unconditioned area (144 m² storage space, and 562 m² of underground parking)
No. Floors	→ 3 floors
Envelope	→ Structure: Insulated floor above parking, concrete foundation, wood-framed above-grade structure → Walls: fiber cement siding (Hardie) or stone veneer, fibreglass batt insulation → Roof: pitched roof w/ batt insulation, asphalt singles → Windows: 20% WWR, double-glazed, air-filled, aluminum frames → Doors: Opaque entrance doors, glass patio doors
Lighting	→ Interior: LED pot or surface-mounted lighting → Exterior: LED wall sconce lighting
Plugs, Appliances, Fixtures	→ Suites: Electric kitchen range/oven and refrigerators. In suite laundry-washer and dryer → Plumbing fixtures, shower heads, toilets, kitchen and bathroom faucets
HVAC	→ Suites served by fan coil units with hydronic heating, core heated with hydronic perimeter baseboards and cooled with spilt Air Condition (AC) systems → Central make-up air unit providing tempered 100% OA to core zones → In-suite ERVs provide ventilation to dwelling units → Heating loop served by two natural gas boilers (lead/lag)

Figure 21: Apartment Example

Figure 22: Apartment Model View

3.3.2 Summary of Key Design Strategies

A summary of the key design strategies and technologies analysed for this archetype are shown in Table 21 below. The table details the building systems that are required to achieve compliance for each of the Tiers, moving from a typical design (Tier 1) to a high-performance design (Tier 4).

Table 21: Design Strategies Summary – Apartment

	Tier 1	Tier 2	Tier 4
Above-Grade Walls	Wood-framed wall with int. batt insulation (R-3.3 SI / R-19 IP eff.) Non-thermally broken balconies	Wood-framed wall with int. batt insulation + ext. semi-rigid insulation with strapping for cladding support (R-5.3 SI / R-30 IP eff.) Non-thermally broken balconies	Wood-framed wall with int. batt insulation + increased ext. semi-rigid insulation with thermally broken clips for cladding support (R-6.3 SI / R-36 IP eff.) Non-thermally broken balconies
Below-Grade Walls	n/a	n/a	n/a
Slab-on-Grade Floors	n/a	n/a	n/a
Floors Over Unheated Spaces	Interior batt + foam board below (R-7.2 SI / R-41 IP eff.)	Match Tier 1	Match Tier 1
Roofs	Wood-framed, blown-in / batt insulation (R-7.0 SI / R-40 IP eff.)	Wood-framed, blown-in / batt insulation (R-8.3 SI / R-47 IP eff.)	Wood-framed, blown-in / batt insulation (R-10.6 SI / R-60 IP eff.)
Windows	Double-glazed, aluminum frames, low-e coating (U-1.99 SI / U-0.35 IP, SHGC-0.60)	Double-glazed, fibreglass frames, low-e coating (U-1.25 SI / U-0.22 IP, SHGC-0.60)	Triple-glazed, fibreglass frames, two low-e coatings (U-0.85 SI / U-0.15 IP, SHGC-0.60)
Window-to-Wall Ratio	20%	Match Tier 1	Match Tier 1
Doors	Swing: Non-thermally broken (U-2.38 SI / U-0.42 IP eff.) Garage: n/a	Match Tier 1	Swing: Thermally broken (U-1.48 SI / U-0.26 IP eff.) Garage: n/a
Infiltration	1.5 L/s/m^2 @ 75 Pa (0.48 @ 5 Pa)	1.25 L/s/m^2 @ 75 Pa (0.40 @ 5 Pa)	0.5 L/s/m^2 @ 75 Pa (0.16 @ 5 Pa)

	Tier 1	Tier 2	Tier 4
Lighting	Suite LPD reduction vs. ref.: 0% Suites (Dwelling Unit): 4.9 W/m^2 (0.46 W/ft^2) Storage >5m^2: 4.1 W/m^2 (0.38 W/ft^2) Parking Garage: 1.8 W/m^2 (0.17 W/ft^2)	Match Tier 1	Suite LPD reduction vs. ref.: 40% Suites (Dwelling Unit): 3.0 W/m^2 (0.28 W/ft^2) Storage >5m^2: Match Tier 1 Parking Garage: Match Tier 1
Lighting Control (Daylighting)	None	Match Tier 1	Match Tier 1
Misc. Equipment	Suite EPD reduction vs. Ref.: 0% Suites (Dwelling Unit): 4.9 W/m^2 (0.46 W/ft^2)	Match Tier 1	Suite EPD reduction vs. Ref.: 20% Suites (Dwelling Unit): 3.9 W/m^2 (0.37 W/ft^2)
HVAC	Heating: Two natural gas condensing boilers serving a central hot water loop (90% rated eff.) Cooling: DX coils in distributed FCUs (13 EER)	Cold-climate ASHPs with VRF switch-over and electric baseboards for supplemental perimeter heating (4.0 COPh, 4.8 COPc)	Geo-exchange field with vertical boreholes, serving ground-connected ambient loop Water-cooled VRF units connected to ground-loop, serving terminal units (3.9 sCOPh, 4.9 sCOPc).
Hydronic Pumps	High efficiency motors, single speed (78% eff.)	Premium efficiency motors, VFDs (85% eff.)	Premium efficiency motors, VFDs (85% eff.)
Ventilation	In-suite ERV (65% eff.) OA: 44 L/s per suite, 0.8 Ez	In-suite ERV (65% eff.) OA: 44 L/s per suite, 0.8 Ez	In-suite ERV (85% eff.) OA: 42 L/s per suite, 1.0 Ez
DHW Equipment	Natural gas storage heater (85% rated eff.)	DHW ASHP (3.0 rated COP) Recovery: 15%	DHW ASHP (3.8 rated COP) Recovery: 15%
DHW Load	Load reduction vs. ref: 0% 27.63 kW (2.34 gpm)	Match Tier 1	Load reduction vs. ref: 15% 23.49 kW (1.99 gpm)
Solar PV	None	Match Tier 1	54 kW PV system

3.3.3 Current Energy Code Compliance

Part 3 Compliance Targets

Tier 1

- 0% energy improvement vs. NECB 2020 reference
  - 231 ekWh/m2/y TEUI target for this archetype

Tier 2

- 25% energy improvement vs. NECB 2020 reference
  - 130 ekWh/m2/y TEUI target for this archetype

Tier 4

- 60% energy improvement vs. NECB 2020 reference
  - 69 ekWh/m2/y TEUI target for this archetype

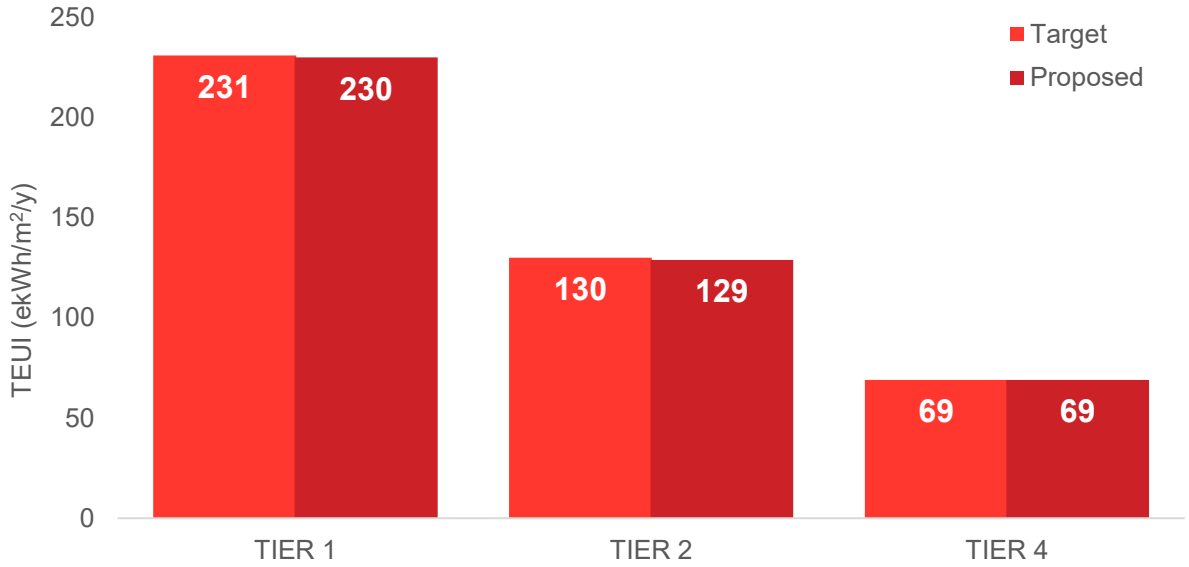

Figure 23: TEUI Current Compliance Results – Apartment

Figure 23 shows the comparison of the Apartment model compared to the NECB 2020 performance compliance requirements for each Tier. Other secondary energy and emissions related metrics are shown in Table 22.

Table 22: Secondary Energy Metrics – Current Code – Apartment

Tier	TEUI (kWh/m²/y)	GHGI (kgCO₂/m²/y)	TEDI (kWh/m²/y)	Peak Demand (W/m²)
Tier 1	230	35	77	22
Tier 2	129	10	58	81
Tier 4	69	5	32	25

3.3.4 Future Energy Code Compliance

Anticipated Future Part 3 Compliance Targets

Tier 1

- 225 ekWh/m²/y absolute TEUI target

Tier 2

- Assumed 25% reduction vs. Tier 1
- 169 ekWh/m²/y absolute TEUI target

Tier 4

- Assumed 60% reduction vs. Tier 1
- 90 ekWh/m²/y absolute TEUI target

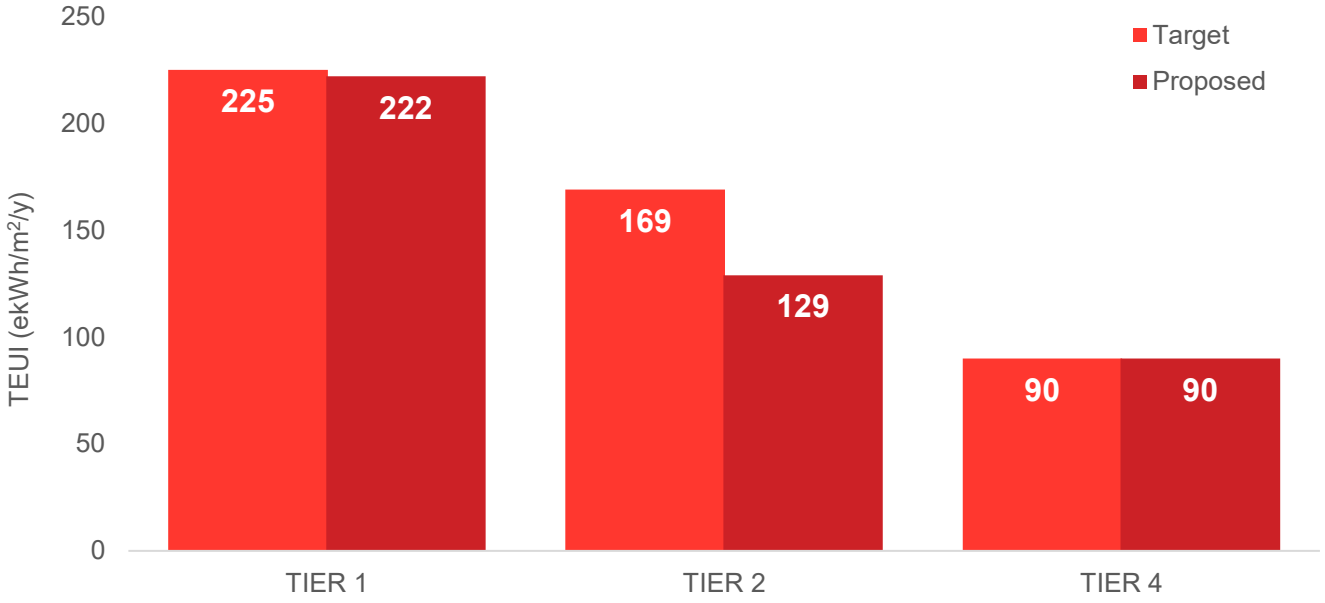

Figure 24: TEUI Future Compliance Results – Apartment

Figure 24 shows the comparison of the Apartment model compared to the NECB 2025 performance compliance requirements for each Tier. Other secondary energy and emissions related metrics are shown in Table 23.

Key Observations on Future Code Compliance

The NECB 2020 baseline compliance is marginally easier to achieve than the equivalent proposed NECB 2025 Tier 1. Some minor additional DHW reduction measures were included to meet Future Code Tier 1 targets

Achieving higher Tiers requires fuel-switching, which gain greater credit under the NECB 2025 absolute pathways, offering greater design flexibility while placing larger emphasis on reducing process loads. The proposed NECB 2025 Tier 4 package required significantly less PV

Table 23: Secondary Energy Metrics – Future Code - Apartment

Tier	TEUI (kWh/m²/y)	GHGI (kgCO₂/m²/y)	TEDI (kWh/m²/y)	Peak Demand (W/m²)	GHG Emissions Performance Level
Tier 1	222	33	77	22	F (-1%)
Tier 2	129	10	61	81	C (71%)
Tier 4	90	7	32	25	B (80%)

3.3.5 Construction Costs and LCCA Results

Figure 25 below shows the capital costs between different Tiered performance results. A similar comparison is shown for energy costs in Figure 26 below. Note that the cost estimates presented below only consider costs for implementing the design strategies. Analysis results relative to total construction cost and incremental return on investment is shown on the following page.

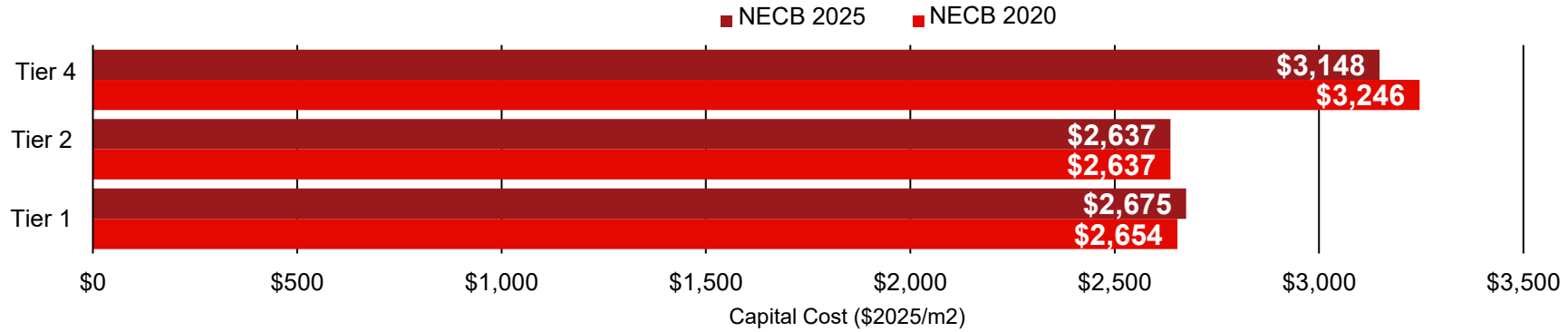

Figure 25: Capital Costs – Apartment

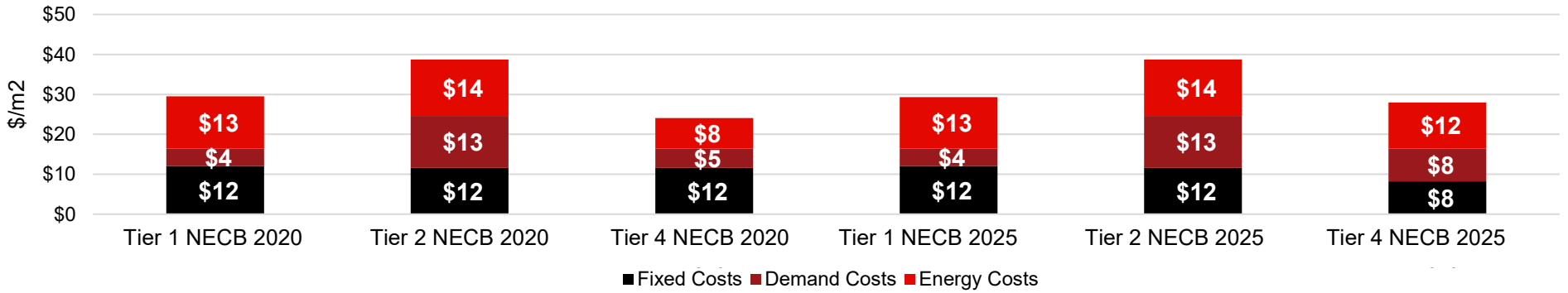

Figure 26: Estimated Annual Energy Costs – Apartment

Table 24 and Table 25 below include additional results of the financial analysis. To understand the relative benefit of incremental investment in design strategies/technologies to achieve the higher Tier of performance, WSP considered what the return on investment was with respect to the additional capital investment required compared to the additional energy and emissions savings between the minimum Tier (Tier 1) and the higher Tiers (Tiers 2 and 5). The incremental net present value metric provides insight into to return on investment relative to the additional energy savings achieved for the additional capital investment to improve energy performance. The incremental abatement rate metric provides insight into how "efficient" the capital investment was in reducing operational emissions.

Table 24: Construction Cost - Apartment

	Capital Cost ($2025/m^2)	Total Building Capital Cost ($2025/m^2)	Estimated % of Total Building Capital Cost	Incremental Capital Cost ($2025/m^2)	Capital Costs ($2025/ft^2)	Total Building Capital Cost ($2025/ft^2)
Tier 1 2020	$2,650	$7,960	33%	-	$250	$740
Tier 2 2020	$2,640	$7,940	33%	- $20	$250	$740
Tier 4 2020	$3,250	$8,550	38%	$590	$300	$790
Tier 1 2025	$2,680	$7,980	34%	$20	$250	$740
Tier 2 2025	$2,640	$7,940	33%	- $20	$250	$740
Tier 4 2025	$3,150	$8,450	37%	$500	$290	$790

Table 25: Financial Metrics - Apartment

	Incremental Energy Cost ($2025/m^2)	Life-Cycle Costs ($M)	Incremental Net Present Value ($M)	Incremental Abatement Rate ($/Tonne)
Tier 1 2020	-	$7.8	-	-
Tier 2 2020	$9.2	$8.4	-$0.6	$280
Tier 4 2020	-$5.5	$9.3	-$1.4	$570
Tier 1 2025	-$0.2	$7.9	-$0.1	$440
Tier 2 2025	$9.2	$8.4	-$0.6	$280
Tier 4 2025	-$1.5	$9.1	-$1.3	$580

KEY OBSERVATIONS

- From a total building capital cost perspective, Tier 2 shows the same performance of Tier 1, while Tier 4 has a higher cost premium of 7% due to additional enclosure and higher performing geo-exchange system.
- From a life-cycle cost perspective, Tier 2 has a better performance when compared to Tier 4 (as it has the lowest capital investment and recapitalization costs despite higher operational costs).
- Due to lower incremental NPV performance, Tier 2 offers an attractive scenario in terms of abatement cost. For Tier 4, there is a higher net cost per tonne of emission reduced (~$570/T). While this is significantly higher than other abatement benchmarks (e.g. former carbon tax peaked at $170/T), the $570/T is still a significantly better abatement performance than what has typically been observed for similar retrofits.
- Similar observations can be drawn for the respective 2025 scenarios.

3.4 Mixed-Use

3.4.1 Archetype Features

A summary of the archetype's features used for the energy and costing analysis is presented Table 26. Note that the summary is meant to represent the current typical construction features for this specific archetype in Banff and based on a review of the documentation provided by the Town. Figure 27 provides a visual presentation of what a mixed use building may look like; however, analysis and other insights are not necessarily based on the specific building shown here. Figure 28 shows the energy model generated by WSP for this archetype.

Table 26: Archetype Features Summary – Mixed-Use

General Features	→ Residential building with 12 dwelling units per floor (24 units total) with a shared interior space, ground floor commercial/retail uses, no underground parking → 1-2 bedrooms, 1 bathroom per dwelling unit, central HVAC systems → Elevator and egress stairwells serve building access and egress requirements
Floor Area	→ 2,370 m² total conditioned area, including 8 commercial spaces (784 m²)
No. Floors	→ 3 floors including ground floor commercial and retail
Envelope	→ Structure: uninsulated concrete slab floor, concrete foundation, wood-framed above-grade structure → Walls: fiber cement siding (Hardie) or stone veneer, fibreglass batt insulation → Roof: flat roof with continuous board insulation → Windows: 25% WWR, double-glazed, air-filled, aluminum frames → Doors: opaque entrance doors, glass patio doors
Lighting	→ Interior LED pot or surface-mounted lighting and exterior LED wall sconce lighting
Plugs, Appliances, Fixtures	→ Suites: Electric kitchen range/oven and refrigerators. In-suite laundry- washer and dryer → Plumbing fixtures: shower heads, toilets, kitchen and bathroom faucets. → Ground floor: Commercial kitchen, refrigeration, commercial-style washrooms
HVAC	→ Suites served by fan coil units with hydronic heating, core heated with hydronic perimeter baseboards and cooled with split AC units → Central make-up air unit providing tempered 100% OA to core zones → In-suite ERVs provide ventilation to dwelling units → Main floor served by hydronic RTUs and heating loop served by two natural gas boilers (lead/lag)

Figure 27: Mixed-Use Example

Figure 28: Mixed-Use Model View

3.4.2 Summary of Key Design Strategies

A summary of the key design strategies and technologies analysed for this archetype are shown in Table 27.

Table 27: Design Strategies Summary – Mixed-Use

	Tier 1	Tier 2	Tier 4
Above-Grade Walls	Wood-framed wall with int. batt insulation (R-3.3 SI / R-19 IP eff.) Non-thermally broken balconies	Wood-framed wall with int. batt insulation + ext. semi-rigid insulation with strapping for cladding support (R-5.3 SI / R-30 IP eff.) Non-thermally broken balconies	Wood-framed wall with int. batt insulation + increased ext. semi-rigid insulation with thermally broken clips for cladding support (R-7.0 SI / R-40 IP eff.) Non-thermally broken balconies
Below-Grade Walls	n/a	n/a	n/a
Slab-on-Grade Floors	Perimeter foam board R-1.3 SI for 1.2 m (R-7.5 IP for 4 ft)	Match Tier 1	Match Tier 1
Floors Over Unheated Spaces	n/a	n/a	n/a
Roofs	Wood-framed, blown-in / batt insulation (R-7.0 SI / R-40 IP eff.)	Wood-framed, blown-in / batt insulation (R-8.3 SI / R-47 IP eff.)	Wood-framed, blown-in / batt insulation (R-10.6 SI / R-60 IP eff.)
Windows	Residential: Double-glazed, aluminum frames, low-e coating (U-1.99 SI / U-0.35 IP, SHGC-0.60) Commercial: Double-glazed, aluminum frames, low-e coating (U-1.99 SI / U-0.35 IP, SHGC-0.60)	Residential: Double-glazed, fibreglass frames, low-e coating (U-1.25 SI / U-0.22 IP, SHGC-0.60) Commercial: Double-glazed, fibreglass frames, low-e coating (U-1.99 SI / U-0.35 IP, SHGC-0.60)	Residential: Double-glazed, aluminum frames, low-e coating (U-0.85 SI / U-0.15 IP, SHGC-0.60) Commercial: Triple-glazed, fibreglass frames, two low-e coatings (U-1.70 SI / U-0.30 eff., SHGC-0.60)

	Tier 1	Tier 2	Tier 4
Window-to-Wall Ratio	Residential: 20% Commercial: 40%	Match Tier 1	Residential: Match Tier 1 Commercial: 20%
Doors	Opaque Swing: Non-thermally broken (U-2.38 SI / U-0.42 IP eff.)	Match Tier 1	Match Tier 1
Infiltration	1.5 L/s/m^2 @ 75 Pa (0.48 @ 5 Pa)	1.25 L/s/m^2 @ 75 Pa (0.40 @ 5 Pa)	0.5 L/s/m^2 @ 75 Pa (0.16 @ 5 Pa)
Lighting	Residential: LPD reduction vs. ref.: 0% Suites (Dwelling Unit): 5.0 W/m^2 (0.46 W/ft^2) Commercial: LPD reduction vs. ref.: 0% Office: 6.6 W/m^2 (0.61 W/ft^2) Restaurant (Food Prep): 5.6 W/m^2 (0.52 W/ft^2) Retail (Sales Area): 11.3 W/m^2 (1.05 W/ft^2)	Residential: Same as Tier 1 Commercial: LPD reduction vs. ref.: 30% Office: 4.6 W/m^2 (0.43 W/ft^2) Restaurant (Food Prep): 3.9 W/m^2 (0.36 W/ft^2) Retail (Sales Area): 7.9 W/m^2 (0.74 W/ft^2)	Residential: Same as Tier 1 Commercial: LPD reduction vs. ref.: 40% Office: 4.0 W/m^2 (0.37 W/ft^2) Restaurant (Food Prep): 3.4 W/m^2 (0.31 W/ft^2) Retail (Sales Area): 6.8 W/m^2 (0.63 W/ft^2)
Lighting Control (Daylighting)	None	Match Tier 1	Commercial: Daylighting controls in 2 southern retail spaces
Misc. Equipment	Residential: EPD reduction vs. ref.: 0% Suites (Dwelling Unit): 5.0 W/m^2 (0.46 W/ft^2) Commercial: EPD reduction vs. ref.: 0% Office: 7.5 W/m^2 (0.70 W/ft^2) Restaurant: 1.0 W/m^2 (0.09 W/ft^2) Retail (Sales Area): 2.5 W/m^2 (0.23 W/ft^2)	Match Tier 1	Match Tier 1

	Tier 1	Tier 2	Tier 4
HVAC	Heating: Natural gas condensing boiler serving central hot water loop (90% eff.) Cooling: DX coils in MAU, RTUs, and distributed FCUs (MAU: 9.8 EER, RTU: 10 EER, FCU: 13 EER)	Cold climate ASHPs with VRF switch-over and central outdoor unit and headers on each floor, connected to VRF coils in MAU, commercial RTUs and in-suite units (Suite VRF: 4.0 COPh, 4.8 COPc MAU:4.0 COPh, 2.9 COPc)	Geo-exchange field with vertical boreholes, serving ground-connected ambient loop Water-cooled VRF units connected to ground-loop, serving terminal units (3.9 sCOPh, 5.0 sCOPc).
Hydronic Pumps	High efficiency motors, single speed (78% eff.)	Premium efficiency motors, VFDs (85% eff.)	Premium efficiency motors, VFDs (85% eff.)
Ventilation	Residential: In-Suite ERV (65% eff) OA: 44 L/s per suite, 0.8 Ez Commercial: ERV (50% eff.) OA: 140 L/s, 0.8 Ez, No DCV	Residential: In-Suite ERV (75% eff) OA: 44 L/s per suite, 0.8 Ez Commercial: ERV (80% eff.) OA: 59 - 140 L/s; 0.8 Ez, CO_2 DCV	Residential: Centralized ERV (90% eff.) OA: 42 L/s, 1.0 Ez Commercial: ERV (90% eff.) OA: 48 - 112 L/s, 1.0 Ez, CO_2 DCV
DHW Equipment	Residential: Gas Storage (85% eff.) Commercial: Natural Gas Storage (85% eff.)	Residential / Commercial: DHW ASHP + Elec redundancy: 3.3 COP Energy recovery potential: 15%	Residential / Commercial: DHW ASHP + elec. backup (3.8 COP), Energy recovery potential: 15%
DHW Load	Load Reduction vs. Ref: 0% 26 kW (2.27 gpm process load)	Match Tier 1	Load Reduction vs. Ref: 15% 22 kW (1.93 gpm process load)
Solar PV	None	Match Tier 1	65 kW PV System

3.4.3 Current Energy Code Compliance

Part 3
Compliance Targets

Tier 1

- 0% energy improvement vs. NECB 2020 reference
  - 242 ekWh/m2/y TEUI target for this archetype

Tier 2

- 25% energy improvement vs. NECB 2020 reference
  - 134 ekWh/m2/y TEUI target for this archetype

Tier 4

- 60% energy improvement vs. NECB 2020 reference
  - 71 ekWh/m2/y TEUI target for this archetype

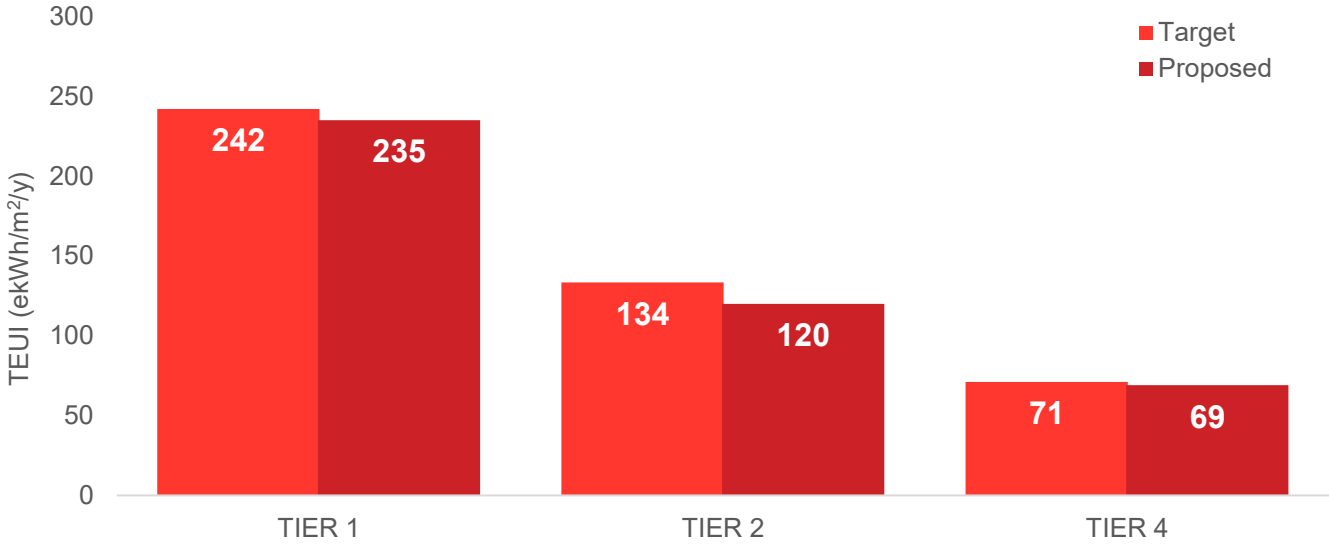

Figure 29: TEUI Current Compliance Results – Apartment

Figure 29 shows the comparison of the Apartment model compared to the NECB 2020 performance compliance requirements for each Tier. Other secondary energy and emissions related metrics are shown in Table 28.

Table 28: Secondary Energy Metrics – Current Code – Apartment

Tier	TEUI (kWh/m²/y)	GHGI (kgCO₂/m²/y)	TEDI (kWh/m²/y)	Peak Demand (W/m²)
Tier 1	235	35	70	22
Tier 2	120	10	41	65
Tier 4	69	6	12	23

3.4.4 Future Energy Code Compliance

Anticipated Future Part 3 Compliance Targets

Tier 1

- Blended 2/3 MURB ≤ 6 storeys and 1/3 Office
- 208 ekWh/m²/y absolute TEUI target

Tier 2

- Assumed 25% reduction vs. Tier 1
- 156 ekWh/m²/y absolute TEUI target

Tier 4

- Assumed 60% reduction vs. Tier 1
- 83 ekWh/m²/y absolute TEUI target

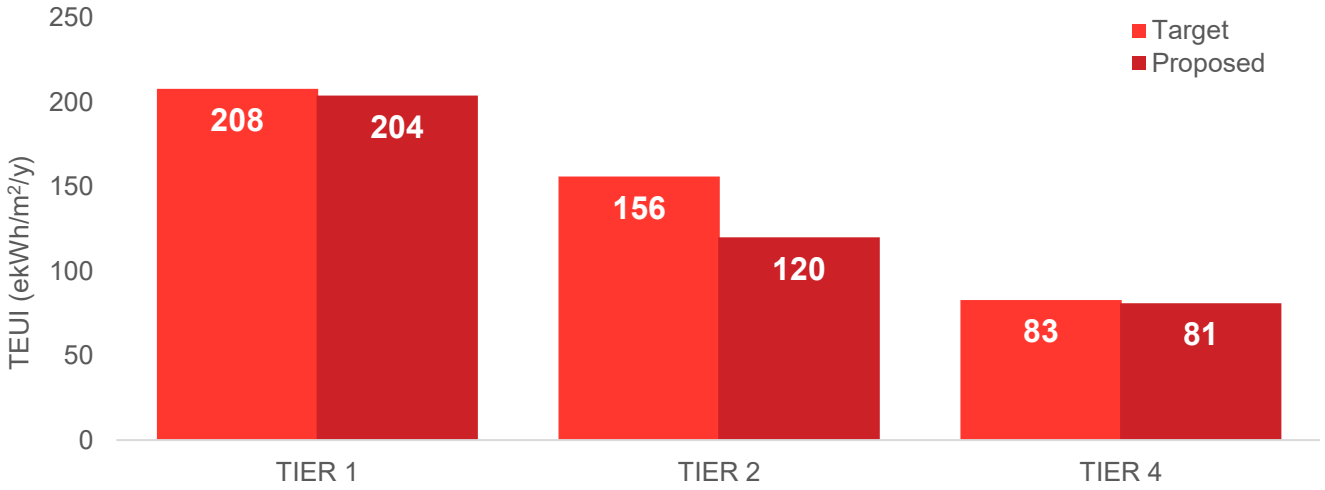

Figure 30: TEUI Current Compliance Results – Mixed-Use

Figure 30 shows the comparison of the Mixed-Use model compared to the NECB 2025 performance compliance requirements for each Tier. Other secondary energy and emissions related metrics are shown below in Table 29.

Key Observations on Future Code Compliance

For the mixed-use archetype, NECB 2020 baseline compliance is easier to achieve than proposed NECB 2025 Tier 1. For the Future Code Tier 1 package, ERV performance was improved by 10% in addition to DHW reduction measures

With greater credit for fuel-switching, the higher Tier packages under the proposed NECB 2025 requirements allowed some relaxation of measures. Specifically, the Future Code Tier 4 package required significantly less PV

Diverse commercial tenant space requirements can introduce new case-specific operational complications, process loads and equipment, and new opportunities for energy conservation measures - all of which may become more impactful under the proposed NECB 2025 absolute targets

Table 29: Secondary Energy Metrics – Future Code – Mixed-Use

Tier	TEUI (kWh/m²/y)	GHGI (kgCO₂/m²/y)	TEDI (kWh/m²/y)	Peak Demand (W/m²)	GHG Emissions Performance Level
Tier 1	204	30	55	21	E (11%)
Tier 2	120	10	41	65	C (72%)
Tier 4	81	6	12	23	B (81%)

3.4.5 Construction Costs and LCCA Results

Figure 31 below shows the capital costs between different Tiered performance results. A similar comparison is shown for energy costs in Figure 32. Note that the cost estimates presented below only consider costs for implementing the design strategies. Analysis results relative to total construction cost and incremental return on investment is shown on the following page.

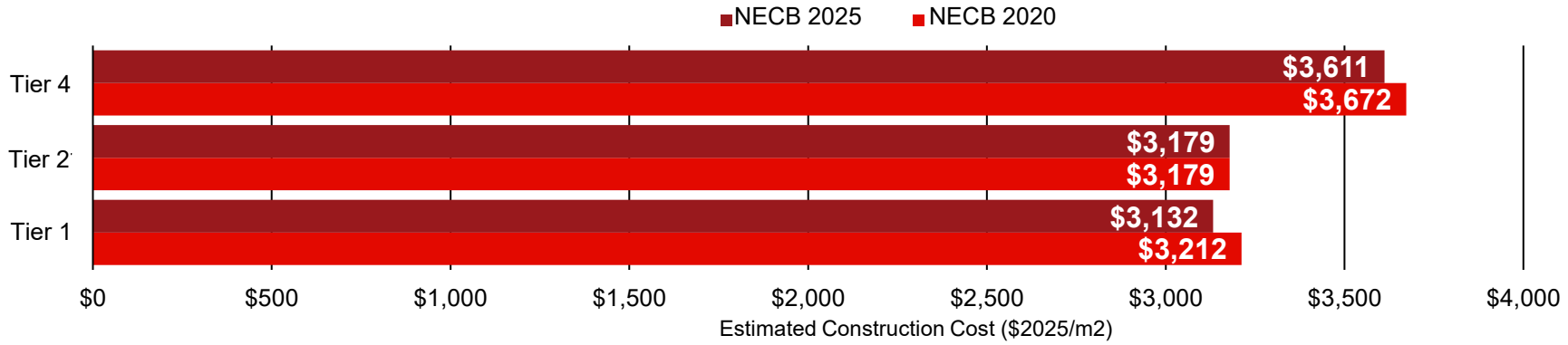

Figure 31: Capital Costs – Mixed-Use

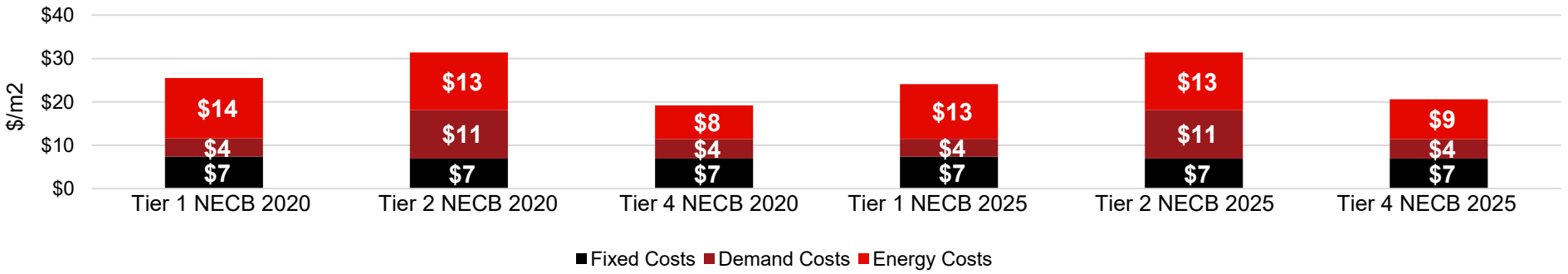

Figure 32: Estimated Annual Energy Costs – Mixed-Use

Table 30 and Table 31 below include additional results of the financial analysis. To understand the relative benefit of incremental investment in design strategies/technologies to achieve the higher Tier of performance, WSP considered what the return on investment was with respect to the additional capital investment required compared to the additional energy and emissions savings between the minimum Tier (Tier 1) and the higher Tiers (Tiers 2 and 4). The incremental net present value metric provides insight into to return on investment relative to the additional energy savings achieved for the additional capital investment to improve energy performance. The incremental abatement rate metric provides insight into how "efficient" the capital investment was in reducing operational emissions.

Table 30: Construction Costs – Mixed-Use

	Capital Cost ($2025/m^2)	Total Building Capital Cost ($2025/m^2)	Estimated % of Total Building Capital Cost	Incremental Capital Cost ($2025/m^2)	Capital Costs ($2025/ft^2)	Total Building Capital Cost ($2025/ft^2)
Tier 1 2020	$3,210	$8,610	37%	-	$300	$800
Tier 2 2020	$3,180	$8,570	37%	- $33	$300	$800
Tier 4 2020	$3,670	$9,070	41%	$460	$340	$840
Tier 1 2025	$3,130	$8,530	37%	- $80	$290	$790
Tier 2 2025	$3,180	$8,570	37%	- $33	$300	$800
Tier 4 2025	$3,610	$9,000	40%	$340	$340	$840

Table 31: Financial Metrics – Mixed-Use

	Incremental Energy Cost ($2025/m^2)	Life-Cycle Costs ($M)	Incremental Net Present Value ($M)	Incremental Abatement Rate ($/Tonne)
Tier 1 2020	-	$11	-	-
Tier 2 2020	$5.9	$11	-$0.5	$190
Tier 4 2020	-$6.3	$12	-$1.2	$440
Tier 1 2025	-$1.5	$11	$0.2	-$400
Tier 2 2025	$5.9	$11	-$0.5	$190
Tier 4 2025	-$4.9	$12	-$1.1	$400

KEY OBSERVATIONS

- From a total building capital cost perspective, Tier 2 shows a similar performance of Tier 1, while Tier 4 has a 5% cost premium for additional enclosure and higher performing geo-exchange system.
- Compared to capital costs, the life-cycle cost performance of Tier 4 is very similar to that of Tier 1 over time, as operational savings over the study period are realized. Tier 2 has the best performance (as it has the lowest capital investment and recapitalization costs despite higher operational costs).
- Due to lower incremental NPV performance, Tier 2 offers an attractive abatement rate. For Tier 4, there is a higher net cost per tonne of emission reduced (~$440/T). While this is significantly higher than other abatement benchmarks (e.g. former carbon tax peaked at $170/T), the $440/T is still a significantly better abatement performance than what has typically been observed for similar retrofits.
- Tier 4 in the 2025 scenarios offers a better overall financial performance when compared to the respective Tier 4 the 2020 code compliance scenario, primarily due to requiring less rooftop PV.

3.5 Sensitivity Analysis Results

3.5.1 Impact of Building Orientation to Compliance

A sensitivity analysis was conducted to evaluate the potential impact of different building orientations on the design performance and code compliance. The analysis was conducted for one building archetype for each section of the code, as summarized below.

Part 3 Buildings

For Part 3 buildings, the analysis was conducted for the Mixed-Use archetype. For each of the three design Tiers, three new energy simulations were created to reflect three additional building orientations. For each of them a new reference simulation was also created. The impact of the orientation change was evaluated by comparing the resulting total energy use intensity (TEUI) metric between design and reference cases.

Results summarized in Table 32 below show that compliance is satisfied for all design Tiers and all orientations.

Table 32: Part 3 Orientation Sensitivity Analysis – Mixed-Use TEUI

	Azimuth Angle	TEUI (ekWh/m²/y)					
		Tier 1		Tier 2		Tier 4	
		Target	Prop.	Target	Prop.	Target	Prop.
Orientation 1 (Baseline)	0°	246	**236**	135	**122**	72	**69**
Orientation 2	90°	249	**237**	136	**120**	72	**70**
Orientation 3	180°	249	**237**	136	**121**	73	**70**
Orientation 4	270°	250	**238**	136	**121**	73	**70**

Part 9 Buildings

For Part 9 buildings, the analysis was conducted for the Fourplex archetype. Similar to the process followed for Part 3, four new energy simulations were created for each Tier to evaluate the impact of different building orientations. For each of them a new reference simulation was also created. The impact of the orientation change was evaluated by comparing the resulting Adjusted Energy Use Intensity (EUI_{adj}) and Heat Loss metrics between design and reference cases.

Energy results summarized in Table 33 below show that compliance is satisfied for all design Tiers and all orientations.

Heat loss results summarized in Table 34 show that for some orientations, the heat loss target is not being met by a small margin, due primarily to varying WWRs across different sides of the building. This indicates that some

consideration should be given to the amount and placement of windows to minimize heat loss, although small deficiencies like those shown in the table can be compensated with a higher performance enclosure.

Table 33: Part 9 Orientation Sensitivity Analysis – Fourplex EUI_{adj}

	Azimuth Angle	Adjusted EUI (ekWh/m²/y)					
		Tier 1		Tier 3		Tier 5	
		Target	Prop.	Target	Prop.	Target	Prop.
Baseline	31°	214	**192**	171	**162**	64	**35**
Orientation 1	0°	212	**188**	169	**164**	64	**35**
Orientation 2	90°	230	**199**	184	**168**	69	**35**
Orientation 3	180°	220	**188**	176	**156**	66	**34**
Orientation 4	270°	210	**192**	168	**166**	63	**36**

Table 34: Part 9 Orientation Sensitivity Analysis – Fourplex Heat Loss

	Azimuth Angle	Heat Loss (ekWh/m²/y)					
		Tier 1		Tier 3		Tier 5	
		Target	Prop.	Target	Prop.	Target	Prop.
Baseline	31°	162	**159**	146	**141**	97	**99**
Orientation 1	0°	164	**160**	148	**141**	98	**100**
Orientation 2	90°	165	**158**	145	**139**	97	**98**
Orientation 3	180°	165	**157**	148	**138**	99	**97**
Orientation 4	270°	167	**159**	151	**140**	100	**99**

Additional Considerations

When solar PV is included in the proposed design, supplemental analysis indicated approximately 15-20% difference in annual PV production due to orientation changes alone (from South-facing to East-facing). It is recommended to consider orientation, roof geometry and site-specific shading constraints when optimizing for direct solar exposure of the PV array.

Drawn out from the orientation sensitivity analysis, additional design strategies for optimizing energy savings are outlined in Table 35.

Table 35: Additional Design Considerations to Optimize Orientation in Mountain Climates

Things to include…	Things to avoid…
→ Large windows on the South side, and smaller windows on the North side → Window placement that accounts for site-specific shading constraints and seasonal changes → Simple sloped roof designs, with South-facing tilt close to altitude → Dominant East-West axis (proportionally greater South-facing exposed wall, roof, and window areas) → Align to avoid or harness prevailing winds to reduce infiltration	→ Large windows on the North side → Window placement resulting in significant shading by adjacent buildings, trees and terrain (especially during winter months) → Over-articulated roof geometry, increasing potential for thermal bridging, air-vapour barrier gaps, and limiting solar PV opportunity → Flat roof designs → Dominant North-South axis (proportionally less South-facing exposed wall and roof areas)

3.5.2 Impact of Key Study Assumptions to Business Case

A key outcome of this research study for the Town is a better understanding of financial implications for stricter Tiers and the potential cost/benefits. Therefore, developing a range of financial scenarios and studying the associated impact to financial performance (payback, incremental cost savings, etc.) can provide beneficial insights on the research analysis.

WSP completed sensitivity analysis on key financial assumptions to understand the impact to the financial outputs. Based on the scope of work, this analysis was completed only for the Apartment building archetype. Although not explicitly studied, it is likely the general insights from the sensitivity analysis are applicable to the other archetypes. Sensitivity scenarios considered include:

1. The impact of higher than estimated capital costs of the design strategies (25% higher)
2. The impact of assuming no further decarbonization of the Alberta provincial electricity grid
3. The impact of higher discount rates (up to 8% discount rate)
4. The impact of higher utility rates (utilities increase by 5% year over year)
5. What if peak shaving electrical demand strategies are implemented?

Impact of Higher Capital Costs

A sensitivity run was conducted by applying a 25% cost premium to capital costs for the Apartment building archetype. This scenario reflects a market for decarbonization options that accelerates faster than the base market, which is possible in a regime where the technologies and/or skilled trades required for installation are in high demand, but production and service levels have not accelerated to match.

Results are shown in Table 36 below in terms of key impacted financial metrics for the 2020 code compliance scenarios.

Table 36: Potential impact of Higher Capital Costs

	Tier	Capital Cost ($M-2025)	LCC ($M)	Incremental NPV ($M)	ILCC/Tonne ($/Tonne)
Baseline	Tier 1	$5.67	$7.8	-	-
	Tier 2	$5.63	$8.4	-$0.58	$277
	Tier 4	$6.93	$9.3	-$1.43	$573
Sensitivity	Tier 1	$7.08	$9.8	-	-
	Tier 2	$7.04	$10	-$0.61	$291
	Tier 4	$8.66	$12	-$1.86	$744

As expected, the increased capital costs result in a higher 40-year total life-cycle costs, due to the impact of initial capital costs, as well as replacement cycles occurring throughout the building life span. In terms of Incremental NPV performance, an increased gap with Tier 1 performance (and therefore with cost neutrality) is noticeable. The incremental abatement value over Tier 1 is also higher, due to increased costs and no other areas of additional cost savings.

Geo-exchange system costs estimates in Banff and surrounding areas remain highly variable, creating challenges for project planning and risk management. In preparing costs for this project, discussions between contractors and cost consultants indicated borehole costs ranging from $17,000 to $21,000, while the Town of Banff referenced recent projects coming in between $30,000 - $36,000 per borehole. Generally cost estimates in this study are intended to be conservative, however, these costs are relatively significant in terms of the geo-exchange system itself. However, as shown in Figure 33, even considering these higher per borehole costs is relatively minor compared to the total estimated costs for implementing the Tier 4 strategies, and within the range of the sensitivity analysis for 25% higher costs (i.e. within the Class C accuracy bounds consistent with the capital cost estimates developed by the cost consultant).

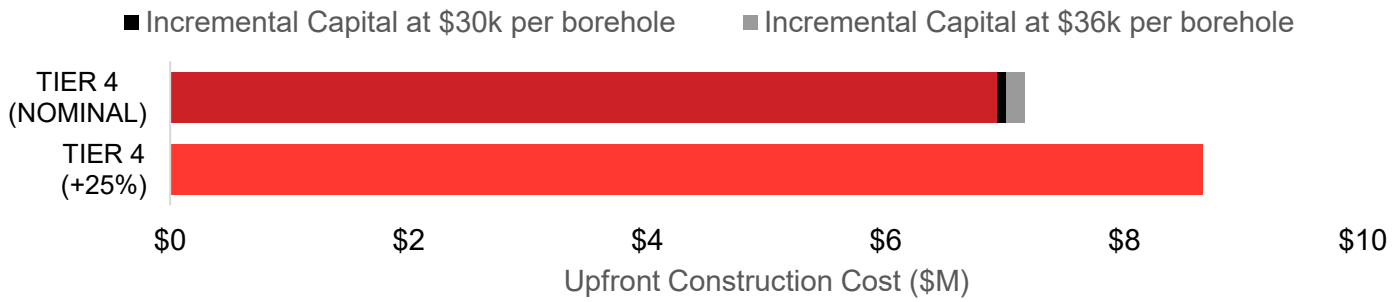

Figure 33: Comparison of incremental cost for higher per borehole costs for Tier 4

Therefore, while the potential cost for a geo-exchange system is highly variable, the general conclusions and implications of the nominal analysis and the higher capital analysis generally remain true (i.e. higher capital costs drive poorer financial performance, and increase GHG abatement rates)

This variability in pricing underscores the need for ongoing cost monitoring as decarbonization strategies and high-performance building standards become more prevalent. At present, the uncertainty surrounding geo-exchange pricing could be a significant barrier to pursuing higher performance tiers, as the financial risk compared to conventional systems such as furnaces, boilers, and air-source heat pumps remains considerable. Over time, as more geo-exchange projects are completed and market experience grows, costs are expected to stabilize, improving predictability and supporting broader adoption. The Town could support with collecting data on potential costs, and publishing them for the broader building industry (either through its own facilities, or through initiatives like developing case studies with builders who have implemented the systems at their properties).

Impact of Changing Grid Emission Factors

A sensitivity run was conducted by assuming a different decarbonization trend for the local electrical grid (i.e. assuming the grid emission factor to be constant at the current value of approx. 271 tCO_2e/GWh as reported by ECCC and shown in Figure 34).

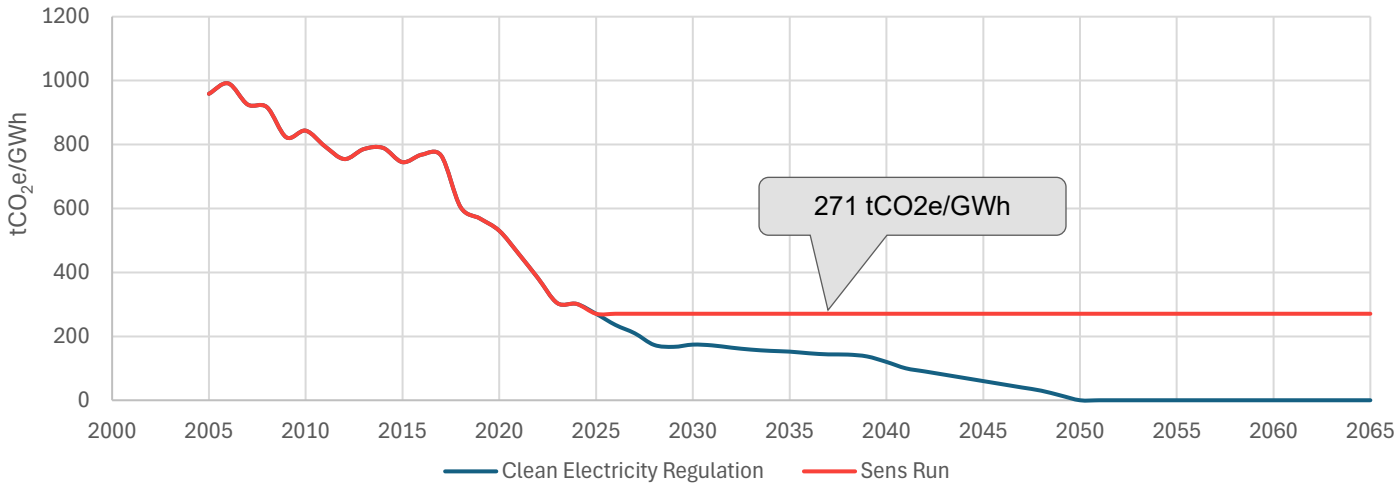

Figure 34: Alberta Emission Factor Projection

Table 37 below shows the impact of the emissivity grid on the overall carbon saving potential as well as the project key financial metrics.

Table 37: Potential impact of Changing Grid Emission Factor

	Tier	40-yr Emissions (tCO2e)	Total Emissions saved (tCO2e)	LCC ($M)	Incremental NPV ($M)	ILCC/Tonne ($/Tonne)
Baseline	Tier 1	2,983	-	$7.8	-	-
	Tier 2	895 (-70%)	2,088	$8.4	-$0.6	$277
	Tier 4	481 (-84%)	2,502	$9.3	-$1.4	$573
Sensitivity	Tier 1	4,300	-	$7.8	-	-
	Tier 2	2,973 (-31%)	1,327	$8.4	-$0.6	$436
	Tier 4	1,595 (-63%)	2,705	$9.3	-$1.4	$530

The impact of a higher-than-expected grid emission factor results in higher total emissions compared to the baseline scenario but no impact over the overall project financial performance. In terms of tons of emissions

saved over Tier 1, in the high emissivity grid scenario Tier 2 presents smaller reductions, while the opposite can be observed for Tier 4 (absolute total emissions saved are greater than in the fully decarbonized grid scenario). This leads to a worse abatement rate for Tier 2 (when compared to Tier 1) but a better abatement rate for Tier 4, due to greater total emissions savings, making the business case for Tier 4 more compelling.

Impact of a Higher Discount Rate

A sensitivity run was conducted to evaluate the impact of a different cashflow value future by increasing the discount rate to 8% (from a baseline assumption of 5.2%). Results are shown in Table 38 below in terms of key impacted financial metrics.

Table 38: Potential impact of Higher Discount Rates

	Tier	LCC ($M)	Incremental NPV ($M)	ILCC/Tonne ($/Tonne)
Baseline	Tier 1	$7.8	-	-
	Tier 2	$8.4	-$0.6	$277
	Tier 4	$9.3	-$1.4	$573
Sensitivity	Tier 1	$6.9	-	-
	Tier 2	$7.2	-$0.4	$176
	Tier 4	$8.2	-$1.3	$528

As expected, a higher discount rate generates a smaller cashflow value over time resulting in both lower total life-cycle costs as well as incremental NPV values. As well, the abatement rate is reduced for Tier 2 and 4.

Impact of High Utility Rates

A sensitivity run was conducted by applying a 5% utility rate escalation factor to both electricity and natural gas baseline prices for the Apartment building archetype. Results are shown in Table 39 below in terms of key impacted financial metrics for the 2020 code compliance scenarios.

Table 39: Baseline scenario utility rate assumptions

	Baseline Variable Rate	Baseline Fixed Rate
Electricity	$30.50/GJ	$688/suite/y
Natural Gas	$7.67/GJ	$955/y

Table 40: Potential impact of Higher Utility Rates

	Tier	40-Year Energy Costs ($/m²)	LCC ($M)	Incremental NPV ($M)	ILCC/Tonne ($/Tonne)
Baseline	Tier 1	$1,181	$7.8	-	-
	Tier 2	$1,550	$8.4	-$0.6	$277
	Tier 4	$961	$9.3	-$1.4	$573
Sensitivity	Tier 1	$2,454	$17.3	-	-
	Tier 2	$3,162	$19.2	-$0.9	$421
	Tier 4	$1,938	$18.7	-$1.3	$502

Table 40 shows that, as expected, an increase in 5% of utility rates results in a significant total operating costs increase (by approx. a factor of 2) over the study period. Total life-cycle costs are also substantially impacted, showing an approximate 130% increase for Tier 2, and a more modest 120% and 100% increase for respectively Tier 1 and 4. The worst Tier 2 performance is likely due to the increased energy cost due to electrification and higher price of electricity, while a more modest increase for Tier 4 results from a high efficiency improvements and lower electricity consumption

Impact of Peak Demand Shaving Strategies

A sensitivity run was conducted to assess the potential impact on utility costs of the implementation of electrical peak shaving strategies. For the purpose of the run, WSP adopted a default 25% reduction of monthly electrical peak demand for all design Tiers and evaluated the resulting operating costs and key financial performance metrics, as shown in Table 41.

Table 41: Potential impact of Electrical Demand Shaving Strategies

	Tier	40-Year Energy Costs ($/m²)	LCC ($M)	Incremental NPV ($M)	ILCC/Tonne ($/Tonne)
Baseline	Tier 1	$1,181	$7.8	-	-
	Tier 2	$1,550	$8.4	-$0.6	$277
	Tier 4	$961	$9.3	-$1.4	$573
Sensitivity	Tier 1	$1,158	$7.8	-	-
	Tier 2	$1,419	$8.2	-$0.4	$213
	Tier 4	$933	$9.2	-$1.4	$571

As shown in the table above, reducing the electrical peak demand by 25% results a modest decrease in operational costs over the study period when compared to the baseline case, driven by the reduced electrical demand cost. A more appreciable reduction of 8% is noticeable for Tier 2, due to the increased share of electricity consumption and higher demand. The impact on overall life-cycle costs appears to be negligible for all Tiers, as this metric is mainly driven by capital costs. In terms of abatement value, the resulting demand cost savings show a modest improvement of the total cost spent per tonne saved for both scenarios.

4 Discussion

The following section summarizes key discussion items based on observations of the analysis outlined in Section 3.

4.1 Cost Effective Design Strategies for High Performance Tiers

→ **For Apartment and Mixed-Use Archetypes, Tier 2 can be achieved for a similar capital cost as Tier 1.**

To achieve baseline NECB 2020 compliance, Part 3 apartment buildings will already require a mix of high-performance enclosure design, multi-stage in-suite HVAC delivery with heat-recovery, and high-efficiency central systems. Mixed-use residential buildings will share many of same design strategies as apartments, with additional consideration for shared spaces (corridors and amenity) and commercial tenant units. Analysis showed baseline code compliance (Tier 1) is achievable for both Apartment and Mixed-Use buildings without fuel-switching, using relatively cost-effective standard design approaches.

Achieving Tier 2 for Part 3 buildings will require additional attention to enclosure design and a comprehensive air tightness plan to reduce heating demand and facilitate fuel-switching of baseload heating. The net capital cost for these additional strategies was estimated to provide up-front savings of 0.2-1.0% when compared to Tier 1.

The Tier 2 performance targets allow some value-engineering to optimize cost-effectiveness among the incremental increases for wall insulation and window performance, heat recovery, and potential for reduction in up-front costs from Tier 1 for the heating and cooling plant through the use of cold climate air source heat pumps, optimally sized for base load heating while providing all cooling required (removing the need for extra equipment).

→ **For Garage Suite and Fourplex Archetypes, Tier 3 can be achieved for a similar capital cost as Tier 1.**

Analysis showed baseline code compliance (Tier 1) is achievable for both Garage Suite and Fourplex buildings **without fuel-switching**, using relatively cost-effective standard design features, which included:

- R-3.5 SI walls, R-10.4 SI roofs, double-glazed windows
- A central forced-air system with a natural gas furnace and split DX cooling
- No energy recovery required for ventilation
- Natural gas storage water heater

Achieving Tier 3 performance requirements necessitate slightly better enclosure performance in both the Garage Suite and Fourplex as well as higher efficiency HVAC systems. The cost premium estimated for these additional strategies was estimated at 0.4-1.6%. Cost effective strategies included:

- Increasing HVAC efficiency using electric DHW heaters in both buildings and a central ASHP system in the Fourplex
- The Garage Suite would also benefit from increased air tightness, which can be challenging in attain practice.

For the Fourplex and Garage Suite archetypes, electric technologies for space heating and domestic hot water were estimated to be very similar or in some cases less costly than typical gas fired equipment. For example:

- For Heating Systems, fuel-switching from a 95% efficient gas-fired forced-air system in the Tier 1 baseline design to a 300% efficient (3.0 COP) air-source heat pump system in Tier 3 was estimated to be comparable in equipment price
- For DHW Systems, fuel switching from a 55% efficient gas-fired DHW heater to a 100% efficient electric DHW heater was estimated to be is 23% less expensive; switching to a 400% efficient (4.0 COP) ASHP DHW heater is only 6% more expensive

This finding suggests that electrification of heating and domestic hot water systems could be achieved for a marginal upfront capital cost premium. In other words, to fully fuel-switch from natural gas to electricity would not require significant additional capital even in Tier 1 compliant buildings, and as Alberta's electricity grid continues to decarbonization this would potentially mean a Tier 1 compliant building can benefit from reduced carbon emissions and a significant increase in energy performance. However, without the counterpart focus on load reductions considered in higher Tiers, there could be significant ongoing operational cost implications; these implications are further discussion in Section 4.2.

Another observation was that insulated concrete forms (ICFs) for below-grade walls perform much better than cast-in-place concrete walls (R-7.0 SI vs. R-3.5 SI), and were estimated to be much cheaper to implement, primarily due to labour saved from setting up separate forms. The cost delta was estimated to be ~20% less expensive per unit area of below grade wall area ($650/m^2 vs. $820/m^2)

→ **For Apartment and Mixed-Use Archetypes, cost effective strategies to comply with Tier 4 results in a 5-7% additional upfront capital investment**

Attaining Tier 4 will involve minimizing demands through meticulous attention to all aspects of enclosure design, space loads, and centralization of HVAC delivery towards supporting a fully electric building. The capital cost premium estimated for these additional strategies was estimated at 14-23% across the affected elements, or 5-8% for whole building.

Ground source heat pumps are a force-multiplier for energy and emissions reduction, becoming necessary for achieving the highest Tier of performance and cost-effective compared to comparable measures that may see diminishing returns, especially in colder mountain climates.

Another cost-effective strategy is minimizing untreated outdoor air (i.e. outdoor air not passing through heat recovery) as much as possible. A comprehensive air tightness plan will need to address suite-level compartmentalization as well as whole-building boundaries. Air tightness in apartments can be addressed by focusing on unit compartmentalization and conducting suite-level testing. From the HVAC side, optimal sizing and proper commissioning of in-suite ventilation units is a cost-effective way to reduce over-ventilation. Mixed-use buildings must also minimize make-up air for corridor pressurization, with a move to centralized outdoor air delivery (with return ducting and premium heat recovery) becoming cost-effective when targeting Tier 4 performance.

Finally, mixed-use buildings have commercial tenant spaces that may be only partially fit-out under base building, which may adversely impact performance after tenant fit out is completed. A cost-effective strategy to influence building performance is to provide capped connections to the central plant along with binding tenant lease agreements that have energy performance requirements.

- **For Garage Suite and Fourplex Archetypes, cost effective strategies to comply with Tier 5 results in a 6-11% additional upfront capital investment**

  Attaining the highest Tier 5 will involve minimizing demands by designing for the best performing enclosure, with very high R-values and very low infiltration rates. The cost premium estimated for these additional strategies was estimated at 15-23% across the affected elements, or 6-11% for the whole building. Cost effective strategies included fully fuel-switching the HVAC system by implementing a central ground-source heat pump system, which can achieve high COPs in cold climates like Banff.

  Achieving higher Tiers in the NBC requires most of the focus to be on improving the enclosure and HVAC system; lights, plugs, occupancy, ventilation, and DHW loads are all pre-defined in the NBC AE modelling rules, so direct reductions cannot be included in compliance calculations. In other words, lighting power reductions, drain water heat recovery, demand-controlled ventilation systems, etc. are not factored into achieving the higher performance Tiers (even though these strategies all save energy in practice).

The construction cost premiums for each modelled archetype Tier, shown below in Figure 35 as a percentage of total construction cost and compared to other cost premium estimates for similar studies for the Alberta market. While the study objectives and archetypes varied from the archetypes and methodology used in this study, these are useful as a high level comparator to the implications of building to the highest Tier studied by others. The figure below compares the estimated study cost premiums for each archetype to results from

other similar studies. Generally, the estimated cost premiums are generally lower than estimated by others, which may in part be related to the higher cost to building in communities like Banff.

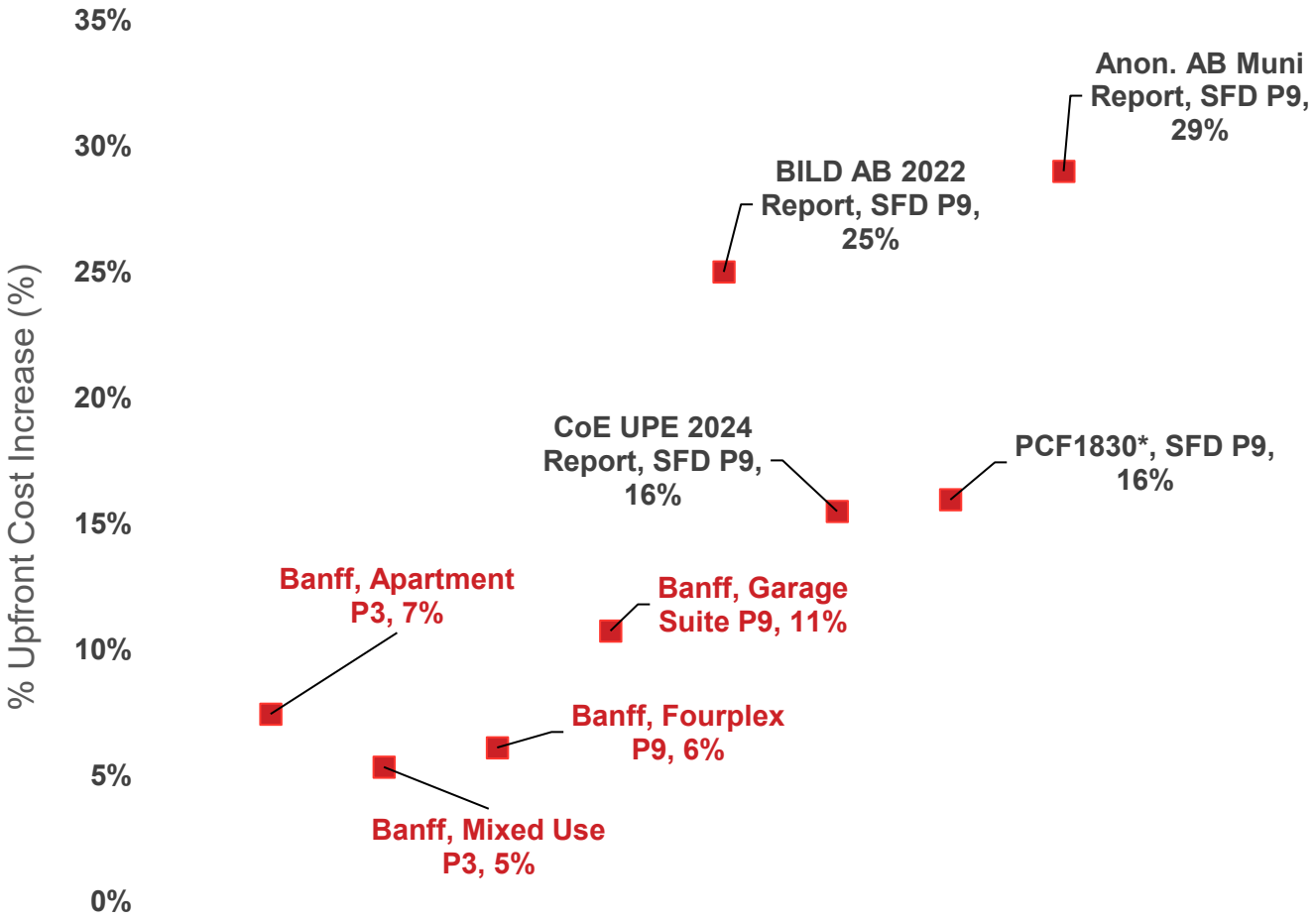

Figure 35: Comparison of Estimated Total Capital Cost Premiums to Achieve Upper Tier Performance

4.2 Upfront Capital Costs Only Tells Part of the Story

→ **Life-cycle is an enhanced view of cost-effectiveness, and also reveals the typical high-Tier buildings as performing as well or better than their mid-Tier counterparts**

'Cost Effective' is a key study term defined in Section 1.2 and is defined as "the lowest construction cost, or the lowest upfront expense to the owner/developer to build." Another metric analyzed in this study related to cost effectiveness is 'Life-Cycle Cost', which is defined as "the initial and recurring capital costs, operating costs (utility costs), and residual value over the life of the project." This metric is especially important when considering the highest Tier buildings, which as discussed previously showed capital cost premiums above

baseline ranging from 0% to 36%. Table 42 below shows the comparison of the estimated capital costs vs. the life-cycle cost.

Table 42: Capital and Life-Cycle Cost Summary

	Tier 1	Mid Tier	Upper Tier
Fourplex			
Design Package Capital Cost ($M)	$1.9	$1.9	$2.2
Total Life-Cycle Costs ($M)	$3.0	$2.9	$2.8
Garage Suite			
Design Package Capital Cost ($K)	$400	$400	$500
Total Life-Cycle Costs ($K)	$600	$600	$600
Apartment			
Design Package Capital Cost ($M)	$5.7	$5.6	$6.9
Total Life-Cycle Costs ($M)	$7.8	$8.4	$9.2
Mixed-Use			
Design Package Capital Cost ($M)	$7.6	$7.5	$8.7
Total Life-Cycle Costs ($M)	$11.0	$11.0	$12.0

Another notable insight is the for mid Tiers, electrifying heating systems without implementing substantial load reduction strategies required to achieve the highest Tiers can result in elevated operational costs, particularly for building archetypes with commercial-grade metering. Larger buildings, which are often billed based on peak demand, face the greatest financial impact. For example, Figure 36 below shows for the Apartment Building, operational utility costs per unit of area increase by nearly 30% in the Tier 2 scenario compared to a saving of 19% in the Tier 4 scenario.

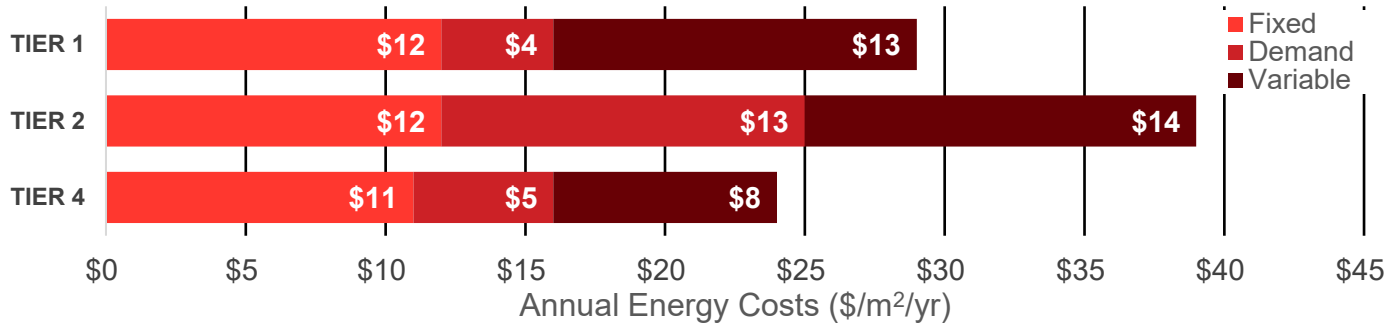

Figure 36: Annual Energy Costs by Tier for Apartment Archetype

Since utility expenses are frequently passed through to tenants, new developments with high operational costs can exacerbate issues of housing affordability and raise concerns around energy equity. Evaluating building performance through a life-cycle cost lens – rather than focusing solely on upfront construction costs – can help mitigate these risks by promoting design strategies that reduce long-term energy use and financial burden. Considering current estimate ratios of renters in Banff of living costs relative to income, these additional costs could further exacerbate potential housing poverty and energy equity considerations. A recent report[9] released by Pembina Institute highlights a significant increase of population exposed to energy poverty in Canada (energy poverty occurs when a household spends more than 6% of their income on energy costs, according to the Canadian Urban Sustainability Practitioners). The study points out that 6% of the low-income households currently live in energy poverty in Alberta and highlights the importance of investing in affordable and energy efficiency housing solutions. For context, the average total income in Banff was estimated to be around $51,000[10], meaning that those paying more than ~$3,000 yearly energy costs would meet the Pembina definition of energy poverty. Middle Tiers for each of the archetype studied could place occupants at or above this threshold, especially for Tier 3 Part 9 building (garage and fourplex archetypes) whereas at the highest Tiers, this risk is significantly decreased due to the increased investment in load reduction strategies to achieve Tier 5 performance (which reduces energy costs). This highlights a key consideration for the Town as it looks to encourage higher performing buildings, and highlights a potential tension between focusing on encouraging higher performance buildings to mitigate community emissions (most of the mid Tiers studied included building electrification, which means both the mid Tier and highest Tier buildings will be operationally carbon neutral by 2050, if the grid decarbonizes as expected) and potential trade-offs.

→ **There are other benefits to higher performance buildings that are challenging to quantify into a cost/benefit analysis for the incremental capital required**

Investing in high-performing buildings offer a range of benefits beyond just energy efficiency. For example, Figure 37 and Figure 38 below show the calculated GHG abatement rate for the higher Tiers compared to abatement rates estimated for retrofits of similar building types. The figures show that investing in higher performance to reduce GHG emissions at the new construction stage is more cost effective (in terms of

[9] Affordable_Home_Energy_for_All-revised.pdf
[10] CareerBeacon - Average Cost of Living in Banff

capital dollars invested per tonne of GHG reduced) than retrofit buildings at a later stage to achieve similar performance. However, to properly incorporate this into decision making at early stages to develop to higher performance, reducing the GHG emissions intensity of the building needs to be one of the core decision making principles.

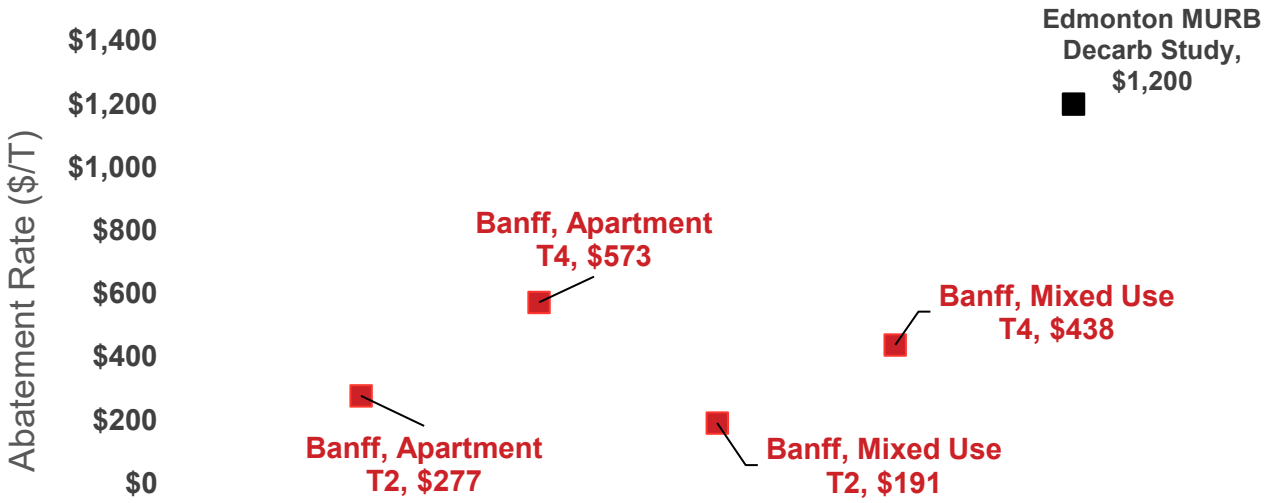

Figure 37: Comparison of GHG Abatement Rates for Part 3 Archetypes

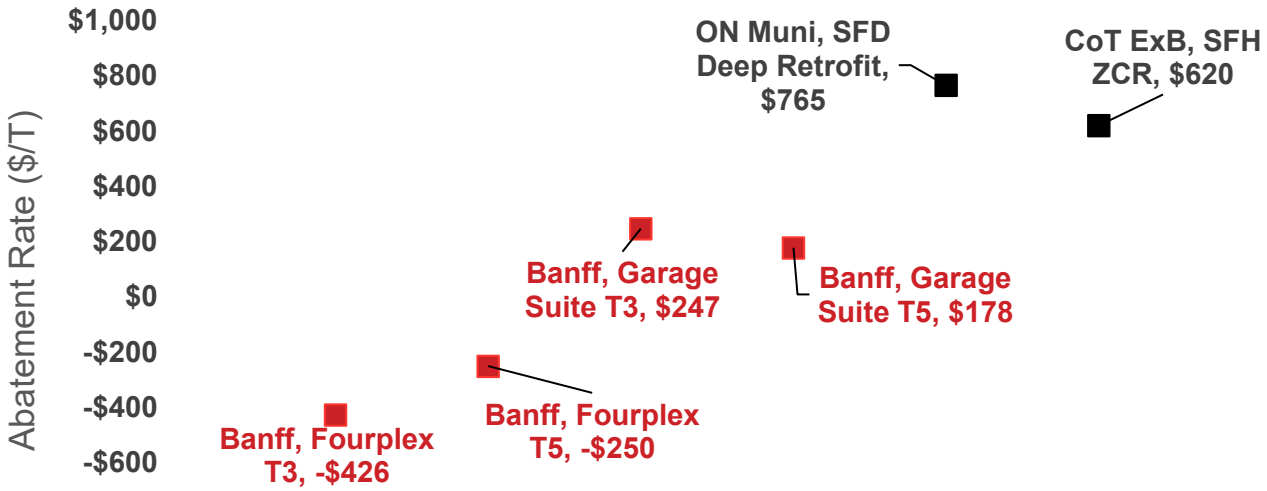

Figure 38: Comparison of GHG Abatement Rates for Part 9 Archetypes

Other potential benefits include improved indoor air quality, thermal comfort, and natural lighting, which contribute to better occupant health, productivity, and satisfaction. Additionally, high-performing buildings can enhance property value, support climate resilience, and contribute to broader community goals such as reduced urban heat island effects. Despite the growing recognition of the benefits associated with high-

performing buildings—such as energy efficiency, improved occupant health, and climate resilience—accurately reflecting these advantages in property valuations remains a significant challenge. This disconnect can hinder investment and policy support for sustainable building practices, particularly in regions like Alberta where the market for high-performance buildings is still emerging. One of the primary barriers is the lack of standardized metrics for quantifying non-traditional benefits. Conventional valuation methods, such as income-based or comparable sales approaches, are not well-equipped to capture intangible or long-term advantages like enhanced indoor air quality, reduced absenteeism, or improved cognitive performance. These benefits, while real and impactful, often fall outside the scope of traditional financial analysis. Data limitations further complicate the issue. There is a scarcity of localized, consistent data linking high-performance features to measurable financial outcomes. For example, while studies may show that natural lighting improves productivity, translating that into a dollar value for a specific building in Alberta is difficult without robust, region-specific benchmarks. Another challenge is market recognition. If buyers, tenants, or lenders do not fully understand or prioritize high-performance features, valuators may be reluctant to assign them additional value. This creates a feedback loop where sustainable features are underappreciated in the market, further discouraging their inclusion in valuations. In Alberta, the issue is compounded by a limited pool of comparable properties. With relatively few high-performing buildings in the province, it is difficult for appraisers to find appropriate benchmarks, making it harder to justify premium valuations.

4.3 Considerations for Non-Energy Co-Benefits

As discussed in the previous section, there is a significant incremental investment for building to the highest Tiers of performance, and the incremental investment is not paid back on energy savings alone. There are other, additional benefits to higher performing buildings that are either not traditionally considered in decision-making or challenging to quantify at the decision-making stage which may influence business casing/decision making for building to higher Tiers of performance. To support an understanding of how these non-energy co-benefits could potentially influence the financial return of pursuing higher Tiers, WSP conducted desktop research of industry and other public reports to develop qualitative estimates of different non-energy co-benefits of higher performing buildings and conduct a sensitivity analysis to explore how the financial metrics are impacted. As well, there are other non-energy co-benefits are more appropriately qualified as opposed to quantified (such as climate adaptation), and some discussion is included in this section as well.

The infographic in Figure 39 below summarizes non-energy co-benefits considered, for which an individual discussion is provided as follows.

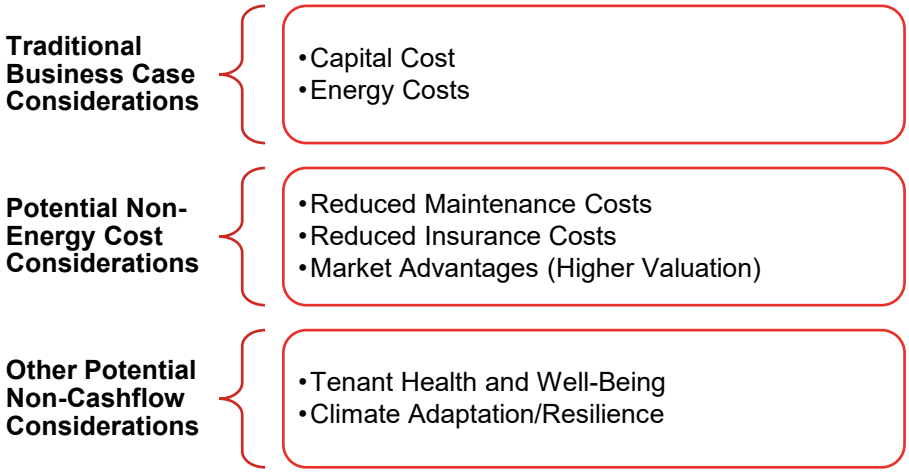

Figure 39: Non-Energy Co-Benefits of Higher Performing Buildings

Potential Annual Maintenance Cost Savings

High performing buildings can offer several operational maintenance-related cost savings, which could impact the business case for opting to achieve different Tiers of performance. Examples of potential maintenance savings in higher performing buildings include:

- Reduced equipment wear and tear due to systems operating under optimized conditions, reducing strain and unnecessary cycling of equipment.
- Longer service life of materials and equipment as higher performance typically requires higher quality of construction.
- Reduced staff time for complaint response due to increased tenant comfort.

Potential maintenance cost savings are typically challenging to quantify and are often assessed on a building-by-building basis. The EPA's Energy Star program outlines some qualitative estimates for quantifiable cost savings of high performance buildings. Energy Star estimates that high performing buildings have the potential to save up to $6.46/m² ($0.60/ft²) on operations and maintenance expenses annually compared to typical buildings. Similar conclusions were drawn by other research conducted by The Atmospheric Fund (TAF), which indicates a 3% maintenance cost savings is typically achievable with the integration of high energy efficiency features in multi-unit residential buildings.

Potential Insurance Savings

Energy-efficient new buildings in Canada can potentially benefit from insurance premium savings, although the exact amount varies depending on the insurer and building type. Examples of potential reasons why insurance premiums could be less include:

- Reduced risk from moisture damage due to higher performing enclosure systems

- More durable materials, due to higher quality of construction required to achieve higher levels of performance
- Higher performing buildings may be more climate resilient, which reduces the potential for climate related insurance claims.

Estimates of potential annual insurance premiums vary greatly. TAF estimates high performing buildings could see potential premium savings of 5-24%[9]. Other reports of discounts offered by insurers are reportedly closer to 10%[11] (and it should be noted that the discount is associated with Leadership in Energy and Environmental Design (LEED) certification (although generally LEED certification can be taken as a proxy for high performing buildings. The variations also can vary by building size. For example, smaller homes/units may be eligible for a partial premium refund on mortgage loan insurance through CMHC's Eco Plus Program, if homes have an energy efficiency certificate or meet specific energy efficiency or greenhouse gas targets. As there is little evidence of any potential premium savings that vary by level of performance, there is likely negligible benefit that can be appropriately quantified for influence the business case for building to a higher Tier, and therefore potential variations between Tiers was not considered in the sensitivity analysis. However, there appears to be a benefit more generally, although mostly tied to achieving a sustainable building certification.

Potential Asset Valuation Appreciation

Market research conducted by the American Institute of Architects[12], as well as data collected from FCIQ, highlighted that high-efficient building design is strongly correlated with increased asset value. Below are some key findings from studies being reviewed. Tracking similar metrics with local data would make a stronger business case for high performing building design in Banff:

- Higher Marketability & Sale Price: Buildings with green certifications (such as LEED or ENERGY STAR) tend to sell for 16% more than conventional buildings, while green homes were found to be typically worth 7-9% more than traditional ones (FCIQ).
- Rental Premiums: Energy-efficient buildings command higher rental rates, with some studies showing a 3–5% increase per certification level.
- Operational Cost Savings: Every $1 saved in energy costs can increase a building's market value by $18.32, assuming a capitalization rate of 5.5%.
- Occupancy Rates: LEED-certified office spaces have a 4.1% higher occupancy rate, while ENERGY STAR buildings see a 3.6% increase.
- Investor Interest: High-performance buildings attract more investment due to their longer economic lifespan and lower risk of obsolescence.

[11] https://canadianunderwriter.ca/news/industry/the-co-operators-introduces-discount-for-leed-certification/
[12] ROI: Increasing asset values

Increased Occupant Comfort

Several studies have been demonstrating the strict correlation between building deep retrofits and tenants' health benefits. A recent report from the Pembina Institute titled 'Valuing Deep Retrofit'[13] describes how deep retrofits in residential buildings can improve health outcomes and reduce healthcare costs in Alberta. The study aimed to expand the business case for deep retrofits by incorporating non-energy benefits such as health, safety, resilience, insurance, and affordability. It also sought to highlight the chronic health impacts of poor-quality housing. Below are some of the key co-benefits that emerged from the study that could be leveraged by developers to improve the business case for high performing buildings in Town of Banff:

- Better indoor air quality: Upgrading insulation and ventilation systems reduces exposure to pollutants, allergens, and mold, leading to fewer respiratory issues.
- Healthier indoor temperatures: Improved heating and cooling systems help maintain stable indoor temperatures, reducing risks associated with extreme cold or heat.
- Reduced stress and mental health benefits: Lower energy costs and improved living conditions alleviate financial strain and stress, contributing to better mental well-being.
- Lower healthcare costs: International examples were leveraged to show that deep retrofits lead to significant healthcare savings. For instance, a New Zealand program returned four dollars in health and energy savings for every dollar spent, which reinforces the importance of integrating health considerations into retrofit policies.

The study presented some final recommendations on how to contribute to better health and equity for Albertans within the housing realm. Some of the proposes actions included investing in retrofits that enhance health outcomes, with priority to low-income households facing high energy burdens and poor housing conditions. Additional considerations on this topic are discussed in the section below.

4.4 Possible Implications of Upcoming Code Updates

For Part 9 buildings, it is anticipated that a similar labelling approach will be adopted for carbon emission compliance, and that GHG emission threshold levels will be tied to a required minimum energy performance level. For the purpose of this study, WSP focused on evaluating compliance with the current code, as the complexity of the upcoming changes will require a deeper study of the final code version. However, in the effort of understanding the potential implications of future code changes for this category, WSP engaged with the industry subject matter experts Building Knowledge Canada, who provided the following insights with the upcoming NCB 2025 version.

- **Insights on Timelines:** A new National Building Code update is expected to be released at the end of 2025. An 18-month harmonization period will follow, while year 2027 is the expected timeline for builders to adopt the current code for new constructions.

[13] Valuing Deep Retrofits | Pembina Institute

- **Insights on Energy Requirements:** Energy compliance will still be required under one of the proposed pathways (Prescriptive, Trade-Off, or Performance), however an additional 'Tiered Prescriptive' path will be introduced for Tiers 1, 2, and 5 as an alternate compliance method. It is expected that meeting Tier 3 and 4 compliance under the prescriptive pathway will be easier, due to the introduction of an easier calculation method, as well as additional measure categories. Under this pathway, the code will provide the total number of points needed to comply with each Tier.
- **Insights on GHG Requirements:** The new code will introduce a carbon compliance requirement through a new letter-based labelling system for GHG prescriptive compliance (similar to what is shown for Part 3 buildings in Table 5). Compliance will be demonstrated by achieving a minimum score required for energy conservation, as well as meeting a new metric introduced to calculate the GHG emitted per unit of energy consumed. It is expected that by following this approach, electric-only buildings only will be able to meet upper Tiers, while hybrid energy generation systems will not be able to go past level C. Emission factor values will be provided for both natural gas (historical) and electricity (projected). The code will require the use these references if calculations are not already available by the province or local utility companies. It was noted that the latest (2024) electricity emission factor projected values provided by Environment and Climate Change Canada[14] for Alberta trend below the natural gas emission factor, which will help make the case for adoption of heat pump technology in the province.
- **Other Insights:** The new code will introduce prescriptive requirements for windows as well as requirements to limit over-heating of spaces. The current version of the code (2020) addresses over-heating by requiring the design heat load to be smaller than the reference model, making it a difficult item to address. The future code will introduce a window solar heat gain coefficient threshold to reduce the risk of over-heating often related to maximizing energy savings. Whenever this prescriptive requirement is not met, designers will need to switch to the performance path by demonstrating meeting a lower cooling intensity or design of a cooling system

→ **For Part 9 buildings, following the EnerGuide Rating System pathway as opposed to the relative performance pathway may be more advantageous to achieve higher Tiers, dependent on the size of the house**

Although the study focused on achieving high Tier code compliance under existing relative performance pathways of NBC AE 2023, as described above, additional analysis was performed to determine what design changes would be required if an alternate compliance path was followed under the EnerGuide Rating System that uses an EnergyStar absolute target of 82 GJ/y[15,16]. Key insights from this analysis includes:

- The EnergyStar target is not scaled by area, meaning that all sizes of houses pursuing this path must consume less than 82 GJ/y; larger houses will have a harder time meeting this target than smaller houses

[14] https://data-donnees.az.ec.gc.ca/data/substances/monitor/canada-s-greenhouse-gas-emissions-projections/Current-Projections-Actuelles/Energy-Energie/Reference-Scenario-de-reference/Grid-O%26G-Intensities-Intensites-Reseau-Delectricite-P%26G?lang=en
[15] The option for pursuing the EnergGuide Rating System is listed in NBC AE 9.36.5.3.(1).
[16] The EnergyStar absolute target of 82 GJ/y is listed in EnergyStar for New Home Standard v.12.8 Section 6.1.3.

- The point above proved true when analysing the Garage Suite and Fourplex archetypes, each having dwelling units of 111 m^2 and 211 m^2, respectively. The Garage Suite had an easier time meeting the 82 GJ/y EnergyStar target compared to Tier 1 in the relative performance pathway, whereas the Fourplex (almost twice the size of the Garage Suite) had harder time meeting the 82 GJ/y EnergyStar target compared to Tier 1 in the relative performance pathway
- Hypothetically, if higher Tiers were available under the EnerGuide Rating System, and they followed the same % savings thresholds as the relative performance pathway (e.g. 20% for Tier 3 = 66 GJ/y and 70% for Tier 5 = 25 GJ/y), then the Fourplex would need an ASHP upgrade to achieve Tier 3, whereas the relative performance pathway would allow for a natural gas forced air system. Similarly, following the EnerGuide Rating System the air tightness would need to improve to 1.5 ACH and 0.6 ACH (e.g. Passive House levels) to achieve Tier 3 and Tier 5, respectively, whereas the relative performance pathway would allow for more moderate values of 2.1 ACH and 1.3 ACH

Therefore, it may be more advantageous to follow either the relative performance pathway or the EnerGuide Rating System depending on the size of the house; larger houses may fair better and require less energy upgrades following the relative performance pathway

→ **Because of the switch to a climate action imperative, the NBC/NECB 2025 may offer more (and easier) pathways for compliance which also align with the goal of decarbonization.**

The National Research Council (NRC) will release updates to the NBC and NECB in 2025, addressing building safety, energy efficiency, and environmental sustainability, and with the goal of promoting low-carbon construction in Canada. In the upcoming updates, there are some potential implications to achieving higher performance in buildings.

Achieving baseline code compliance under NECB 2020 for the Apartment and Mixed-Use buildings remains more straightforward using the relative performance pathways approach compared to the absolute pathways outlined under the proposed NECB 2025 update. However, higher Tiers of performance necessitate fuel-switching, which is more fully credited under absolute performance pathways, make the tentative NECB 2025 targets more viable. This result would be further emphasized under emissions-based metrics (contingent on improvements to the grid intensity).

Another related observation is that photovoltaics (PV) can provide significant benefit even in mountain communities, and up to 35% rooftop coverage may be necessary to achieve Tier 4 under NECB 2020 (notably less so under NECB 2025); but this requires case-specific attention to site context and rooftop geometry. Absolute targets may permit the inclusion of PV where relative performance targets more easily.

Absolute targets also place greater emphasis on reducing process loads and other aspects that are largely considered "like-for-like" in relative pathways. While authorities having jurisdiction may allow some exclusions, major shared process loads can pose a more substantial burden under absolute targets. Identifying opportunities to reduce these demands, fuel-switch, and/or integrate them into the building-level plant will be critical during design development. Examples of major shared process loads include:

- Heating equipment that traditionally might use natural gas (such as parking garage unit heaters or snow melt systems for ramps and walkways)
- Tenant appliances (refrigerators, stoves, etc.) and special amenities (pools, saunas, workout areas, etc.)

Mixed-use buildings may also need to anticipate high-load commercial equipment (commercial kitchen appliances, dedicated exhaust, refrigeration equipment, etc.) or have these equipment types excluded by authorities having jurisdiction.

For smaller Fourplex and Garage Suite buildings, the next version of the NBC there is the possibility that GHG emissions may be used as an alternate compliance path:

- Planned updates to the NECB 2025 show a rating system that uses GHG Performance Levels to rank buildings on their carbon emissions using letter grades
- Although the NECB 2025 GHG Performance Levels wouldn't apply to Part 9 buildings following NBC AE, a calculation was performed to see how each Tier of each archetype would perform, hypothetically:
    - Garage Suite
        - Tier 1: D (28% GHG savings)
        - Tier 3: B (77% GHG savings)
        - Tier 5: A (91% GHG savings)
    - Fourplex
        - Tier 1: D (43% GHG savings)
        - Tier 3: C (52% GHG savings)
        - Tier 5: A (94% GHG savings)

Under this rating system, a 'B' grade is attainable just by fuel switching, as in the case of the Tier 2 Garage Suite, which uses electric DHW and ASHPs. To get the top 'A' grade, however, it takes considerably more investment to implement measures found in the Tier 3 designs, including a significantly improved enclosure, a comprehensive air tightness plan, and better COPs from cold-climate GSHPs.

Beyond the potential benefits of absolute targets and GHG emission reduction pathways, it is also likely that the next version of the code will make achievement of upper Tiers easier through adjustments of the rules and requirements as well as the addition of prescriptive packages for Part 9 buildings. In discussion with a firm involved in the NECB 2025 development process, Building Knowledge Canada, WSP confirmed that code development leaders have also identified that significant capital cost – including in technologies such as PV generation – is perceived to be required to achieve the higher Tiers of the standard. Based on a summary by Building Knowledge, understand that changes to compliance pathways to make it easier for smaller buildings to achieve compliance (e.g. following a new prescriptive path) are coming and can be reviewed now.

4.5 Other Considerations

→ **Certain design strategies can be straightforward to model in energy simulation software or include in a design package but may pose challenges for contractors and tradespeople during construction. Higher-performing buildings necessitate tradespeople with specialized skills.**

What is easy to design and model can be difficult to implement in practice. Certain design strategies can be straightforward to model in energy simulation software but may pose challenges for contractors and tradespeople during construction. Higher-performing buildings necessitate tradespeople with specialized skills. This is particularly true for enclosures, where space constraints and physical limitations affect the amount of insulation that can be implement (for example, extent of insulation installed in an attic). Proper heat pump sizing, equipment selection, balancing of seasonal loads, and controls (such as freeze protection, resets, and supplemental switchovers) also require specialized expertise and consideration for cold mountain climates.

Achieving higher levels of air tightness called for at higher Tiers is especially challenging. Infiltration represents a significant heating load if not addressed in higher Tier designs. In modelling, airtightness is represented as a single value (e.g., 1.3 ACH @ 50 Pa) and across all Tiers and archetypes air infiltration is assumed to significantly improve to comply with higher Tiers. In practice, achieving this requires meticulous detailing, taping, and testing. Even small gaps around windows, doors, or service penetrations can compromise airtightness. Achieving extremely airtight buildings requires careful attention and coordination through all phases of design and construction by multiple disciplines, and often performance is only evident after on-site testing. Some best practices for smaller buildings (such as pre-drywall blower door testing) are highly useful but are not required and can represent missed opportunities if it is not required or the value of such tests are not known. Similarly, ground source heat pumps (GSHPs) are modeled with stable ground temperatures and high efficiency. In practice, drilling boreholes performance (and costs) can be very uniquely site-dependent, and may face permitting or space constraints

- **Green building industry reports estimate a significant technical skills gap for tradespeople in Alberta with respect to high performing buildings, resulting in an imbalance of qualified trades that could increase upfront construction costs and lead other challenges.**

  While Alberta has a large skilled buildings workforce, industry reports indicate a technical skills gap among Alberta tradespeople with respect to high performance buildings and technologies. This gap may have implications to potentially higher construction costs of higher performing buildings. This potential cost premium due to a smaller labor pool with the skills required for high performing buildings is challenging to estimate and has not been considered in the cost estimates present in this study, but is an important consideration as projects move from design to construction.

- **Embodied carbon is a growing consideration in new construction, and similar to operational GHG emissions, addressing embodied carbon emissions is likely more effective done at the new construction stage**

  While not part of the study scope, it should be noted that consideration for embodied carbon is growing in Canada, and if this becomes a relevant consideration for the Town of Banff, then additional work and effort would be required to understand potential impacts of alternative design selections that could have similar thermal performance but reducing embodied emissions.

5 Conclusion

To realize the ambitions of the Town of Banff's Renewable Energy Transition Roadmap, significant transformational change in the building sector is required. This analysis assessed potential strategies for new builds to achieve higher 2050 emission reductions goals for key building archetypes. Key takeaways from the work are summarized below:

- Achieving "mid Tier" performance (i.e. Tier 2 Performance under NECB 2020 and Tier 3 Performance under NBC AE: 2023) was observed to be possible for study archetypes for similar capital investment as the baseline Tier. By 2050, these mid Tier buildings would be operationally emissions neutral, which would be in directly alignment with the Town's goals. However, there will be operational cost trade offs in the form of increased utility costs, which may ultimately burden future occupants of the buildings. This finding aligns with data analyzed by the Emissions Neutral Building Exchange (ENBIX), which indicates that Calgary and Edmonton are trending towards greater energy efficiency in building practices. Currently, 44% to 48% of builders using the performance path in these cities were estimated to construct Part 9 buildings to Tier 2 standards[17].
- Focusing on cost effectiveness defined as only lowest upfront construction cost does not adequately incorporate other benefits of building to higher performance. Life-cycle cost and abatement rate are two complementary metrics to evaluate the cost effectiveness of investment into higher performance buildings. In most cases, the life-cycle cost differences over a 40-year period between the baseline and highest Tier (i.e. Tier 4 Performance under NECB 2020 and Tier 5 Performance under NBC AE: 2023) were comparable, which suggests relatively minor net increase in costs over the same long-term period.
- The incremental investment to achieve the highest Tiers is still significant and will continue to be a barrier to higher performance construction. The analysis generally demonstrates that higher performing buildings have a poor traditional business case (high incremental capital costs, negative net present value (i.e., energy savings do not payback incremental investment).
- Abatement rates to reduce greenhouse gas emissions are much more attractive for higher performing Tiers compared to abatement rates for retrofit projects that would achieve similar performance (i.e. retrofits are "more expensive" to reduce emissions than investing in higher performing buildings in the first place). To accelerate the voluntary development of higher performing buildings, the Town can help owners understand alternative metrics for creating a business case that include valuing the other metrics higher performing buildings can bring. For example, a recent Pembina report[18] proposes a paradigm shift of considering project values based on climate priorities such as deep energy efficiency and climate mitigation potential, climate adaptiveness, health and safety benefits and affordable heating and cooling costs. The report recommends using long-term, holistic metrics like illnesses and deaths prevented and energy returned to the grid. The

[17] https://www.enbix.ca/understanding-the-updates-to-albertas-building-Codes/
[18] https://www.pembina.org/reports/beyond-energy-efficiency.pdf.

Town can help drive change by encouraging owners to adopt climate- and equity-focused evaluation criteria for new projects.

- Regulatory changes will also help accelerate higher performance buildings. Accelerating high-performing buildings can be done at the provincial level, as provinces set minimum performance standards and municipalities cannot exceed them. While some provinces have published timelines for adopting higher Tiers, Alberta has yet to do so. Having the Town advocate for a clear schedule for Tier adoption remains important, even without formal regulations.
- The Town Can Play a key role to educate, support and catalyze change in the new building sector. To achieve its targets, the Town must actively promote and support accelerated change. Due to the operational costs of mid-Tier improvements and the higher capital costs of top performance Tiers, voluntary actions alone will likely be insufficient, and awareness efforts cannot cover these premiums. To encourage higher performance, coordinated action by the Town and its partners is essential, including sector-appropriate requirements and effective support measures. Table 43 summarises potential strategies for the Town of Banff. Examples of how other jurisdictions are supporting these action areas or how other organizations are recommending these actions be addressed by municipalities are also summarized.

Table 43: Opportunity Areas for the City of Banff to Accelerate Action and Address Cost Barriers

Levers for Action	Relevant Examples
Promote Owner Awareness of Benefits to Building to Higher Performance Tiers	
• *Collect Data to Drive Awareness* • *Communicate and Improve the Value of Higher Performance New Builds* • *Identify and Harness Opportunities to Influence Owner Decisions*	• Alberta EcoTrust's Emissions Neutral Building Information Exchange (ENBIX) (supported by City of Edmonton and City of Calgary) • Metro Vancouver's Zero Emissions Building Exchange (ZEBx) • CaGBC ZCB Case Studies • Similar Archetypal CAF related studies (occurring in Whistler, Manitoba and Yukon)
Provide Knowledge on Funding and Financing	
• *Help Owners Understand Potential Funding/Financing Mechanisms to Fund Additional Capital Requirements*	• RBC's Green Home Mortgage
Clearly Define Performance Expectations and Timing for the Broader Community	
• *Update the Renewable Energy Strategy to clearly outline aspirations for new buildings with respect to Tier performance*	• City of Whistler's Climate Change Strategy Big Move 4
• *Continue to Support Higher Performance through Voluntary means (guidance, support, performance incentives etc)*	• City of Calgary's Green Buildings Priority Stream Program and upcoming Sustainable Buildings Guide • City of Edmonton's Affordable Housing Sustainability Guidebook • City of Vancouver's Green Buildings, Higher Buildings, Low-Carbon Energy Systems, and Zero Emissions Building Catalyst policies
Continue to Remove Barriers	

Levers for Action	Relevant Examples
• *Advocate for transition to decarbonized electrical grid and continued installation of local renewable energy sources*	• The Green Energy Alliance's Guide for Municipalities • MCCAC's Community Renewable Energy Development Through Aggregation
• *Coordinate with Electrical Utilities and Regulatory Authorities to alleviate barriers for electrification strategies*	• BC Hydro's Distribution Extension Policy engagement • Hydro Ottawa's Electricity Load Capacity Map
• *Support Development of Strong Trades and Local Workforce*	• Canada Green Building Council's recent report Building Our Future: A Low-Carbon Training Strategy for the Trades outlines several industry-driven recommendations for accelerating trade development in the low carbon building sector. • Canada's Building Trades Union has released a climate-focused construction curriculum Building it Green

5.1 Next Steps & Future Work

While the study completed for the Town of Banff represents a robust set of work, the following items were raised as opportunities for future work:

- **Encourage/support builders with guidelines, information and programs specific to meeting higher performance Tiers**: Cost effective strategies examined included improving air infiltration, air source and ground source heat pump systems and high performance enclosure systems. The Town can help to accelerate change by developing bespoke guides or connecting builders, examples observed in other jurisdictions include:
    - City of Ottawa Geothermal Resourcing Study
    - Enbridge's Savings by Design program that supports builders to "de-risk" building higher performing buildings via free design expertise and financial incentives:
    - Pre-Drywall Blower Door Testing Incentives
- **Convene an Industry Working Group**: A Working Group represents a set of engaged building industry members willing to provide their time and insights to help the Town of Banff move towards its goals. The Town should consider convening a working group following the completion of this report to hold a deeper conversation on the types of policies, programs and/or other supports necessary to enable higher performance buildings. Regular touchpoints to seek guidance on and support for upcoming Town initiatives is also recommended.
- **Explore the next version of the NBC/NECB to align intents:** A next step for the Town, and other communities, may be to review the changes to the NECB and NBC to be released in 2025 in the context of this study and their broader goals. The new versions of the energy requirements may offer a more suitable reference point for voluntary standards, given the anticipated (eventual) transition at the provincial level to align and harmonize with these same documents. In general, the cycle of the code change can be slow. Municipalities like Banff are doing important work to bridge the gap between the ambitions of decarbonization that municipalities have and using the Code as the main tool to motivate action; a virtuous cycle that should continue through voluntary standards and incentive program alignment with future codes.
- **Acknowledge that progress is gradual**: The primary objective of this project is to initiate a dialogue regarding the advantages of higher performance buildings for Alberta mountain communities, as well as to

identify potential opportunities and challenges for owners, developers, occupants, and the broader community. This study does not serve as a prescriptive manual for builders, nor does it define a singular pathway to achieving enhanced building performance or specify exact costs. The outcomes and expenses associated with new construction are significantly affected by project-specific variables. Accordingly, this report aims to inform and support decision-making from the early stages of development through to the construction phase. Furthermore, the findings and conclusions outlined herein can be refined through active engagement with industry professionals and by benchmarking against real-world data.

Appendices

Appendix A – Methodology

This project was delivered following a phased approach as illustrated below.

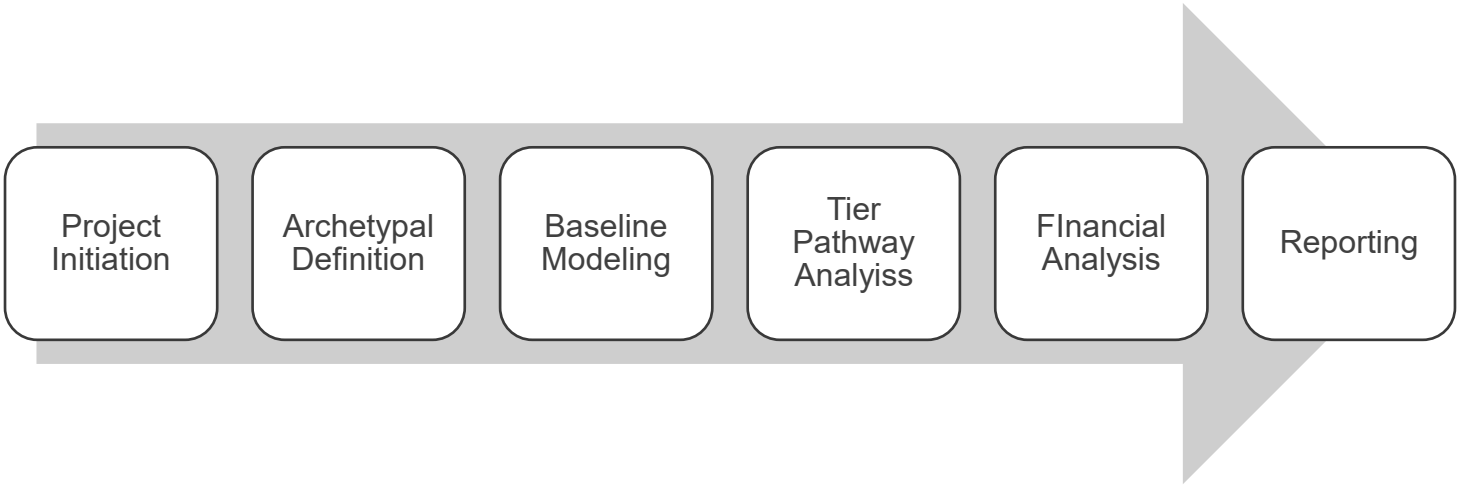

Figure 40: Project Key Milestones

A.1 Project Initiation

WSP met with Town of Banff to confirm the typical design characteristics of the identified archetypes and discuss the expected key project outcomes in terms of evaluation metrics and areas of focus. During this phase WSP confirmed a list of required documentation and data to be collected to begin the energy modelling task, such as existing architectural, mechanical and electrical drawing set and design specifications for selected existing buildings representative of each archetype.

At this stage, WSP also conducted a throughout review of the following building code documentation to familiarize with specific energy code design requirements associated to each energy Tier. Upcoming code changes scheduled to be enforced in 2025 were also part of our review.

- National Building Code Alberta Edition (NBC AE) – 2023 (current);
- National Energy Building Code (NECB) – 2020 (current);
- National Building Code Alberta Edition (NBC) – 2025 (upcoming);
- National Energy Building Code (NEBC) – 2025 (upcoming).

a result of our review, it was noted that upcoming changes in compliance requirements and reporting metrics might materially affect the design solutions needed to meet the new set of Tiered performance. As such, it was decided to extend the study to assess compliance of the design strategies proposed to meet the current code to the upcoming code changes.

A.2 Archetypal Definition

Upon a detailed review of the collected information and in review with local Subject Matter Experts in the field of building envelope and mechanical system design, WSP elaborated distinct design packages to reflect the performance levels associated with the baseline design Tier (Tier 1) for each archetype. For each package, the main energy consuming systems (envelope, lighting, plugs and process loads, HVAC distribution and energy plant) were described in terms of their expected technical performance levels and typical design characteristics. Cost-effectiveness and implementation challenges were also key factors considered in determining potential design strategies, as well as minimum design strategies and assumptions already carried by the current energy codes.

Individual systems selected were then discussed with the Town of Banff during our first workshop to confirm their suitability to represent the Town's building stock, meet specific local building requirements and discuss potential foreseeable implementation constraints. During this workshop, WSP also highlighted potential design strategies that would likely be considered to meet the upper design Tiers requirements.

A.3 Baseline Modeling

Following confirmation of the design strategies, WSP developed an hourly energy model for each of the selected building archetypes to assess the Tier 1 expected performance levels in terms of the reporting energy metrics. Compliance with the current version of the code was assessed by demonstrating a better energy performance over the development of a reference energy model created for each of the archetypes.

Results were issued to the Town in a tabular format to summarize archetypal modelling assumptions as well as final Tier 1 energy results by relevant metrics.

A.4 Tier Pathway analysis

Similarly to the previous step, a bundle of proposed design measures was developed for each Tier for all archetypes based on best design practices, internal consultations with subject matter experts and our extensive modelling experience.

Assumptions were presented and confirmed with Town of Banff during a second workshop hosted with the key stakeholders. Table 11, Table 16, Table 21, and Table 27 provide a detailed description of the final decarbonization measures confirmed during the workshop.

The presentation material was provided at the end of the workshop, as well as an excel result summary file.

A.5 Financial Analysis

Class C capital cost estimates were developed for each identified measure by our cost consultant A.W. Hooker and were used in our proprietary tool to determine the life-cycle cost analysis (LCCA) for each of the proposed

Tiers. Prior to commencing the analysis, life-cycle cost financial assumptions were confirmed with the Town, as well as other additional assumptions around financial sensitivity analysis and grid carbon emission projections.

Upon completion of the LCCA task, WSP hosted a final workshop with Town of Banff to present the financial results and discuss the implications of the design Tier packages selected on capital and operating costs. A

Measure level Class C estimates are provided in Appendix D, while a full list of LCCA assumptions is summarized in Appendix C.

A.6 Reporting

Upon completion of the financial analysis, WSP drafted a 60% project report of the work conducted for Town of Banff's review and comment. A final report integrating the received feedback and additional supporting technical material constituted our final project deliverable.

Appendix B – Energy Analysis

This appendix provides detailed energy results to supplement the highlights presented in the main report.

B.1 Archetype Modelling Assumptions

Table B-1 below summarises the primary massing features of each archetype. These features were derived from real-world examples provided by the Town.

Table B-1: Archetype Energy Model Features

Archetype	Floor Area (m^2)	Window Area (m^2)	Wall Area (m^2) [Opaque]	Wall + Window Area (m^2)	Storeys	Number of Dwelling Units
Fourplex	844	94	840	934	4 (including basement)	n/a
Garage	111	32	185	216	2	n/a
Apartment	2,135	234	935	1,169	3	36
Mixed-Use	2,370	312	897	1,209	3	24

Table B-2 below shows the GHG emission factors used in the study.

Table B-2: Emissions Factors

Year	Baseline Case Electricity Emission Factor (gCO_2e/kWh)[1]	Sensitivity Case Electricity Emission Factor (gCO_2e/kWh)[2]	Natural Gas Emission Factor (gCO_2e/kWh)[3]
2025	271	271	190
2026	236	271	190
2027	210	271	190
2028	173	271	190
2029	167	271	190
2030	174	271	190
2031	172	271	190
2032	165	271	190
2033	159	271	190
2034	155	271	190
2035	152	271	190
2036	147	271	190

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Year	Baseline Case Electricity Emission Factor (gCO_2e/kWh)[1]	Sensitivity Case Electricity Emission Factor (gCO_2e/kWh)[2]	Natural Gas Emission Factor (gCO_2e/kWh)[3]
2037	144	271	190
2038	143	271	190
2039	137	271	190
2040	120	271	190
2041	100	271	190
2042	90	271	190
2043	80	271	190
2044	70	271	190
2045	60	271	190
2046	50	271	190
2047	40	271	190
2048	30	271	190
2049	15	271	190
2050	0	271	190
2051	0	271	190
2052	0	271	190
2053	0	271	190
2054	0	271	190
2055	0	271	190
2056	0	271	190
2057	0	271	190
2058	0	271	190
2059	0	271	190
2060	0	271	190
2061	0	271	190
2062	0	271	190
2063	0	271	190
2064	0	271	190
2065	0	0	190

Sources:
1. Baseline: ECCC EF Projection (2024-2050, assumed 0 after 2050)
2. Sensitivities: ECCC EF Projection (2024)
3. Natural Gas: National Inventory Report (NIR)

Table B-3 below details the energy rates used to calculate annual energy costs used in the life-cycle cost analysis. All other financial assumptions are provided in Appendix C.1 Financial Analysis Assumptions.

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Table B-3: Utility Rate Summary

Utility	Total Variable Fee	Total Fixed Fee ($/y)	Demand Charge ($/kW/day)
Part 3			
Electricity	$30.50/GJ	$688/y	$0.39/kW/day (system usage charge) $0.27/kW/day (total capacity and local charges)
Natural Gas	$7.70/GJ	$955/y	n/a
Part 9			
Electricity	$50.10/GJ	$552/y	n/a
Natural Gas	$7.92/GJ	$428/y	n/a

B.2 Archetype Energy Modelling Results

The results in Table B-4 to B-9 summarize the main energy and carbon metrics for each archetype for each Tier.

Results by Archetype

Table B-4: Fourplex Archetype Results

Metric	Tier 1	Tier 3	Tier 5
Electricity EUI_{adj} ($kWh/m^2/y$)	84	68	35
Natural Gas EUI_{adj} ($kWh/m^2/y$)	108	94	0
EUI_{adj} ($kWh/m^2/y$)	192	162	35
Heat Loss Intensity ($kWh/m^2/y$)	159	141	97
TEUI ($kWh/m^2/y$)	224	193	67
TEDI ($kWh/m^2/y$)	162	136	60
Electricity Peak Demand (W/m^2)	23	19	17
Year 2025 GHGI ($kgCO_2e/m^2/y$)	30	26	5

Table B-5: Garage Suite Archetype Results

Metric	Tier 1	Tier 3	Tier 5
Electricity EUI_{adj} ($kWh/m^2/y$)	46	92	40
Natural Gas EUI_{adj} ($kWh/m^2/y$)	117	5	0

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Metric	Tier 1	Tier 3	Tier 5
EUI_{adj} (kWh/m²/y)	163	97	40
Heat Loss Intensity (kWh/m²/y)	149	136	89
TEUI (kWh/m²/y)	224	158	100
TEDI (kWh/m²/y)	122	104	48
Electricity Peak Demand (W/m²)	28	36	24
Year 2025 GHGI ($kgCO_2e/m^2/y$)	31	13	8

Table B-6: Apartment Archetype Results – NECB 2020

Metric	Tier 1	Tier 2	Tier 4
Electricity EUI (kWh/m²/y)	82	129	69 (Including PV)
Natural Gas EUI (kWh/m²/y)	148	0	0
TEUI (kWh/m²/y)	230	129	69
TEDI (kWh/m²/y)	77	58	32
Electricity Peak Demand (W/m²)	22	81	25
Year 2025 GHGI ($kgCO_2e/m^2/y$)	35	10	5

Table B-7: Apartment Archetype Results – NECB 2025 Proposed Code Update

Metric	Tier 1	Tier 2	Tier 4
Electricity EUI (kWh/m²/y)	82	129	90 (Including PV)
Natural Gas EUI (kWh/m²/y)	140	0	0
TEUI (kWh/m²/y)	222	129	90
TEDI (kWh/m²/y)	77	61	32
Electricity Peak Demand (W/m²)	22	81	25
Year 2025 GHGI ($kgCO_2e/m^2/y$)	33	10	7

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Table B-8: Mixed-Use Archetype Results – NECB 2020

Metric	Tier 1	Tier 2	Tier 4
Electricity EUI (kWh/m²)	91	120	69 (Including PV)
Natural Gas EUI (kWh/m²)	144	0	0
TEUI (kWh/m²)	235	120	69
TEDI (kWh/m²)	70	41	12
Electricity Peak Demand (W/m²)	22	65	23
Year 2025 GHGI (kgCO_2e/m²)	35	10	6

Table B-9: Mixed-Use Archetype Results – NECB 2025 Proposed Code Update

Metric	Tier 1	Tier 2	Tier 4
Electricity EUI (kWh/m²)	88	120	81 (including PV)
Natural Gas EUI (kWh/m²)	116	0	0
TEUI (kWh/m²)	204	120	81
TEDI (kWh/m²)	55	41	12
Electricity Peak Demand (W/m²)	21	65	23
Year 2025 GHGI (kgCO_2e/m²)	30	10	6

Appendix C – Financial Analysis

This section provides additional financial performance results of the proposed design packages. Specifically, the charts summarize the main life-cycle financial performance metrics for all packages/archetypes, as well as a 40-year projection of associated carbon emissions, cashflow, and operational costs.

For each archetype a main table presents the capital, operational, and life-cycle costs associated to all Tiers, as well as the incremental abatement rate. The figures following illustrate the expected carbon emission projection and end-use breakdown for each of the proposed packages over the study period, as well as the associated implementation cashflow and operational cost savings. Note that the cashflow chart is meant to represent the initial and recurring capital expenditures for the design package energy measures (negative costs), as well as associated operational cost savings. Equipment residual value is also factored into this analysis and is usually represented as a positive value at the end of the study period.

The operational savings chart offers a visual representation of the yearly energy cost savings offered by the package when compared to the baseline scenario (Tier 1). Note that in some cases, where the package results in an increased yearly energy costs, the chart shows negative values.

Assumptions related to the life-cycle cost analysis conducted for the baseline scenario as well as the sensitivity analysis presented in Section 3.5 are summarized in Table C-1 below.

C.1 Financial Analysis Assumptions

Table C-1: Key Study Financial Assumptions

	Baseline Analysis	Sensitivity 1	Sensitivity 2	Sensitivity 3	Sensitivity 4	Sensitivity 5
Inflation[19]	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Capital Cost Escalation	2.0%	Assume ECMs Capital Costs Increase by 25% (in 2025 Dollars)	2.0%	2.0%	2.0%	2.0%
Discount Rate	5.2%	5.2%	5.2%	5.2%	8.0%	5.2%
Study Period	40 years	40 years	40 years	40 years	40 years	40 years
Electricity Costs, Part 3 ($2025)	Variable: $30.50/GJ Fixed: $688/suite/y Demand/System Charges: $0.39/kW/day	Variable: $30.50/GJ Fixed: $688/suite/y Demand/System Charges: $0.39/kW/day	Variable: $30.50/GJ Fixed: $688/suite/y Demand/System Charges: $0.39/kW/day	Variable: $30.50/GJ Fixed: $688/suite/y Demand/System Charges: $0.39/kW/day	Variable: $30.50/GJ Fixed: $688/suite/y Demand/System Charges: $0.39/kW/day	Variable: $30.50/GJ Fixed: $688/suite/y Demand/System Charges: $0.39/kW/day

[19] Inflation refers to the rate at which the general level of prices for goods and services rises each year.

APPENDIX C

	Baseline Analysis	Sensitivity 1	Sensitivity 2	Sensitivity 3	Sensitivity 4	Sensitivity 5
	Demand/Local Charges: $0.27/kW/day	Demand/Local Charges: $0.27/kW/day	Demand/Local Charges: $0.27/kW/day	Demand/Local Charges: $0.27/kW/day	Demand/Local Charges: $0.27/kW/day	Demand/Local Charges: $0.27/kW/day
Electricity Costs, Part 9 ($2025)	Variable: $50/GJ Fixed: $552/y	Variable: $50/GJ Fixed: $552/y	Variable: $50/GJ Fixed: $552/y	Variable: $50/GJ Fixed: $552/y	Variable: $50/GJ Fixed: $552/y	Variable: $50/GJ Fixed: $552/y
Fossil Fuel Cost, Part 3 ($2025)	Variable: $7.67/GJ Fixed: $955/y	Variable: $7.67/GJ Fixed: $955/y	Variable: $7.67/GJ Fixed: $955/y	Variable: $7.67/GJ Fixed: $955/y	Variable: $7.67/GJ Fixed: $955/y	Variable: $7.67/GJ Fixed: $955/y
Fossil Fuel Cost, Part 9 ($2025)	Variable: $7.92/GJ Fixed: $428/y	Variable: $7.92/GJ	Variable: $7.92/GJ	Variable: $7.92/GJ	Variable: $7.92/GJ	Variable: $7.92/GJ
Energy Rate Cost Escalation	2.0%	2.0%	5.0%	2.0%	2.0%	2.0%
Price of Carbon	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded
Taxes (e.g. HST/GST)	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded
Maintenance Cost Changes	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded
Residual Value	Included	Excluded	Excluded	Excluded	Excluded	Excluded
PPA/RNG Procurement	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded
Peak Electricity Demand	As modelled	As modelled	As modelled	As modelled	As modelled	Assume a decrease of Monthly Electricity Demand by 25%
Emissions Factors	Refer to Appendix B, Table B-2: Emission factors (Baseline Case)	Refer to Appendix B, Table B-2: Emission factors (Baseline Case)	Refer to Appendix B, Table B-2: Emission factors (Baseline Case)	Refer to Appendix B, Table B-2: Emission factors (Sensitivity Case)	Refer to Appendix B, Table B-2: Emission factors (Baseline Case)	Refer to Appendix B, Table B-2: Emission factors (Baseline Case)

Table C-2: Measure Category Service Life Assumptions

Archetype	Enclosure Systems	HVAC Plant	HVAC Delivery	HVAC Piping and Ducting	PV	Geothermal Plant	All Other
Fourplex	30 Years	15 Years	15 Years	15 Years	-	50 Years	-
Garage Suite	30 Years	15 Years	15 Years	15 Years	-	50 Years	-
Apartment	30 Years	25 Years	20 Years	40 Years	25 Years	60 Years	40 Years
Mixed-Use	30 Years	25 Years	20 Years	40 Years	25 Years	60 Years	40 Years

APPENDIX C

C.2 Geo-Exchange Assumptions

The assumptions for the design and costing the geo-exchange measures included in the higher-level Tiers for each of the archetypes were developed through past project experience, discussions with geo-exchange contractors in the province of Alberta, hydrogeology subject matter experts, and A.W. Hooker.

The number of boreholes were estimated using a rule-of-thumb 2 tons of peak heating/cooling per 500 ft borehole. This was linearly adjusted to 8.4 kW per 600 ft borehole for the Part 3 buildings and 5.6 kW 400 borehole for the Part 9 buildings. The peak heating/cooling from the modeling results was used to calculate the total number of boreholes, as shown in Table C-3 below. It was noted by the Town that installations may try to limit drilling depth to 150m (~492ft) to avoid potentially needing a provincial well license from the Alberta Energy Regulator. The implications of this consideration on cost estimates is discussed in the sensitivity analysis section.

Table C-3: Geo-Exchange Borehole Calculations

Archetype	Code Compliance Level	Borehole Depth (ft)	Heating / Cooling Capacity (kW) per Borehole	Max of Modeled Peak Heating / Cooling (kW)	# Boreholes Required
Fourplex	Tier 5	400	5.6	25	**5**
Garage Suite	Tier 5	400	5.6	4	**1**
Apartment	Tier 4	600	8.4	101	**12**
Mixed-Use	Tier 4	600	8.4	76	**10**

Through discussions with the project team, including a geo-exchange contractor with experience drilling boreholes in Edmonton and Calgary, it was estimated that field plus tie-in costs for 400 ft boreholes would range from about $12,000 to $15,000 per borehole for the Edmonton area. Adding a premium for drilling in Banff, A.W. Hooker estimated $17,000 per borehole for the Part 9 buildings and $23,000 per borehole for the Part 3 buildings. The Town of Banff on a recent project received estimates of $30,000-$36,000 per borehole. The following assumptions were used in the discussions to reach the cost estimates:

Site Assumptions:

- The area is in an alluvial valley with typically silts/sands gravel and cobbles in the overburden
- Bedrock is as shallow as 25 meters-below-grade and is assumed to be limestone/dolostone
- Water level is roughly between 1.5 to 4 metres below grade
- Drilling projects in National Parks may be subject to additional environmental mitigations that could increase costs

APPENDIX C

Borehole Field Assumptions:

- 6 in. vertical boreholes, 30 ft. spacing
- Single-circuit U-tube, 1 in. pipe
- Water and propyl glycol mix
- Boreholes installed below building

APPENDIX C

C.3 Archetype Financial Modelling Results

Fourplex

Table C-4: Fourplex Archetype Results

	Tier 1	Tier 3	Tier 5
Capital Cost ($2025/m²)	$2,347	$2,357	$2,697
Total Building Capital Cost ($2025/m²)	$5,719	$5,726	$6,069
Total Energy Cost ($2025/m²)	$29	$25	$15
Life-Cycle Cost ($M)	$3.0	$2.9	$2.8
Incremental Abatement Rate ($2025/Tonne)	-	-$426	-$250

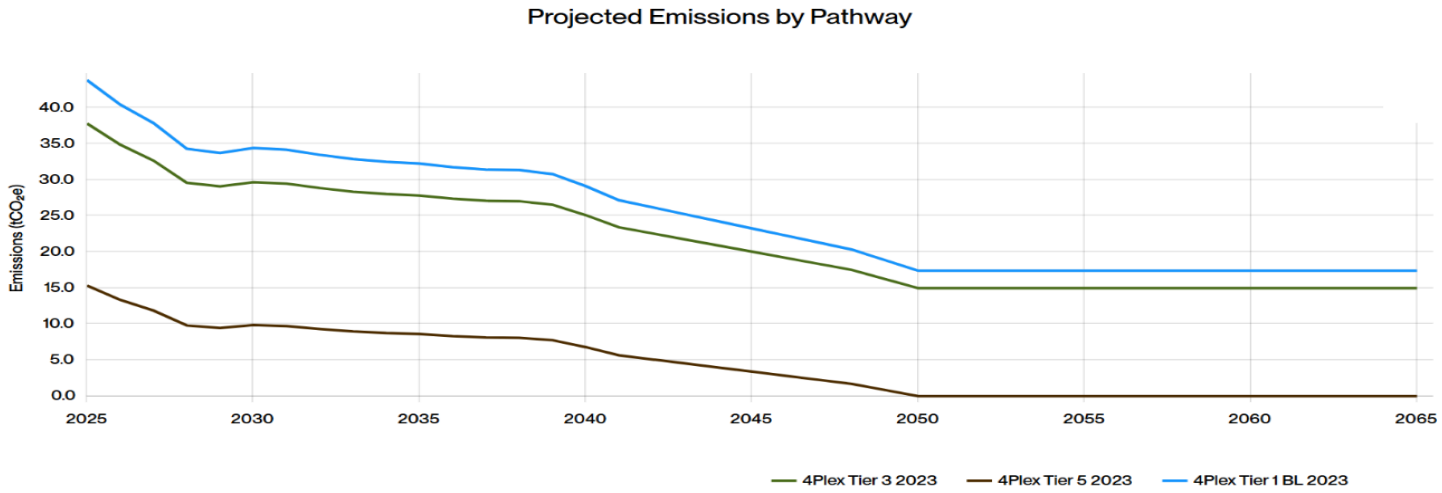

Figure C-1: Fourplex Emission Projection Over Time – All Tiers

APPENDIX C

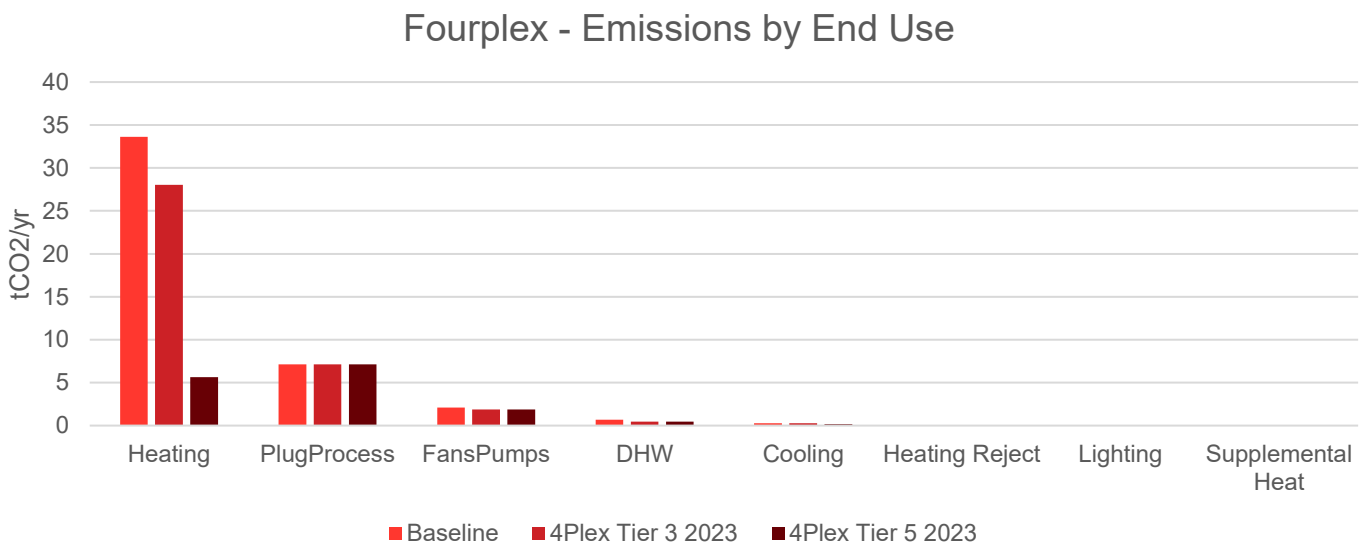

Figure C-2: Fourplex End-Use Breakdown Chart – All Tiers

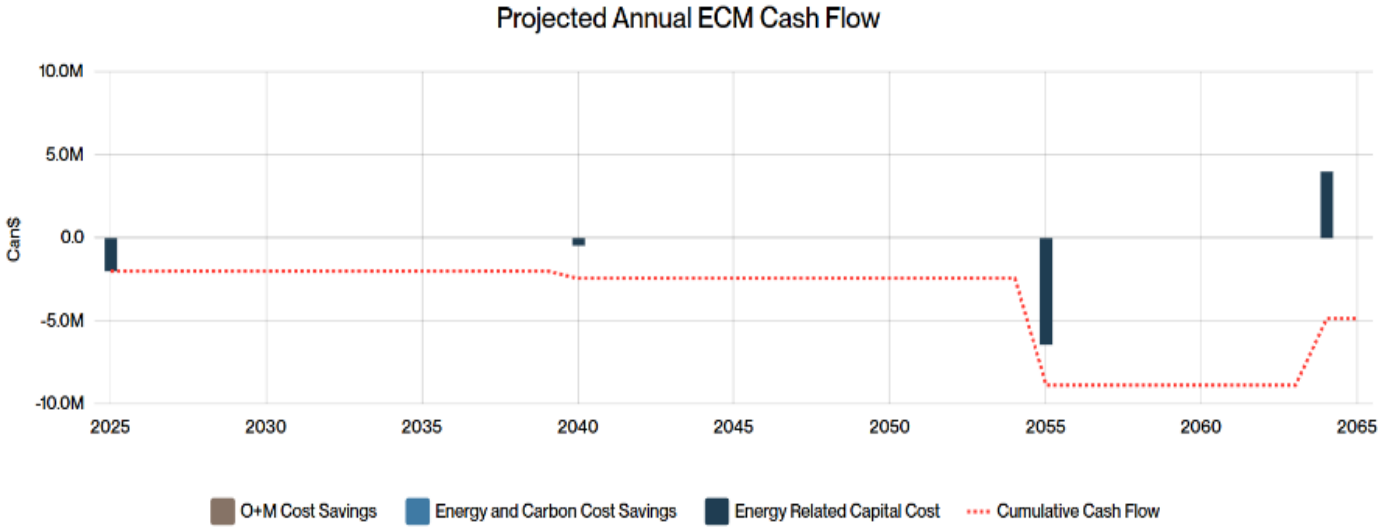

Figure C-3: Fourplex Cash Flow Chart – Tier 1

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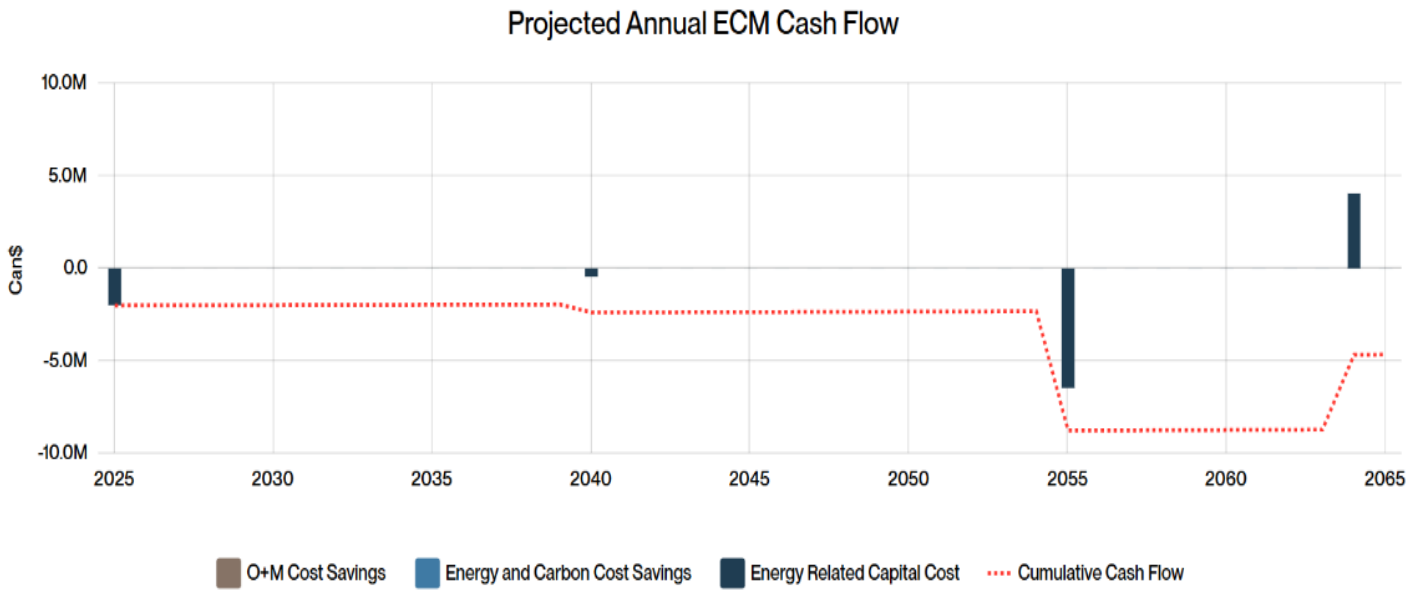

Figure C-4: Fourplex Cash Flow Chart – Tier 3

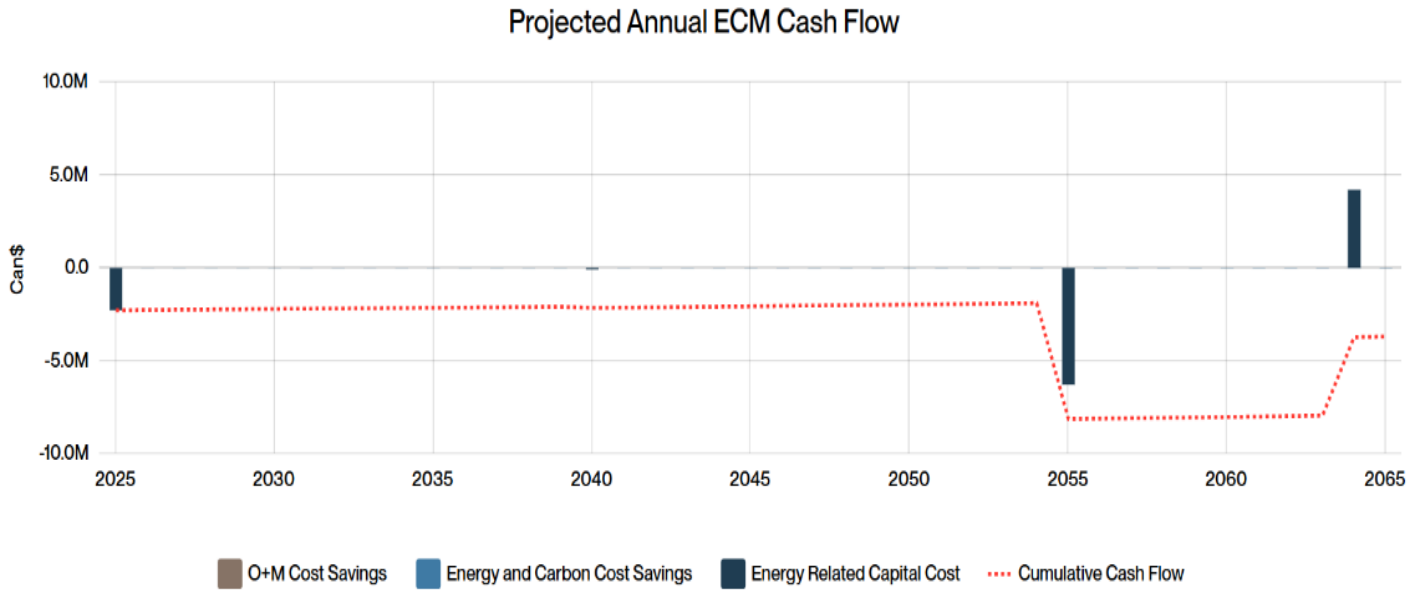

Figure C-5: Fourplex Cash Flow Chart – Tier 5

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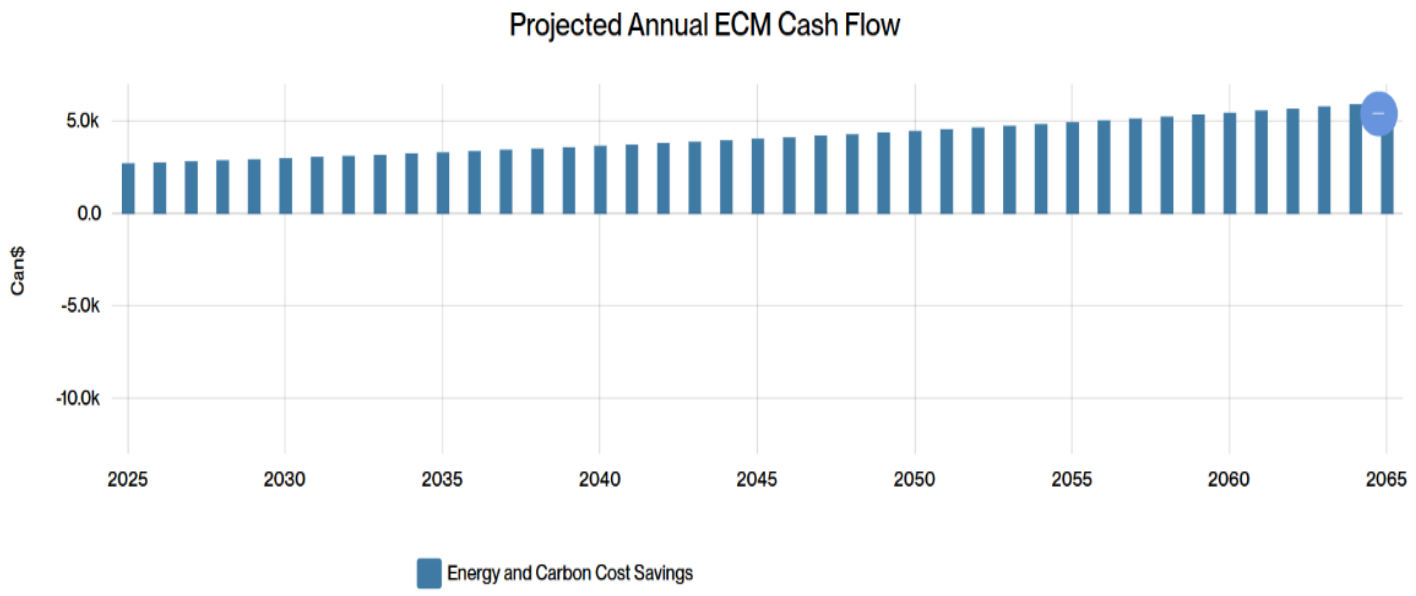

Figure C-6: Fourplex Operational Cost Savings – Tier 3

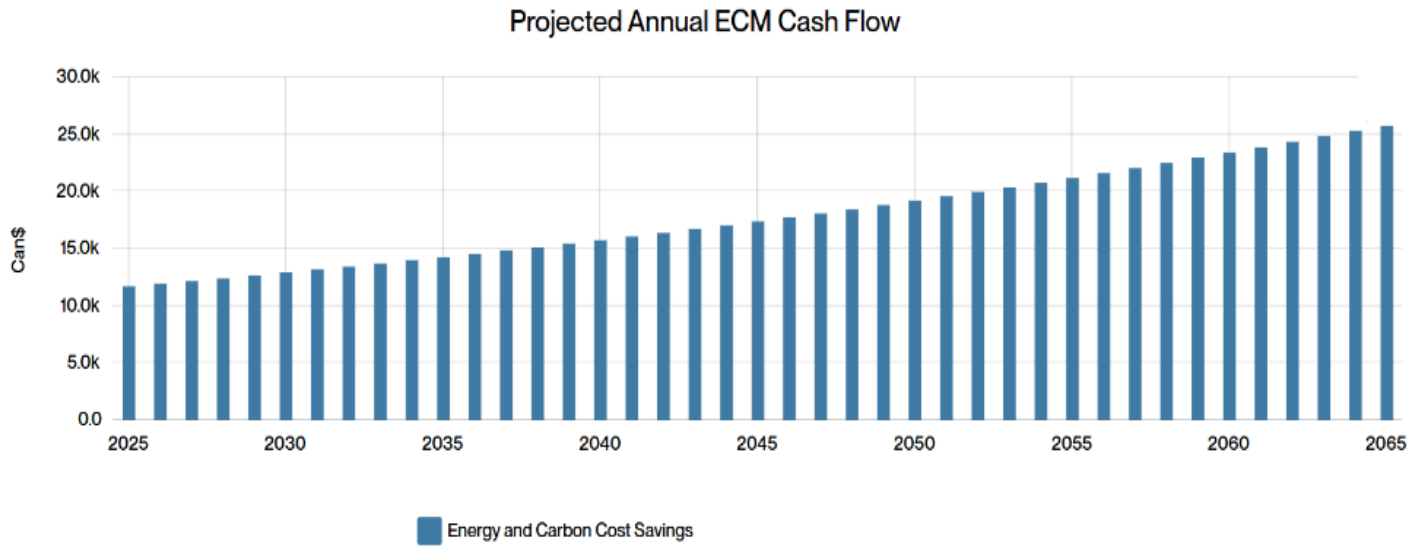

Figure C-7: Fourplex Operational Cost Savings – Tier 5

APPENDIX C

Garage Suite

Table C-5: Garage Suite Archetype Results

	Tier 1	Tier 3	Tier 5
Capital Cost ($2025/m²)	$3,564	$3,621	$4,383
Total Building Capital Cost ($2025/m²)	$7,615	$7,672	$8,434
Total Energy Cost ($2025/m²)	$31	$37	$23
Life-Cycle Cost ($M)	$0.62	$0.64	$0.64
Incremental Abatement Rate ($2025/Tonne)	-	$247	$178

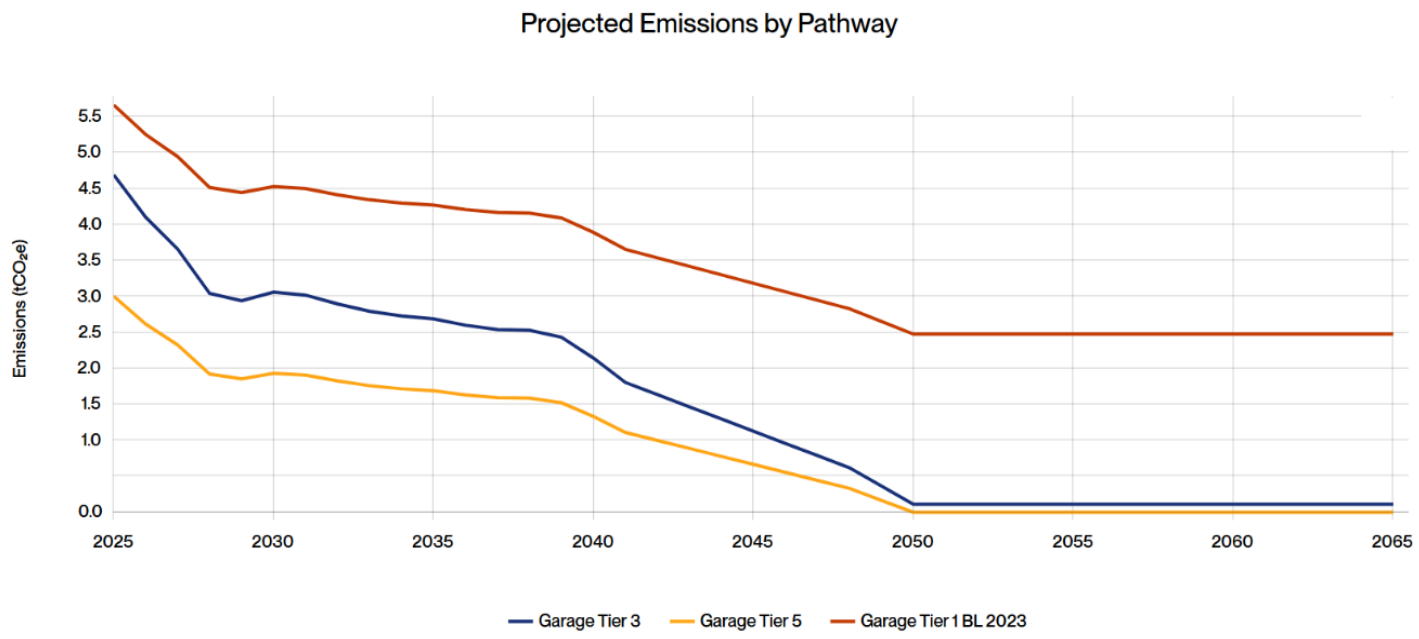

Figure C-8: Garage Suite Emission Projection Over Time – All Tiers

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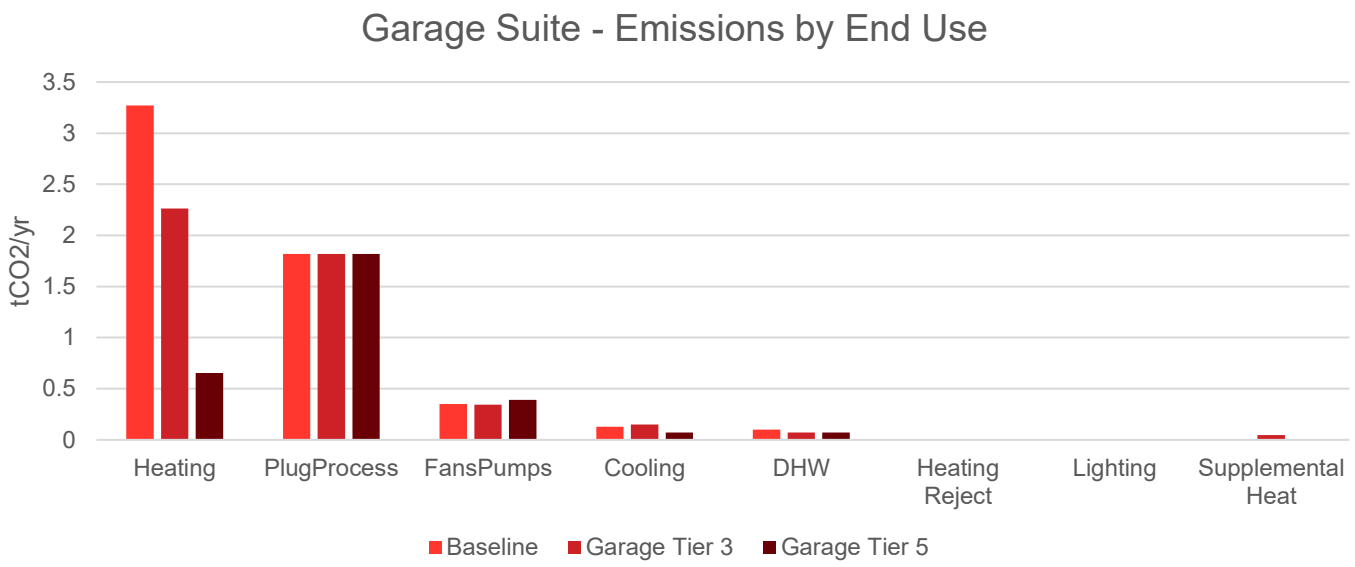

Figure C-9: Garage Suite End-Use Breakdown Chart – All Tiers

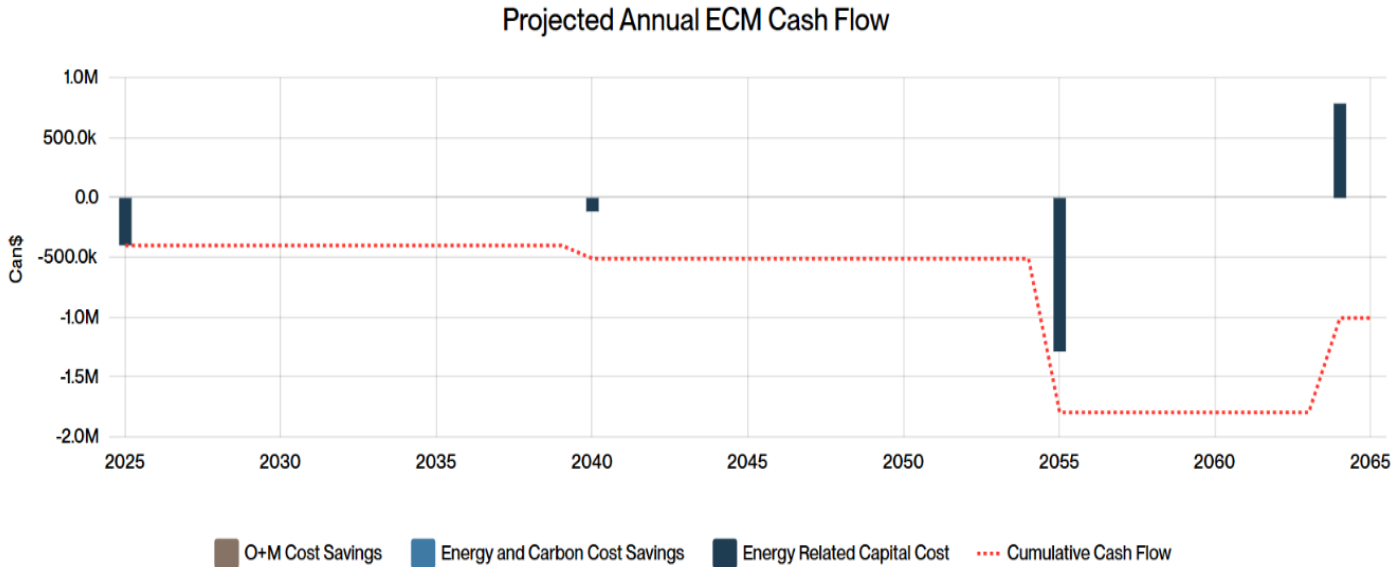

Figure C-10: Garage Suite Cash Flow Chart – Tier 1

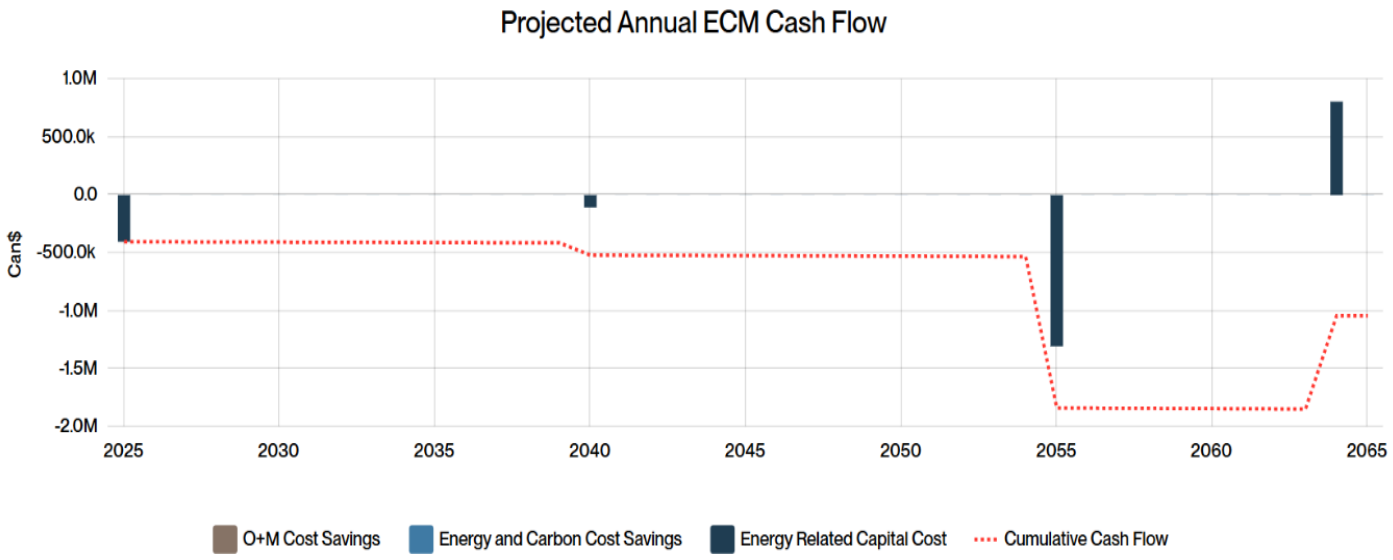

Figure C-11: Garage Suite Cash Flow Chart – Tier 3

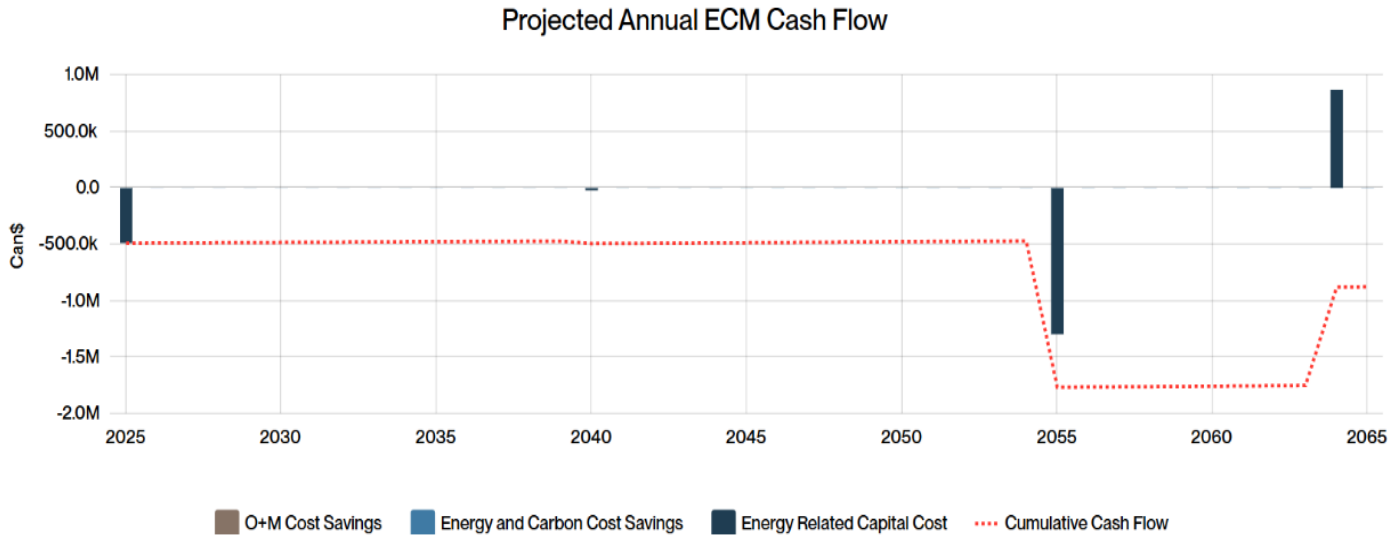

Figure C-12: Garage Suite Cash Flow Chart – Tier 5

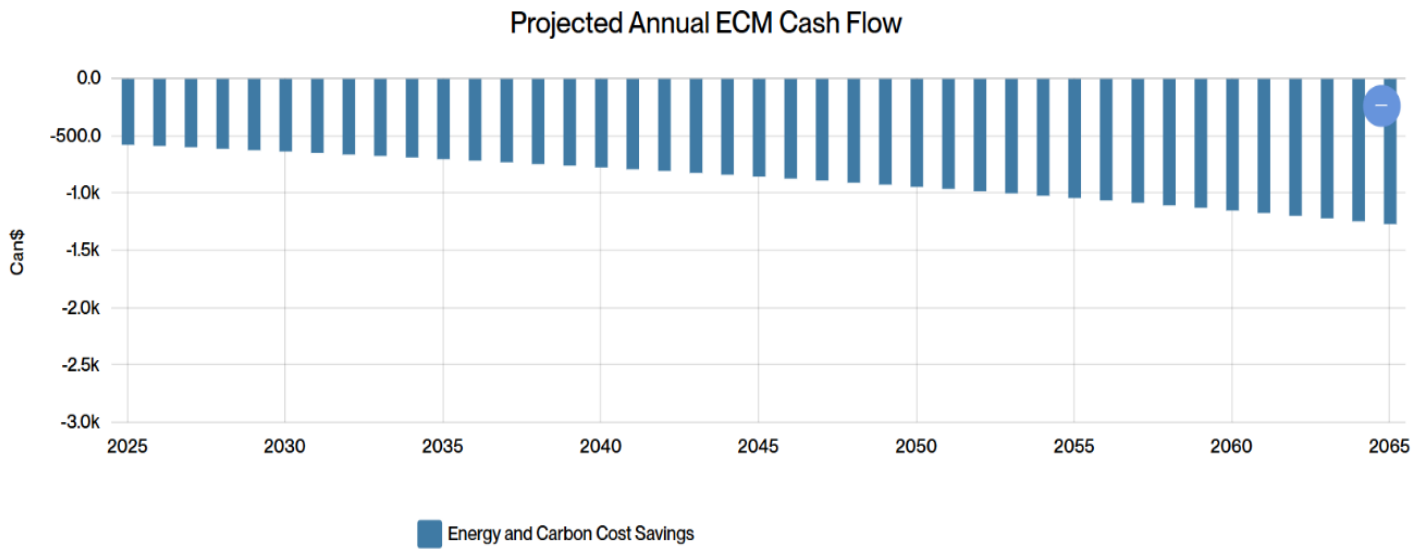

Figure C-13: Garage Suite Operational Cost Savings – Tier 3

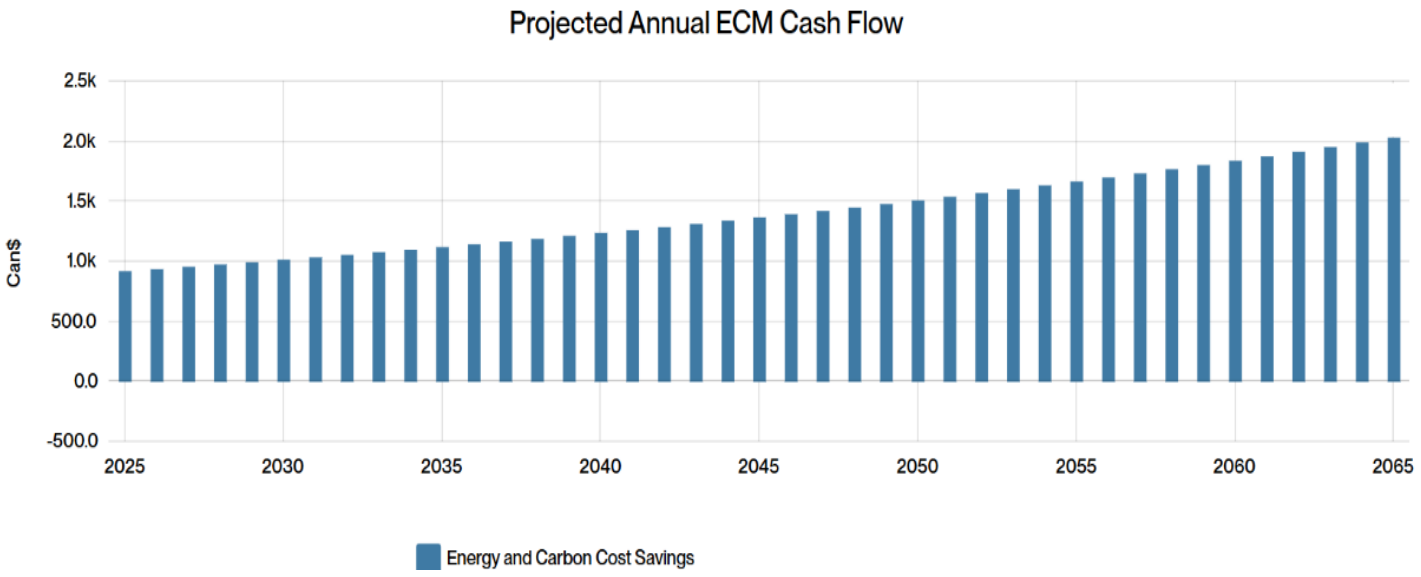

Figure C-14: Garage Suite Operational Cost Savings – Tier 5

APPENDIX C

Apartment

Table C-6: Apartment Archetype Results

	Tier 1	Tier 3	Tier 5
Capital Cost ($2025/m²)	$2,654	$2,637	$3,246
Total Building Capital Cost ($2025/m²)	$7,958	$7,942	$8,551
Total Energy Cost ($2025/m²)	$30	$39	$24
Life-Cycle Cost ($M)	$7.82	$8.4	$9.26
Incremental Abatement Rate ($2025/Tonne)	-	$277	$573

Table C-7: Apartment Archetype Results – NECB 2025 Proposed Update

	Tier 1	Tier 3	Tier 5
Capital Cost ($2025/m²)	$2,675	$2,637	$3,148
Total Building Capital Cost ($2025/m²)	$7,980	$7,942	$8,453
Total Energy Cost ($2025/m²)	$29	$39	$28
Life-Cycle Cost ($M)	$7.88	$8.4	$9.12
Incremental Abatement Rate ($2025/Tonne)	-	$266	$584

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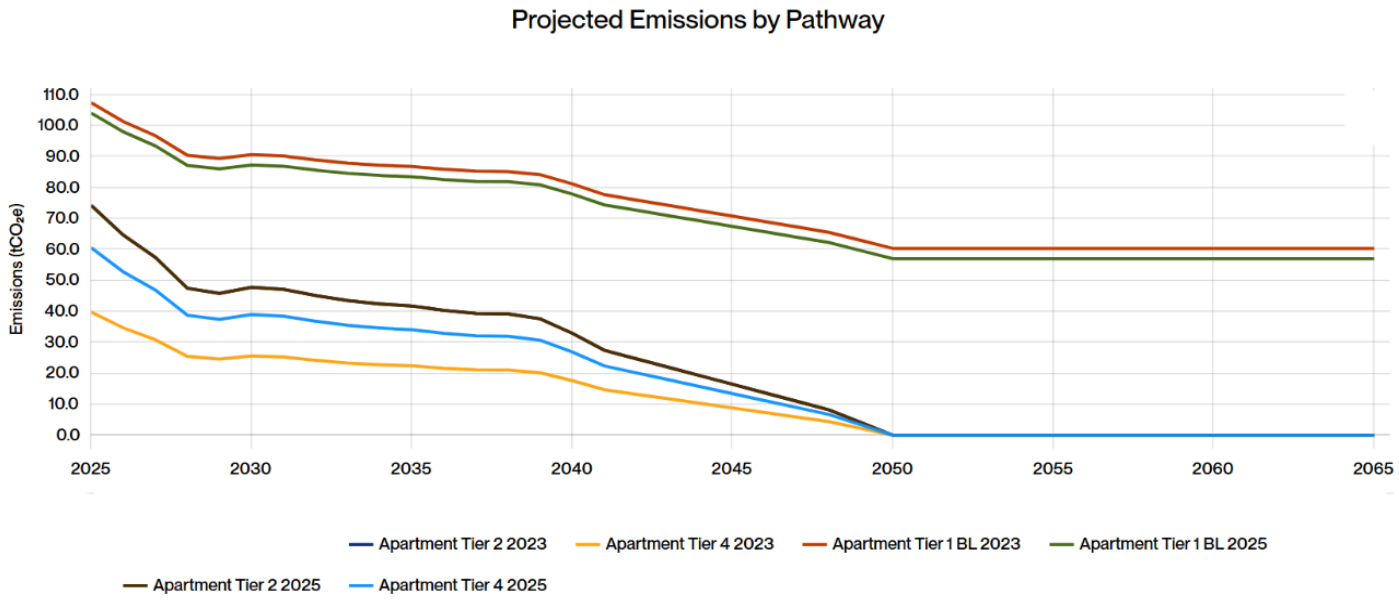

Figure C-15: Apartment Emission Projection Over Time – All Tiers

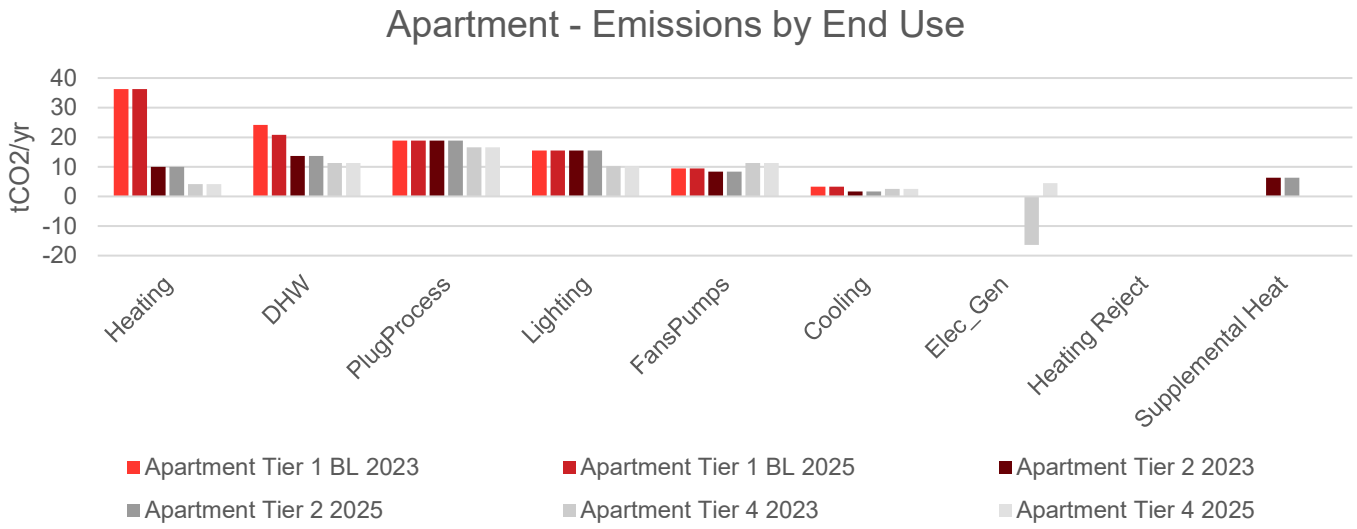

Figure C-16: Apartment End-Use Breakdown Chart – All Tiers

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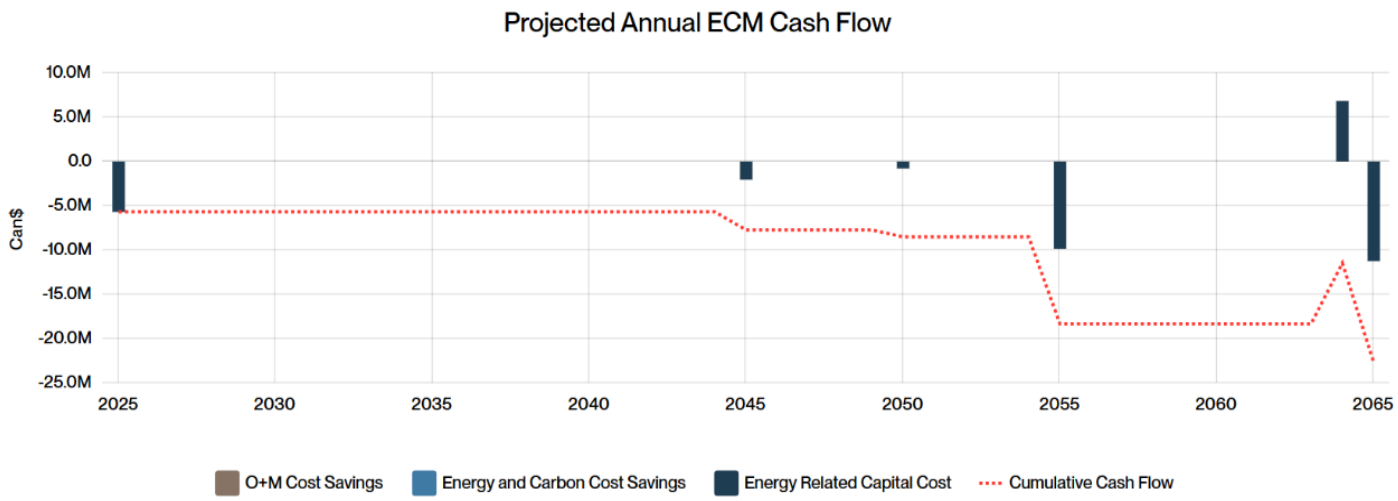

Figure C-17: Apartment Cash Flow Chart – Tier 1 2020

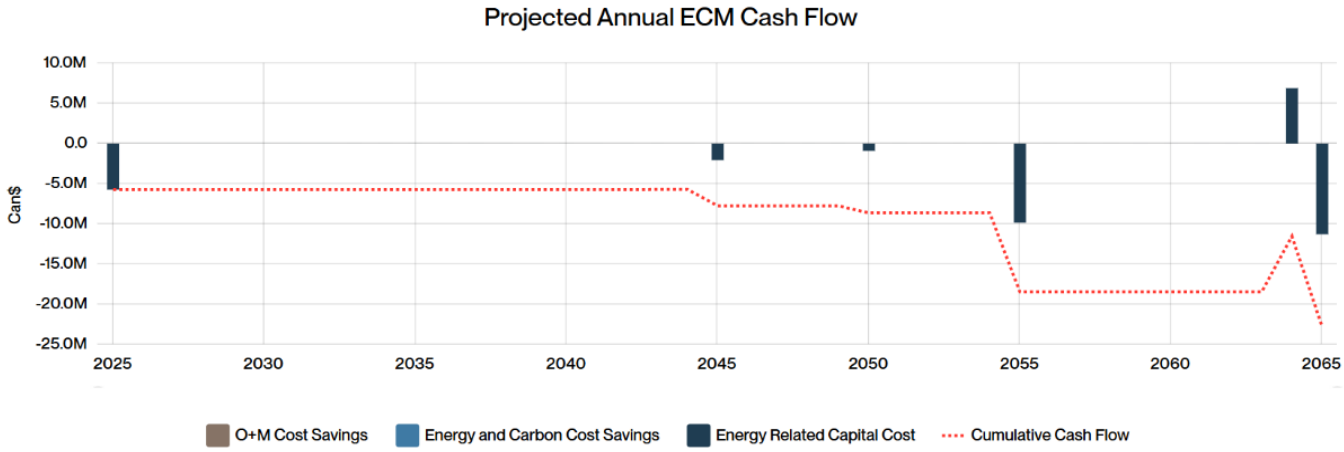

Figure C-18: Apartment Cash Flow Chart – Tier 1 2025

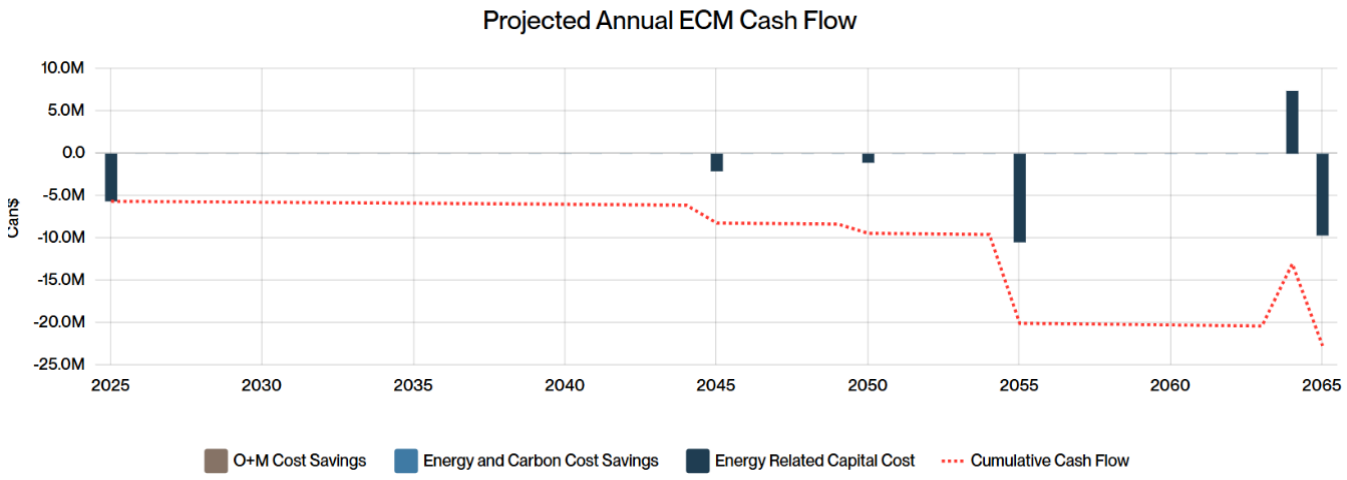

Figure C-19: Apartment Cash Flow Chart – Tier 2 2020

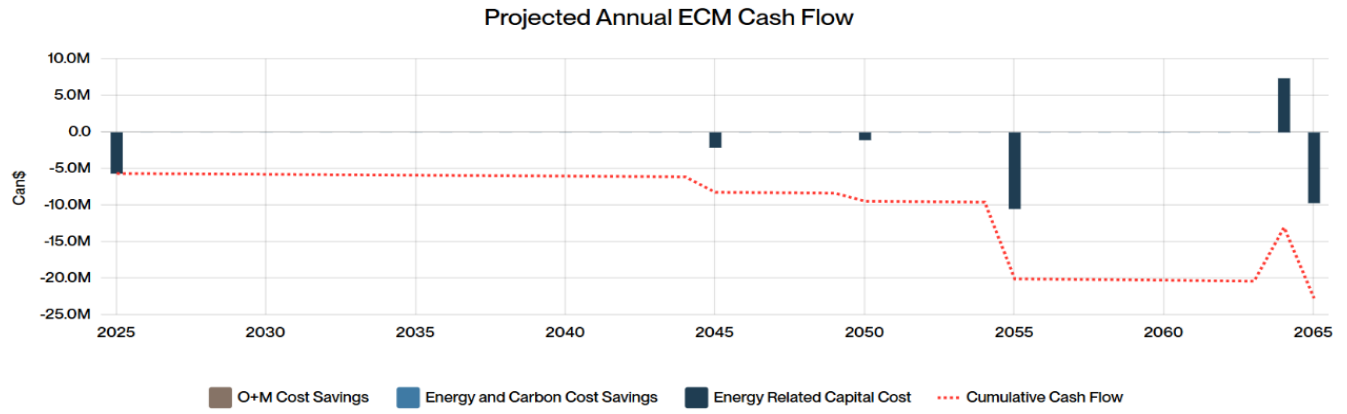

Figure C-20: Apartment Cash Flow Chart – Tier 2 2025

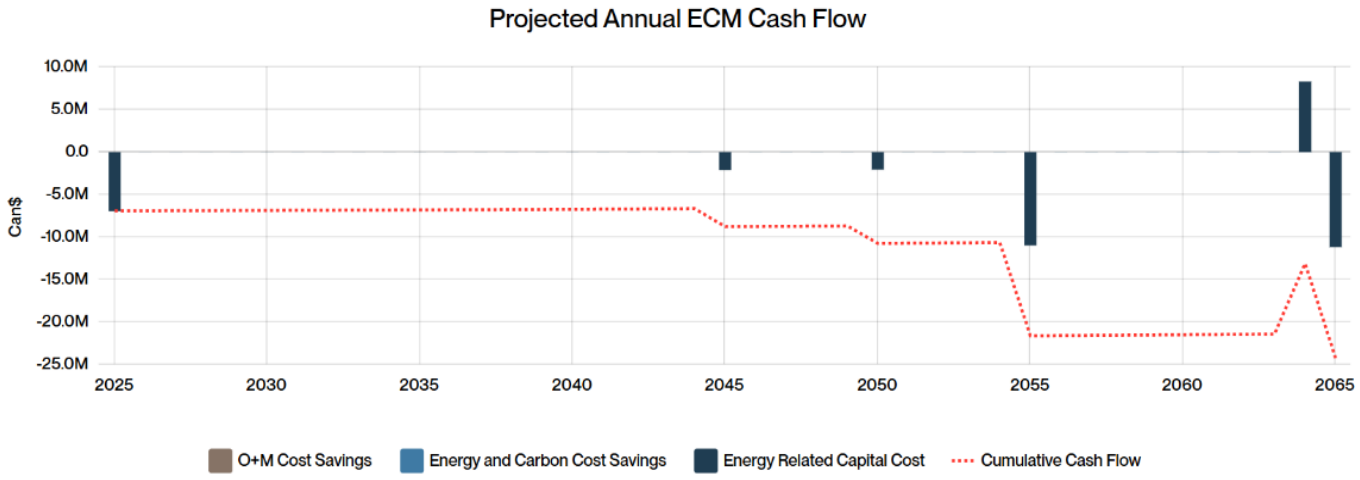

Figure C-21: Apartment Cash Flow Chart – Tier 4 2020

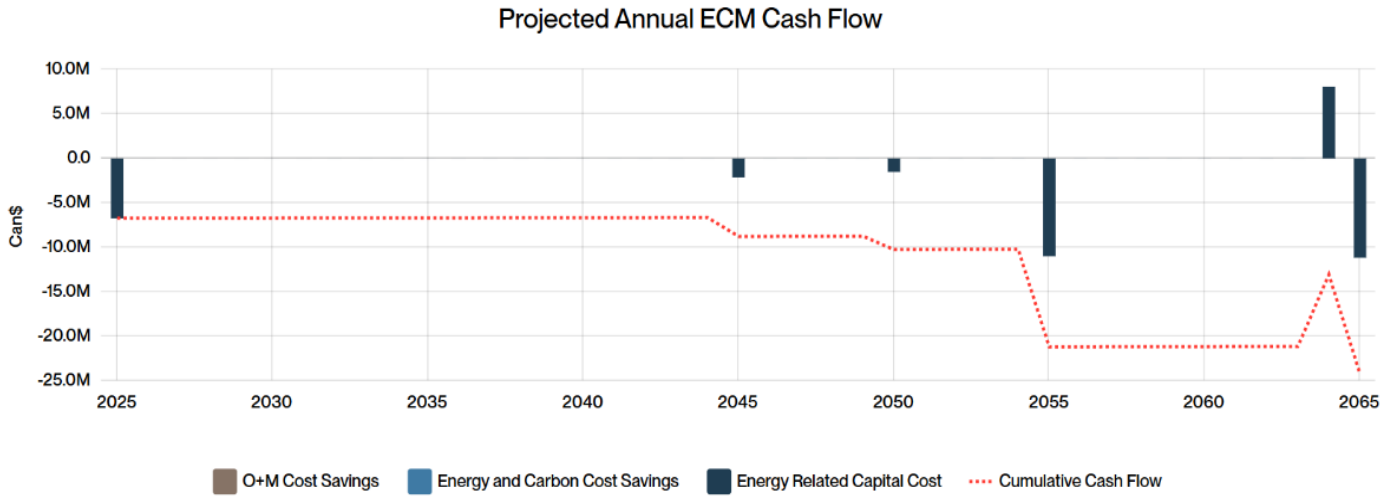

Figure C-22: Apartment Cash Flow Chart – Tier 4 2025

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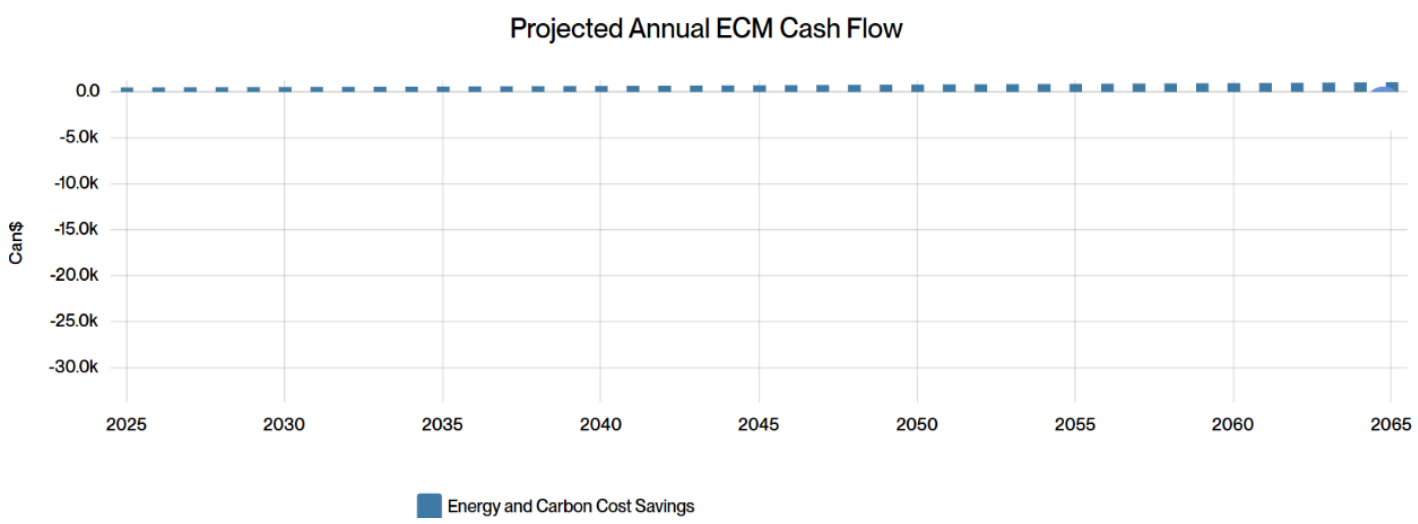

Figure C-23: Apartment Operational Cost Savings – Tier 1 2025

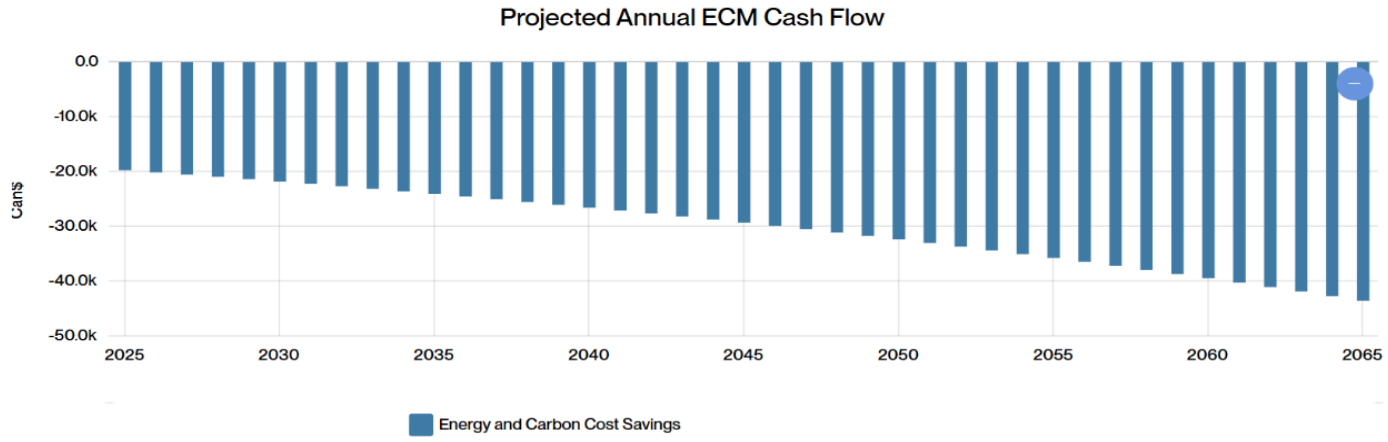

Figure C-24: Apartment Operational Cost Savings – Tier 2 2020

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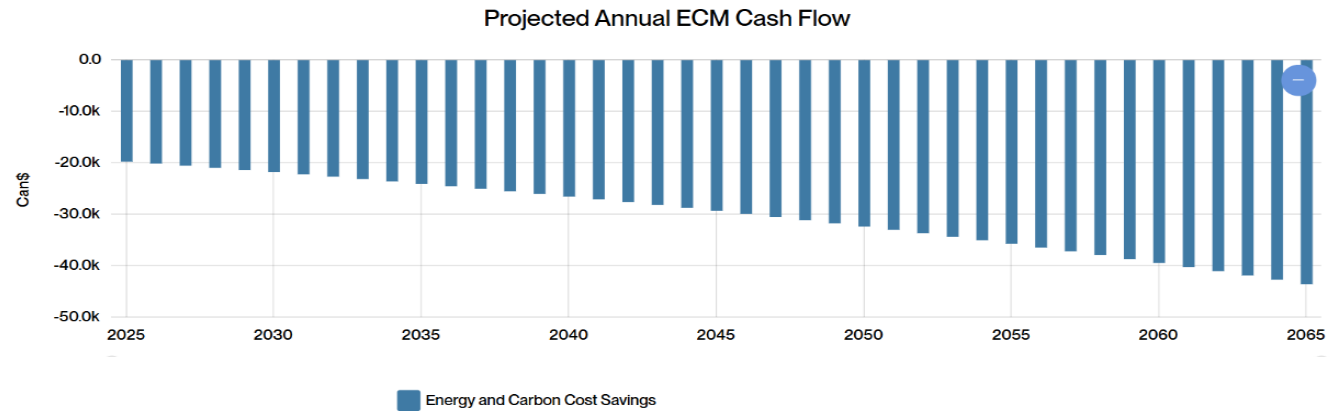

Figure C-25: Apartment Operational Cost Savings – Tier 2 2025

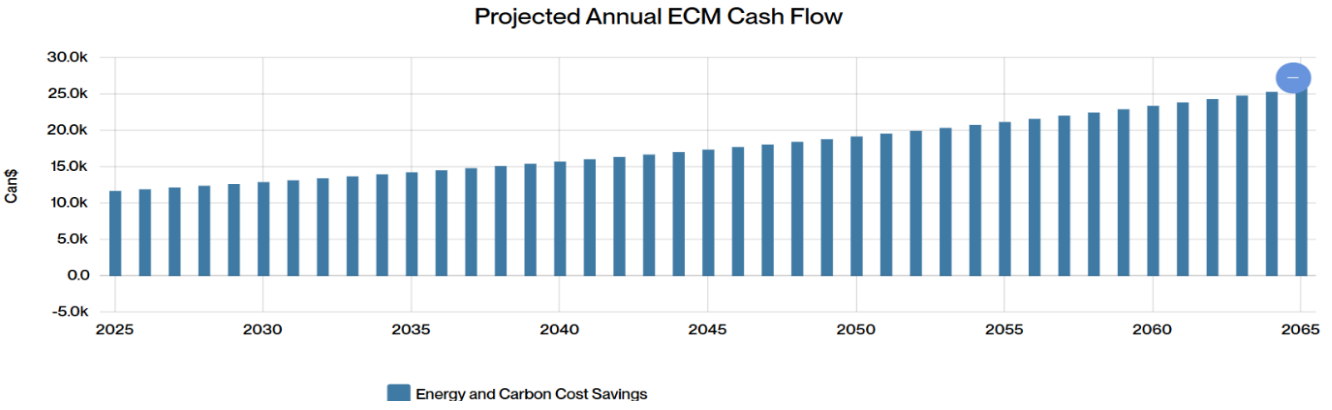

Figure C-26: Apartment Operational Cost Savings – Tier 4 2020

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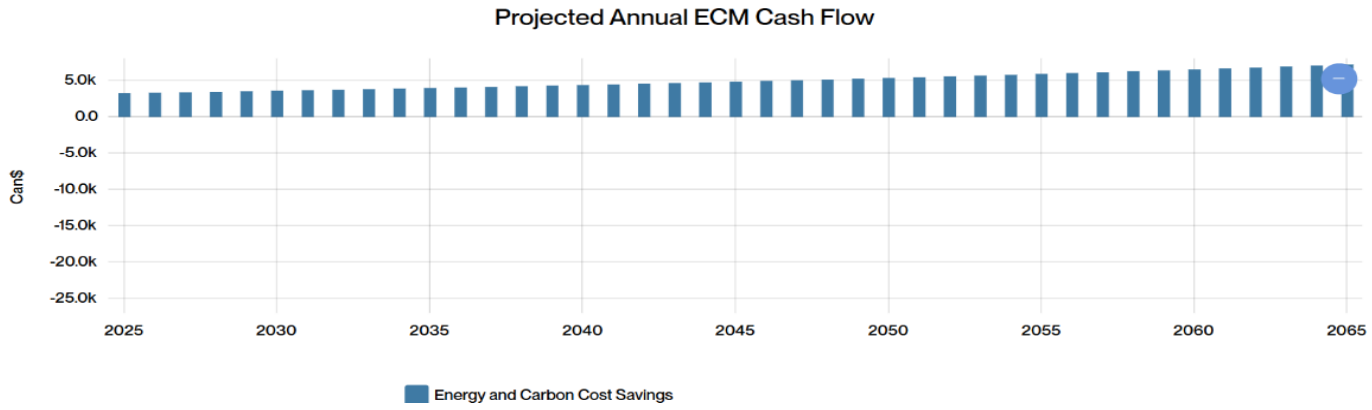

Figure C-27: Apartment Operational Cost Savings – Tier 4 2025

APPENDIX C

Mixed-Use

Table C-8: Mixed-Use Archetype Results

	Tier 1	Tier 3	Tier 5
Capital Cost ($2025/m²)	$3,212	$3,179	$3,672
Total Building Capital Cost ($2025/m²)	$8,605	$8,572	$9,065
Total Energy Cost ($2025/m²)	$26	$31	$19
Life-Cycle Cost ($M)	$11	$11	$12
Incremental Abatement Rate ($2025/Tonne)	-	$191	$438

Table C-9: Mixed-Use Archetype Results – Future Code

	Tier 1	Tier 3	Tier 5
Capital Cost ($2025/m²)	$3,132	$3,179	$3,611
Total Building Capital Cost ($2025/m²)	$8,525	$8,572	$9,004
Total Energy Cost ($2025/m²)	$24	$31	$21
Life-Cycle Cost ($M)	$11	$11	$12
Incremental Abatement Rate ($2025/Tonne)	-	$350	$580

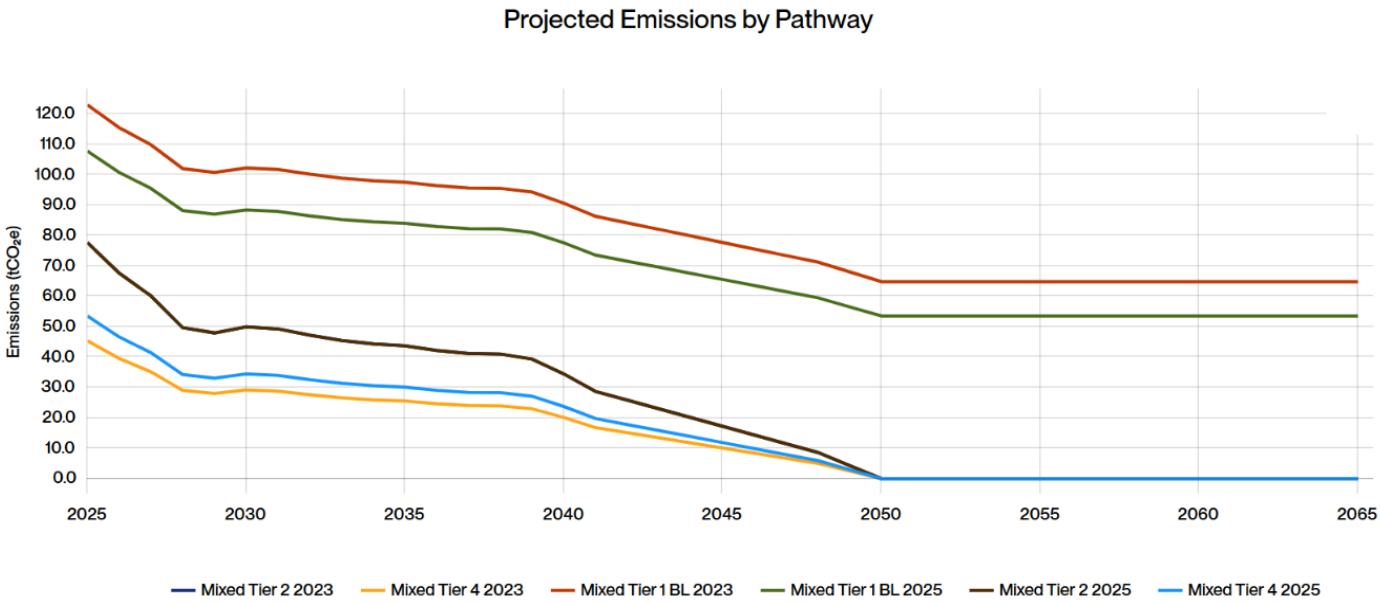

Figure C-28: Mixed-Use Emission Projection Over Time – All Tiers

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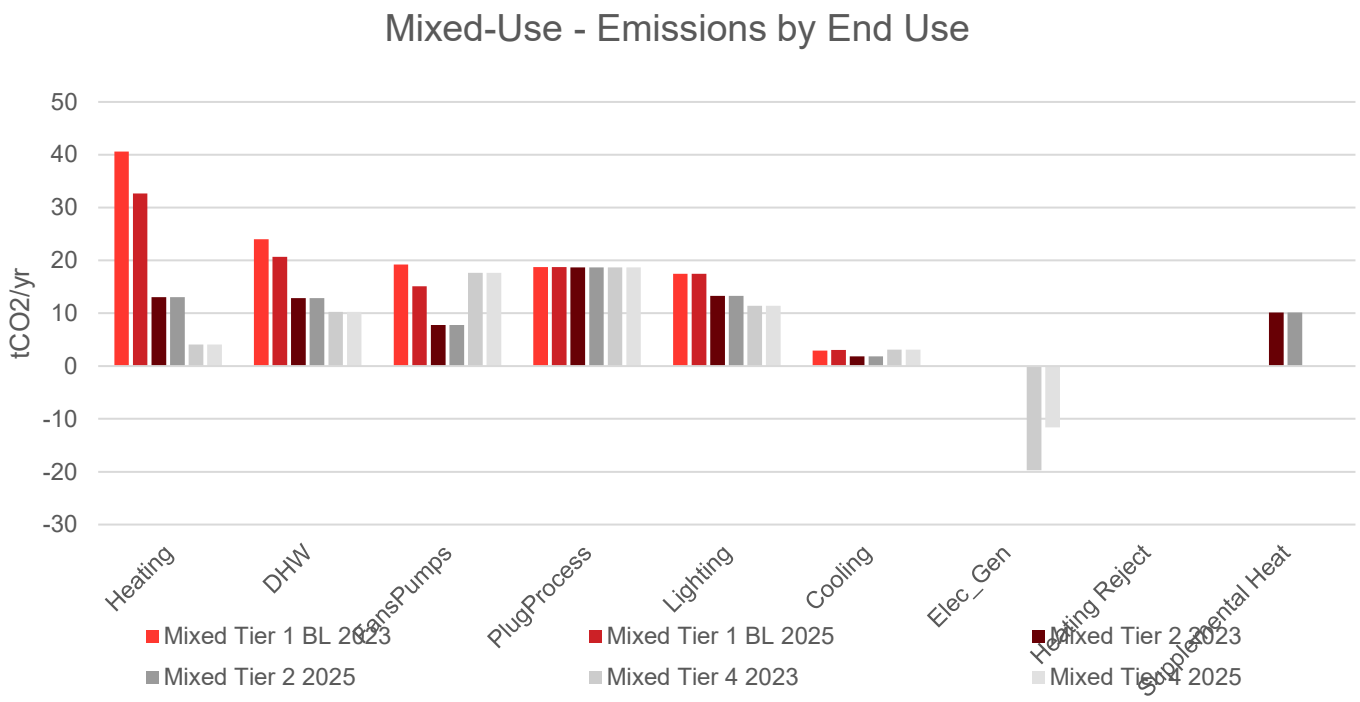

Figure C-29: Mixed-Use End-Use Breakdown Chart – All Tiers

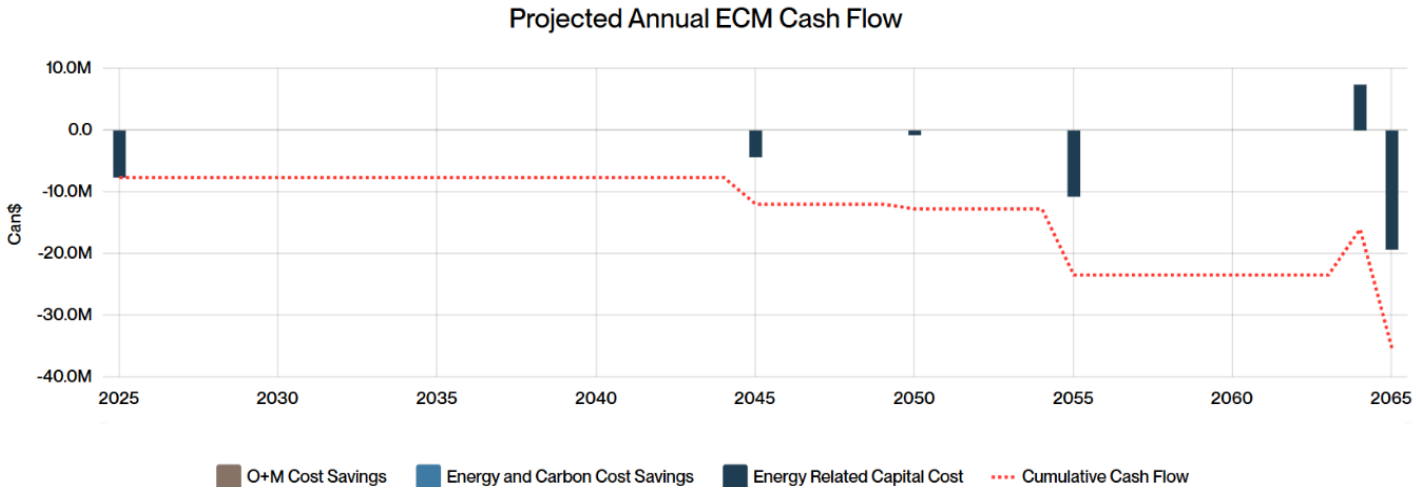

Figure C-30: Mixed-Use Cash Flow Chart – Tier 1 2020

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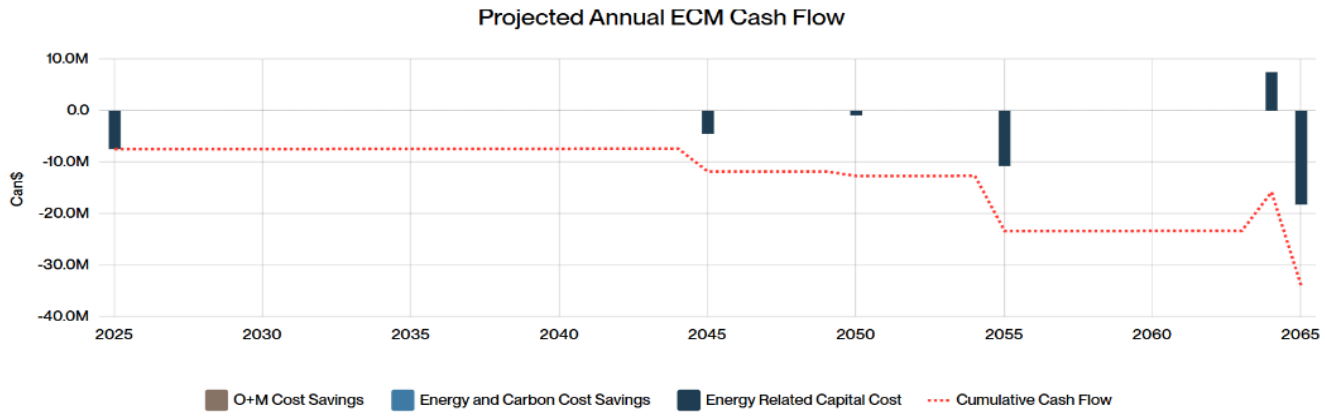

Figure C-31: Mixed-Use Cash Flow Chart – Tier 1 2025

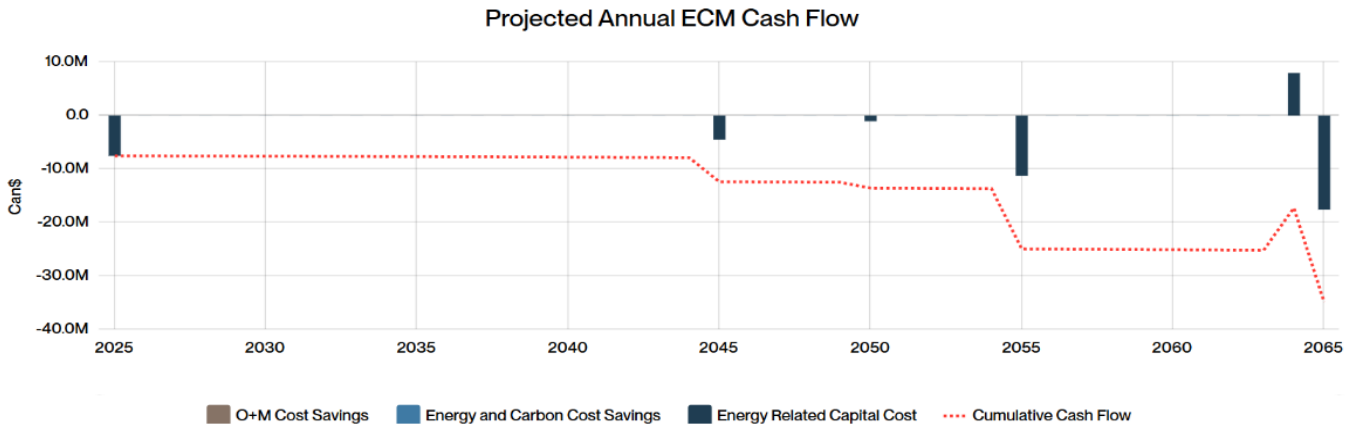

Figure C-32: Mixed-Use Cash Flow Chart – Tier 2 2020

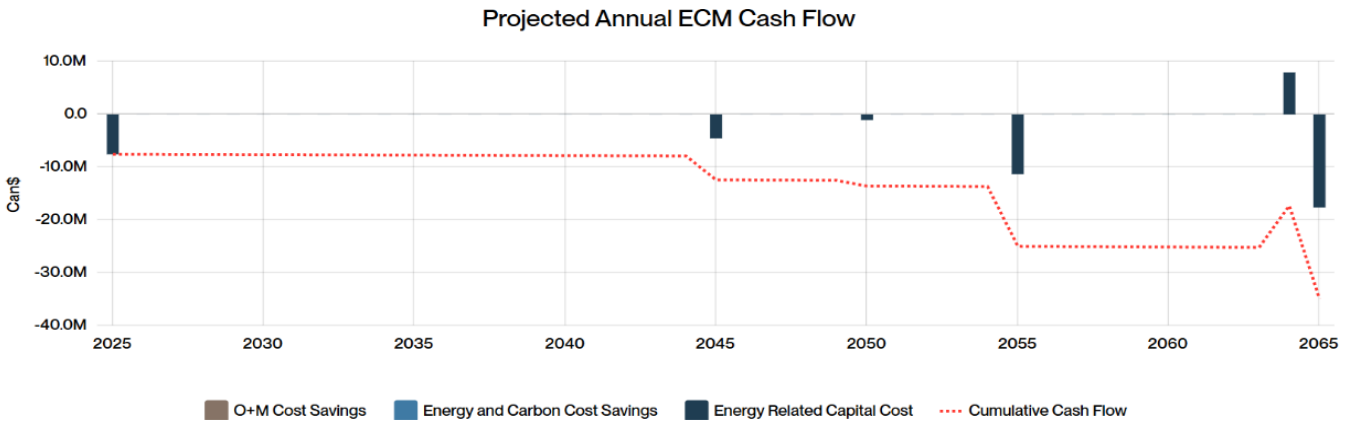

Figure C-33: Mixed-Use Cash Flow Chart – Tier 2 2025

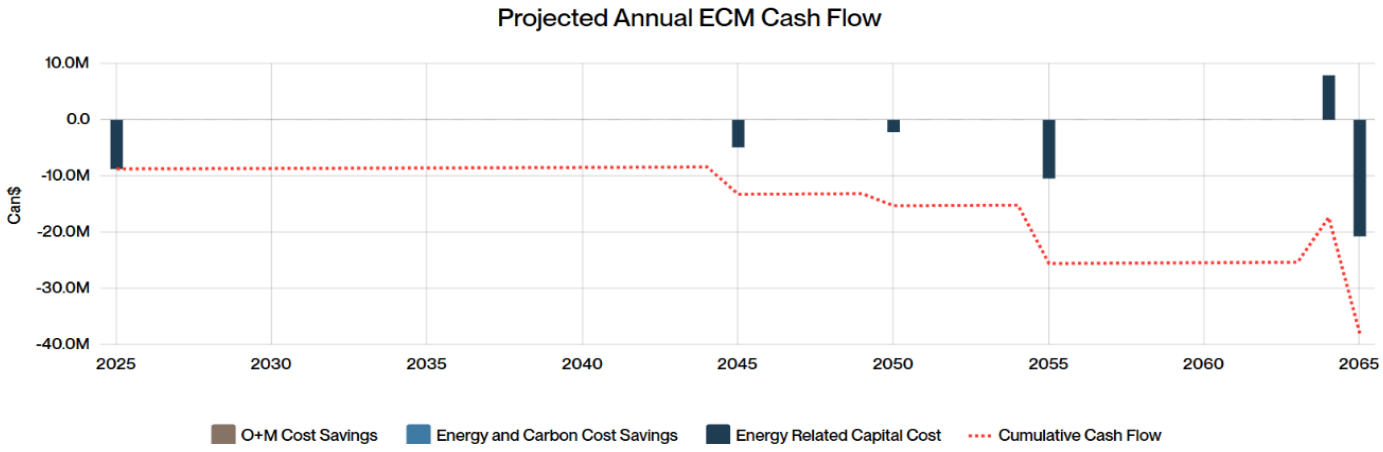

Figure C-34: Mixed-Use Cash Flow Chart – Tier 4 2020

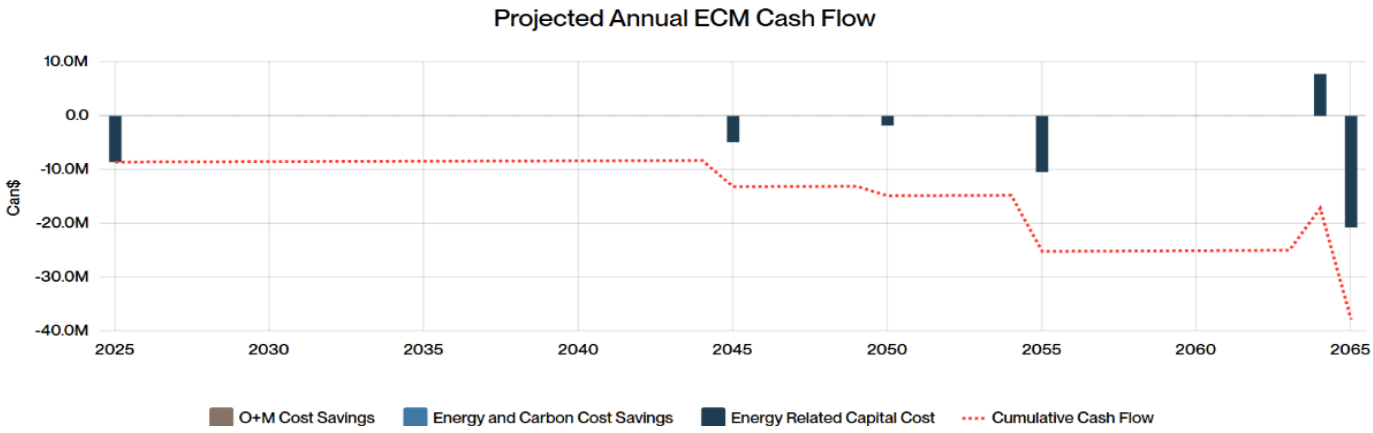

Figure C-35: Mixed-Use Cash Flow Chart – Tier 4 2025

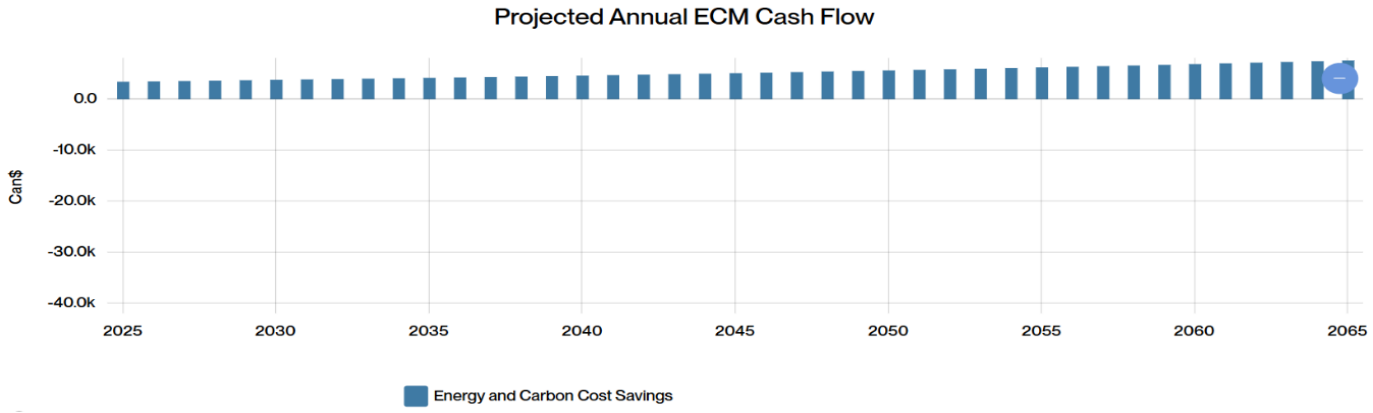

Figure C-36: Mixed-Use Operational Cost Savings – Tier 1 2025

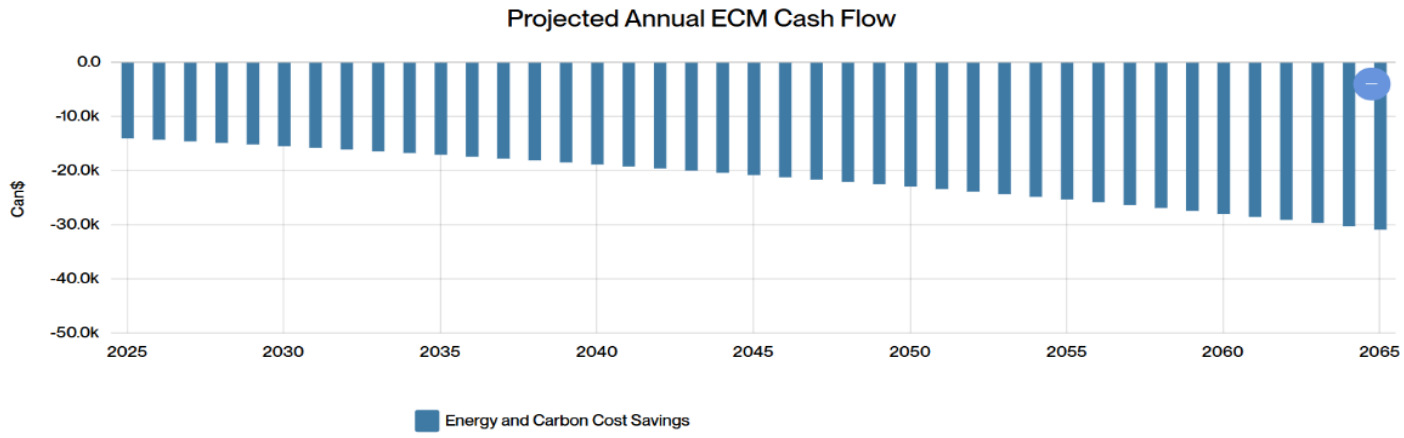

Figure C-37: Mixed-Use Operational Cost Savings – Tier 2 2020

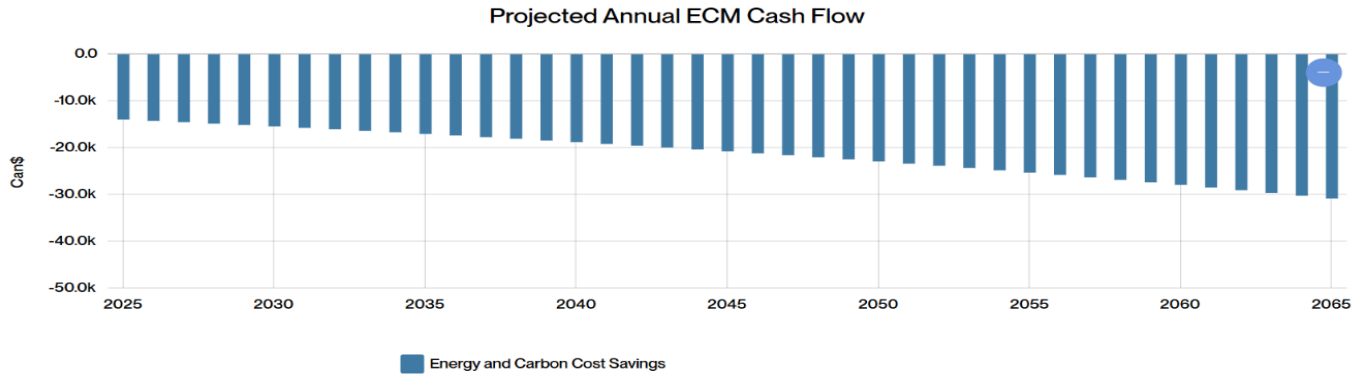

Figure C-38: Mixed-Use Operational Cost Savings – Tier 2 2025

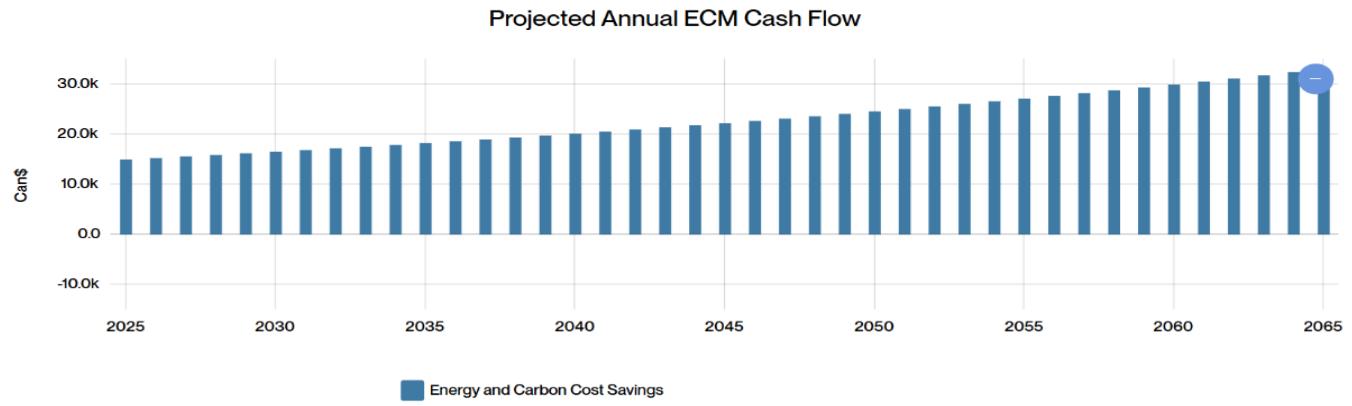

Figure C-39: Mixed-Use Operational Cost Savings – Tier 4 2020

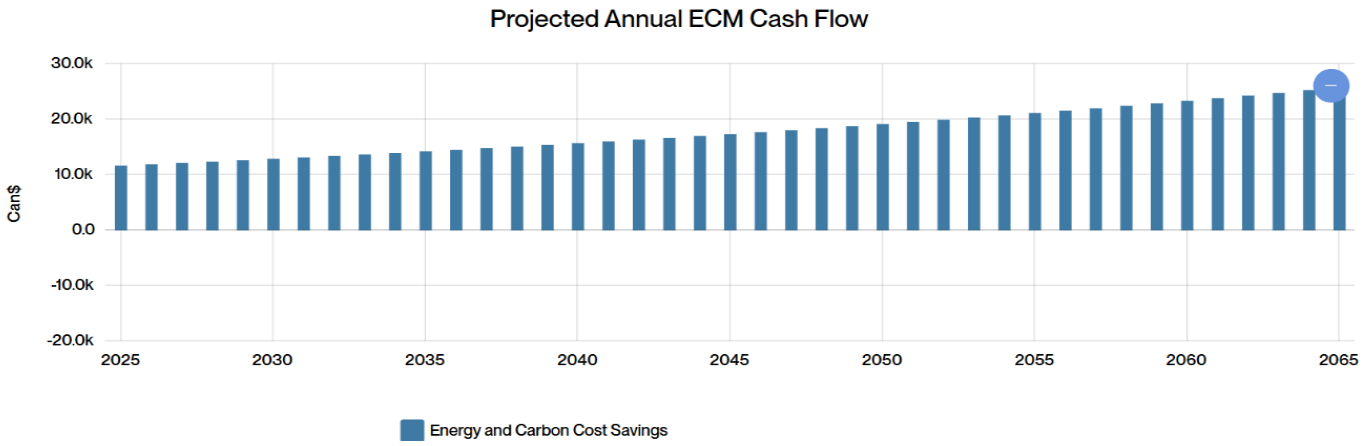

Figure C-40: Mixed-Use Operational Cost Savings – Tier 4 2025

Appendix D – Capital Cost Estimates

This appendix summarizes the capital costs received by the cost consultant (A.W. Hooker), as well as adjustments made to those costs to better match the analyses included in the study.

D.1 Fourplex

Capital costs provided by A.W. Hooker for the Fourplex are summarized in Table D-1 below. For the Part 9 archetypes, the costing provided by A.W. Hooker was meant to align with a Proposed NECB 2025 Future Code analysis; however, this Future Code analysis turned out to be more speculative than originally intended and a detailed analysis was ultimately excluded from the study. To repurpose the Future Code costing for the Current Code analysis, adjustment factors were calculated as described below and applied to A.W. Hooker's costing, also shown in Table D-1 below. Costs in grey text indicate no change from values provided by A.W. Hooker.

- For the above-grade wall in Tier 1, the insulation level was reduced from R-20 to R-17.5.
- For the below-grade wall in Tiers 3 and 5, the Current Code design strategy aligned with Tier 1.
- For the windows in Tier 3, Current Code design strategy maintained the same specifications Tier 1.
- For the opaque doors, this ECM was not included in the Future Code design strategy; however, it was introduced for the Current Code design strategy. The corresponding cost estimate was developed specifically for the Garage archetype.
- For the HVAC distribution systems, the Future Code design strategy proposed the use of ASHP with gas backup for Tiers 1 and 3. Since the Current Code design strategies did not require the same level of savings, a gas furnace was selected for Tiers 1 and 3 instead.
- For infiltration, the Future Code design strategy required a tighter building envelope to achieve the targeted savings. In contrast, the Current Code design strategy did not necessitate such stringent requirements; therefore, the infiltration costs were adjusted downward across all current code Tiers.

Table D-1: Fourplex Capital Cost Adjustment

	Provided by A.W. Hooker			Adjusted for Current Code Analysis		
	Tier 1	Tier 3	Tier 5	Tier 1	Tier 3	Tier 5
Above Grade Wall	$811,000	$811,000	$865,000	$804,000	$811,000	$865,000

	Provided by A.W. Hooker			Adjusted for Current Code Analysis		
	Tier 1	Tier 3	Tier 5	Tier 1	Tier 3	Tier 5
Below Grade Wall	$772,000	$823,000	$612,000	$772,000	$772,000	$772,000
Roof	$407,000	$414,000	$427,000	$407,000	$414,000	$427,000
Floor Over Unheated	$31,000	$31,000	$45,000	$31,000	$31,000	$45,000
Window	$260,000	$284,000	$284,000	$260,000	$260,000	$284,000
Opaque Doors	n/a	n/a	n/a	$163,000	$163,000	$191,000
Garage Doors	Included in OD above.	Included in OD above.	Included in OD above.	Included in OD above.	Included in OD above.	Included in OD above.
DHW	$41,000	$33,000	$45,000	$41,000	$33,000	$45,000
HVAC Distribution	$190,000	$190,000	$344,000	$206,000	$206,000	$344,000
Infiltration	$74,000	$74,000	$79,000	$69,000	$71,000	$75,000

D.2 Garage Suite

Capital costs provided by A.W. Hooker for the Garage Suite are summarized in Table D-2 below. For the Garage Suite, the design strategies developed for the Future Code analysis were consistent with the Current Code analysis, so no adjustment factors needed to be applied to A.W. Hooker's costs, as shown in the table.

Table D-2: Garage Capital Cost Adjustment

	Provided by A.W. Hooker			Adjusted for Current Code Analysis		
	Tier 1	Tier 3	Tier 5	Tier 1	Tier 3	Tier 5
Above Grade Wall	$101,000	$108,000	$114,000	$101,000	$108,000	$114,000
Slabs-on-Floor	$15,000	$15,000	$22,000	$15,000	$15,000	$22,000
Roof	$20,000	$20,000	$25,000	$20,000	$20,000	$25,000
Floor Over Unheated	$22,000	$22,000	$32,000	$22,000	$22,000	$32,000
Windows	$78,000	$81,000	$87,000	$78,000	$81,000	$87,000
Opaque Doors	$72,000	$72,000	$84,000	$72,000	$72,000	$84,000
DHW	$10,000	$8,000	$11,000	$10,000	$8,000	$11,000
HVAC Distribution	$51,000	$51,000	$88,000	$51,000	$51,000	$88,000
Infiltration	$24,000	$24,000	$24,000	$24,000	$24,000	$24,000

APPENDIX D

D.3 Apartment

Capital costs provided by A.W. Hooker for the Garage Suite are summarized in Table D-3 below. For the Part 3 archetypes, the Current Code design strategy was provided to the A.W. team for cost estimation by Tier. As shown in the table below, the Current Code strategy is divided into three main sections: the first shows A.W. Hooker's initial costs, the second shows the costs aligned with the Current Code strategy after adjustments, and the third shows costs aligned with the Future Code strategy after adjustments.

The revised costs were calculated using details in A.W. Hooker's costing report, also shown in Table D-3 below. Costs in grey text indicate no change from values provided by A.W. Hooker.

- For the doors across all Tiers in the Current and Future Code design strategies, the scope includes adding 37 opaque suite entry doors, along with a cost increase to account for higher-quality door specifications. In Tier 4, it was assumed that the doors would consistently result in a 5% derating of the wall R-value. Accordingly, as wall performance improves, door performance improves proportionally.
- For the infiltration across all Tiers in the Current and Future Code design strategies, building science experts advised that infiltration should be estimated at 5% of the envelope cost. As noted above, since doors were added as an ECM in both the Current and Future Code design strategies, the infiltration cost would be adjusted accordingly.
- For the DHW plant in Tiers 2 and 4, the strategy now specifies a commercial hybrid heat pump DHW heater with 12 kW of electric resistance heating capacity (equivalent to the AO Smith CHP 120), instead of a fully heat pump-based system.
- For the Future Code design strategies in Tier 1 (DWHRs), it was decided to implement the same approach as in Tiers 2 and 4.
- For the Future Code design strategies in Tier 4 (Solar PV), PV is still required to achieve performance targets, but the required capacity is reduced compared with the Current Code design strategies

Table D-3: Apartment Capital Cost Adjustment

	Provided by A.W. Hooker			Adjusted for Current Code Analysis			Adjusted for Future Code Analysis		
	Tier 1	Tier 2	Tier 4	Tier 1	Tier 2	Tier 4	Tier 1	Tier 2	Tier 4
Above Grade Wall	$1,400,000	$1,484,000	$1,556,000	$1,400,000	$1,484,000	$1,556,000	$1,400,000	$1,484,000	$1,556,000
Doors	$0	$0	$0	$238,000	$278,000	$324,000	$238,000	$278,000	$324,000

APPENDIX D

	Provided by A.W. Hooker			Adjusted for Current Code Analysis			Adjusted for Future Code Analysis		
	Tier 1	Tier 2	Tier 4	Tier 1	Tier 2	Tier 4	Tier 1	Tier 2	Tier 4
Roof	$616,000	$628,000	$647,000	$616,000	$628,000	$647,000	$616,000	$628,000	$647,000
Window	$634,000	$678,000	$697,000	$634,000	$678,000	$697,000	$634,000	$678,000	$697,000
Infiltration	$132,000	$140,000	$204,000	$144,000	$153,000	$161,000	$144,000	$153,000	$161,000
Heating / Cooling Plant	$473,000	$255,000	$990,000	$473,000	$255,000	$990,000	$473,000	$255,000	$990,000
Pumps	$67,000	$0	$106,000	$67,000	$0	$106,000	$67,000	$0	$106,000
HVAC Distribution	$1,882,000	$1,721,000	$1,721,000	$1,882,000	$1,721,000	$1,721,000	$1,882,000	$1,721,000	$1,721,000
DHW Plant	$66,000	$884,000	$884,000	$66,000	$239,000	$239,000	$66,000	$239,000	$239,000
DWHRs	$0	$45,000	$45,000	$0	$45,000	$45,000	$45,000	$45,000	$45,000
DW Load Reduction	$146,000	$146,000	$165,000	$146,000	$146,000	$165,000	$146,000	$146,000	$165,000
Lighting	$0	$0	$0	$0	$0	$0	$0	$0	$0
Solar PV	$0	$0	$279,000	$0	$0	$279,000	$0	$0	$70,000

D.4 Mixed-Use

Capital costs provided by A.W. Hooker for the Garage Suite are summarized in Table D-4 below. For the Part 3 archetypes, the Current Code design strategy was provided to the A.W. team for cost estimation by Tier. As shown in the table below, the Current Code strategy is divided into three main sections: the first shows A.W. Hooker's initial costs, the second shows the costs aligned with the Current Code strategy after adjustments, and the third shows costs aligned with the Future Code strategy after adjustments.

The revised costs were calculated using details in A.W. Hooker's costing report, also shown in Table D-4 below. Costs in grey text indicate no change from values provided by A.W. Hooker.

- For the doors across all Tiers in the Current Code and Future Code design strategies, The baseline provided to A.W. was missing some doors. In addition, a price increase was applied to account for higher-quality doors, using the Garage Suite archetype door ECM cost rate as a reference.
- For the infiltration across all Tiers in the Current Code and Future Code design strategies, building science experts advised that infiltration should be estimated at 5% of the envelope cost. Since doors

were added as an ECM in both the Current Code and Future Code strategies, the infiltration cost was adjusted accordingly.

- For the Future Code Design Strategy – Tier 1 (HVAC Distribution – Decentralized) and Tier 1 (HVAC Distribution – Commercial), the same approach used in Tier 2 was applied.
- For the Future Code Design Strategy – Tier 1 (DWHRs), the same approach used in Tier 2 was applied.
- For the Future Code Design Strategy – Tier 4 (Solar PV), PV remains necessary to achieve performance targets; however, the required capacity is reduced compared with the Current Code design strategies.

Table D-4: Mixed-Use Capital Cost Adjustment

	Provided by A.W. Hooker			Adjusted for Current Code Analysis			Adjusted for Future Code Analysis		
	Tier 1	Tier 2	Tier 4	Tier 1	Tier 2	Tier 4	Tier 1	Tier 2	Tier 4
Above Grade Wall	$1,362,000	$1,443,000	$1,582,000	$1,362,000	$1,443,000	$1,582,000	$1,362,000	$1,443,000	$1,582,000
Doors	$18,000	$35,000	$35,000	$35,000	$37,000	$39,000	$35,000	$37,000	$39,000
Roof	$618,000	$639,000	$651,000	$618,000	$639,000	$651,000	$618,000	$639,000	$651,000
Window - Residential	$444,000	$477,000	$493,000	$444,000	$477,000	$493,000	$444,000	$477,000	$493,000
Window - Commercial	$408,000	$408,000	$203,000	$408,000	$408,000	$203,000	$408,000	$408,000	$203,000
Infiltration	$123,000	$130,000	$146,000	$143,000	$150,000	$148,000	$143,000	$150,000	$148,000
Heating / Cooling Plant	$453,000	$249,000	$932,000	$453,000	$249,000	$932,000	$453,000	$249,000	$932,000
HVAC Distribution - Decentralized	$1,913,000	$1,525,000	$1,276,000	$1,913,000	$1,525,000	$1,276,000	$1,525,000	$1,525,000	$1,276,000
HVAC Distribution - Residential	$174,000	$212,000	$476,000	$174,000	$212,000	$476,000	$174,000	$212,000	$476,000
HVAC Distribution - Commercial	$1,490,000	$1,643,000	$1,929,000	$1,490,000	$1,643,000	$1,929,000	$1,643,000	$1,643,000	$1,929,000
DHW Plant	$66,000	$239,000	$239,000	$66,000	$239,000	$239,000	$66,000	$239,000	$239,000
DWHRs	$0	$45,000	$45,000	$0	$45,000	$45,000	$45,000	$45,000	$45,000
DW Load Reduction	$146,000	$146,000	$165,000	$146,000	$146,000	$165,000	$146,000	$146,000	$165,000
Solar	$0	$0	$328,000	$0	$0	$328,000	$0	$0	$183,000
Lighting	$295,000	$323,000	$92,000	$295,000	$323,000	$92,000	$295,000	$323,000	$92,000
Pump	$67,000	$0	$106,000	$67,000	$0	$106,000	$67,000	$0	$106,000

Town of Banff Energy Archetype Analysis

Class C Estimate (Rev.2)

Prepared for:

WSP Canada

Prepared by:

A.W. HOOKER ®
QUANTITY SURVEYORS

2904 South Sheridan Way, Suite 202
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June 25, 2025

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THE PEOPLE | THE DIFFERENCE®

June 25, 2025

WSP Canada Inc.
Suite 1200, 10909 Jasper Avenue
Edmonton, Alberta T5J 3L9

Attn: Joseph Der, M.Sc., P.Eng., LEED AP BD+C Technical Lead, Energy & Carbon Analysis

Re: Town of Banff Archetype Analysis– Class C Estimates (R2)

Dear Contact,

Please find enclosed our Class C Estimates for the above project. The estimate is based on preliminary design information provided by WSP received on April 15, 2025 ,along with subsequent revisions, clarifications, and responses to RFIs.

This estimate is meant to reflect the fair market value for the construction of this project; it is not intended to be the prediction of the lowest bid and should be representative of the median bid amount received in a competitive bidding scenario.

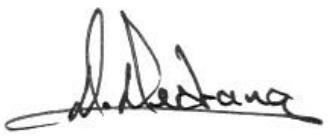
We recommend that the owner and/or the design team carefully review the cost estimate report, including line item descriptions, unit price clarifications, exclusions, inclusions and assumptions, contingencies, escalation, and mark-ups. This is to ensure that the design intent is captured within the content of the report.

Please refer to the preamble of our cost report for all exclusions, assumptions, and information pertaining to the estimate.

Requests for modifications of any apparent errors or omissions to this document must be made to A.W. Hooker Associates Ltd. within ten (10) business days of receipt of this estimate. Otherwise, it will be understood that the contents in this estimate have been concurred with and accepted as final version of the cost report.

We trust our work will assist in the decision making process and look forward to our continued involvement in this important project.

Sincerely,
A.W. Hooker Associates Ltd



Deroy Destang, PQS, CET
Senior Quantity Surveyor

Sincerely,
A.W. Hooker Associates Ltd

Bineesh Susamma, PMP, PQS
Associate (Mechanical)

Encl. (Class C Estimates (R2) – June 25, 2025)

Table of Contents

1. Introduction to the Estimate

1.1 Project Description

This project analyzes sustainable design and performance strategies for new construction in Town of Banff, focusing on four representative building archetypes. Each archetype is assessed across NECB energy performance tiers. The study examines key systems impacting energy efficiency and emissions, including the building envelope, HVAC (plant and distribution), in-suite heating and cooling, ventilation, domestic hot water generation, lighting, renewable energy integration etc. The objective is to generate data driven insights that support the advancement of future developments toward net-zero energy-ready construction.

1.2 Type of Estimate

This Class C Estimates is intended to establish a realistic estimate of the hard construction costs based on the level of design information provided. The estimates are based on preliminary design information provided by WSP, supplemented by several assumptions to account for the generic nature of the building types. Only the building structures have been considered; site-related costs are excluded. The estimates reflect our opinion as to the fair market value for the hard construction of this project. As the project is still in the feasibility phase and has not advanced to detailed design, this estimate should be considered a preliminary budgeting tool rather than a definitive cost projection.

The accuracy of the estimate is based on the documentation provided, with an intended margin of accuracy during the pre-design stage of approximately +/- 20%-30%. This accuracy is based on the definition for Estimate Classifications (Class (A, B, C & D) outlined in the *Guide to Cost Predictability in Construction prepared by the Joint Federal Government & an Industry Cost Predictability Taskforce. Contingencies are included to offset the accuracy risk, to the extent that the estimated amount represents the current opinion of the likely fair market value at the time of tender.

The intention of the estimate is not to predict the low bid price received; typically based on historical tender results estimates are more likely to be towards the median value of bids received under competitive conditions as per common practice based CIQS guidelines. This is a deliberate methodology due to the inherent risk in attempting to predict the low bid and numerous factors which can contribute to lower than anticipated tender submissions which are beyond our control.

2. Basis of the Estimate

2.1 General Information

From the design information provided, we have measured quantities where possible and applied typical unit rates for each of the specific elements based on the project specifications. Where specific design information has not been provided, unit rates are based on historical cost data for this type of project. In some instances where design information is limited, we have made reasonable assumptions based on our experience with projects of a similar scope and design. Estimates for mechanical and electrical systems are developed based on information prepared by the project engineers, historical projects and experience.

Significant changes to the basis of design will impact the estimate value; this is particularly critical where changes are made after the final estimate prior to tender. We recommend that all major design or scope changes be reviewed for their cost, time and constructability impact prior to incorporation in a finalized tender package.

2.2 Location Cost Base

The location cost base for this estimate is Banff, Alberta.

2.3 Unit Rates

The unit rates in the preparation of the elemental estimate include labour and material, equipment, and subcontractors overheads and profits. We have assumed for pricing purposes that union contractors would perform the work.The unit rates for each of the elements are based on typical mid-range costs for the type of design, construction, and materials proposed.

Unit rates in all estimates combine the material, labour, and equipment components for a single unit cost for ease of presentation. This estimate is not a prediction of low bid. Pricing assumes competitive bidding for every aspect of the work.

2.4 Taxes

Harmonized Sales Tax (HST) is excluded from our estimate.

2.5 Construction Schedule

The estimate has been prepared on the assumption that the work will be performed within the timelines of a normal construction schedule. The duration of the schedule would be based on the work being performed during regular daytime work hours. We have assumed the structural components of the building would be constructed in predominantly non-winter months. No allowances have been included for premium time and after hours work associated with an accelerated construction schedule.

2.6 General Requirements and Fees

The General Requirements for the General Contractor are included as a percentage of the hard construction cost. This estimate of the prime contractor's site overheads includes site supervision and labour, access to the site, site accommodations, site protection, temporary utilities, clean up, equipment, and other miscellaneous project requirements provided by the General Contractor.

The Fee element of the estimate is meant to cover the General Contractor's fee to perform the work. The fee would be based on the competitive nature of the bidding process and the market conditions at the time of tender.

2.7 Bonding and Insurance

We have included the median estimated costs for 50% Performance and 50% Labour and Materials. These are the traditional bonding requirements commonly requested by the owner. The actual final bonding costs will vary depending on the selected contractors' performance history.

The estimate includes an allowance for general liability and builder's risk insurance based on an average cost per $1,000 of estimated hard construction costs. The actual insurance costs would be subject to the insurance requirements for the project.

2.8 Procurement

It was assumed for the preparation of this estimate that the project would be tendered to a prequalified list of bidders with a project specific lump sum contract. Pricing is based on competitive tender results with a minimum of four (preferably six tender submissions) at General Contractor's and major trade level. Pre-qualification with a restrictive list of contractors or subcontractors may result in a higher tendered cost due to the inherent reduction in competitiveness. Tenders receiving two or less submissions (occasionally three) historically tend to have a much higher risk of an overrun in cost when compared to the budget established in an estimate. Ensuring adequate bonafide bidders is a prerequisite for competitive bidding scenarios, on which the estimate is predicated.

2.9 Specifications

Where detailed and comprehensive specifications are unavailable, we have assumed that no onerous special requirements will be applicable to this project. It was assumed that all materials and equipment could be substituted with an alternative product to avoid sole-sourcing which results in a non-competitive market condition.

2.10 Soft Costs

The estimated soft costs have been excluded in this estimate.

These costs include items traditionally funded by the owner and separate from the hard construction costs which would be applicable to the contractor. The soft costs include items such as consultant fees; disbursements; project management fees; independent inspection and testing; third party commissioning; legal fees; permits and development charges; operational and moving expenses; financing and loan fees; owner supplied furnishings, fixtures, and equipment; land acquisition costs; and Harmonized Sales Tax.

3. Contingencies

3.1 Design and Pricing Contingency

A design and pricing contingency has been included in the estimate as a percentage of the hard construction costs including the general requirements and fees. This contingency is meant to cover design and pricing unknowns in the preparation of this estimate and reflect the incomplete nature of the design information provided at the time the estimate is prepared.

The estimate includes the following design and pricing contingencies by discipline:

Design Contingencies		
Architectural	-	20%
Structural	-	20%
Mechanical	-	20%
Electrical	-	20%
Siteworks	-	20%

The contingency where included in our estimate is not meant to cover significant additional program space or quality modifications, but rather to provide some flexibility as the design develops. The design contingency typically decreases as the design progresses and more definition and detail is available to refine the basis of the cost estimate. If the owner anticipates significant changes to the basis of design we recommend additional contingency be retained as a reserve for the scope modifications.

3.2 Escalation Contingency

The estimate excludes an allowance for escalation. This allowance, when included, is meant to provide for increases in construction costs due to changes in market conditions between the time of the estimate and the potential construction commencement. For projects with a schedule in excess of 12 months, the contingency is based on a timeframe that takes escalation to the midpoint of the construction phase.

Escalation during construction is included in the unit rates; essentially this allowance is the risk carried by the general contractor and trades with a fixed price made years before the work is completed or carried out for some trades.

3.3 Construction Contingency (Post Contract Changes)

The estimate includes a contingency for the construction phase of the project. This contingency is meant to cover the potential cost of post contract changes that may occur after the project is tendered.

This allowance of 10%is to provide for increases in construction costs due to Change Orders issued during construction.

This contingency excludes any major program or scope requests by the client; these should form part of an overall project management reserve or be reflected in increased funding.

4. General Liability

4.1 Statement of Probable Costs

A.W. Hooker Associates Ltd. (HOOKER) has no control over the cost of labour and materials, the general contractors or any subcontractors' methods of determining prices, or competitive bidding and market conditions. This opinion of probable cost of construction is based on the experience, qualifications, and best judgment of the professional consultant familiar with the construction industry. HOOKER does not warranty that proposals or actual construction costs will not vary from this or subsequent estimates.

4.2 Ongoing Cost Control

A.W. Hooker Associates Ltd. recommends that the owner and/or the design team carefully review the cost estimate report, including line item descriptions, unit price clarifications, exclusions, inclusions and assumptions, contingencies, escalation, and mark-ups. This is to ensure that the design intent is captured within the content of the report. This is especially important at early stage estimates which tend to be based on a lesser level of design completion.

If the project is over budget or there are unresolved budget issues, alternative systems or schemes should ideally be evaluated before proceeding with the design phase. We recommend that cost control be implemented throughout the various stages of the design process to ensure the proposed design remains within the overall budget. It is recommended that the final estimate be produced by HOOKER using Bid Documents to determine overall cost changes, which may have occurred since the preparation of this estimate. The final update estimate will address changes and additions to the documents as well as addenda issued during the bidding process. HOOKER cannot reconcile bid results to any estimate not produced from bid documents including all addenda.

5. Estimate Scope Clarifications

5.1 List of Exclusions

1. Harmonized Sales Tax (HST)
2. Project Soft Costs (as described in item 2.10 above and shown on Master Estimate Summary)
3. Furniture, furnishings, and equipment (except as noted in the estimate)
4. Premium time / after hours work
5. Accelerated construction schedule
6. Escalation Contingency allowance
7. Handling and removal of contaminated soils
8. Special foundation systems such as caissons or pile foundations
9. Premium for construction management or alternate approaches to procurement
10. Sole sourced equipment or control systems
11. Consumption costs for any utilities used during construction (gas, water, hydro etc.)
12. Tariffs and risks of potential additional tariffs due to geopolitical uncertainty

5.2 List of Assumptions

Architectural / Structural / Landscaping:

1. We have assumed the majority of the work to be performed during regular day shifts (unrestricted access to the building during the hours of 8AM to 6 PM Monday to Friday).
2. Contractor will clean up daily to general housekeeping standards.
3. We have carried forward balcony doors to suites as part of the Fenestration measure
4. The builder's work required to support the mechanical measures represents our best estimate of potential additional costs if these measures are implemented, compared to standard base building construction.

Mechanical:

5. Work will be conducted by union or fair wage contractors.
6. Please refer to the back-up estimate for the assumptions made to quantify the scope. Quantities and scope of works are primarily determined from the measure description provided.
7. The estimate assumes that typical suites in the apartment building have minimal ductwork distribution within the units, and accordingly, allowances for ductwork, drop ceilings, and bulkheads have been included.
8. Building TAB works applies only for the specific scope stipulated.
9. Third party tests, certifications etc. are excluded.
10. Building automation system is included for the base building systems in the apartment and mixed-use buildings, with standalone controls provided for in-suite systems.
11. An allowance for the GHX field has been included based on the available information. However, actual site conditions including location-specific factors such as drilling conditions, soil/rock type etc. can significantly impact the actual cost.
12. Please refer to backup estimates for the various assumptions we have considered

Electrical:

13. Work will be performed using union labor during regular work hours.
14. We are assuming that electrical distribution and power panels will not be included in this exercise.
15. Estimate includes for breakers to accommodate mechanical equipment.
16. Refer to the estimate for further scope and assumptions.

General:

17. Due to limited data, we cannot confirm full alignment between the project scope used in this estimate and the intended design. However, we have filled gaps using our professional judgment to provide the most accurate estimate possible. We recommend reviewing the estimate and scope alongside project requirements to ensure completeness. Any changes to the scope may significantly impact accuracy. We have utilized the Archetype Features to identify requirements and overall building loads. Quantities and the scope of work have been adjusted based on List of Measures/Mechanical Selections, as well as our best judgment from similar projects.

18. Unless otherwise noted, the estimate assumes that measures included in this report will be implemented as part of major project, without any phasing.
19. Various assumptions have been made based on the design information available and our experience with projects of a similar nature. Please refer to the specific items within the estimate for the detailed assumptions made.
20. It is assumed that the mechanical spaces and base building services are part of the core building construction and are therefore excluded from all the options.
21. A premium has been applied to reflect the additional cost of transporting and accommodating contractors from Calgary or surrounding areas due to the project's location in Banff

6. Documentation Received

Drawings and design documentation were prepared by WSP:

Pages	Documentation	Documentation Received
22 Pages	4plex - 349 Beaver St Full Arch Drawing	April 06, 2025
33 Pages	Apartment and Mixed Use - 433 Marten	April 06, 2025
9 Pages	Garage - 433 Marten	April 06, 2025
1 Excel File	Mechanical Selections	April 28,2025
1 Excel File	ToB - Energy Measure Matrix (3)_AWH Qs_WSP responses	May 09,2025
	Emails	Various

MULTIPLE ESTIMATE SUMMARY

TOWN OF BANFF ARCHETYPE ANALYSIS - FOURPLEX

CLASS C ESTIMATE

JUNE 25, 2025

A.W. HOOKER ® QUANTITY SURVEYORS

	Estimate Breakdown Construction Costs	Baseline	Low	High
1	**Above-Grade Wall Upgrade**	**$810,990**	**$810,990**	**$865,190**
	Architectural	$501,490	$501,490	$535,090
	Mechanical	$0	$0	$0
	Electrical	$0	$0	$0
	General Conditions & Requirements	$112,500	$112,500	$120,100
	Contingencies	$197,000	$197,000	$210,000
2	**Below-Grade Wall Upgrade**	**$771,817**	**$823,152**	**$612,450**
	Architectural	$476,717	$508,452	$378,050
	Mechanical	$0	$0	$0
	Electrical	$0	$0	$0
	General Conditions & Requirements	$108,100	$114,700	$85,400
	Contingencies	$187,000	$200,000	$149,000
3	**Roof Upgrade**	**$406,900**	**$414,120**	**$427,312**
	Architectural	$250,600	$255,720	$263,912
	Mechanical	$0	$0	$0
	Electrical	$0	$0	$0
	General Conditions & Requirements	$57,300	$57,400	$59,400
	Contingencies	$99,000	$101,000	$104,000
4	**Window Upgrade**	**$260,300**	**$283,700**	**$283,700**
	Architectural	$161,600	$175,700	$175,700
	Mechanical	$0	$0	$0
	Electrical	$0	$0	$0
	General Conditions & Requirements	$35,700	$39,000	$39,000
	Contingencies	$63,000	$69,000	$69,000
5	**Infiltration Reduction**	**$74,480**	**$74,480**	**$78,630**
	Architectural	$46,000	$46,000	$49,000
	Mechanical	$0	$0	$0
	Electrical	$0	$0	$0
	General Conditions & Requirements	$10,480	$10,480	$10,630
	Contingencies	$18,000	$18,000	$19,000
6	**Floor over Unheated Space**	**$30,860**	**$30,860**	**$44,700**
	Architectural	$19,040	$19,040	$27,440
	Mechanical	$0	$0	$0
	Electrical	$0	$0	$0
	General Conditions & Requirements	$4,320	$4,320	$6,160
	Contingencies	$7,500	$7,500	$11,100
7	**HVAC Distribution**	**$190,462**	**$190,462**	**$344,273**
	Architectural	$3,000	$3,000	$6,000
	Mechanical	$110,400	$110,400	$200,200
	Electrical	$4,042	$4,042	$7,473
	General Conditions & Requirements	$27,020	$27,020	$47,600
	Contingencies	$46,000	$46,000	$83,000
8	**DHW**	**$40,768**	**$33,223**	**$44,843**
	Architectural	$3,000	$0	$0
	Mechanical	$20,050	$16,750	$23,750
	Electrical	$2,288	$3,823	$3,823
	General Conditions & Requirements	$5,730	$4,650	$6,170
	Contingencies	$9,700	$8,000	$11,100
9	**Solar PV**			
	Architectural			
	Mechanical			
	Electrical			
	General Conditions & Requirements			
	Contingencies			
	Total Estimated Construction Costs (nearest ,000)	**$2,587,000**	**$2,661,000**	**$2,701,000**

Construction Costs	Baseline	Low	High
Hard Costs			
Architectural	$1,461,447	$1,509,402	$1,435,192
Mechanical	$130,450	$127,150	$223,950
Electrical	$6,330	$7,865	$11,296
General Conditions & Requirements	$361,150	$370,070	$374,460
Subtotal - Hard Costs	**$1,959,377**	**$2,014,487**	**$2,044,898**
Contingencies			
Design & Pricing	$391,700	$403,700	$410,000
Escalation	Excluded	Excluded	Excluded
Construction	$235,500	$242,800	$246,200
Subtotal - Contingencies	**$627,200**	**$646,500**	**$656,200**
Hard Costs including Contingencies (nearest ,000)	**$2,587,000**	**$2,661,000**	**$2,701,000**

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Above-Grade Wall Upgrade					
	FH-1 BL - Wood framed wall with cavity insulation (R-20)					
	Architectural					$501,490
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling, assumed 25%	210	m2	$125.00	$26,250	
2	Wood framed exterior cladding, including:	840	m2	$561.00	$471,240	
2.1	- hardiplank siding, assumed					
2.2	- wood battens @ 400mm o/c, assumed					
2.3	- 12mm OSB sheathing, assumed					
2.4	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
2.5	- fiberglass batt cavity insulation (R-20), assumed					
2.6	- 12mm gypsum board drywall, assumed					
3	Allowance for caulking and sealant	1	LS	$4,000.00	$4,000	
	Subtotal 1				$501,490	
4	Prime Contractor's General Requirements	1	LS	$75,000	$75,000	15.0%
5	Building permit				Excluded	
6	General Liability and Builder's Risk insurance	1	LS	$3,500	$3,500	
7	Labour & Material and Performance bonding	1	LS	$5,000	$5,000	
8	Miscellaneous Allowances				Excluded	
9	Prime Contractor's Fee	1	LS	$29,000	$29,000	5.0%
	Subtotal 2				$613,990	
10	Design Contingency	1	LS	$123,000	$123,000	20.0%
11	Escalation Contingency				Excluded	0.0%
12	Construction Contingency (Post Contract)	1	LS	$74,000	$74,000	10.0%
	Total for Above-Grade Wall Upgrade				**$810,990**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Above-Grade Wall Upgrade					
	FH-1 High - Wood framed wall with cavity insulation (R-40)					
	Architectural					$535,090
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling, assumed 25%	210	m2	$125.00	$26,250	
2	Wood framed exterior cladding, including:	840	m2	$601.00	$504,840	
2.1	- hardiplank siding, assumed					
2.2	- thermally broken cladding clips, assumed					
2.3	- wood battens @ 400mm o/c, assumed					
2.4	- 150mm exterior mineral wool insulation, assumed					
2.5	- 12mm OSB sheathing, assumed					
2.6	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
2.7	- fiberglass batt cavity insulation (R-20), assumed					
2.8	- 12mm gypsum board drywall, assumed					
3	Allowance for caulking and sealant	1	LS	$4,000.00	$4,000	
	Subtotal 1				$535,090	
4	Prime Contractor's General Requirements	1	LS	$80,000	$80,000	15.0%
5	Building permit				Excluded	
6	General Liability and Builder's Risk insurance	1	LS	$3,700	$3,700	
7	Labour & Material and Performance bonding	1	LS	$5,400	$5,400	
8	Miscellaneous Allowances				Excluded	
9	Prime Contractor's Fee	1	LS	$31,000	$31,000	5.0%
	Subtotal 2				$655,190	
10	Design Contingency	1	LS	$131,000	$131,000	20.0%
11	Escalation Contingency				Excluded	0.0%
12	Construction Contingency (Post Contract)	1	LS	$79,000	$79,000	10.0%
	Total for Above-Grade Wall Upgrade				**$865,190**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Below-Grade Wall Upgrade					
	FL-1/FH-2 Base - Concrete, int. fiberglass batt, (R-20)					
	Architectural					$476,717
1	Concrete masonry wall below grade, including:	577	m2	$821.00	$473,717	
1.1	- concrete masonry wall including reinforcing steel, formwork & concrete					
1.2	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
1.3	- 140mm fiberglass batt insulation, assumed (R-20)					
1.4	- 12mm gypsum board drywall, assumed					
2	Allowance for caulking and sealant	1	LS	$3,000.00	$3,000	
	Subtotal 1				$476,717	
3	Prime Contractor's General Requirements	1	LS	$72,000	$72,000	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$3,300	$3,300	
6	Labour & Material and Performance bonding	1	LS	$4,800	$4,800	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$28,000	$28,000	5.0%
	Subtotal 2				$584,817	
9	Design Contingency	1	LS	$117,000	$117,000	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$70,000	$70,000	10.0%
	Total for Below-Grade Wall Upgrade				**$771,817**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Below-Grade Wall Upgrade					
	FL-1 Low - Increase insulation (R-30) Add 2" of exterior XPS					
	Architectural					$508,452
1	Concrete masonry wall below grade, including:	577	m2	$876.00	$505,452	
1.1	- concrete masonry wall including reinforcing steel, formwork & concrete					
1.2	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
1.3	- 140mm fiberglass batt insulation, assumed					
1.4	- 50mm exterior XPS insulation					
1.5	- 12mm gypsum board drywall, assumed					
2	Allowance for caulking and sealant	1	LS	$3,000.00	$3,000	
	Subtotal 1				$508,452	
3	Prime Contractor's General Requirements	1	LS	$76,000	$76,000	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$3,600	$3,600	
6	Labour & Material and Performance bonding	1	LS	$5,100	$5,100	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$30,000	$30,000	5.0%
	Subtotal 2				$623,152	
9	Design Contingency	1	LS	$125,000	$125,000	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$75,000	$75,000	10.0%
	Total for Below-Grade Wall Upgrade				**$823,152**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Below-Grade Wall Upgrade					
	FH-2 High - ICF interior and exterior insulation (R-40)					
	Architectural					$378,050
1	ICF wall below grade (R-40), including:	577	m2	$650.00	$375,050	
1.1	- insulated concrete form wall (ICF), assumed					
1.2	- 300mm concrete including reinforcing steel, assumed					
1.3	- insulated concrete form wall (ICF), assumed					
1.4	- waterproofing, assumed peel & stick system					
2	Allowance for caulking and sealant	1	LS	$3,000.00	$3,000	
	Subtotal 1				$378,050	
3	Prime Contractor's General Requirements	1	LS	$57,000	$57,000	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$2,600	$2,600	
6	Labour & Material and Performance bonding	1	LS	$3,800	$3,800	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$22,000	$22,000	5.0%
	Subtotal 2				$463,450	
9	Design Contingency	1	LS	$93,000	$93,000	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$56,000	$56,000	10.0%
	Total for Below-Grade Wall Upgrade				**$612,450**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Roof Upgrade					
	FL-2/FH-4 Base - Wood framed, Blown-in/batt (R-60)					
	Architectural					$250,600
1	Equipment rentals, including:					
1.1	- crane, assumed 1 @ 1 week	1	NO	$16,000.00	$16,000	
1.2	- telehandler, assumed 1 @ 1 week	1	NO	$7,000.00	$7,000	
2	Engineered wood truss roof construction, including:	512	m2	$425.00	$217,600	
2.1	- pre-engineered roof trusses including incidental framing bracing, sheathing, eaves framing and temporary works					
2.2	- cross strapping for ventilation below sheathing					
2.3	- exterior grade plywood sheathing					
2.4	- attic insulation (R-60)					
2.5	- insulation at joist cavity					
2.6	- air/ vapour barrier, assumed					
2.7	- 16mm gypsum board, assumed					
3	Allowance for framing to openings, assumed	1	LS	$10,000.00	$10,000	
	Subtotal 1				$250,600	
4	Prime Contractor's General Requirements	1	LS	$38,000	$38,000	15.0%
5	Building permit				Excluded	
6	General Liability and Builder's Risk insurance	1	LS	$1,800	$1,800	
7	Labour & Material and Performance bonding	1	LS	$2,500	$2,500	
8	Miscellaneous Allowances				Excluded	
9	Prime Contractor's Fee	1	LS	$15,000	$15,000	5.0%
	Subtotal 2				$307,900	
10	Design Contingency	1	LS	$62,000	$62,000	20.0%
11	Escalation Contingency				Excluded	0.0%
12	Construction Contingency (Post Contract)	1	LS	$37,000	$37,000	10.0%
	Total for Roof Upgrade				**$406,900**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Roof Upgrade						
	FL-2 Low - Blown-in/batt (R-70)						
	Architectural					$255,720	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 1 week	1	NO	$16,000.00	$16,000		
1.2	- telehandler, assumed 1 @ 1 week	1	NO	$7,000.00	$7,000		
2	Engineered wood truss roof construction, including:	512	m2	$435.00	$222,720		
2.1	- pre-engineered roof trusses including incidental framing bracing, sheathing, eaves framing and temporary works						
2.2	- cross strapping for ventilation below sheathing						
2.3	- exterior grade plywood sheathing						
2.4	- attic insulation (R-70)						
2.5	- insulation at joist cavity						
2.6	- air/ vapour barrier, assumed						
2.7	- 16mm gypsum board, assumed						
3	Allowance for framing to openings, assumed	1	LS	$10,000.00	$10,000		
	Subtotal 1				$255,720		
4	Prime Contractor's General Requirements	1	LS	$38,000	$38,000		15.0%
5	Building permit				Excluded		
6	General Liability and Builder's Risk insurance	1	LS	$1,800	$1,800		
7	Labour & Material and Performance bonding	1	LS	$2,600	$2,600		
8	Miscellaneous Allowances				Excluded		
9	Prime Contractor's Fee	1	LS	$15,000	$15,000		5.0%
	Subtotal 2				$313,120		
10	Design Contingency	1	LS	$63,000	$63,000		20.0%
11	Escalation Contingency				Excluded		0.0%
12	Construction Contingency (Post Contract)	1	LS	$38,000	$38,000		10.0%
	Total for Roof Upgrade				**$414,120**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Roof Upgrade						
	FH-4 Blown-in/batt (R-80)						
	Architectural					$263,912	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 1 week	1	NO	$16,000.00	$16,000		
1.2	- telehandler, assumed 1 @ 1 week	1	NO	$7,000.00	$7,000		
2	Engineered wood truss roof construction, including:	512	m2	$451.00	$230,912		
2.1	- pre-engineered roof trusses including incidental framing bracing, sheathing, eaves framing and temporary works						
2.2	- cross strapping for ventilation below sheathing						
2.3	- exterior grade plywood sheathing						
2.4	- attic insulation (R-80)						
2.5	- insulation at joist cavity						
2.6	- air/ vapour barrier, assumed						
2.7	- 16mm gypsum board, assumed						
3	Allowance for framing to openings, assumed	1	LS	$10,000.00	$10,000		
	Subtotal 1				$263,912		
4	Prime Contractor's General Requirements	1	LS	$40,000	$40,000		15.0%
5	Building permit				Excluded		
6	General Liability and Builder's Risk insurance	1	LS	$1,800	$1,800		
7	Labour & Material and Performance bonding	1	LS	$2,600	$2,600		
8	Miscellaneous Allowances				Excluded		
9	Prime Contractor's Fee	1	LS	$15,000	$15,000		5.0%
	Subtotal 2				$323,312		
10	Design Contingency	1	LS	$65,000	$65,000		20.0%
11	Escalation Contingency				Excluded		0.0%
12	Construction Contingency (Post Contract)	1	LS	$39,000	$39,000		10.0%
	Total for Roof Upgrade				**$427,312**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Window Upgrade						
	FL-3/FH-5 Base - Double-glazed (U-0.28, SHGC-0.26); 16% FDWR						
	Architectural					$161,600	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 1 week	1	NO	$19,000.00	$19,000		
1.2	- telehandler, assumed 1 @ 1 week	1	NO	$7,000.00	$7,000		
2	Fiberglass framed double glazed window units, low-e coating (U-0.28, SHGC-0.26), similar to Inline 400 series	94	m2	$1,150.00	$108,100		
3	Extra over for operable units, assumed	94	m2	$250.00	$23,500		
4	Caulking, and sealing	1	LS	$4,000.00	$4,000		
	Subtotal 1				$161,600		
5	Prime Contractor's General Requirements	1	LS	$24,000	$24,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$1,100	$1,100		
8	Labour & Material and Performance bonding	1	LS	$1,600	$1,600		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$9,000	$9,000		5.0%
	Subtotal 2				$197,300		
11	Design Contingency	1	LS	$39,000	$39,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$24,000	$24,000		10.0%
	Total for Window Upgrade				**$260,300**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Window Upgrade						
	FL-3 Low - DG IGU with triple silver low-e coating, fibreglass window frame						
	Architectural					$175,700	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 1 week	1	NO	$19,000.00	$19,000		
1.2	- telehandler, assumed 1 @ 1 week	1	NO	$7,000.00	$7,000		
2	Fiberglass framed triple glazed window units, with triple silver low-e coating (U-0.15, SHGC-0.26), similar to Inline 400 series	94	m2	$1,300.00	$122,200		
3	Extra over for operable units, assumed	94	m2	$250.00	$23,500		
4	Allowance for caulking, and sealing	1	LS	$4,000.00	$4,000		
	Subtotal 1				$175,700		
5	Prime Contractor's General Requirements	1	LS	$26,000	$26,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$1,200	$1,200		
8	Labour & Material and Performance bonding	1	LS	$1,800	$1,800		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$10,000	$10,000		5.0%
	Subtotal 2				$214,700		
11	Design Contingency	1	LS	$43,000	$43,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$26,000	$26,000		10.0%
	Total for Window Upgrade				**$283,700**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Window Upgrade						
	FH-5 High - Fibreglass windows with triple glazed IGUs, double low-e coating						
	Architectural					$175,700	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 1 week	1	NO	$19,000.00	$19,000		
1.2	- telehandler, assumed 1 @ 1 week	1	NO	$7,000.00	$7,000		
2	Fiberglass framed triple glazed window units, with triple silver low-e coating (U-0.15, SHGC-0.26), similar to Inline 400 series	94	m2	$1,300.00	$122,200		
3	Extra over for operable units, assumed	94	m2	$250.00	$23,500		
4	Allowance for caulking, and sealing	1	LS	$4,000.00	$4,000		
	Subtotal 1				$175,700		
5	Prime Contractor's General Requirements	1	LS	$26,000	$26,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$1,200	$1,200		
8	Labour & Material and Performance bonding	1	LS	$1,800	$1,800		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$10,000	$10,000		5.0%
	Subtotal 2				$214,700		
11	Design Contingency	1	LS	$43,000	$43,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$26,000	$26,000		10.0%
	Total for Window Upgrade				**$283,700**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Infiltration Reduction					
	FH-6 Base - ACH 1.5 @ 50 Pa (0.32 @ 5 Pa)					
	Architectural					$46,000
1	Allowance for infiltration reduction of building envelope including envelope reviews and site	1	LS	$46,000.00	$46,000	
	Subtotal 1				$46,000	
2	Prime Contractor's General Requirements	1	LS	$7,000	$7,000	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$320	$320	
5	Labour & Material and Performance bonding	1	LS	$460	$460	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$2,700	$2,700	5.0%
	Subtotal 2				$56,480	
8	Design Contingency	1	LS	$11,000	$11,000	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$7,000	$7,000	10.0%
	Total for Infiltration Reduction				**$74,480**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Infiltration Reduction					
	FH-6 High - ACH 0.6 @ 50 Pa (0.13 @ 5 Pa)					
	Architectural					$49,000
1	*(Recommend adding 5% to total envelope construction cost or minimum $15k to account for increased QAQC, envelope reviews, and site testing.)*					
2	Allowance for infiltration reduction of building envelope including envelope reviews and site	1	LS	$49,000.00	$49,000	
	Subtotal 1				$49,000	
3	Prime Contractor's General Requirements	1	LS	$7,000	$7,000	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$340	$340	
6	Labour & Material and Performance bonding	1	LS	$490	$490	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$2,800	$2,800	5.0%
	Subtotal 2				$59,630	
9	Design Contingency	1	LS	$12,000	$12,000	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$7,000	$7,000	10.0%
	Total for Infiltration Reduction				**$78,630**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Floor over Unheated Space					
	FH-3 Base - Interior batt (R-28)					
	Architectural					$19,040
1	Insulate floor over unheated space, including:	112	m2	$170.00	$19,040	
1.1	- interior batt insulation (R-28)					
1.2	- suspended gypsum board ceiling, assumed					
	Subtotal 1				$19,040	
2	Prime Contractor's General Requirements	1	LS	$2,900	$2,900	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$130	$130	
5	Labour & Material and Performance bonding	1	LS	$190	$190	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$1,100	$1,100	5.0%
	Subtotal 2				$23,360	
8	Design Contingency	1	LS	$4,700	$4,700	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$2,800	$2,800	10.0%
	Total for Floor over Unheated Space				**$30,860**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Floor over Unheated Space					
	FH-3 High - Interior batt + foam board below (R-50)					
	Architectural					$27,440
1	Insulate floor over unheated space, including:	112	m2	$245.00	$27,440	
1.1	- interior batt insulation (R-28)					
1.2	- foam board insulation (R-22)					
1.3	- suspended gypsum board ceiling, assumed					
	Subtotal 1				$27,440	
2	Prime Contractor's General Requirements	1	LS	$4,100	$4,100	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$190	$190	
5	Labour & Material and Performance bonding	1	LS	$270	$270	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$1,600	$1,600	5.0%
	Subtotal 2				$33,600	
8	Design Contingency	1	LS	$7,000	$7,000	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$4,100	$4,100	10.0%
	Total for Floor over Unheated Space				**$44,700**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	HVAC Distribution						
	FH-7 Base - One (1) Central cold-climate ASHP per unit						
	Architectural					$3,000	
1	Mechanical room space included as part of base building construction						
2	Allowance for mechanical service openings	4	NO	$750.00	$3,000		
	Mechanical					$110,400	
3	Allowance for air source heat pump units (no dual fuel option is considered)	4	NO	$15,500.00	$62,000		
3.1	- multi position airhandling c/w heat pump condensing units - 3 Ton cooling (as per mechanical selection)						
3.2	- refrigerant line, accessories and refrigerant charge ~ 8m - 10m refrigerant line						
3.3	- outdoor unit weather proof covers				excluded		
4	Allowance for air distribution including						
4.1	- ductwork	800	KG	$30.00	$24,000		
4.2	- thermal insulation				Assume not required		
4.3	- air diffusion devices	1	LS	$2,000.00	$2,000		
4.4	- miscellaneous ductwork components	1	LS	$2,400.00	$2,400		
5	General allowance						
5.1	- noise and vibration isolation	1	LS	$600.00	$600		
5.2	- starters/VFDs and mechanical wiring				Included		
5.3	- TAB work	1	LS	$600.00	$600		
5.4	- basic start-up and contractor's commissioning	1	LS	$800.00	$800		
5.5	- condensate drain	1	LS	$1,000.00	$1,000		
5.6	- natural gas service to the unit				n/a		
6	Miscellaneous works and general accounts	1	NO	$11,000.00	$11,000		
7	Allowance for system controls including field devices thermostat/controller	1	LS	$6,000.00	$6,000		
	Electrical					$4,042	
8	New breaker to accommodate power connection below	4	NO	$260.00	$1,040		
9	Power connection with line and load side wiring including disconnect switch for air source heat pump unit	4	NO	$600.00	$2,400		
10	General Requirements including:					$602	
10.1	- Supervision	1	LS	$289.00	$289		
10.2	- Premium time, etc.				N/A		
10.3	- Job set-up, etc.	1	LS	$184.00	$184		
10.4	- Rentals, small tools, etc.	1	LS	$74.00	$74		
10.5	- Permits & inspections	1	LS	$48.00	$48		
10.6	- Insurance	1	LS	$7.00	$7		
	Subtotal 1				$117,442		
11	Prime Contractor's General Requirements	1	LS	$18,000	$18,000		15.0%
12	Building permit				Excluded		
13	General Liability and Builder's Risk insurance	1	LS	$820	$820		
14	Labour & Material and Performance bonding	1	LS	$1,200	$1,200		
15	Miscellaneous Allowances				Excluded		
16	Prime Contractor's Fee	1	LS	$7,000	$7,000		5.0%
	Subtotal 2				$144,462		
17	Design Contingency	1	LS	$29,000	$29,000		20.0%
18	Escalation Contingency				Excluded		0.0%
19	Construction Contingency (Post Contract)	1	LS	$17,000	$17,000		10.0%
	Total for HVAC Distribution				**$190,462**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	HVAC Distribution						
	FH-7 High - One (1) Central GSHP unit per suite						
	Architectural					$6,000	
1	Mechanical room space included as part of base building construction						
2	Allowance for mechanical service openings	4	NO	$1,500.00	$6,000		
	Mechanical					$200,200	
3	Allowance for geothermal heat pump air handler, variable speed c/w 5kW back-up electric resistance heating - 1.5 ton (as per mechanical selections)	4	NO	$14,000.00	$56,000		
4	Allowance for pump assembly c/w valving and piping	4	NO	$4,000.00	$16,000		
5	DHW desuperheater connection/preheat tank				excluded		
6	Allowance for air distribution including						
6.1	- ductwork	800	KG	$30.00	$24,000		
6.2	- thermal insulation				Assume not required		
6.3	- air diffusion devices	1	LS	$2,000.00	$2,000		
6.4	- miscellaneous ductwork components	1	LS	$2,400.00	$2,400		
7	General allowance						
7.1	- noise and vibration isolation	1	LS	$600.00	$600		
7.2	- starters/VFDs and mechanical wiring				Included		
7.3	- TAB work	1	LS	$1,400.00	$1,400		
7.4	- basic start-up and contractor's commissioning	1	LS	$1,800.00	$1,800		
7.5	- condensate drain	1	LS	$1,000.00	$1,000		
8	Miscellaneous works and general accounts	1	NO	$13,000.00	$13,000		
9	Allowance for vertical GHX heat exchanger loop including drilling, loop installation, tie-in loop and commissioning - 400' deep	4	NO	$17,000.00	$68,000		
10	Thermal conductivity test				excluded		
11	Allowance for system controls including field devices thermostat/controller	1	LS	$14,000.00	$14,000		
	Electrical					$7,473	
12	New breaker to accommodate power connection below	4	NO	$380.00	$1,520		
13	Power connection with line and load side wiring for geothermal heat pump air handler c/w 5kW back-up electric resistance heating	8	NO	$600.00	$4,800		
14	General Requirements including:					$1,153	
14.1	- Supervision	1	LS	$578.00	$578		
14.2	- Premium time, etc.				N/A		
14.3	- Job set-up, etc.	1	LS	$338.00	$338		
14.4	- Rentals, small tools, etc.	1	LS	$135.00	$135		
14.5	- Permits & inspections	1	LS	$88.00	$88		
14.6	- Insurance	1	LS	$14.00	$14		
	Subtotal 1				$213,673		
15	Prime Contractor's General Requirements	1	LS	$32,000	$32,000		15.0%
16	Building permit				Excluded		
17	General Liability and Builder's Risk insurance	1	LS	$1,500	$1,500		
18	Labour & Material and Performance bonding	1	LS	$2,100	$2,100		
19	Miscellaneous Allowances				Excluded		
20	Prime Contractor's Fee	1	LS	$12,000	$12,000		5.0%
	Subtotal 2				$261,273		
21	Design Contingency	1	LS	$52,000	$52,000		20.0%
22	Escalation Contingency				Excluded		0.0%
23	Construction Contingency (Post Contract)	1	LS	$31,000	$31,000		10.0%
	Total for HVAC Distribution				**$344,273**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DHW					
	FL-4/ FH-8 Base - One (1) natural gas storage heater per suite (150 L, 54.5% eff.) located in 1st floor Mech room.					
	Architectural					$3,000
1	Mechanical room space included as part of base building construction					
2	Allowance for service penetrations serving DHW venting	1	LS	$3,000.00	$3,000	
	Mechanical					$20,050
3	Allowance for domestic hot water plant including:					
3.1	- gas fired storage tanks heater, residential vertical tank c/w venting - 150L, 4.5kW	4	NO	$2,200.00	$8,800	
3.2	- recirculating system				not required	
4	Allowance for distribution piping including:					
4.1	- DHW plant room piping, pex tubing	40	m	$75.00	$3,000	
4.2	- Line valves and piping accessories	1	LS	$750.00	$750	
5	General allowance					
5.1	- TAB work				not required	
5.2	- Basic start-up and contractor's commissioning	1	LS	$1,000.00	$1,000	
5.3	- System condensate/drains	1	LS	$2,000.00	$2,000	
5.4	- natural gas service to the unit	1	LS	$1,500.00	$1,500	
6	Miscellaneous works and general accounts	1	NO	$2,000.00	$2,000	
7	Allowance for DHW plant controls including field devices, sensors and wiring	1	LS	$1,000.00	$1,000	
	Electrical					$2,288
8	New breaker to accommodate power connection below	4	LS	$80.00	$320	
9	Power connection with line and load side wiring including disconnect switch for gas fired storage tank heater	4	NO	$400.00	$1,600	
10	General Requirements including:					$368
10.1	- Supervision	1	LS	$193.00	$193	
10.2	- Premium time, etc.				N/A	
10.3	- Job set-up, etc.	1	LS	$103.00	$103	
10.4	- Rentals, small tools, etc.	1	LS	$41.00	$41	
10.5	- Permits & inspections	1	LS	$27.00	$27	
10.6	- Insurance	1	LS	$4.00	$4	
	Subtotal 1				$25,338	
11	Prime Contractor's General Requirements	1	LS	$3,800	$3,800	15.0%
12	Building permit				Excluded	
13	General Liability and Builder's Risk insurance	1	LS	$180	$180	
14	Labour & Material and Performance bonding	1	LS	$250	$250	
15	Miscellaneous Allowances				Excluded	
16	Prime Contractor's Fee	1	LS	$1,500	$1,500	5.0%
	Subtotal 2				$31,068	
17	Design Contingency	1	LS	$6,000	$6,000	20.0%
18	Escalation Contingency				Excluded	0.0%
19	Construction Contingency (Post Contract)	1	LS	$3,700	$3,700	10.0%
	Total for DHW				**$40,768**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DHW					
	FL-4 Low - One (1) electric storage DHW heater per unit (150 L) located in 1st floor Mech room.					
	Architectural					$0
1	Mechanical room space included as part of base building construction					
	Mechanical					$16,750
2	Allowance for domestic hot water plant including:					
2.1	- Electric storage tanks heater, residential vertical tank - 150L, 4.5kW	4	NO	$1,750.00	$7,000	
2.2	- recirculating system				not required	
3	Allowance for distribution piping including:					
3.1	- DHW plant room piping, pex tubing	40	m	$75.00	$3,000	
3.2	- Line valves and piping accessories	1	LS	$750.00	$750	
4	General allowance					
4.1	- TAB work				not required	
4.2	- Basic start-up and contractor's commissioning	1	LS	$1,000.00	$1,000	
4.3	- System condensate/drains	1	LS	$2,000.00	$2,000	
5	Miscellaneous works and general accounts	1	NO	$2,000.00	$2,000	
6	Allowance for DHW plant controls including field devices, sensors and wiring	1	LS	$1,000.00	$1,000	
	Electrical					$3,823
7	New breaker to accommodate power connection below	4	NO	$260.00	$1,040	
8	Power connection with line and load side wiring including disconnect switch for electric storage tank heater	4	NO	$550.00	$2,200	
9	General Requirements including:					$583
9.1	- Supervision	1	LS	$289.00	$289	
9.2	- Premium time, etc.				N/A	
9.3	- Job set-up, etc.	1	LS	$173.00	$173	
9.4	- Rentals, small tools, etc.	1	LS	$69.00	$69	
9.5	- Permits & inspections	1	LS	$45.00	$45	
9.6	- Insurance	1	LS	$7.00	$7	
	Subtotal 1				$20,573	
10	Prime Contractor's General Requirements	1	LS	$3,100	$3,100	15.0%
11	Building permit				Excluded	
12	General Liability and Builder's Risk insurance	1	LS	$140	$140	
13	Labour & Material and Performance bonding	1	LS	$210	$210	
14	Miscellaneous Allowances				Excluded	
15	Prime Contractor's Fee	1	LS	$1,200	$1,200	5.0%
	Subtotal 2				$25,223	
16	Design Contingency	1	LS	$5,000	$5,000	20.0%
17	Escalation Contingency				Excluded	0.0%
18	Construction Contingency (Post Contract)	1	LS	$3,000	$3,000	10.0%
	Total for DHW				**$33,223**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DHW					
	FH-8 High - One (1) indoor ASHP DHW heater per suite, similar to Rheem ProTerra.					
	Architectural					$0
1	Mechanical room space included as part of base building construction					
	Mechanical					$23,750
2	Allowance for domestic hot water heater, residential type equal to AO smith/Rheem					
2.1	- hybrid heat pump domestic hot water tank heater - 150L, 4.5kW	4	NO	$3,500.00	$14,000	
2.2	- recirculating system				not required	
3	Allowance for distribution piping including:					
3.1	- DHW plant room piping, pex tubing	40	m	$75.00	$3,000	
3.2	- Line valves and piping accessories	1	LS	$750.00	$750	
4	General allowance					
4.1	- TAB work				not required	
4.2	- Basic start-up and contractor's commissioning	1	LS	$1,000.00	$1,000	
4.3	- System condensate/drains	1	LS	$2,000.00	$2,000	
5	Miscellaneous works and general accounts	1	NO	$2,000.00	$2,000	
6	Allowance for DHW plant controls including field devices, sensors and wiring	1	LS	$1,000.00	$1,000	
	Electrical					$3,823
7	New breaker to accommodate power connection below	4	NO	$260.00	$1,040	
8	Power connection with line and load side wiring including disconnect switch for hybrid heat pump domestic hot water tank heater	4	NO	$550.00	$2,200	
9	General Requirements including:					$583
9.1	- Supervision	1	LS	$289.00	$289	
9.2	- Premium time, etc.				N/A	
9.3	- Job set-up, etc.	1	LS	$173.00	$173	
9.4	- Rentals, small tools, etc.	1	LS	$69.00	$69	
9.5	- Permits & inspections	1	LS	$45.00	$45	
9.6	- Insurance	1	LS	$7.00	$7	
	Subtotal 1				$27,573	
10	Prime Contractor's General Requirements	1	LS	$4,100	$4,100	15.0%
11	Building permit				Excluded	
12	General Liability and Builder's Risk insurance	1	LS	$190	$190	
13	Labour & Material and Performance bonding	1	LS	$280	$280	
14	Miscellaneous Allowances				Excluded	
15	Prime Contractor's Fee	1	LS	$1,600	$1,600	5.0%
	Subtotal 2				$33,743	
16	Design Contingency	1	LS	$7,000	$7,000	20.0%
17	Escalation Contingency				Excluded	0.0%
18	Construction Contingency (Post Contract)	1	LS	$4,100	$4,100	10.0%
	Total for DHW				**$44,843**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Solar PV					
1	*N/A*					
	Total for Solar PV					**$0**

MULTIPLE ESTIMATE SUMMARY
TOWN OF BANFF ARCHETYPE ANALYSIS - GARAGE
CLASS C ESTIMATE
JUNE 25, 2025

A.W. HOOKER ®
QUANTITY SURVEYORS

	Estimate Breakdown Construction Costs	Baseline		Low		High	
1	**Above-Grade Wall Upgrade**		**$100,930**		**$107,520**		**$113,860**
	Architectural	$63,160		$66,490		$70,560	
	Mechanical	$0		$0		$0	
	Electrical	$0		$0		$0	
	General Conditions & Requirements	$13,770		$15,030		$16,300	
	Contingencies	$24,000		$26,000		$27,000	
2	**Slab-on-Grade Upgrade**		**$15,320**		**$15,320**		**$21,700**
	Architectural	$9,500		$9,500		$13,400	
	Mechanical	$0		$0		$0	
	Electrical	$0		$0		$0	
	General Conditions & Requirements	$2,120		$2,120		$3,000	
	Contingencies	$3,700		$3,700		$5,300	
3	**Roof Upgrade**		**$20,152**		**$20,152**		**$24,639**
	Architectural	$12,412		$12,412		$15,289	
	Mechanical	$0		$0		$0	
	Electrical	$0		$0		$0	
	General Conditions & Requirements	$2,840		$2,840		$3,450	
	Contingencies	$4,900		$4,900		$5,900	
4	**Window Upgrade**		**$78,430**		**$81,250**		**$86,620**
	Architectural	$48,800		$50,400		$53,600	
	Mechanical	$0		$0		$0	
	Electrical	$0		$0		$0	
	General Conditions & Requirements	$10,630		$11,850		$12,020	
	Contingencies	$19,000		$19,000		$21,000	
5	**Door Upgrade**		**$72,250**		**$72,250**		**$84,380**
	Architectural	$43,900		$43,900		$51,500	
	Mechanical	$0		$0		$0	
	Electrical	$0		$0		$0	
	General Conditions & Requirements	$10,350		$10,350		$11,880	
	Contingencies	$18,000		$18,000		$21,000	
6	**Infiltration Reduction**		**$24,340**		**$24,340**		**$24,340**
	Architectural	$15,000		$15,000		$15,000	
	Mechanical	$0		$0		$0	
	Electrical	$0		$0		$0	
	General Conditions & Requirements	$3,440		$3,440		$3,440	
	Contingencies	$5,900		$5,900		$5,900	
7	**Floor over Unheated Space**		**$22,320**		**$22,320**		**$32,185**
	Architectural	$13,770		$13,770		$19,845	
	Mechanical	$0		$0		$0	
	Electrical	$0		$0		$0	
	General Conditions & Requirements	$3,150		$3,150		$4,540	
	Contingencies	$5,400		$5,400		$7,800	
8	**HVAC Distribution**		**$51,374**		**$50,714**		**$87,650**
	Architectural	$1,000		$750		$1,500	
	Mechanical	$29,600		$29,300		$51,200	
	Electrical	$1,034		$1,034		$1,820	
	General Conditions & Requirements	$7,040		$7,030		$12,130	
	Contingencies	$12,700		$12,600		$21,000	
9	**DHW**		**$10,495**		**$8,065**		**$11,139**
	Architectural	$750		$0		$0	
	Mechanical	$5,115		$4,190		$5,940	
	Electrical	$620		$815		$979	
	General Conditions & Requirements	$1,460		$1,130		$1,520	
	Contingencies	$2,550		$1,930		$2,700	
10	**Solar PV**						
	Architectural						
	Mechanical						
	Electrical						
	General Conditions & Requirements						
	Contingencies						
	Total Estimated Construction Costs (nearest ,000)		**$396,000**		**$402,000**		**$487,000**

Construction Costs	Baseline		Low		High	
Hard Costs						
Architectural	$208,292		$212,222		$240,694	
Mechanical	$34,715		$33,490		$57,140	
Electrical	$1,654		$1,849		$2,799	
General Conditions & Requirements	$54,800		$56,940		$68,280	
Subtotal - Hard Costs		**$299,461**		**$304,501**		**$368,913**
Contingencies						
Design & Pricing	$60,100		$60,700		$73,300	
Escalation	Excluded		Excluded		Excluded	
Construction	$36,050		$36,730		$44,300	
Subtotal - Contingencies		**$96,150**		**$97,430**		**$117,600**
Hard Costs including Contingencies (nearest ,000)		**$396,000**		**$402,000**		**$487,000**

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Above-Grade Wall Upgrade					
	GL-2 Base - Wood framed wall with cavity insulation (R-20)					
	Architectural					$63,160
1	Wood framed exterior cladding, including:	185	m2	$336.00	$62,160	
1.1	- fiber cement lap siding, assumed					
1.2	- wood battens @ 400mm o/c, assumed					
1.3	- 12mm OSB sheathing, assumed					
1.4	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
1.5	- cavity insulation (R-20)					
1.6	- 12mm gypsum board drywall, assumed					
2	Allowance for caulking and sealant	1	LS	$1,000.00	$1,000	
	Subtotal 1				$63,160	
3	Prime Contractor's General Requirements	1	LS	$9,000	$9,000	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$440	$440	
6	Labour & Material and Performance bonding	1	LS	$630	$630	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$3,700	$3,700	5.0%
	Subtotal 2				$76,930	
9	Design Contingency	1	LS	$15,000	$15,000	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$9,000	$9,000	10.0%
	Total for Above-Grade Wall Upgrade				**$100,930**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Above-Grade Wall Upgrade					
	GL-2 Low - Wood framed wall with cavity insulation + 1.5" exterior mineral wool insulation					
	Architectural					$66,490
1	Wood framed exterior cladding, including:	185	m2	$354.00	$65,490	
1.1	- fiber cement lap siding, assumed					
1.2	- pressure treated wood strapping @ 400mm o/c, assumed					
1.3	- 38mm exterior mineral wool insulation (R-5), assumed					
1.4	- 12mm OSB sheathing, assumed					
1.5	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
1.6	- cavity insulation (R-18)					
1.7	- 12mm gypsum board drywall, assumed					
2	Allowance for caulking and sealant	1	LS	$1,000.00	$1,000	
	Subtotal 1				$66,490	
3	Prime Contractor's General Requirements	1	LS	$10,000	$10,000	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$470	$470	
6	Labour & Material and Performance bonding	1	LS	$660	$660	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$3,900	$3,900	5.0%
	Subtotal 2				$81,520	
9	Design Contingency	1	LS	$16,000	$16,000	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$10,000	$10,000	10.0%
	Total for Above-Grade Wall Upgrade				**$107,520**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Above-Grade Wall Upgrade					
	GH-1 High - Wood framed, better interior and exterior insulation (R-40 eff.)					
	Architectural					$70,560
1	Wood framed exterior cladding, including:	185	m2	$376.00	$69,560	
1.1	- fiber cement lap siding, assumed					
1.2	- new thermally broken cladding clips					
1.3	- pressure treated wood strapping @ 400mm o/c, assumed					
1.4	- 150mm exterior mineral wool insulation					
1.5	- 12mm OSB sheathing, assumed					
1.6	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
1.7	- cavity insulation (R-20)					
1.8	- 12mm gypsum board drywall, assumed					
2	Allowance for caulking and sealant	1	LS	$1,000.00	$1,000	
	Subtotal 1				$70,560	
3	Prime Contractor's General Requirements	1	LS	$11,000	$11,000	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$490	$490	
6	Labour & Material and Performance bonding	1	LS	$710	$710	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$4,100	$4,100	5.0%
	Subtotal 2				$86,860	
9	Design Contingency	1	LS	$17,000	$17,000	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$10,000	$10,000	10.0%
	Total for Above-Grade Wall Upgrade				**$113,860**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Slab-on-Grade Upgrade					
	GH-6 Base - 2" XPS insulation below slab-on-grade (R-10)					
	Architectural					$9,500
1	Concrete slab on grade including:	25	m2	$320.00	$8,000	
1.1	- level and compact subgrade, assumed					
1.2	- 200mm granular sub base, assumed					
1.3	- 6mil poly moisture barrier					
1.4	- edge formwork					
1.5	- wire mesh reinforcing, assumed					
1.6	- 50mm XPS insulation (R-10)					
1.7	- 100mm concrete, assumed					
1.8	- concrete finish					
2	Allowance concrete equipment pads, assumed	1	LS	$1,500.00	$1,500	
	Subtotal 1				$9,500	
3	Prime Contractor's General Requirements	1	LS	$1,400	$1,400	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$70	$70	
6	Labour & Material and Performance bonding	1	LS	$100	$100	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$550	$550	5.0%
	Subtotal 2				$11,620	
9	Design Contingency	1	LS	$2,300	$2,300	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$1,400	$1,400	10.0%
	Total for Slab-on-Grade Upgrade				**$15,320**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Slab-on-Grade Upgrade					
	GH-6 High - 8" polyiso. Insulation below slab-on grade (R-48)					
	Architectural					$13,400
1	Concrete slab on grade including:	25	m2	$476.00	$11,900	
1.1	- level and compact subgrade, assumed					
1.2	- 200mm granular sub base, assumed					
1.3	- 6mil poly moisture barrier					
1.4	- edge formwork					
1.5	- wire mesh reinforcing, assumed					
1.6	- 200mm XPS insulation					
1.7	- 100mm concrete, assumed					
1.8	- concrete finish					
2	Allowance concrete equipment pads, assumed	1	LS	$1,500.00	$1,500	
	Subtotal 1				$13,400	
3	Prime Contractor's General Requirements	1	LS	$2,000	$2,000	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$90	$90	
6	Labour & Material and Performance bonding	1	LS	$130	$130	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$780	$780	5.0%
	Subtotal 2				$16,400	
9	Design Contingency	1	LS	$3,300	$3,300	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$2,000	$2,000	10.0%
	Total for Slab-on-Grade Upgrade				**$21,700**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Roof Upgrade					
	GH-2 Base - Blown-in/batt (R-59)					
	Architectural					$12,412
1	Allowance for mobile scaffolding, assumed	1	LS	$2,000.00	$2,000	
2	Blown in batt insulation (R-59)	137	m2	$76.00	$10,412	
	Subtotal 1				$12,412	
3	Prime Contractor's General Requirements	1	LS	$1,900	$1,900	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$90	$90	
6	Labour & Material and Performance bonding	1	LS	$120	$120	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$730	$730	5.0%
	Subtotal 2				$15,252	
9	Design Contingency	1	LS	$3,100	$3,100	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$1,800	$1,800	10.0%
	Total for Roof Upgrade				**$20,152**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Roof Upgrade					
	GH-2 High - Blown-in/batt (R-80)					
	Architectural					$15,289
1	Allowance for mobile scaffolding, assumed	1	LS	$2,000.00	$2,000	
2	Blown in batt insulation (R-80)	137	m2	$97.00	$13,289	
	Subtotal 1				$15,289	
3	Prime Contractor's General Requirements	1	LS	$2,300	$2,300	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$110	$110	
6	Labour & Material and Performance bonding	1	LS	$150	$150	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$890	$890	5.0%
	Subtotal 2				$18,739	
9	Design Contingency	1	LS	$3,700	$3,700	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$2,200	$2,200	10.0%
	Total for Roof Upgrade				**$24,639**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Window Upgrade					
	GL-1 Base - Double-glazed, fibreglass (U-0.15, SHGC-0.26); 25% FDWR					
	Architectural					$48,800
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling	1	LS	$3,000.00	$3,000	
2	Fiberglass framed double glazed window units, low-e coating (U-0.28, SHGC-0.26), similar to Inline 400 series	32	m2	$1,150.00	$36,800	
3	Extra over for operable units, assumed	32	m2	$250.00	$8,000	
4	Caulking, and sealing	1	LS	$1,000.00	$1,000	
	Subtotal 1				$48,800	
5	Prime Contractor's General Requirements	1	LS	$7,000	$7,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$340	$340	
8	Labour & Material and Performance bonding	1	LS	$490	$490	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$2,800	$2,800	5.0%
	Subtotal 2				$59,430	
11	Design Contingency	1	LS	$12,000	$12,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$7,000	$7,000	10.0%
	Total for Window Upgrade				**$78,430**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Window Upgrade					
	GL-1 Low - Better double-glazed, fibreglass (U-0.22, SHGC-0.26); 25% FDWR					
	Architectural					$50,400
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling	1	LS	$3,000.00	$3,000	
2	Fiberglass framed double glazed window units, low-e coating (U-0.22, SHGC-0.26), similar to Inline 400 series	32	m2	$1,200.00	$38,400	
3	Extra over for operable units, assumed	32	m2	$250.00	$8,000	
4	Caulking, and sealing	1	LS	$1,000.00	$1,000	
	Subtotal 1				$50,400	
5	Prime Contractor's General Requirements	1	LS	$8,000	$8,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$350	$350	
8	Labour & Material and Performance bonding	1	LS	$500	$500	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$3,000	$3,000	5.0%
	Subtotal 2				$62,250	
11	Design Contingency	1	LS	$12,000	$12,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$7,000	$7,000	10.0%
	Total for Window Upgrade				**$81,250**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Window Upgrade					
	GH-3 High - Triple-glazed windows (U-0.15, SHGC-0.26); 25% FDWR					
	Architectural					$53,600
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling	1	LS	$3,000.00	$3,000	
2	Fiberglass framed triple glazed window units, with triple silver low-e coating (U-0.15, SHGC-0.26), similar to Inline 400 series	32	m2	$1,300.00	$41,600	
3	Extra over for operable units, assumed	32	m2	$250.00	$8,000	
4	Caulking, and sealing	1	LS	$1,000.00	$1,000	
	Subtotal 1				$53,600	
5	Prime Contractor's General Requirements	1	LS	$8,000	$8,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$380	$380	
8	Labour & Material and Performance bonding	1	LS	$540	$540	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$3,100	$3,100	5.0%
	Subtotal 2				$65,620	
11	Design Contingency	1	LS	$13,000	$13,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$8,000	$8,000	10.0%
	Total for Window Upgrade				**$86,620**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Door Upgrade					
	GH-4 Base - Seven (7) non-thermally broken swing doors (U-0.28) Per unit.					
	One (1) 2.1-m by 4.9-m non-thermaly broken garage door (U-0.28) Per unit.					
	Architectural					$43,900
1	Thermally broken fiberglass door on frame including installation and finish:					
1.1	- single door (U-0.28)	7	NO	$4,700.00	$32,900	
2	Thermally broken overhead door and frame including installation and finish:					
2.1	- overhead door (U-0.28)	1	NO	$8,000.00	$8,000	
3	Caulking, sealing and weather stripping, assumed	1	LS	$3,000.00	$3,000	
	Subtotal 1				$43,900	
4	Prime Contractor's General Requirements	1	LS	$7,000	$7,000	15.0%
5	Building permit				Excluded	
6	General Liability and Builder's Risk insurance	1	LS	$310	$310	
7	Labour & Material and Performance bonding	1	LS	$440	$440	
8	Miscellaneous Allowances				Excluded	
9	Prime Contractor's Fee	1	LS	$2,600	$2,600	5.0%
	Subtotal 2				$54,250	
10	Design Contingency	1	LS	$11,000	$11,000	20.0%
11	Escalation Contingency				Excluded	0.0%
12	Construction Contingency (Post Contract)	1	LS	$7,000	$7,000	10.0%
	Total for Door Upgrade				**$72,250**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Door Upgrade						
	GH-4 High - Upgrade swing and garage doors to be thermally broken with improved performance (U-0.20 for swing U-0.10 for garage)						
	Architectural					$51,500	
1	Thermally broken fiberglass door on frame including installation and finish:						
1.1	- single door (U-0.20)	7	NO	$5,500.00	$38,500		
2	Thermally broken overhead door and frame including installation and finish:						
2.1	- overhead door (U-0.10)	1	NO	$10,000.00	$10,000		
3	Caulking, sealing and weather stripping, assumed	1	LS	$3,000.00	$3,000		
	Subtotal 1				$51,500		
4	Prime Contractor's General Requirements	1	LS	$8,000	$8,000		15.0%
5	Building permit				Excluded		
6	General Liability and Builder's Risk insurance	1	LS	$360	$360		
7	Labour & Material and Performance bonding	1	LS	$520	$520		
8	Miscellaneous Allowances				Excluded		
9	Prime Contractor's Fee	1	LS	$3,000	$3,000		5.0%
	Subtotal 2				$63,380		
10	Design Contingency	1	LS	$13,000	$13,000		20.0%
11	Escalation Contingency				Excluded		0.0%
12	Construction Contingency (Post Contract)	1	LS	$8,000	$8,000		10.0%
	Total for Door Upgrade				**$84,380**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Infiltration Reduction					
	GH-5 Base - ACH 2.5 @ 50 Pa (0.53 @ 5 Pa)					
	Architectural					$15,000
1	Allowance for infiltration reduction of building envelope including envelope reviews and site	1	LS	$15,000.00	$15,000	
	Subtotal 1				$15,000	
2	Prime Contractor's General Requirements	1	LS	$2,300	$2,300	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$110	$110	
5	Labour & Material and Performance bonding	1	LS	$150	$150	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$880	$880	5.0%
	Subtotal 2				$18,440	
8	Design Contingency	1	LS	$3,700	$3,700	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$2,200	$2,200	10.0%
	Total for Infiltration Reduction				**$24,340**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Infiltration Reduction					
	GH-5 High - ACH 2.3 @ 50 Pa (0.49 @ 5 Pa)					
	Architectural					$15,000
1	Allowance for infiltration reduction of building envelope including envelope reviews and site	1	LS	$15,000.00	$15,000	
	Subtotal 1				$15,000	
2	Prime Contractor's General Requirements	1	LS	$2,300	$2,300	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$110	$110	
5	Labour & Material and Performance bonding	1	LS	$150	$150	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$880	$880	5.0%
	Subtotal 2				$18,440	
8	Design Contingency	1	LS	$3,700	$3,700	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$2,200	$2,200	10.0%
	Total for Infiltration Reduction				**$24,340**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Floor over Unheated Space					
	GH-7 Base - Interior batt (R-28)					
	Architectural					$13,770
1	Insulate floor over over unheated space, including:	81	m2	$170.00	$13,770	
1.1	- interior batt insulation (R-28)					
1.2	- suspended gypsum board ceiling, assumed					
	Subtotal 1				$13,770	
2	Prime Contractor's General Requirements	1	LS	$2,100	$2,100	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$100	$100	
5	Labour & Material and Performance bonding	1	LS	$140	$140	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$810	$810	5.0%
	Subtotal 2				$16,920	
8	Design Contingency	1	LS	$3,400	$3,400	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$2,000	$2,000	10.0%
	Total for Floor over Unheated Space				**$22,320**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Floor over Unheated Space					
	GH-7 High Interior batt + add 4" foam board below (R-50)					
	Architectural					$19,845
1	Insulate floor over over unheated space, including:	81	m2	$245.00	$19,845	
1.1	- interior batt insulation (R-28)					
1.2	- foam board insulation (R-22)					
1.3	- suspended gypsum board ceiling, assumed					
	Subtotal 1				$19,845	
2	Prime Contractor's General Requirements	1	LS	$3,000	$3,000	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$140	$140	
5	Labour & Material and Performance bonding	1	LS	$200	$200	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$1,200	$1,200	5.0%
	Subtotal 2				$24,385	
8	Design Contingency	1	LS	$4,900	$4,900	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$2,900	$2,900	10.0%
	Total for Floor over Unheated Space				**$32,185**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	HVAC Distribution						
	GL-3 Base - One (1) forced-air system per unit (Selection to come) Gas furnace (95% eff.) DX cooling (11.5 EER), No ERV						
	Architectural					$1,000	
1	Mechanical room space included as part of base building construction						
2	Allowance for mechanical service openings	1	NO	$1,000.00	$1,000		
	Mechanical					$29,600	
3	Allowance for gas furnace unit with remote condensing unit	1	NO	$13,000.00	$13,000		
3.1	- furnace airhandling c/w condensing units - 2 Ton cooling (as per mechanical selection)						
3.2	- refrigerant line, accessories and refrigerant charge ~ 8m - 10m refrigerant line						
3.3	- outdoor unit weather proof covers				excluded		
4	Allowance for air distribution including						
4.1	- ductwork	275	KG	$30.00	$8,250		
4.2	- thermal insulation			Assume not required			
4.3	- air diffusion devices	1	LS	$500.00	$500		
4.4	- miscellaneous ductwork components	1	LS	$800.00	$800		
5	General allowance						
5.1	- noise and vibration isolation	1	LS	$150.00	$150		
5.2	- starters/VFDs and mechanical wiring				Included		
5.3	- TAB work	1	LS	$150.00	$150		
5.4	- basic start-up and contractor's commissioning	1	LS	$200.00	$200		
5.5	- condensate drain	1	LS	$250.00	$250		
5.6	- natural gas service to the unit	1	LS	$1,800.00	$1,800		
6	Miscellaneous works and general accounts	1	NO	$3,000.00	$3,000		
7	Allowance for system controls including field devices thermostat/controller	1	LS	$1,500.00	$1,500		
	Electrical					$1,034	
8	New breaker to accommodate power connection below	1	NO	$260.00	$260		
9	Power connection with line and load side wiring including disconnect switch for air source heat pump unit	1	NO	$600.00	$600		
10	General Requirements including:					$174	
10.1	- Supervision	1	LS	$96.00	$96		
10.2	- Premium time, etc.	1	LS	$0.00	$0		
10.3	- Job set-up, etc.	1	LS	$46.00	$46		
10.4	- Rentals, small tools, etc.	1	LS	$18.00	$18		
10.5	- Permits & inspections	1	LS	$12.00	$12		
10.6	- Insurance	1	LS	$2.00	$2		
10.7	- Performance bond	1	LS	$0.00	$0		
10.8	- Labour & material bond	1	LS	$0.00	$0		
10.9	- Contingency	1	LS	$0.00	$0		
	Subtotal 1				$31,634		
11	Prime Contractor's General Requirements	1	LS	$4,700	$4,700		15.0%
12	Building permit				Excluded		
13	General Liability and Builder's Risk insurance	1	LS	$220	$220		
14	Labour & Material and Performance bonding	1	LS	$320	$320		
15	Miscellaneous Allowances				Excluded		
16	Prime Contractor's Fee	1	LS	$1,800	$1,800		5.0%
	Subtotal 2				$38,674		
17	Design Contingency	1	LS	$8,000	$8,000		20.0%
18	Escalation Contingency				Excluded		0.0%
19	Construction Contingency (Post Contract)	1	LS	$4,700	$4,700		10.0%
	Total for HVAC Distribution				**$51,374**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	HVAC Distribution						
	GL-3 Low - One (1) Central cold-climate ASHP per unit, No ERV						
	Architectural					$750	
1	Mechanical room space included as part of base building construction						
2	Allowance for mechanical service openings	1	NO	$750.00	$750		
	Mechanical					$29,300	
3	Allowance for air source heat pump units (no dual fuel option is considered)	1	NO	$14,500.00	$14,500		
3.1	- multi position airhandling c/w heat pump condensing units - 2.5 Ton cooling (as per mechanical selection)						
3.2	- refrigerant line, accessories and refrigerant charge ~ 8m - 10m refrigerant line						
3.3	- outdoor unit weather proof covers				excluded		
4	Allowance for air distribution including						
4.1	- ductwork	275	KG	$30.00	$8,250		
4.2	- thermal insulation				Assume not required		
4.3	- air diffusion devices	1	LS	$500.00	$500		
4.4	- miscellaneous ductwork components	1	LS	$800.00	$800		
5	General allowance						
5.1	- noise and vibration isolation	1	LS	$150.00	$150		
5.2	- starters/VFDs and mechanical wiring				Included		
5.3	- TAB work	1	LS	$150.00	$150		
5.4	- basic start-up and contractor's commissioning	1	LS	$200.00	$200		
5.5	- condensate drain	1	LS	$250.00	$250		
5.6	- natural gas service to the unit				n/a		
6	Miscellaneous works and general accounts	1	NO	$3,000.00	$3,000		
7	Allowance for system controls including field devices thermostat/controller	1	LS	$1,500.00	$1,500		
	Electrical					$1,034	
8	New breaker to accommodate power connection below	1	NO	$260.00	$260		
9	Power connection with line and load side wiring including disconnect switch for air source heat pump unit	1	NO	$600.00	$600		
10	General Requirements including:					$174	
10.1	- Supervision	1	LS	$96.00	$96		
10.2	- Premium time, etc.	1	LS	$0.00	$0		
10.3	- Job set-up, etc.	1	LS	$46.00	$46		
10.4	- Rentals, small tools, etc.	1	LS	$18.00	$18		
10.5	- Permits & inspections	1	LS	$12.00	$12		
10.6	- Insurance	1	LS	$2.00	$2		
10.7	- Performance bond	1	LS	$0.00	$0		
10.8	- Labour & material bond	1	LS	$0.00	$0		
10.9	- Contingency	1	LS	$0.00	$0		
	Subtotal 1				$31,084		
11	Prime Contractor's General Requirements	1	LS	$4,700	$4,700		15.0%
12	Building permit				Excluded		
13	General Liability and Builder's Risk insurance	1	LS	$220	$220		
14	Labour & Material and Performance bonding	1	LS	$310	$310		
15	Miscellaneous Allowances				Excluded		
16	Prime Contractor's Fee	1	LS	$1,800	$1,800		5.0%
	Subtotal 2				$38,114		
17	Design Contingency	1	LS	$8,000	$8,000		20.0%
18	Escalation Contingency				Excluded		0.0%
19	Construction Contingency (Post Contract)	1	LS	$4,600	$4,600		10.0%
	Total for HVAC Distribution				**$50,714**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	HVAC Distribution						
	GH-8 High - One (1) Central GSHP unit per suite, No ERV						
	Architectural					$1,500	
1	Mechanical room space included as part of base building construction						
2	Allowance for mechanical service openings	1	NO	$1,500.00	$1,500		
	Mechanical					$51,200	
3	Allowance for geothermal heat pump air handler, variable speed c/w 5kW back-up electric resistance heating - 1.25 ton (as per mechanical selections)	1	NO	$13,000.00	$13,000		
4	Allowance for pump assembly c/w valving and piping	1	NO	$4,000.00	$4,000		
5	DHW desuperheater connection/preheat tank				excluded		
6	Allowance for air distribution including						
6.1	- ductwork	275	KG	$30.00	$8,250		
6.2	- thermal insulation				Assume not required		
6.3	- air diffusion devices	1	LS	$500.00	$500		
6.4	- miscellaneous ductwork components	1	LS	$800.00	$800		
7	General allowance						
7.1	- noise and vibration isolation	1	LS	$150.00	$150		
7.2	- starters/VFDs and mechanical wiring				Included		
7.3	- TAB work	1	LS	$350.00	$350		
7.4	- basic start-up and contractor's commissioning	1	LS	$400.00	$400		
7.5	- condensate drain	1	LS	$250.00	$250		
8	Miscellaneous works and general accounts	1	NO	$3,000.00	$3,000		
9	Allowance for vertical GHX heat exchanger loop including drilling, loop installation, tie-in loop and commissioning - 400' deep	1	NO	$17,000.00	$17,000		
10	Thermal conductivity test				excluded		
11	Allowance for system controls including field devices thermostat/controller	1	LS	$3,500.00	$3,500		
	Electrical					$1,820	
12	New breaker to accommodate power connection below	1	NO	$380.00	$380		
13	Power connection with line and load side wiring for geothermal heat pump air handler c/w 5kW back-up electric resistance heating	2	NO	$600.00	$1,200		
14	General Requirements including:					$240	
14.1	- Supervision	1	LS	$96.00	$96		
14.2	- Premium time, etc.	1	LS	$0.00	$0		
14.3	- Job set-up, etc.	1	LS	$85.00	$85		
14.4	- Rentals, small tools, etc.	1	LS	$34.00	$34		
14.5	- Permits & inspections	1	LS	$22.00	$22		
14.6	- Insurance	1	LS	$3.00	$3		
14.7	- Performance bond	1	LS	$0.00	$0		
14.8	- Labour & material bond	1	LS	$0.00	$0		
14.9	- Contingency	1	LS	$0.00	$0		
	Subtotal 1				$54,520		
15	Prime Contractor's General Requirements	1	LS	$8,000	$8,000		15.0%
16	Building permit				Excluded		
17	General Liability and Builder's Risk insurance	1	LS	$380	$380		
18	Labour & Material and Performance bonding	1	LS	$550	$550		
19	Miscellaneous Allowances				Excluded		
20	Prime Contractor's Fee	1	LS	$3,200	$3,200		5.0%
	Subtotal 2				$66,650		
21	Design Contingency	1	LS	$13,000	$13,000		20.0%
22	Escalation Contingency				Excluded		0.0%
23	Construction Contingency (Post Contract)	1	LS	$8,000	$8,000		10.0%
	Total for HVAC Distribution				**$87,650**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	DHW						
	GL-4 Base - One (1) natural gas storage heater (150 L, 54.5% eff.) located in 1st floor Mech room.						
	Architectural					$750	
1	Mechanical room space included as part of base building construction						
2	Allowance for service penetrations serving DHW venting	1	LS	$750.00	$750		
	Mechanical					$5,115	
3	Allowance for domestic hot water plant including:						
3.1	- gas fired storage tanks heater, residential vertical tank c/w venting - 150L, 4.5kW	1	NO	$2,200.00	$2,200		
3.2	- recirculating system				not required		
4	Allowance for distribution piping including:						
4.1	- DHW plant room piping, pex tubing	10	m	$75.00	$750		
4.2	- Line valves and piping accessories	1	LS	$190.00	$190		
5	General allowance						
5.1	- TAB work				not required		
5.2	- Basic start-up and contractor's commissioning	1	LS	$300.00	$300		
5.3	- System condensate/drains	1	LS	$500.00	$500		
5.4	- natural gas service to the unit	1	LS	$375.00	$375		
6	Miscellaneous works and general accounts	1	NO	$500.00	$500		
7	Allowance for DHW plant controls including field devices, sensors and wiring	1	LS	$300.00	$300		
	Electrical					$620	
8	New breaker to accommodate power connection below	1	LS	$80.00	$80		
9	Power connection with line and load side wiring including disconnect switch for gas fired storage tank heater	1	NO	$400.00	$400		
10	General Requirements including:					$140	
10.1	- Supervision	1	LS	$96.00	$96		
10.2	- Premium time, etc.	1	LS	$0.00	$0		
10.3	- Job set-up, etc.	1	LS	$26.00	$26		
10.4	- Rentals, small tools, etc.	1	LS	$10.00	$10		
10.5	- Permits & inspections	1	LS	$7.00	$7		
10.6	- Insurance	1	LS	$1.00	$1		
10.7	- Performance bond	1	LS	$0.00	$0		
10.8	- Labour & material bond	1	LS	$0.00	$0		
10.9	- Contingency	1	LS	$0.00	$0		
	Subtotal 1				$6,485		
11	Prime Contractor's General Requirements	1	LS	$970	$970		15.0%
12	Building permit				Excluded		
13	General Liability and Builder's Risk insurance	1	LS	$50	$50		
14	Labour & Material and Performance bonding	1	LS	$60	$60		
15	Miscellaneous Allowances				Excluded		
16	Prime Contractor's Fee	1	LS	$380	$380		5.0%
	Subtotal 2				$7,945		
17	Design Contingency	1	LS	$1,600	$1,600		20.0%
18	Escalation Contingency				Excluded		0.0%
19	Construction Contingency (Post Contract)	1	LS	$950	$950		10.0%
	Total for DHW				**$10,495**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	DHW						
	GL-4 Low - One (1) electric storage DHW heater per unit (150 L) located in 1st floor Mech room.						
	Architectural					$0	
1	Mechanical room space included as part of base building construction						
	Mechanical					$4,190	
2	Allowance for domestic hot water plant including:						
2.1	- Electric storage tanks heater, residential vertical tank - 150L, 4.5kW	1	NO	$1,750.00	$1,750		
2.2	- recirculating system				not required		
3	Allowance for distribution piping including:						
3.1	- DHW plant room piping, pex tubing	10	m	$75.00	$750		
3.2	- Line valves and piping accessories	1	LS	$190.00	$190		
4	General allowance						
4.1	- TAB work				not required		
4.2	- Basic start-up and contractor's commissioning	1	LS	$300.00	$300		
4.3	- System condensate/drains	1	LS	$500.00	$500		
5	Miscellaneous works and general accounts	1	NO	$400.00	$400		
6	Allowance for DHW plant controls including field devices, sensors and wiring	1	LS	$300.00	$300		
	Electrical					$815	
7	New breaker to accommodate power connection below	1	NO	$260.00	$260		
8	Power connection with line and load side wiring including disconnect switch for electric storage tank heater	1	NO	$400.00	$400		
9	General Requirements including:					$155	
9.1	- Supervision	1	LS	$96.00	$96		
9.2	- Premium time, etc.	1	LS	$0.00	$0		
9.3	- Job set-up, etc.	1	LS	$35.00	$35		
9.4	- Rentals, small tools, etc.	1	LS	$14.00	$14		
9.5	- Permits & inspections	1	LS	$9.00	$9		
9.6	- Insurance	1	LS	$1.00	$1		
9.7	- Performance bond	1	LS	$0.00	$0		
9.8	- Labour & material bond	1	LS	$0.00	$0		
9.9	- Contingency	1	LS	$0.00	$0		
	Subtotal 1				$5,005		
10	Prime Contractor's General Requirements	1	LS	$750	$750		15.0%
11	Building permit				Excluded		
12	General Liability and Builder's Risk insurance	1	LS	$40	$40		
13	Labour & Material and Performance bonding	1	LS	$50	$50		
14	Miscellaneous Allowances				Excluded		
15	Prime Contractor's Fee	1	LS	$290	$290		5.0%
	Subtotal 2				$6,135		
16	Design Contingency	1	LS	$1,200	$1,200		20.0%
17	Escalation Contingency				Excluded		0.0%
18	Construction Contingency (Post Contract)	1	LS	$730	$730		10.0%
	Total for DHW				**$8,065**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DHW					
	GH-9 High - One (1) electric instantaneous DW heater					
	Architectural					$0
1	Mechanical room space included as part of base building construction					
	Mechanical					$5,940
2	Allowance for domestic hot water heater, residential type equal to AO smith/Rheem					
2.1	- hybrid heat pump domestic hot water tank heater - 150L, 4.5kW	1	NO	$3,500.00	$3,500	
2.2	- recirculating system				not required	
3	Allowance for distribution piping including:					
3.1	- DHW plant room piping, pex tubing	10	m	$75.00	$750	
3.2	- Line valves and piping accessories	1	LS	$190.00	$190	
4	General allowance					
4.1	- TAB work				not required	
4.2	- Basic start-up and contractor's commissioning	1	LS	$0.00	$0	
4.3	- System condensate/drains	1	LS	$500.00	$500	
5	Miscellaneous works and general accounts	1	NO	$1,000.00	$1,000	
6	Allowance for DHW plant controls including field devices, sensors and wiring	1	LS	$0.00	$0	
	Electrical					$979
7	New breaker to accommodate power connection below	1	NO	$260.00	$260	
8	Power connection with line and load side wiring including disconnect switch for hybrid heat pump domestic hot water tank heater	1	NO	$550.00	$550	
9	General Requirements including:					$169
9.1	- Supervision	1	LS	$96.00	$96	
9.2	- Premium time, etc.	1	LS	$0.00	$0	
9.3	- Job set-up, etc.	1	LS	$43.00	$43	
9.4	- Rentals, small tools, etc.	1	LS	$17.00	$17	
9.5	- Permits & inspections	1	LS	$11.00	$11	
9.6	- Insurance	1	LS	$2.00	$2	
9.7	- Performance bond	1	LS	$0.00	$0	
9.8	- Labour & material bond	1	LS	$0.00	$0	
9.9	- Contingency	1	LS	$0.00	$0	
	Subtotal 1				$6,919	
10	Prime Contractor's General Requirements	1	LS	$1,000	$1,000	15.0%
11	Building permit				Excluded	
12	General Liability and Builder's Risk insurance	1	LS	$50	$50	
13	Labour & Material and Performance bonding	1	LS	$70	$70	
14	Miscellaneous Allowances				Excluded	
15	Prime Contractor's Fee	1	LS	$400	$400	5.0%
	Subtotal 2				$8,439	
16	Design Contingency	1	LS	$1,700	$1,700	20.0%
17	Escalation Contingency				Excluded	0.0%
18	Construction Contingency (Post Contract)	1	LS	$1,000	$1,000	10.0%
	Total for DHW				**$11,139**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Solar PV					
1	*N/A*					
	Subtotal 1				$0	
2	Prime Contractor's General Requirements	1	LS	$0	$0	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$0	$0	
5	Labour & Material and Performance bonding	1	LS	$0	$0	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$0	$0	5.0%
	Subtotal 2				$0	
8	Design Contingency	1	LS	$0	$0	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$0	$0	10.0%
	Total for Solar PV				**$0**	

MULTIPLE ESTIMATE SUMMARY
TOWN OF BANFF ARCHETYPES ANALYSIS - APARTMENT

CLASS C ESTIMATE
JUNE 25, 2025

A.W. HOOKER QUANTITY SURVEYORS

	Estimate Breakdown Construction Costs	Baseline		Low		High		High - Option 1		Alternate	
1	**Above-Grade Wall Upgrade**		**$1,400,320**		**$1,484,245**		**$2,726,545**				
	Architectural	$865,620		$917,045		$1,685,645					
	Mechanical	$0		$0		$0					
	Electrical	$0		$0		$0					
	General Conditions & Requirements	$195,700		$207,200		$379,900					
	Contingencies	$339,000		$360,000		$661,000					
2	**Roof Upgrade**		**$615,700**		**$628,330**		**$646,825**				
	Architectural	$381,200		$388,730		$400,025					
	Mechanical	$0		$0		$0					
	Electrical	$0		$0		$0					
	General Conditions & Requirements	$85,500		$87,600		$89,800					
	Contingencies	$149,000		$152,000		$157,000					
3	**Window Upgrade**		**$633,520**		**$678,100**		**$697,000**				
	Architectural	$390,920		$419,000		$430,700					
	Mechanical	$0		$0		$0					
	Electrical	$0		$0		$0					
	General Conditions & Requirements	$88,600		$94,100		$97,300					
	Contingencies	$154,000		$165,000		$169,000					
4	**Door Upgrade**										
	Architectural										
	Mechanical										
	Electrical										
	General Conditions & Requirements										
	Contingencies										
5	**Infiltration Reduction**		**$132,190**		**$140,480**		**$204,180**				
	Architectural	$82,000		$87,000		$126,000					
	Mechanical	$0		$0		$0					
	Electrical	$0		$0		$0					
	General Conditions & Requirements	$18,190		$19,480		$28,180					
	Contingencies	$32,000		$34,000		$50,000					
6	**Heating/Cooling Plant**		**$472,752**		**$255,367**		**$989,713**				
	Architectural	$16,500		$4,500		$6,000					
	Mechanical	$265,700		$143,400		$594,600					
	Electrical	$9,652		$9,767		$10,713					
	General Conditions & Requirements	$65,900		$35,700		$138,400					
	Contingencies	$115,000		$62,000		$240,000					
7	**Pump - GSHP VFD**						**$67,010**		**$105,800**		
	Architectural					$0		$0			
	Mechanical					$41,900		$64,900			
	Electrical					$0		$0			
	General Conditions & Requirements					$9,110		$14,900			
	Contingencies					$16,000		$26,000			
8	**HVAC Distribution**		**$1,882,168**		**$1,720,824**		**$1,720,824**				
	Architectural	$185,000		$185,000		$185,000					
	Mechanical	$946,210		$786,774		$786,774					
	Electrical	$32,358		$92,450		$92,450					
	General Conditions & Requirements	$262,600		$239,600		$239,600					
	Contingencies	$456,000		$417,000		$417,000					
9	**DHW Plant**		**$65,540**		**$883,886**		**$883,983**				**$239,283**
	Architectural	$1,000		$10,500		$10,500				$6,000	
	Mechanical	$37,150		$521,900		$521,900				$127,500	
	Electrical	$2,310		$14,186		$14,283				$14,283	
	General Conditions & Requirements	$9,080		$123,300		$123,300				$33,500	
	Contingencies	$16,000		$214,000		$214,000				$58,000	
10	**DWHRS**				**$45,380**		**$45,380**				
	Architectural			$0		$0					
	Mechanical			$28,000		$28,000					
	Electrical			$0		$0					
	General Conditions & Requirements			$6,280		$6,280					
	Contingencies			$11,100		$11,100					
11	**DW Load Reduction**		**$146,165**		**$146,165**		**$165,112**				
	Architectural	$0		$0		$0					
	Mechanical	$90,625		$90,625		$102,392					
	Electrical	$0		$0		$0					
	General Conditions & Requirements	$20,540		$20,540		$22,720					
	Contingencies	$35,000		$35,000		$40,000					
12	**Lighting**										
	Architectural										
	Mechanical										
	Electrical										
	General Conditions & Requirements										
	Contingencies										
13	**Solar PV**						**$278,874**				
	Architectural					$0					
	Mechanical					$0					
	Electrical					$172,974					
	General Conditions & Requirements					$38,900					
	Contingencies					$67,000					
	Total Estimated Construction Costs (nearest ,000)		**$5,348,000**		**$5,983,000**		**$8,425,000**				

Construction Costs	Baseline	Low	High	High - Option 1	Alternate
Hard Costs					
Architectural	$1,922,240	$2,011,775	$2,843,870	$0	$6,000
Mechanical	$1,339,685	$1,570,699	$2,075,566	$64,900	$127,500
Electrical	$44,320	$116,403	$290,420	$0	$14,283
General Conditions & Requirements	$746,110	$833,800	$1,173,490	$14,900	$33,500
Subtotal - Hard Costs	**$4,052,355**	**$4,532,677**	**$6,383,346**		
Contingencies					
Design & Pricing	$810,000	$907,000	$1,277,000	$16,000	$36,000
Escalation	Excluded	Excluded	Excluded	Excluded	Excluded
Construction	$486,000	$543,100	$765,100	$10,000	$22,000
Subtotal - Contingencies	**$1,296,000**	**$1,450,100**	**$2,042,100**		
Hard Costs including Contingencies (nearest ,000)	**$5,348,000**	**$5,983,000**	**$8,425,000**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Above-Grade Wall Upgrade					
	Base - Nom R-25, U-0.04, Eff R-19 + derate 5% for doors, Wood framed wall with cavity insulation (R-19 eff) Standard Balconies not thermally broken (Total length 808 feet, depth 5 feet)					
	Architectural					$865,620
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling, assumed 25%	234	m2	$125.00	$29,250	
2	Wood framed exterior cladding, including:	935	m2	$602.00	$562,870	
2.1	- hardiplank siding, assumed					
2.2	- wood battens @ 400mm o/c, assumed					
2.3	- 38mm exterior insulation, assumed					
2.4	- 12mm OSB sheathing, assumed					
2.5	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
2.6	- fiberglass batt cavity insulation (R-19), assumed					
2.7	- 12mm gypsum board drywall, assumed					
3	Allowance for caulking and sealant	1	LS	$11,000.00	$11,000	
4	Standard walkway, non-self supported and non-thermally broken	375	m2	$700.00	$262,500	
	Subtotal 1				$865,620	
5	Prime Contractor's General Requirements	1	LS	$130,000	$130,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$6,000	$6,000	
8	Labour & Material and Performance bonding	1	LS	$8,700	$8,700	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$51,000	$51,000	5.0%
	Subtotal 2				$1,061,320	
11	Design Contingency	1	LS	$212,000	$212,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$127,000	$127,000	10.0%
	Total for Above-Grade Wall Upgrade				**$1,400,320**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Above-Grade Wall Upgrade					
	AL-1 Low - Wood framed wall with cavity insulation with Add 2" of exterior XPS Insulation (R-30 eff.)					
	Architectural					$917,045
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling, assumed 25%	234	m2	$125.00	$29,250	
2	Wood framed exterior cladding, including:	935	m2	$657.00	$614,295	
2.1	- hardiplank siding, assumed					
2.2	- wood battens @ 400mm o/c, assumed					
2.3	- 38mm exterior insulation, assumed					
2.4	- 50mm exterior XPS insulation, assumed					
2.5	- 12mm OSB sheathing, assumed					
2.6	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
2.7	- fiberglass batt cavity insulation (R-19), assumed					
2.8	- 12mm gypsum board drywall, assumed					
3	Allowance for caulking and sealant	1	LS	$11,000.00	$11,000	
4	Standard walkway, non-self supported and non-thermally broken	375	m2	$700.00	$262,500	
	Subtotal 1				$917,045	
5	Prime Contractor's General Requirements	1	LS	$138,000	$138,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$6,000	$6,000	
8	Labour & Material and Performance bonding	1	LS	$9,200	$9,200	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$54,000	$54,000	5.0%
	Subtotal 2				$1,124,245	
11	Design Contingency	1	LS	$225,000	$225,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$135,000	$135,000	10.0%
	Total for Above-Grade Wall Upgrade				**$1,484,245**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Above-Grade Wall Upgrade					
	AH-1 High - Add 6" exterior mineral wool insulation and thermally broken cladding clips for cladding support (R-36 eff.) Self-supported exterior walkway thermally broken surroundings the entire building on 2nd and 3rd floor (Total length 808 feet, depth 5)					
	Architectural					$1,685,645
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling, assumed 25%	234	m2	$125.00	$29,250	
2	Wood framed exterior cladding, including:	935	m2	$717.00	$670,395	
2.1	- hardiplank siding, assumed					
2.2	- thermally broken cladding clips, assumed					
2.3	- wood battens @ 400mm o/c, assumed					
2.3	- 38mm exterior insulation, assumed					
2.4	- 50mm exterior XPS insulation, assumed					
2.5	- 12mm OSB sheathing, assumed					
2.6	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
2.7	- fiberglass batt cavity insulation (R-19), assumed					
2.8	- 150mm exterior mineral wool insulation, assumed					
2.9	- 12mm gypsum board drywall, assumed					
3	Allowance for caulking and sealant	1	LS	$11,000.00	$11,000	
4	Self supported exterior walkway thermally broken to building perimeter at second and third floor	375	m2	$2,600.00	$975,000	
	Subtotal 1				$1,685,645	
5	Prime Contractor's General Requirements	1	LS	$253,000	$253,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$12,000	$12,000	
8	Labour & Material and Performance bonding	1	LS	$16,900	$16,900	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$98,000	$98,000	5.0%
	Subtotal 2				$2,065,545	
11	Design Contingency	1	LS	$413,000	$413,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$248,000	$248,000	10.0%
	Total for Above-Grade Wall Upgrade				**$2,726,545**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Roof Upgrade						
	Base - Cavity insulation, exterior and interior insulated sloped roof (R-40)						
	Architectural					$381,200	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$55,000.00	$55,000		
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$10,000.00	$10,000		
2	Engineered wood truss roof construction, including:	753	m2	$400.00	$301,200		
2.1	- pre-engineered roof trusses including incidental framing bracing, sheathing, eaves framing and temporary works						
2.2	- cross strapping for ventilation below sheathing						
2.3	- exterior grade plywood sheathing						
2.4	- attic insulation (R-40)						
2.5	- insulation at joist cavity						
2.6	- air/ vapour barrier, assumed						
2.7	- 16mm gypsum board, assumed						
3	Allowance for framing to openings, assumed	1	LS	$15,000.00	$15,000		
	Subtotal 1				$381,200		
4	Prime Contractor's General Requirements	1	LS	$57,000	$57,000		15.0%
5	Building permit				Excluded		
6	General Liability and Builder's Risk insurance	1	LS	$2,700	$2,700		
7	Labour & Material and Performance bonding	1	LS	$3,800	$3,800		
8	Miscellaneous Allowances				Excluded		
9	Prime Contractor's Fee	1	LS	$22,000	$22,000		5.0%
	Subtotal 2				$466,700		
10	Design Contingency	1	LS	$93,000	$93,000		20.0%
11	Escalation Contingency				Excluded		0.0%
12	Construction Contingency (Post Contract)	1	LS	$56,000	$56,000		10.0%
	Total for Roof Upgrade				**$615,700**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Roof Upgrade						
	AL-3 Low - Cavity insulation, exterior and interior insulated sloped roof (eff R-46.9, U-0.021)						
	Architectural					$388,730	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$55,000.00	$55,000		
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$10,000.00	$10,000		
2	Engineered wood truss roof construction, including:	753	m2	$410.00	$308,730		
2.1	- pre-engineered roof trusses including incidental framing bracing, sheathing, eaves framing and temporary works						
2.2	- cross strapping for ventilation below sheathing						
2.3	- exterior grade plywood sheathing						
2.4	- attic insulation (R-46.9)						
2.5	- insulation at joist cavity						
2.6	- air/ vapour barrier, assumed						
2.7	- 16mm gypsum board, assumed						
3	Allowance for framing to openings, assumed	1	LS	$15,000.00	$15,000		
	Subtotal 1				$388,730		
4	Prime Contractor's General Requirements	1	LS	$58,000	$58,000		15.0%
5	Building permit				Excluded		
6	General Liability and Builder's Risk insurance	1	LS	$2,700	$2,700		
7	Labour & Material and Performance bonding	1	LS	$3,900	$3,900		
8	Miscellaneous Allowances				Excluded		
9	Prime Contractor's Fee	1	LS	$23,000	$23,000		5.0%
	Subtotal 2				$476,330		
10	Design Contingency	1	LS	$95,000	$95,000		20.0%
11	Escalation Contingency				Excluded		0.0%
12	Construction Contingency (Post Contract)	1	LS	$57,000	$57,000		10.0%
	Total for Roof Upgrade				**$628,330**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Roof Upgrade						
	AH-3 High - Cavity insulation, exterior and interior insulated sloped roof (R-60)						
	Architectural					$400,025	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$55,000.00	$55,000		
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$10,000.00	$10,000		
2	Engineered wood truss roof construction, including:	753	m2	$425.00	$320,025		
2.1	- pre-engineered roof trusses including incidental framing bracing, sheathing, eaves framing and temporary works						
2.2	- cross strapping for ventilation below sheathing						
2.3	- exterior grade plywood sheathing						
2.4	- attic insulation (R-60)						
2.5	- insulation at joist cavity						
2.6	- air/ vapour barrier, assumed						
2.7	- 16mm gypsum board, assumed						
3	Allowance for framing to openings, assumed	1	LS	$15,000.00	$15,000		
	Subtotal 1				$400,025		
4	Prime Contractor's General Requirements	1	LS	$60,000	$60,000		15.0%
5	Building permit				Excluded		
6	General Liability and Builder's Risk insurance	1	LS	$2,800	$2,800		
7	Labour & Material and Performance bonding	1	LS	$4,000	$4,000		
8	Miscellaneous Allowances				Excluded		
9	Prime Contractor's Fee	1	LS	$23,000	$23,000		5.0%
	Subtotal 2				$489,825		
10	Design Contingency	1	LS	$98,000	$98,000		20.0%
11	Escalation Contingency				Excluded		0.0%
12	Construction Contingency (Post Contract)	1	LS	$59,000	$59,000		10.0%
	Total for Roof Upgrade				**$646,825**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Window Upgrade						
	Base - Double-glazed (U-0.35, SHGC-0.6); 20% FDWR						
	Architectural					$390,920	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$47,000.00	$47,000		
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$10,000.00	$10,000		
2	Aluminum framed double glazed window units, low-e coating (U-0.35, SHGC-0.6), similar to Inline 400 series	234	m2	$1,130.00	$264,420		
3	Extra over for operable units, assumed	234	m2	$250.00	$58,500		
4	Caulking, and sealing	1	LS	$11,000.00	$11,000		
	Subtotal 1				$390,920		
5	Prime Contractor's General Requirements	1	LS	$59,000	$59,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$2,700	$2,700		
8	Labour & Material and Performance bonding	1	LS	$3,900	$3,900		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$23,000	$23,000		5.0%
	Subtotal 2				$479,520		
11	Design Contingency	1	LS	$96,000	$96,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$58,000	$58,000		10.0%
	Total for Window Upgrade				**$633,520**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Window Upgrade					
	AL-4 Low - Eff R-4.5, U-0.22, Dual IGU with triple silver low-e coating, fibreglass window frame					
	Architectural					$419,000
1	Equipment rentals, including:					
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$47,000.00	$47,000	
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$10,000.00	$10,000	
2	Fiberglass framed double glazed window units, with triple silver low-e coating (U-0.22), similar to Inline 400 series	234	m2	$1,250.00	$292,500	
3	Extra over for operable units, assumed	234	m2	$250.00	$58,500	
4	Caulking, and sealing	1	LS	$11,000.00	$11,000	
	Subtotal 1				$419,000	
5	Prime Contractor's General Requirements	1	LS	$63,000	$63,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$2,900	$2,900	
8	Labour & Material and Performance bonding	1	LS	$4,200	$4,200	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$24,000	$24,000	5.0%
	Subtotal 2				$513,100	
11	Design Contingency	1	LS	$103,000	$103,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$62,000	$62,000	10.0%
	Total for Window Upgrade				**$678,100**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Window Upgrade						
	AH-4 High - Triple-glazed windows (U-0.15, SHGC-0.6); 20% FDWR, Fibreglass windows with triple glazed IGUs, double low-e coating						
	Architectural					$430,700	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$47,000.00	$47,000		
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$10,000.00	$10,000		
2	Fiberglass framed triple glazed window units, low-e coating (U-0.15, SHGC-0.6), similar to Inline 400 series	234	m2	$1,300.00	$304,200		
3	Extra over for operable units, assumed	234	m2	$250.00	$58,500		
4	Caulking, and sealing	1	LS	$11,000.00	$11,000		
	Subtotal 1				$430,700		
5	Prime Contractor's General Requirements	1	LS	$65,000	$65,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$3,000	$3,000		
8	Labour & Material and Performance bonding	1	LS	$4,300	$4,300		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$25,000	$25,000		5.0%
	Subtotal 2				$528,000		
11	Design Contingency	1	LS	$106,000	$106,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$63,000	$63,000		10.0%
	Total for Window Upgrade				**$697,000**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Door Upgrade					
1	*N/A*					
	Subtotal 1				$0	
2	Prime Contractor's General Requirements	1	LS	$0	$0	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$0	$0	
5	Labour & Material and Performance bonding	1	LS	$0	$0	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$0	$0	5.0%
	Subtotal 2				$0	
8	Design Contingency	1	LS	$0	$0	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$0	$0	10.0%
	Total for Door Upgrade					**$0**

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Infiltration Reduction					
	Base - 1.5 L/s/m2 @ 75 Pa (0.48 L/s/m2 @ 5 Pa)					
	Architectural					$82,000
1	Allowance for infiltration reduction of building envelope including envelope reviews and site	1	LS	$82,000.00	$82,000	
	Subtotal 1				$82,000	
2	Prime Contractor's General Requirements	1	LS	$12,000	$12,000	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$570	$570	
5	Labour & Material and Performance bonding	1	LS	$820	$820	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$4,800	$4,800	5.0%
	Subtotal 2				$100,190	
8	Design Contingency	1	LS	$20,000	$20,000	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$12,000	$12,000	10.0%
	Total for Infiltration Reduction				**$132,190**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Infiltration Reduction					
	AL-2 Low - 1.25 L/s/m2 @ 75 Pa (0.4 L/s/m2 @ 5 Pa) - Recommend adding 5% to total envelope construction cost to account for increased QAQC, envelope reviews, and site testing.					
	Architectural					$87,000
1	Allowance for infiltration reduction of building envelope including envelope reviews and site	1	LS	$87,000.00	$87,000	
	Subtotal 1				$87,000	
2	Prime Contractor's General Requirements	1	LS	$13,000	$13,000	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$610	$610	
5	Labour & Material and Performance bonding	1	LS	$870	$870	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$5,000	$5,000	5.0%
	Subtotal 2				$106,480	
8	Design Contingency	1	LS	$21,000	$21,000	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$13,000	$13,000	10.0%
	Total for Infiltration Reduction				**$140,480**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Infiltration Reduction					
	AH-2 High - 0.50 L/s/m2 @ 75 Pa (0.16 L/s/m2 @ 5 Pa) - Recommend adding 5% to total envelope construction cost account for increased QAQC, envelope reviews, and site testing.					
	Architectural					$126,000
1	Allowance for infiltration reduction of building envelope including envelope reviews and site	1	LS	$126,000.00	$126,000	
	Subtotal 1				$126,000	
2	Prime Contractor's General Requirements	1	LS	$19,000	$19,000	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$880	$880	
5	Labour & Material and Performance bonding	1	LS	$1,300	$1,300	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$7,000	$7,000	5.0%
	Subtotal 2				$154,180	
8	Design Contingency	1	LS	$31,000	$31,000	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$19,000	$19,000	10.0%
	Total for Infiltration Reduction				**$204,180**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Heating/Cooling Plant					
	Base - heating: 2x natural gas condensing boiler serving central hot water loop (90% eff.)(2@ 400MBh boilers; 2@ 40gpm boiler pumps; 2@ 62gpm lead/lag secondary pumps); cooling: distributed split-AC integrated into FCUs in suites					
	Architectural					$16,500
1	Allowance for builders works					
1.1	- service pads	1	LS	$10,500.00	$10,500	
1.2	- gas boiler vents service penetrations including sealing and fire stopping	2	NO	$2,000.00	$4,000	
1.3	- louvers for boiler room ventilation	1	LS	$2,000.00	$2,000	
2	Mechanical space, assumed part of base building				Info Only	
	Mechanical					$265,700
3	Allowance for central hydronic plant including:					
3.1	- condensing boilers, 60% peak heating capacity - 400 MBH	2	NO	$33,000.00	$66,000	
3.2	- boiler circulators, 40 gpm	2	NO	$6,000.00	$12,000	
3.3	- heating water distribution pumps, 62 gpm	2	NO	$8,500.00	$17,000	
3.4	- plant appurtenances including air/expansion control devices and chemical treatment	1	LS	$7,000.00	$7,000	
4	Allowance for hydronic piping					
4.1	- main/plant room piping ~ 80mm dia.	75	m	$420.00	$31,500	
4.2	- risers/distribution to terminal units, assume part of base construction				Info Only	
4.3	- miscellaneous line valves and piping components	1	LS	$4,700.00	$4,700	
4.4	- hook-up connections assemblies:					
4.5	- boilers	2	NO	$4,000.00	$8,000	
4.6	- heating water pumps	4	NO	$4,000.00	$16,000	
4.7	- plant appurtenances	1	LS	$3,750.00	$3,750	
5	General allowance					
5.1	- noise and vibration isolation	1	LS	$500.00	$500	
5.2	- starters, VFD and mechanical wiring	1	LS	$2,000.00	$2,000	
5.3	- TAB work	1	LS	$4,000.00	$4,000	
5.4	- basic start-up and contractor's commissioning	1	LS	$4,000.00	$4,000	
5.5	- flushing, cleaning, purging	1	LS	$750.00	$750	
5.6	- boiler ventilation system including flue vent	1	LS	$12,000.00	$12,000	
5.7	- natural gas services	1	LS	$4,500.00	$4,500	
5.8	- make-up water connection	1	NO	$3,000.00	$3,000	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$30,000.00	$30,000	
7	Allowance for BAS plant controls (assume main plant control through DDC controls)					
7.1	- boiler	2	NO	$6,000.00	$12,000	
7.2	- hydronic pumps	4	NO	$4,000.00	$16,000	
7.3	- plant appurtenances	1	LS	$3,000.00	$3,000	
7.4	- miscellaneous field devices, control wiring and commissioning	1	LS	$8,000.00	$8,000	
	Electrical					$9,652
8	New breakers for power connections below	1	LS	$2,010.00	$2,010	
9	Power connection including line and load side wiring c/w disconnect switch for boiler	2	NO	$950.00	$1,900	
10	Power connection including line and load side wiring c/w disconnect switch for pump	4	NO	$1,080.00	$4,320	
11	General Requirements including:					$1,422
11.1	- Supervision	1	LS	$674.00	$674	
11.2	- Premium time, etc.				N/A	
11.3	- Job set-up, etc.	1	LS	$440.00	$440	
11.4	- Rentals, small tools, etc.	1	LS	$176.00	$176	
11.5	- Permits & inspections	1	LS	$114.00	$114	
11.6	- Insurance	1	LS	$18.00	$18	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$291,852	
12	Prime Contractor's General Requirements	1	LS	$44,000	$44,000	15.0%
13	Building permit				Excluded	
14	General Liability and Builder's Risk insurance	1	LS	$2,000	$2,000	
15	Labour & Material and Performance bonding	1	LS	$2,900	$2,900	
16	Miscellaneous Allowances				Excluded	
17	Prime Contractor's Fee	1	LS	$17,000	$17,000	5.0%
	Subtotal 2				$357,752	
18	Design Contingency	1	LS	$72,000	$72,000	20.0%
19	Escalation Contingency				Excluded	0.0%
20	Construction Contingency (Post Contract)	1	LS	$43,000	$43,000	10.0%
	Total for Heating/Cooling Plant				**$472,752**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Heating/Cooling Plant						
	AL-8 Low - Heating & cooling: cold climate air-source heat pumps (VRF switch-over) with 3x 14 ton central outdoor unit, 3 VRF Headers and connected to VRF coils in-suite units; supplemental electric baseboards for perimeter heating.						
	Architectural					$4,500	
1	Allowance for new structural steel framing to support VRF outdoor units, galvanized	3	NO	$1,500.00	$4,500		
2	Allowance for condensate/refrigerant risers/service penetrations included in base contract cost				Info Only		
	Mechanical					$143,400	
3	Allowance for ASHP VRF plant including:	42	TN	$2,700.00	$113,400		
3.1	- air source heat pump condensing units ~ 14 Tons	3	NO		included		
3.2	- headers and branch joints	1	LS		included		
4	General allowance						
4.1	- Noise and vibration isolation	1	LS	$3,000.00	$3,000		
4.2	- Mechanical wiring				Included		
4.3	- TAB work				n/a		
4.4	- Basic start-up and contractor's commissioning	1	LS	$3,000.00	$3,000		
4.5	- condensate drains	1	LS	$3,000.00	$3,000		
5	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$18,000.00	$18,000		
6	Allowance for VRF system controller	1	LS	$3,000.00	$3,000		
	Electrical					$9,767	
7	New breakers for power connection below	1	LS	$3,800.00	$3,800		
8	Power connection with line and load side wiring including disconnect switch for air source heat pump condensing unit	3	NO	$1,600.00	$4,800		
9	General Requirements including:					$1,167	
9.1	- Supervision	1	LS	$385.00	$385		
9.2	- Premium time, etc.				N/A		
9.3	- Job set-up, etc.	1	LS	$460.00	$460		
9.4	- Rentals, small tools, etc.	1	LS	$184.00	$184		
9.5	- Permits & inspections	1	LS	$120.00	$120		
9.6	- Insurance	1	LS	$18.00	$18		
	Subtotal 1				$157,667		
10	Prime Contractor's General Requirements	1	LS	$24,000	$24,000		15.0%
11	Building permit				Excluded		
12	General Liability and Builder's Risk insurance	1	LS	$1,100	$1,100		
13	Labour & Material and Performance bonding	1	LS	$1,600	$1,600		
14	Miscellaneous Allowances				Excluded		
15	Prime Contractor's Fee	1	LS	$9,000	$9,000		5.0%
	Subtotal 2				$193,367		
16	Design Contingency	1	LS	$39,000	$39,000		20.0%
17	Escalation Contingency				Excluded		0.0%
18	Construction Contingency (Post Contract)	1	LS	$23,000	$23,000		10.0%
	Total for Heating/Cooling Plant				**$255,367**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Heating/Cooling Plant					
	AH-8 High - Geo-exchange field with vertical boreholes(338 MBH), serving ground-connected central riser/ambient loop 2@ 20 gpm boiler pumps; 2 @ 34 gpm lead/lag secondary pumps; water-cooled VRF units connected to ground-loop, serving terminals/coils in each unit (Heating: Nom 5 COP,3.92 SCOP, Cooling: Nom 4.24 COP, 4.89 SCOP)					
	Architectural					$6,000
1	Allowance for builders works, including:					
1.1	- foundation sleeves including puddle flanges and link seal assemblies to accommodate geo loop	1	LS	$3,000.00	$3,000	
1.2	- service pads	1	LS	$3,000.00	$3,000	
2	Additional mechanical space for geothermal plant room, assumed part of base building				Info Only	
3	Site work associated with geothermal scope, assumed part of site development				Info Only	
	Mechanical					$594,600
4	Allowance for central hydronic plant including:					
4.1	- geothermal heat exchanger - 338MBH	1	LS	$10,000.00	$10,000	
4.2	- supplemental condensing boilers (assume not required, does not show in the mechanical selection details)				info only	
4.3	- geothermal field circulator, 34 gpm				Included in pump's measure	
4.4	- heat exchanger circulating pumps, 20 gpm				Included in pump's measure	
4.5	- plant appurtenances including air/expansion control devices and chemical treatment	1	LS	$14,000.00	$14,000	
5	Allowance for hydronic piping					
5.1	- main/plant room piping ~ 80mm dia.	100	m	$420.00	$42,000	
5.2	- miscellaneous line valves and piping components	1	LS	$6,300.00	$6,300	
5.3	- hook-up connections assemblies:					
5.4	- boilers				n/a	
5.5	- heat exchanger	1	NO	$10,000.00	$10,000	
5.6	- condenser water pumps	4	NO	$4,000.00	$16,000	
5.7	- plant appurtenances	1	LS	$7,500.00	$7,500	
5.8	- heat pump units including lateral piping	3	NO	$7,000.00	$21,000	
6	Allowance for heat pump plant - water source VRF heat pump units including:	42	TN	$2,400.00	$100,800	
6.1	- water source heat pump condensing units ~ 14 Tons	3	NO		included	
6.2	- headers and branch joints	1	LS		included	
7	General allowance					
7.1	- noise and vibration isolation	1	LS	$3,500.00	$3,500	
7.2	- starters, VFD and mechanical wiring	1	LS	$2,000.00	$2,000	
7.3	- TAB work	1	LS	$4,500.00	$4,500	
7.4	- basic start-up and contractor's commissioning	1	LS	$12,000.00	$12,000	
7.5	- flushing, cleaning, purging and glycol top-up for the geothermal side plant	1	LS	$2,000.00	$2,000	
7.6	- make-up water connection	1	NO	$6,000.00	$6,000	
7.7	- condensate drains	1	LS	$3,000.00	$3,000	
8	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$39,000.00	$39,000	
9	Allowance for vertical GHX heat exchanger loop including drilling, loop installation, tie-in loop and commissioning - 600' deep	12	NO	$23,000.00	$276,000	
10	Thermal conductivity test				excluded	
11	Allowance for BAS plant controls (assume main plant control through DDC controls)					
11.1	- boiler				n/a	
11.2	- hydronic pumps				Included in pump's measure	
11.3	- plant appurtenances	1	LS	$6,000.00	$6,000	
11.4	- geothermal heat exchanger	1	LS	$6,000.00	$6,000	
11.5	- VRF system controls	1	LS	$3,000.00	$3,000	
11.6	- miscellaneous field devices, control wiring and commissioning	1	LS	$4,000.00	$4,000	
	Electrical					$10,713
12	New breakers for power connection below	1	LS	$4,050.00	$4,050	
13	Power connection with line and load side wiring including disconnect switch for hydronic pump	4	NO	$1,310.00	$5,240	
14	General Requirements including:					$1,423
14.1	- Supervision	1	LS	$578.00	$578	
14.2	- Premium time, etc.				N/A	
14.3	- Job set-up, etc.	1	LS	$497.00	$497	
14.4	- Rentals, small tools, etc.	1	LS	$199.00	$199	
14.5	- Permits & inspections	1	LS	$129.00	$129	
14.6	- Insurance	1	LS	$20.00	$20	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$611,313	
15	Prime Contractor's General Requirements	1	LS	$92,000	$92,000	15.0%
16	Building permit				Excluded	
17	General Liability and Builder's Risk insurance	1	LS	$4,300	$4,300	
18	Labour & Material and Performance bonding	1	LS	$6,100	$6,100	
19	Miscellaneous Allowances				Excluded	
20	Prime Contractor's Fee	1	LS	$36,000	$36,000	5.0%
	Subtotal 2				$749,713	
21	Design Contingency	1	LS	$150,000	$150,000	20.0%
22	Escalation Contingency				Excluded	0.0%
23	Construction Contingency (Post Contract)	1	LS	$90,000	$90,000	10.0%
	Total for Heating/Cooling Plant				**$989,713**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Pump - GSHP VFD						
	Base - Single speed pump						
	Architectural					$0	
1	No work required						
	Mechanical					$41,900	
2	Allowance for ambient loop and heat exchanger circulating pumps	4	NO	$6,500.00	$26,000		
3	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$3,900.00	$3,900		
4	Allowance for controls	4	NO	$3,000.00	$12,000		
	Electrical					$0	
5	No work required				N/A		
6	General Requirements including:					$0	
6.1	- Supervision	1	LS	$0.00	$0		
6.2	- Premium time, etc.				N/A		
6.3	- Job set-up, etc.	1	LS	$0.00	$0		
6.4	- Rentals, small tools, etc.	1	LS	$0.00	$0		
6.5	- Permits & inspections	1	LS	$0.00	$0		
6.6	- Insurance	1	LS	$0.00	$0		
	Subtotal 1				$41,900		
7	Prime Contractor's General Requirements	1	LS	$6,000	$6,000		15.0%
8	Building permit				Excluded		
9	General Liability and Builder's Risk insurance	1	LS	$290	$290		
10	Labour & Material and Performance bonding	1	LS	$420	$420		
11	Miscellaneous Allowances				Excluded		
12	Prime Contractor's Fee	1	LS	$2,400	$2,400		5.0%
	Subtotal 2				$51,010		
13	Design Contingency	1	LS	$10,000	$10,000		20.0%
14	Escalation Contingency				Excluded		0.0%
15	Construction Contingency (Post Contract)	1	LS	$6,000	$6,000		10.0%
	Total for Pump - GSHP VFD				**$67,010**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Pump - GSHP VFD						
	AH-11 High - Premium efficiency VFD pump						
	Architectural					$0	
1	No work required						
	Mechanical					$64,900	
2	Premium for variable speed geothermal pumps	4	NO	$9,750.00	$39,000		
3	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$5,900.00	$5,900		
4	Allowance for controls including new sensors, field devices, controls integration, testing and commissioning	4	NO	$5,000.00	$20,000		
	Electrical					$0	
5	No work required				N/A		
6	General Requirements including:					$0	
6.1	- Supervision	1	LS	$0.00	$0		
6.2	- Premium time, etc.				N/A		
6.3	- Job set-up, etc.	1	LS	$0.00	$0		
6.4	- Rentals, small tools, etc.	1	LS	$0.00	$0		
6.5	- Permits & inspections	1	LS	$0.00	$0		
6.6	- Insurance	1	LS	$0.00	$0		
	Subtotal 1				$64,900		
7	Prime Contractor's General Requirements	1	LS	$10,000	$10,000		15.0%
8	Building permit				Excluded		
9	General Liability and Builder's Risk insurance	1	LS	$450	$450		
10	Labour & Material and Performance bonding	1	LS	$650	$650		
11	Miscellaneous Allowances				Excluded		
12	Prime Contractor's Fee	1	LS	$3,800	$3,800		5.0%
	Subtotal 2				$79,800		
13	Design Contingency	1	LS	$16,000	$16,000		20.0%
14	Escalation Contingency				Excluded		0.0%
15	Construction Contingency (Post Contract)	1	LS	$10,000	$10,000		10.0%
	Total for Pump - GSHP VFD				**$105,800**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	HVAC Distribution					
	Base - 2 ton in-suite FCUs w/ integrated ERV (65% eff.) and multi-stage ECM control, with hydronic heating coils and split-AC cooling (SEER 13)					
	Architectural					$185,000
1	Allowance for architectural enclosure to accommodate new vertical stack AHUs	37	NO	$1,000.00	$37,000	
2	Allowance for floor coring for riser pipes included in base contract cost				Info Only	
3	Allowance for drop ceiling/bulkhead to run horizontal ductwork	370	m	$250.00	$92,500	
4	Create opening in exterior wall for new fresh air and exhaust including sealant and fire stopping	74	NO	$750.00	$55,500	
	Mechanical					$946,210
5	Allowance for hybrid vertical stack fan coil units with integral hydronic heating, DX cooling with remote condensing unit and ERV c/w riser kits and trims~ 2 Tons	37	NO	$12,000.00	$444,000	
6	Allowance for air distribution including					
6.1	- sheet metal ductwork to SMACNA standards of construction and gauges assumed max. 8 - 10m supply ductwork to each suite	3,000	KG	$25.00	$75,000	
6.2	- thermal insulation, assume ductwork passing through the conditioned space and no insulation is not required				Info Only	
6.3	- air diffusion devices	37	NO	$300.00	$11,100	
6.4	- ERV Ductwork fresh air and exhaust - Insulated ductwork	1	LS	$11,000.00	$11,000	
6.5	- exhaust and fresh air louvers c/w wall sleeves and collar	74	NO	$200.00	$14,800	
6.6	- miscellaneous ductwork components	1	LS	$5,250.00	$5,250	
7	Allowance for hydronic piping including:					
7.1	- plant room piping				Included in HVAC plant	
7.2	- distribution mains and risers to terminal FCUs *(assume one ring mains with multiple risers serving stacked apartment, the riser package is included with the vertical stack terminal units. Only include hydronic heating piping, no condenser water piping is include in the estimate)*	2,118	m2	$35.00	$74,130	
7.3	- line valves including isolation and balancing valves	1	LS	$6,000.00	$6,000	
7.4	- hook-up connection assemblies					
7.5	- FCU hydronic hook-up	37	NO	$2,500.00	$92,500	
8	General allowance					
8.1	- Noise and vibration isolation	1	LS	$2,500.00	$2,500	
8.2	- Mechanical wiring				Included	
8.3	- TAB work	1	LS	$8,250.00	$8,250	
8.4	- Basic start-up and contractor's commissioning	1	LS	$9,000.00	$9,000	
8.5	- condensate drains, risers included in the vertical stack unit, mains and branches in the in the lower floor terminated to nearest drain	2,118	m2	$10.00	$21,180	
9	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$116,000.00	$116,000	
10	Allowance for standalone thermostatic controls to FCUs	37	NO	$1,500.00	$55,500	
	Electrical					$32,358
11	New breakers for power connection below	1	LS	$2,310.00	$2,310	
12	Power connection with line & load side wiring for FCUs	37	NO	$670.00	$24,790	
13	General Requirements including:					$5,258
13.1	- Supervision	1	LS	$2,793.00	$2,793	
13.2	- Premium time, etc.				N/A	
13.3	- Job set-up, etc.	1	LS	$1,450.00	$1,450	
13.4	- Rentals, small tools, etc.	1	LS	$580.00	$580	
13.5	- Permits & inspections	1	LS	$377.00	$377	
13.6	- Insurance	1	LS	$58.00	$58	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$1,163,568	
14	Prime Contractor's General Requirements	1	LS	$175,000	$175,000	15.0%
15	Building permit				Excluded	
16	General Liability and Builder's Risk insurance	1	LS	$8,000	$8,000	
17	Labour & Material and Performance bonding	1	LS	$11,600	$11,600	
18	Miscellaneous Allowances				Excluded	
19	Prime Contractor's Fee	1	LS	$68,000	$68,000	5.0%
	Subtotal 2				$1,426,168	
20	Design Contingency	1	LS	$285,000	$285,000	20.0%
21	Escalation Contingency				Excluded	0.0%
22	Construction Contingency (Post Contract)	1	LS	$171,000	$171,000	10.0%
	Total for HVAC Distribution				**$1,882,168**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	HVAC Distribution					
	AL-5 Low - In-suite 2 ton VRF terminal units + ERV (65% eff.) and multi-stage ECM control:					
	Architectural					$185,000
1	Allowance for architectural enclosure to accommodate new AHUs	37	NO	$1,000.00	$37,000	
2	Allowance for floor coring for riser pipes included in base contract cost				Info Only	
3	Allowance for drop ceiling/bulkhead to run horizontal ductwork	370	m	$250.00	$92,500	
4	Create opening in exterior wall for new fresh air and exhaust including sealant and fire stopping	74	NO	$750.00	$55,500	
	Mechanical					$786,774
5	Allowance for VRF multi position airhandling systems	37	NO	$8,000.00	$296,000	
5.1	- AHU				included	
5.2	- refrigerant piping c/w thermal insulation, line valves, control wiring and accessories including refrigerant charge				included	
5.3	- condensing units				included in plant measure	
6	*Note: It is assumed that the majority of the refrigerant piping will run horizontally to the indoor units on each level.*				*Info Only*	
7	Allowance ERV units equal to Fantec ATMO 150H	37	NO	$2,000.00	$74,000	
8	Allowance for supplemental electric baseboard heating (scope as per measure matrix)	37	NO	$1,500.00	$55,500	
9	Allowance for air distribution including					
9.1	- sheet metal ductwork to SMACNA standards of construction and gauges assumed max. 8 - 10m supply ductwork to each suite	3,000	KG	$25.00	$75,000	
9.2	- thermal insulation, assume ductwork passing through the conditioned space and no insulation is not required				Info Only	
9.3	- air diffusion devices	37	NO	$300.00	$11,100	
9.4	- ERV Ductwork fresh air and exhaust - Insulated ductwork	1	LS	$26,000.00	$26,000	
9.5	- exhaust and fresh air louvers c/w wall sleeves and collar	74	NO	$200.00	$14,800	
9.6	- miscellaneous ductwork components	1	LS	$5,250.00	$5,250	
10	General allowance					
10.1	- Noise and vibration isolation	1	LS	$3,500.00	$3,500	
10.2	- Mechanical wiring				Included	
10.3	- TAB work	1	LS	$13,750.00	$13,750	
10.4	- Basic start-up and contractor's commissioning	1	LS	$15,000.00	$15,000	
10.5	- new condensate drains network including risers and mains and branches indirectly terminating to nearest drain in the lower floor	2,118	m2	$18.00	$38,124	
11	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$94,000.00	$94,000	
12	Allowance for VRF system controls, thermostat and interlock wiring	37	NO	$1,750.00	$64,750	
	Electrical					$92,450
13	New breakers for power connections below	1	LS	$2,870.00	$2,870	
14	Power connection with line & load side wiring for terminal units	74	NO	$670.00	$49,580	
15	Power connection with line & load side wiring for ERVs	37	NO	$670.00	$24,790	
16	General Requirements including:					$15,210
16.1	- Supervision	1	LS	$8,186.00	$8,186	
16.2	- Premium time, etc.				N/A	
16.3	- Job set-up, etc.	1	LS	$4,132.00	$4,132	
16.4	- Rentals, small tools, etc.	1	LS	$1,653.00	$1,653	
16.5	- Permits & inspections	1	LS	$1,074.00	$1,074	
16.6	- Insurance	1	LS	$165.00	$165	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$1,064,224	
17	Prime Contractor's General Requirements	1	LS	$160,000	$160,000	15.0%
18	Building permit				Excluded	
19	General Liability and Builder's Risk insurance	1	LS	$7,000	$7,000	
20	Labour & Material and Performance bonding	1	LS	$10,600	$10,600	
21	Miscellaneous Allowances				Excluded	
22	Prime Contractor's Fee	1	LS	$62,000	$62,000	5.0%
	Subtotal 2				$1,303,824	
23	Design Contingency	1	LS	$261,000	$261,000	20.0%
24	Escalation Contingency				Excluded	0.0%
25	Construction Contingency (Post Contract)	1	LS	$156,000	$156,000	10.0%
	Total for HVAC Distribution				**$1,720,824**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	HVAC Distribution					
	AH-5 High - 2 ton in-suite heat pump terminal units + ERV (85% eff.) and multi-stage ECM control					
	Architectural					$185,000
1	Allowance for architectural enclosure to accommodate new AHUs	37	NO	$1,000.00	$37,000	
2	Allowance for floor coring for riser pipes included in base contract cost				Info Only	
3	Allowance for drop ceiling/bulkhead to run horizontal ductwork	370	m	$250.00	$92,500	
4	Create opening in exterior wall for new fresh air and exhaust including sealant and fire stopping	74	NO	$750.00	$55,500	
	Mechanical					$786,774
5	Allowance for VRF multi position airhandling systems	37	NO	$8,000.00	$296,000	
5.1	- AHU				included	
5.2	- refrigerant piping c/w thermal insulation, line valves, control wiring and accessories including refrigerant charge				included	
5.3	- condensing units				included in plant measure	
6	*Note: It is assumed that the majority of the refrigerant piping will run horizontally to the indoor units on each level.*				*Info Only*	
7	Allowance ERV units equal to Fantec ATMO 150H	37	NO	$2,000.00	$74,000	
8	Allowance for supplemental electric baseboard heating (scope as per measure matrix)	37	NO	$1,500.00	$55,500	
9	Allowance for air distribution including					
9.1	- sheet metal ductwork to SMACNA standards of construction and gauges assumed max. 8 - 10m supply ductwork to each suite	3,000	KG	$25.00	$75,000	
9.2	- thermal insulation, assume ductwork passing through the conditioned space and no insulation is not required				Info Only	
9.3	- air diffusion devices	37	NO	$300.00	$11,100	
9.4	- ERV Ductwork fresh air and exhaust - Insulated ductwork	1	LS	$26,000.00	$26,000	
9.5	- exhaust and fresh air louvers c/w wall sleeves and collar	74	NO	$200.00	$14,800	
9.6	- miscellaneous ductwork components	1	LS	$5,250.00	$5,250	
10	General allowance					
10.1	- Noise and vibration isolation	1	LS	$3,500.00	$3,500	
10.2	- Mechanical wiring				Included	
10.3	- TAB work	1	LS	$13,750.00	$13,750	
10.4	- Basic start-up and contractor's commissioning	1	LS	$15,000.00	$15,000	
10.5	- new condensate drains network including risers and mains and branches indirectly terminating to nearest drain in the lower floor	2,118	m2	$18.00	$38,124	
11	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$94,000.00	$94,000	
12	Allowance for VRF system controls, thermostat and interlock wiring	37	NO	$1,750.00	$64,750	
	Electrical					$92,450
13	New breakers for power connections below	1	LS	$2,870.00	$2,870	
14	Power connection with line & load side wiring for terminal units	74	NO	$670.00	$49,580	
15	Power connection with line & load side wiring for ERVs	37	NO	$670.00	$24,790	
16	General Requirements including:					$15,210
16.1	- Supervision	1	LS	$8,186.00	$8,186	
16.2	- Premium time, etc.				N/A	
16.3	- Job set-up, etc.	1	LS	$4,132.00	$4,132	
16.4	- Rentals, small tools, etc.	1	LS	$1,653.00	$1,653	
16.5	- Permits & inspections	1	LS	$1,074.00	$1,074	
16.6	- Insurance	1	LS	$165.00	$165	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$1,064,224	
17	Prime Contractor's General Requirements	1	LS	$160,000	$160,000	15.0%
18	Building permit				Excluded	
19	General Liability and Builder's Risk insurance	1	LS	$7,000	$7,000	
20	Labour & Material and Performance bonding	1	LS	$10,600	$10,600	
21	Miscellaneous Allowances				Excluded	
22	Prime Contractor's Fee	1	LS	$62,000	$62,000	5.0%
	Subtotal 2				$1,303,824	
23	Design Contingency	1	LS	$261,000	$261,000	20.0%
24	Escalation Contingency				Excluded	0.0%
25	Construction Contingency (Post Contract)	1	LS	$156,000	$156,000	10.0%
	Total for HVAC Distribution				**$1,720,824**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	DHW Plant						
	Base - Natural gas storage (85% eff., 250 MBH, 230 GPH), No DHWR						
	Architectural					$1,000	
1	Mechanical room space included as part of base building construction						
2	Allowance for service penetrations serving DHW venting	1	LS	$1,000.00	$1,000		
	Mechanical					$37,150	
3	Allowance for domestic hot water plant including:						
3.1	- High efficiency condensing water heater, 250MBH	1	NO	$12,500.00	$12,500		
3.2	- Domestic hot recirculating pump and expansion tank	1	LS	$2,500.00	$2,500		
4	Allowance for distribution piping including:						
4.1	- DHW plant room piping	25	m	$300.00	$7,500		
4.2	- Line valves and piping accessories	1	LS	$400.00	$400		
5	General allowance						
5.1	- Basic start-up and contractor's commissioning	1	LS	$1,000.00	$1,000		
5.2	- System condensate/drains/neutralization kits	1	LS	$1,000.00	$1,000		
5.3	- System ventilation	1	LS	$1,500.00	$1,500		
5.4	- Natural gas services	1	LS	$3,750.00	$3,750		
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$5,000.00	$5,000		
7	Allowance for DHW plant controls including field devices, sensors and wiring	1	LS	$2,000.00	$2,000		
	Electrical					$2,310	
8	New breakers for power connections below	1	LS	$600.00	$600		
9	Power connection with line & load side wiring for water heater and pump	2	NO	$670.00	$1,340		
10	General Requirements including:					$370	
10.1	- Supervision	1	LS	$193.00	$193		
10.2	- Premium time, etc.				N/A		
10.3	- Job set-up, etc.	1	LS	$104.00	$104		
10.4	- Rentals, small tools, etc.	1	LS	$42.00	$42		
10.5	- Permits & inspections	1	LS	$27.00	$27		
10.6	- Insurance	1	LS	$4.00	$4		
	Subtotal 1				$40,460		
11	Prime Contractor's General Requirements	1	LS	$6,000	$6,000		15.0%
12	Building permit				Excluded		
13	General Liability and Builder's Risk insurance	1	LS	$280	$280		
14	Labour & Material and Performance bonding	1	LS	$400	$400		
15	Miscellaneous Allowances				Excluded		
16	Prime Contractor's Fee	1	LS	$2,400	$2,400		5.0%
	Subtotal 2				$49,540		
17	Design Contingency	1	LS	$10,000	$10,000		20.0%
18	Escalation Contingency				Excluded		0.0%
19	Construction Contingency (Post Contract)	1	LS	$6,000	$6,000		10.0%
	Total for DHW Plant				**$65,540**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DHW Plant					
	AL-6 Low - Air-to-Water Heat Pump (COP 3,250 MBH, 230 GPH), with electric top-up					
	Architectural					$10,500
1	Mechanical room space included as part of base building construction					
2	Allowance for service pads/supports	1	LS	$10,500.00	$10,500	
	Mechanical					$521,900
3	Allowance for domestic hot water plant including:					
3.1	- ASHP water heaters equal to Lync Aegis A 250 c/w heat exchanger module and hydronic package including primary and secondary circulating pumps and hydronic plant appurtenances	1	NO	$314,000.00	$314,000	
3.2	- Storage tank, ASME vertical glass lined insulated stratified storage tank suitable for heat pump application ~ 400 gallon	1	NO	$32,000.00	$32,000	
3.3	- Electric storage tanks heater - 150 gallon, 250MBH	1	NO	$40,000.00	$40,000	
3.4	- Glycol fill-in unit c/w glycol charge	1	LS	$9,000.00	$9,000	
3.5	- Secondary side hydronic devices including circulation pump and expansion tank	1	LS	$6,000.00	$6,000	
3.6	- DHW loop pumps, mixing valve and expansion tank	1	LS	$6,750.00	$6,750	
3.7	- Domestic hot recirculating pump and expansion tank	1	LS	$2,500.00	$2,500	
4	Allowance for distribution piping including:					
4.1	- Glycol piping c/w thermal insulation and weatherproof jacketing, 32mm dia.	50	m	$225.00	$11,250	
4.2	- DHW plant room piping	25	m	$300.00	$7,500	
4.3	- Line valves and piping accessories	1	LS	$900.00	$900	
4.4	- Hook-up connection assemblies					
4.5	- ASHPs c/w secondary circuit heat exchanger	1	NO	$5,250.00	$5,250	
4.6	- circulating pumps	1	NO	$1,250.00	$1,250	
4.7	- heating water plant appurtenances				included above	
5	General allowance					
5.1	- Noise and vibration isolation	1	LS	$1,000.00	$1,000	
5.2	- Starters, VFD and mechanical wiring	1	LS	$1,000.00	$1,000	
5.3	- TAB work	1	LS	$2,000.00	$2,000	
5.4	- Basic start-up and contractor's commissioning	1	LS	$3,000.00	$3,000	
5.5	- System condensate/drains	1	LS	$3,750.00	$3,750	
5.6	- Make-up water connection, extend existing services c/w BFP assemblies	1	LS	$2,750.00	$2,750	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$67,000.00	$67,000	
7	Allowance for DHW plant controls including field devices, sensors and wiring	1	NO	$5,000.00	$5,000	
	Electrical					$14,186
8	New breakers for power connections below	1	LS	$4,660.00	$4,660	
9	Power connection with line and load side wiring including disconnect switch for ASHP water heater	1	NO	$6,960.00	$6,960	
10	Power connection with line and load side wiring for electric storage tank heater	1	NO	$1,030.00	$1,030	
11	General Requirements including:					$1,536
11.1	- Supervision	1	LS	$385.00	$385	
11.2	- Premium time, etc.				N/A	
11.3	- Job set-up, etc.	1	LS	$677.00	$677	
11.4	- Rentals, small tools, etc.	1	LS	$271.00	$271	
11.5	- Permits & inspections	1	LS	$176.00	$176	
11.6	- Insurance	1	LS	$27.00	$27	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$546,586	
12	Prime Contractor's General Requirements	1	LS	$82,000	$82,000	15.0%
13	Building permit				Excluded	
14	General Liability and Builder's Risk insurance	1	LS	$3,800	$3,800	
15	Labour & Material and Performance bonding	1	LS	$5,500	$5,500	
16	Miscellaneous Allowances				Excluded	
17	Prime Contractor's Fee	1	LS	$32,000	$32,000	5.0%
	Subtotal 2				$669,886	
18	Design Contingency	1	LS	$134,000	$134,000	20.0%
19	Escalation Contingency				Excluded	0.0%
20	Construction Contingency (Post Contract)	1	LS	$80,000	$80,000	10.0%
	Total for DHW Plant				**$883,886**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DHW Plant					
	AH-6 High -Air-to-Water Heat Pump (COP 3.8,250 MBH, 230 GPH), with electric top-up					
	Architectural					$10,500
1	Mechanical room space included as part of base building construction					
2	Allowance for service pads	1	LS	$10,500.00	$10,500	
	Mechanical					$521,900
3	Allowance for domestic hot water plant including:					
3.1	- ASHP water heaters equal to Lync Aegis A 250 c/w heat exchanger module and hydronic package including primary and secondary circulating pumps and hydronic plant appurtenances	1	NO	$314,000.00	$314,000	
3.2	- Storage tank, ASME vertical glass lined insulated stratified storage tank suitable for heat pump application ~ 400 gallon	1	NO	$32,000.00	$32,000	
3.3	- Electric storage tanks heater - 150 gallon, 250MBH	1	NO	$40,000.00	$40,000	
3.4	- Glycol fill-in unit c/w glycol charge	1	LS	$9,000.00	$9,000	
3.5	- Secondary side hydronic devices including circulation pump and expansion tank	1	LS	$6,000.00	$6,000	
3.6	- DHW loop pumps, mixing valve and expansion tank	1	LS	$6,750.00	$6,750	
3.7	- Domestic hot recirculating pump and expansion tank	1	LS	$2,500.00	$2,500	
4	Allowance for distribution piping including:					
4.1	- Glycol piping c/w thermal insulation and weatherproof jacketing, 32mm dia.	50	m	$225.00	$11,250	
4.2	- DHW plant room piping	25	m	$300.00	$7,500	
4.3	- Line valves and piping accessories	1	LS	$900.00	$900	
4.4	- Hook-up connection assemblies					
4.5	- ASHPs c/w secondary circuit heat exchanger	1	NO	$5,250.00	$5,250	
4.6	- circulating pumps	1	NO	$1,250.00	$1,250	
4.7	- heating water plant appurtenances				included above	
5	General allowance					
5.1	- Noise and vibration isolation	1	LS	$1,000.00	$1,000	
5.2	- Starters, VFD and mechanical wiring	1	LS	$1,000.00	$1,000	
5.3	- TAB work	1	LS	$2,000.00	$2,000	
5.4	- Basic start-up and contractor's commissioning	1	LS	$3,000.00	$3,000	
5.5	- System condensate/drains	1	LS	$3,750.00	$3,750	
5.6	- Make-up water connection, extend existing services c/w BFP assemblies	1	LS	$2,750.00	$2,750	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$67,000.00	$67,000	
7	Allowance for DHW plant controls including field devices, sensors and wiring	1	NO	$5,000.00	$5,000	
	Electrical					$14,283
8	New breakers for power connections below	1	LS	$4,660.00	$4,660	
9	Power connection with line and load side wiring including disconnect switch for ASHP water heater	1	NO	$6,960.00	$6,960	
10	Power connection with line and load side wiring for electric storage tank heater	1	NO	$1,030.00	$1,030	
11	General Requirements including:					$1,633
11.1	- Supervision	1	LS	$482.00	$482	
11.2	- Premium time, etc.				N/A	
11.3	- Job set-up, etc.	1	LS	$677.00	$677	
11.4	- Rentals, small tools, etc.	1	LS	$271.00	$271	
11.5	- Permits & inspections	1	LS	$176.00	$176	
11.6	- Insurance	1	LS	$27.00	$27	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$546,683	
12	Prime Contractor's General Requirements	1	LS	$82,000	$82,000	15.0%
13	Building permit				Excluded	
14	General Liability and Builder's Risk insurance	1	LS	$3,800	$3,800	
15	Labour & Material and Performance bonding	1	LS	$5,500	$5,500	
16	Miscellaneous Allowances				Excluded	
17	Prime Contractor's Fee	1	LS	$32,000	$32,000	5.0%
	Subtotal 2				$669,983	
18	Design Contingency	1	LS	$134,000	$134,000	20.0%
19	Escalation Contingency				Excluded	0.0%
20	Construction Contingency (Post Contract)	1	LS	$80,000	$80,000	10.0%
	Total for DHW Plant				**$883,983**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	DHW Plant						
	Option - Air-to-Water hybrid heat pump						
	Architectural					$6,000	
1	Mechanical room space included as part of base building construction						
2	Allowance for service pads	1	LS	$6,000.00	$6,000		
	Mechanical					$127,500	
3	Allowance for domestic hot water plant including:						
3.1	- HP commercial hybrid DHW heater with 12kW electric heating equal to AO smith CHP 120. ASHP - 120 Gallon	3	NO	$30,000.00	$90,000		
3.2	- Storage tank, integrated to heat pump unit above				n/a		
3.3	- Back-up electric storage tanks heater				n/a		
3.7	- Domestic hot recirculating pump, mixing valve and expansion tank	1	LS	$6,750.00	$6,750		
4	Allowance for distribution piping including:						
4.2	- DHW plant room piping	25	m	$300.00	$7,500		
4.3	- Line valves and piping accessories	1	LS	$1,500.00	$1,500		
5	General allowance						
5.4	- Basic start-up and contractor's commissioning	1	LS	$1,000.00	$1,000		
5.5	- System condensate/drains	1	LS	$1,000.00	$1,000		
1	Mechanical space services including air conditioning units are as part of base building construction				Info Only		
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$16,000.00	$16,000		
7	Allowance for DHW plant controls including field devices, sensors and wiring	3	NO	$1,250.00	$3,750		
	Electrical					$14,283	
8	New breakers for power connections below	1	LS	$4,660.00	$4,660		
9	Power connection with line and load side wiring including disconnect switch for ASHP water heater	1	NO	$6,960.00	$6,960		
10	Power connection with line and load side wiring for electric storage tank heater	1	NO	$1,030.00	$1,030		
11	General Requirements including:					$1,633	
11.1	- Supervision	1	LS	$482.00	$482		
11.2	- Premium time, etc.				N/A		
11.3	- Job set-up, etc.	1	LS	$677.00	$677		
11.4	- Rentals, small tools, etc.	1	LS	$271.00	$271		
11.5	- Permits & inspections	1	LS	$176.00	$176		
11.6	- Insurance	1	LS	$27.00	$27		
	Subtotal 1				$147,783		
12	Prime Contractor's General Requirements	1	LS	$22,000	$22,000		15.0%
13	Building permit				Excluded		
14	General Liability and Builder's Risk insurance	1	LS	$1,000	$1,000		
15	Labour & Material and Performance bonding	1	LS	$1,500	$1,500		
16	Miscellaneous Allowances				Excluded		
17	Prime Contractor's Fee	1	LS	$9,000	$9,000		5.0%
	Subtotal 2				$181,283		
18	Design Contingency	1	LS	$36,000	$36,000		20.0%
19	Escalation Contingency				Excluded		0.0%
20	Construction Contingency (Post Contract)	1	LS	$22,000	$22,000		10.0%
	Total for DHW Plant				**$239,283**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	DWHRS						
	AL-7 Low - Passive Drain Water Heat Recovery System						
	Architectural					$0	
1	No work required						
	Mechanical					$28,000	
2	Allowance for passive horizontal heat recovery heat exchanger and associated domestic water piping ~ 15m length	15	m	$1,600.00	$24,000		
3	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$4,000.00	$4,000		
	Electrical					$0	
4	No work required				N/A		
5	General Requirements including:					$0	
5.1	- Supervision	1	LS	$0.00	$0		
5.2	- Premium time, etc.				N/A		
5.3	- Job set-up, etc.	1	LS	$0.00	$0		
5.4	- Rentals, small tools, etc.	1	LS	$0.00	$0		
5.5	- Permits & inspections	1	LS	$0.00	$0		
5.6	- Insurance	1	LS	$0.00	$0		
	Subtotal 1				$28,000		
6	Prime Contractor's General Requirements	1	LS	$4,200	$4,200		15.0%
7	Building permit				Excluded		
8	General Liability and Builder's Risk insurance	1	LS	$200	$200		
9	Labour & Material and Performance bonding	1	LS	$280	$280		
10	Miscellaneous Allowances				Excluded		
11	Prime Contractor's Fee	1	LS	$1,600	$1,600		5.0%
	Subtotal 2				$34,280		
12	Design Contingency	1	LS	$7,000	$7,000		20.0%
13	Escalation Contingency				Excluded		0.0%
14	Construction Contingency (Post Contract)	1	LS	$4,100	$4,100		10.0%
	Total for DWHRS				**$45,380**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	DWHRS						
	AH-7 High - Passive Drain Water Heat Recovery System						
	Architectural					$0	
1	No work required						
	Mechanical					$28,000	
2	Allowance for passive horizontal heat recovery heat exchanger and associated domestic water piping ~ 15m length	15	m	$1,600.00	$24,000		
3	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$4,000.00	$4,000		
	Electrical					$0	
4	No work required				N/A		
5	General Requirements including:					$0	
5.1	- Supervision	1	LS	$0.00	$0		
5.2	- Premium time, etc.				N/A		
5.3	- Job set-up, etc.	1	LS	$0.00	$0		
5.4	- Rentals, small tools, etc.	1	LS	$0.00	$0		
5.5	- Permits & inspections	1	LS	$0.00	$0		
5.6	- Insurance	1	LS	$0.00	$0		
	Subtotal 1				$28,000		
6	Prime Contractor's General Requirements	1	LS	$4,200	$4,200		15.0%
7	Building permit				Excluded		
8	General Liability and Builder's Risk insurance	1	LS	$200	$200		
9	Labour & Material and Performance bonding	1	LS	$280	$280		
10	Miscellaneous Allowances				Excluded		
11	Prime Contractor's Fee	1	LS	$1,600	$1,600		5.0%
	Subtotal 2				$34,280		
12	Design Contingency	1	LS	$7,000	$7,000		20.0%
13	Escalation Contingency				Excluded		0.0%
14	Construction Contingency (Post Contract)	1	LS	$4,100	$4,100		10.0%
	Total for DWHRS				**$45,380**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DW Load Reduction					
	Base - Standard Fixtures and Water Appliances					
	Architectural					$0
1	No work required					
	Mechanical					$90,625
2	Allowance for standard plumbing fixtures including fittings and accessories					
2.1	- Water closets - floor mounted, tank type	37	NO	$475.00	$17,575	
2.2	- Lavatory - counter mounted, single handle	37	NO	$625.00	$23,125	
2.3	- Shower valves and head assemblies	37	NO	$200.00	$7,400	
2.4	- Kitchen sink - stainless steel, single compartment, counter mounted, manual faucets	37	NO	$825.00	$30,525	
3	Bath tub - included in the base building plumbing scope					
4	Rough-in - included in the base building plumbing scope					
5	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$12,000.00	$12,000	
	Electrical					$0
6	No work required			$0.00	$0	
				$0.00	$0	
7	General Requirements including:					$0
7.1	- Supervision	1	LS	$0.00	$0	
7.2	- Premium time, etc.	1	LS	$0.00	$0	
7.3	- Job set-up, etc.	1	LS	$0.00	$0	
7.4	- Rentals, small tools, etc.	1	LS	$0.00	$0	
7.5	- Permits & inspections	1	LS	$0.00	$0	
7.6	- Insurance	1	LS	$0.00	$0	
7.7	- Performance bond	1	LS	$0.00	$0	
7.8	- Labour & material bond	1	LS	$0.00	$0	
7.9	- Contingency	1	LS	$0.00	$0	
	Subtotal 1				$90,625	
8	Prime Contractor's General Requirements	1	LS	$14,000	$14,000	15.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	$630	$630	
11	Labour & Material and Performance bonding	1	LS	$910	$910	
12	Miscellaneous Allowances				Excluded	
13	Prime Contractor's Fee	1	LS	$5,000	$5,000	5.0%
	Subtotal 2				$111,165	
14	Design Contingency	1	LS	$22,000	$22,000	20.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)	1	LS	$13,000	$13,000	10.0%
	Total for DW Load Reduction				**$146,165**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DW Load Reduction					
	AH-10 High - Improve DHW Load, Low Shower fixture, Bathroom sink Facet , Energy Star Water Appliances					
	Architectural					$0
1	No work required					
	Mechanical					$102,392
2	Allowance for standard plumbing fixtures including fittings and accessories					
2.1	- Water closets - floor mounted, tank type	37	NO	$521.00	$19,277	
2.2	- Lavatory - counter mounted, single handle	37	NO	$700.00	$25,900	
2.3	- Shower valves and head assemblies	37	NO	$300.00	$11,100	
2.4	- Kitchen sink - stainless steel, single compartment, counter mounted, manual faucets	37	NO	$895.00	$33,115	
3	Bath tub - included in the base building plumbing scope					
4	Rough-in - included in the base building plumbing scope					
5	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$13,000.00	$13,000	
	Electrical					$0
6	No work required			$0.00	$0	
	Subtotal 1				$102,392	
7	Prime Contractor's General Requirements	1	LS	$15,000	$15,000	15.0%
8	Building permit				Excluded	
9	General Liability and Builder's Risk insurance	1	LS	$720	$720	
10	Labour & Material and Performance bonding	1	LS	$1,000	$1,000	
11	Miscellaneous Allowances				Excluded	
12	Prime Contractor's Fee	1	LS	$6,000	$6,000	5.0%
	Subtotal 2				$125,112	
13	Design Contingency	1	LS	$25,000	$25,000	20.0%
14	Escalation Contingency				Excluded	0.0%
15	Construction Contingency (Post Contract)	1	LS	$15,000	$15,000	10.0%
	Total for DW Load Reduction				**$165,112**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Lighting					
1	*N/A*					
	Subtotal 1				$0	
2	Prime Contractor's General Requirements	1	LS	$0	$0	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$0	$0	
5	Labour & Material and Performance bonding	1	LS	$0	$0	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$0	$0	5.0%
	Subtotal 2				$0	
8	Design Contingency	1	LS	$0	$0	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$0	$0	10.0%
	Total for Lighting				**$0**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Solar PV					
	AH-12 High - 55 kW PV System					
	Architectural					$0
1	No work required					
	Mechanical					$0
2	No work required					
	Electrical					$172,974
3	Supply and installation of 55kW roof-mounted photovoltaic system c/w associated Infrastructure for roof mounted photovoltaic system	1	LS	$158,200.00	$158,200	
4	General Requirements including:					$14,774
4.1	- Supervision	1	LS	$385.00	$385	
4.2	- Premium time, etc.				N/A	
4.3	- Job set-up, etc.	1	LS	$8,464.00	$8,464	
4.4	- Rentals, small tools, etc.	1	LS	$3,385.00	$3,385	
4.5	- Permits & inspections	1	LS	$2,201.00	$2,201	
4.6	- Insurance	1	LS	$339.00	$339	
	Subtotal 1				$172,974	
5	Prime Contractor's General Requirements	1	LS	$26,000	$26,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$1,200	$1,200	
8	Labour & Material and Performance bonding	1	LS	$1,700	$1,700	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$10,000	$10,000	5.0%
	Subtotal 2				$211,874	
11	Design Contingency	1	LS	$42,000	$42,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$25,000	$25,000	10.0%
	Total for Solar PV				**$278,874**	

MULTIPLE ESTIMATE SUMMARY

TOWN OF BANFF ARCHETYPE ANALYSIS - MIXED-USE

CLASS C ESTIMATE

JUNE 25, 2025

A.W. HOOKER QUANTITY SURVEYORS

	Estimate Breakdown Construction Costs	Baseline		Low		High		Alternate	
1	**Above-Grade Wall Upgrade**		**$1,361,894**		**$1,442,729**		**$1,821,889**		
	Architectural	$842,494		$891,829		$1,125,589			
	Mechanical	$0		$0		$0			
	Electrical	$0		$0		$0			
	General Conditions & Requirements	$189,400		$200,900		$254,300			
	Contingencies	$330,000		$350,000		$442,000			
2	**Roof Upgrade**		**$617,900**		**$638,565**		**$650,975**		
	Architectural	$382,400		$394,865		$403,175			
	Mechanical	$0		$0		$0			
	Electrical	$0		$0		$0			
	General Conditions & Requirements	$85,500		$88,700		$89,800			
	Contingencies	$150,000		$155,000		$158,000			
3	**Window Upgrade (Residential)**		**$444,400**		**$476,600**		**$492,850**		
	Architectural	$275,700		$295,500		$303,750			
	Mechanical	$0		$0		$0			
	Electrical	$0		$0		$0			
	General Conditions & Requirements	$61,700		$66,100		$69,100			
	Contingencies	$107,000		$115,000		$120,000			
4	**Window Upgrade (Commercial)**		**$407,500**		**$407,500**		**$202,930**		
	Architectural	$251,200		$251,200		$125,750			
	Mechanical	$0		$0		$0			
	Electrical	$0		$0		$0			
	General Conditions & Requirements	$57,300		$57,300		$28,180			
	Contingencies	$99,000		$99,000		$49,000			
5	**Door Upgrade**		**$17,830**		**$35,170**		**$35,170**		
	Architectural	$11,000		$22,000		$22,000			
	Mechanical	$0		$0		$0			
	Electrical	$0		$0		$0			
	General Conditions & Requirements	$2,530		$4,970		$4,970			
	Contingencies	$4,300		$8,200		$8,200			
6	**Infiltration Reduction**		**$122,690**		**$130,060**		**$145,530**		
	Architectural	$76,000		$80,000		$90,000			
	Mechanical	$0		$0		$0			
	Electrical	$0		$0		$0			
	General Conditions & Requirements	$16,690		$18,060		$20,530			
	Contingencies	$30,000		$32,000		$35,000			
7	**Heating/Cooling plant**		**$452,827**		**$248,503**		**$932,013**		
	Architectural	$16,500		$3,000		$12,000			
	Mechanical	$253,875		$142,000		$553,500			
	Electrical	$9,652		$7,903		$10,713			
	General Conditions & Requirements	$62,800		$34,600		$129,800			
	Contingencies	$110,000		$61,000		$226,000			
8	**HVAC Distribution - Decentralized heating, cooling and ventilation**		**$1,912,527**		**$1,525,186**		**$1,275,873**		
	Architectural	$125,000		$125,000		$87,500			
	Mechanical	$1,028,582		$742,443		$646,193			
	Electrical	$29,145		$75,343		$55,280			
	General Conditions & Requirements	$265,800		$212,400		$177,900			
	Contingencies	$464,000		$370,000		$309,000			
9	**HVAC Distribution - Residential Space Central Ventilation and Pressurization**		**$173,956**		**$211,657**		**$475,547**		
	Architectural	$0		$1,500		$0			
	Mechanical	$104,750		$124,750		$290,350			
	Electrical	$3,346		$4,197		$4,197			
	General Conditions & Requirements	$23,860		$30,210		$66,000			
	Contingencies	$42,000		$51,000		$115,000			
10	**HVAC Distribution - Commercial Space Ventilation**		**$1,489,582**		**$1,642,582**		**$1,928,756**		
	Architectural	$0		$0		$0			
	Mechanical	$914,140		$1,009,140		$1,183,160			
	Electrical	$7,242		$7,242		$9,696			
	General Conditions & Requirements	$207,200		$228,200		$268,900			
	Contingencies	$361,000		$398,000		$467,000			
11	**DHW Plant**		**$65,540**		**$883,983**		**$883,983**		**$239,283**
	Architectural	$1,000		$10,500		$10,500		$6,000	
	Mechanical	$37,150		$521,900		$521,900		$127,500	
	Electrical	$2,310		$14,283		$14,283		$14,283	
	General Conditions & Requirements	$9,080		$123,300		$123,300		$33,500	
	Contingencies	$16,000		$214,000		$214,000		$58,000	
12	**DWHRS**				**$45,380**		**$45,380**		
	Architectural			$0		$0			
	Mechanical			$28,000		$28,000			
	Electrical			$0		$0			
	General Conditions & Requirements			$6,280		$6,280			
	Contingencies			$11,100		$11,100			
13	**Solar PV**						**$327,939**		
	Architectural					$0			
	Mechanical					$0			
	Electrical					$202,539			
	General Conditions & Requirements					$45,400			
	Contingencies					$80,000			
14	**Lighting**		**$294,794**		**$322,777**		**$85,309**		
	Architectural	$0		$0		$0			
	Mechanical	$0		$0		$0			
	Electrical	$181,694		$199,377		$52,319			
	General Conditions & Requirements	$41,100		$45,400		$11,990			
	Contingencies	$72,000		$78,000		$21,000			
15	**Commercial Lighting Controls**						**$6,450**		
	Architectural					$0			
	Mechanical					$0			
	Electrical					$3,980			
	General Conditions & Requirements					$900			
	Contingencies					$1,570			
	Total Estimated Construction Costs (nearest ,000)		**$7,361,000**		**$8,011,000**		**$9,311,000**		

Construction Costs	Baseline		Low		High		Alternate	
Hard Costs								
Architectural	$1,981,294		$2,075,394		$2,180,264		$6,000	
Mechanical	$2,338,497		$2,568,233		$3,223,103		$127,500	
Electrical	$233,389		$308,345		$353,007		$14,283	
General Conditions & Requirements	$1,022,960		$1,116,420		$1,297,350		$33,500	
Subtotal - Hard Costs		**$5,576,140**		**$6,068,392**		**$7,053,724**		
Contingencies								
Design & Pricing	$1,116,700		$1,215,000		$1,410,980		$36,000	
Escalation	Excluded		Excluded		Excluded		Excluded	
Construction	$668,600		$727,300		$845,890		$22,000	
Subtotal - Contingencies		**$1,785,300**		**$1,942,300**		**$2,256,870**		
Hard Costs including Contingencies (nearest ,000)		**$7,361,000**		**$8,011,000**		**$9,311,000**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Above-Grade Wall Upgrade					
	Base - Nom R-25, U-0.04, Eff R-19 + derate 5% for doors, Wood framed wall with cavity insulation (R-19 eff) Standard Balconies not thermally broken (Total length 808 feet, depth 5 feet)					
	Architectural					$842,494
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling, assumed 25%	224	m2	$125.00	$28,000	
2	Wood framed exterior cladding, including:	897	m2	$602.00	$539,994	
2.1	- hardiplank siding, assumed					
2.2	- wood battens @ 400mm o/c, assumed					
2.3	- 38mm exterior insulation, assumed					
2.4	- 12mm OSB sheathing, assumed					
2.5	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
2.6	- fiberglass batt cavity insulation (R-19), assumed					
2.7	- 12mm gypsum board drywall, assumed					
3	Allowance for caulking and sealant	1	LS	$12,000.00	$12,000	
4	Standard walkway, non-self supported and non-thermally broken	375	m2	$700.00	$262,500	
	Subtotal 1				$842,494	
5	Prime Contractor's General Requirements	1	LS	$126,000	$126,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$6,000	$6,000	
8	Labour & Material and Performance bonding	1	LS	$8,400	$8,400	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$49,000	$49,000	5.0%
	Subtotal 2				$1,031,894	
11	Design Contingency	1	LS	$206,000	$206,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$124,000	$124,000	10.0%
	Total for Above-Grade Wall Upgrade				**$1,361,894**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Above-Grade Wall Upgrade					
	ML-1 Low - Wood framed wall with cavity insulation with Add 2" of exterior XPS Insulation (R-30 eff.)					
	Architectural					$891,829
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling, assumed 25%	224	m2	$125.00	$28,000	
2	Wood framed exterior cladding, including:	897	m2	$657.00	$589,329	
2.1	- hardiplank siding, assumed					
2.2	- wood battens @ 400mm o/c, assumed					
2.3	- 38mm exterior insulation, assumed					
2.4	- 50mm exterior XPS insulation, assumed					
2.5	- 12mm OSB sheathing, assumed					
2.6	- 50mm x 150mm wood studs @ 400mm o/c, assumed					
2.7	- fiberglass batt cavity insulation (R-19), assumed					
2.8	- 12mm gypsum board drywall, assumed					
3	Allowance for caulking and sealant	1	LS	$12,000.00	$12,000	
4	Standard walkway, non-self supported and non-thermally broken	375	m2	$700.00	$262,500	
	Subtotal 1				$891,829	
5	Prime Contractor's General Requirements	1	LS	$134,000	$134,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$6,000	$6,000	
8	Labour & Material and Performance bonding	1	LS	$8,900	$8,900	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$52,000	$52,000	5.0%
	Subtotal 2				$1,092,729	
11	Design Contingency	1	LS	$219,000	$219,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$131,000	$131,000	10.0%
	Total for Above-Grade Wall Upgrade				**$1,442,729**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Above-Grade Wall Upgrade						
	MH-1 High - Add 6" exterior mineral wool insulation and thermally broken cladding clips for cladding support (R-40 eff.) Self-supported Standard Balconies Thermally broken, (Total length 323.2 ft, Depth 5 ft)						
	Architectural					$1,125,589	
1	Exterior engineered scaffolding, tarps, dust covers, safety and access equipment, including full erection and dismantling, assumed 25%	242	m2	$125.00	$30,250		
2	Wood framed exterior cladding, including:	967	m2	$717.00	$693,339		
2.1	- hardiplank siding, assumed						
2.2	- thermally broken cladding clips, assumed						
2.3	- wood battens @ 400mm o/c, assumed						
2.4	- 38mm exterior insulation, assumed						
2.5	- 50mm exterior insulation, assumed						
2.6	- 12mm OSB sheathing, assumed						
2.7	- 50mm x 150mm wood studs @ 400mm o/c, assumed						
2.8	- fiberglass batt cavity insulation (R-19), assumed						
2.9	- 150mm mineral wool insulation, assumed						
2.10	- 12mm gypsum board drywall, assumed						
3	Allowance for caulking and sealant	1	LS	$12,000.00	$12,000		
4	Self supported exterior balconies thermally broken to building perimeter at second and third floor	150	m2	$2,600.00	$390,000		
	Subtotal 1				$1,125,589		
5	Prime Contractor's General Requirements	1	LS	$169,000	$169,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$8,000	$8,000		
8	Labour & Material and Performance bonding	1	LS	$11,300	$11,300		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$66,000	$66,000		5.0%
	Subtotal 2				$1,379,889		
11	Design Contingency	1	LS	$276,000	$276,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$166,000	$166,000		10.0%
	Total for Above-Grade Wall Upgrade				**$1,821,889**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Roof Upgrade						
	Base - Cavity insulation, exterior and interior insulated sloped roof (R-40)						
	Architectural					$382,400	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 2 weeks	1	NO	$27,000.00	$27,000		
1.2	- telehandler, assumed 1 @ 2 weeks	1	NO	$8,000.00	$8,000		
2	Engineered wood truss roof construction, including:	831	m2	$400.00	$332,400		
2.1	- pre-engineered roof trusses including incidental framing bracing, sheathing, eaves framing and temporary works						
2.2	- cross strapping for ventilation below sheathing						
2.3	- exterior grade plywood sheathing						
2.4	- attic insulation (R-40)						
2.5	- insulation at joist cavity						
2.6	- air/ vapour barrier, assumed						
2.7	- 16mm gypsum board, assumed						
3	Allowance for framing to openings, assumed	1	LS	$15,000.00	$15,000		
	Subtotal 1				$382,400		
4	Prime Contractor's General Requirements	1	LS	$57,000	$57,000		15.0%
5	Building permit				Excluded		
6	General Liability and Builder's Risk insurance	1	LS	$2,700	$2,700		
7	Labour & Material and Performance bonding	1	LS	$3,800	$3,800		
8	Miscellaneous Allowances				Excluded		
9	Prime Contractor's Fee	1	LS	$22,000	$22,000		5.0%
	Subtotal 2				$467,900		
10	Design Contingency	1	LS	$94,000	$94,000		20.0%
11	Escalation Contingency				Excluded		0.0%
12	Construction Contingency (Post Contract)	1	LS	$56,000	$56,000		10.0%
	Total for Roof Upgrade				**$617,900**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Roof Upgrade						
	ML-4 Low - Cavity insulation, exterior and interior insulated sloped roof (R-46.9)						
	Architectural					$394,865	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 2 weeks	1	NO	$27,000.00	$27,000		
1.2	- telehandler, assumed 1 @ 2 weeks	1	NO	$8,000.00	$8,000		
2	Engineered wood truss roof construction, including:	831	m2	$415.00	$344,865		
2.1	- pre-engineered roof trusses including incidental framing bracing, sheathing, eaves framing and temporary works						
2.2	- cross strapping for ventilation below sheathing						
2.3	- exterior grade plywood sheathing						
2.4	- attic insulation (R-46.9)						
2.5	- insulation at joist cavity						
2.6	- air/ vapour barrier, assumed						
2.7	- 16mm gypsum board, assumed						
3	Allowance for framing to openings, assumed	1	LS	$15,000.00	$15,000		
	Subtotal 1				$394,865		
4	Prime Contractor's General Requirements	1	LS	$59,000	$59,000		15.0%
5	Building permit				Excluded		
6	General Liability and Builder's Risk insurance	1	LS	$2,800	$2,800		
7	Labour & Material and Performance bonding	1	LS	$3,900	$3,900		
8	Miscellaneous Allowances				Excluded		
9	Prime Contractor's Fee	1	LS	$23,000	$23,000		5.0%
	Subtotal 2				$483,565		
10	Design Contingency	1	LS	$97,000	$97,000		20.0%
11	Escalation Contingency				Excluded		0.0%
12	Construction Contingency (Post Contract)	1	LS	$58,000	$58,000		10.0%
	Total for Roof Upgrade				**$638,565**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Roof Upgrade						
	MH-4 High - Exterior and interior insulated sloped roof (R-60)						
	Architectural					$403,175	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 2 weeks	1	NO	$27,000.00	$27,000		
1.2	- telehandler, assumed 1 @ 2 weeks	1	NO	$8,000.00	$8,000		
2	Engineered wood truss roof construction, including:	831	m2	$425.00	$353,175		
2.1	- pre-engineered roof trusses including incidental framing bracing, sheathing, eaves framing and temporary works						
2.2	- cross strapping for ventilation below sheathing						
2.3	- exterior grade plywood sheathing						
2.4	- attic insulation (R-60)						
2.5	- insulation at joist cavity						
2.6	- air/ vapour barrier, assumed						
2.7	- 16mm gypsum board, assumed						
3	Allowance for framing to openings, assumed	1	LS	$15,000.00	$15,000		
	Subtotal 1				$403,175		
4	Prime Contractor's General Requirements	1	LS	$60,000	$60,000		15.0%
5	Building permit				Excluded		
6	General Liability and Builder's Risk insurance	1	LS	$2,800	$2,800		
7	Labour & Material and Performance bonding	1	LS	$4,000	$4,000		
8	Miscellaneous Allowances				Excluded		
9	Prime Contractor's Fee	1	LS	$23,000	$23,000		5.0%
	Subtotal 2				$492,975		
10	Design Contingency	1	LS	$99,000	$99,000		20.0%
11	Escalation Contingency				Excluded		0.0%
12	Construction Contingency (Post Contract)	1	LS	$59,000	$59,000		10.0%
	Total for Roof Upgrade				**$650,975**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Window Upgrade (Residential)						
	Base - Double-glazed Aluminum frame (U-0.35, SHGC-0.6); 20 FDWR						
	Architectural					$275,700	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$33,000.00	$33,000		
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$8,000.00	$8,000		
2	Aluminum framed double glazed window units, low-e coating (U-0.35, SHGC-0.6), similar to Inline 400 series	165	m2	$1,130.00	$186,450		
3	Extra over for operable units, assumed	165	m2	$250.00	$41,250		
4	Caulking, and sealing	1	LS	$7,000.00	$7,000		
	Subtotal 1				$275,700		
5	Prime Contractor's General Requirements	1	LS	$41,000	$41,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$1,900	$1,900		
8	Labour & Material and Performance bonding	1	LS	$2,800	$2,800		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$16,000	$16,000		5.0%
	Subtotal 2				$337,400		
11	Design Contingency	1	LS	$67,000	$67,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$40,000	$40,000		10.0%
	Total for Window Upgrade (Residential)				**$444,400**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Window Upgrade (Residential)					
	ML-5 Low - Double-glazed, fibreglass (U-0.22, SHGC-0.26); 20% FDWR, Fibreglass windows with double glazed IGUs, low-e coating					
	Architectural					$295,500
1	Equipment rentals, including:					
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$33,000.00	$33,000	
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$8,000.00	$8,000	
2	Fiberglass framed double glazed window units, low-e coating (U-0.22, SHGC-0.26), similar to	165	m2	$1,250.00	$206,250	
3	Extra over for operable units, assumed	165	m2	$250.00	$41,250	
4	Caulking, and sealing	1	LS	$7,000.00	$7,000	
	Subtotal 1				$295,500	
5	Prime Contractor's General Requirements	1	LS	$44,000	$44,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$2,100	$2,100	
8	Labour & Material and Performance bonding	1	LS	$3,000	$3,000	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$17,000	$17,000	5.0%
	Subtotal 2				$361,600	
11	Design Contingency	1	LS	$72,000	$72,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$43,000	$43,000	10.0%
	Total for Window Upgrade (Residential)				**$476,600**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Window Upgrade (Residential)					
	MH-5 Hig - Triple-glazed, fibreglass (U-0.15, SHGC-0.60); 20% FDWR, Fibreglass windows with triple glazed IGUs, double low-e coating					
	Architectural					$303,750
1	Equipment rentals, including:					
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$33,000.00	$33,000	
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$8,000.00	$8,000	
2	Fiberglass framed triple glazed window units, low-e coating on 2 surfaces (U-0.15, SHGC-0.60), similar to Inline 400 series	165	m2	$1,300.00	$214,500	
3	Extra over for operable units, assumed	165	m2	$250.00	$41,250	
4	Allowance for caulking, and sealing	1	LS	$7,000.00	$7,000	
	Subtotal 1				$303,750	
5	Prime Contractor's General Requirements	1	LS	$46,000	$46,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$2,100	$2,100	
8	Labour & Material and Performance bonding	1	LS	$3,000	$3,000	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$18,000	$18,000	5.0%
	Subtotal 2				$372,850	
11	Design Contingency	1	LS	$75,000	$75,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$45,000	$45,000	10.0%
	Total for Window Upgrade (Residential)				**$492,850**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Window Upgrade (Commercial)						
	Base - Double-glazed aluminum frame (U-0.304, SHGC-0.6); 40% FDWR						
	Architectural					$251,200	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$30,000.00	$30,000		
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$8,000.00	$8,000		
2	Aluminum framed double glazed window units, low-e coating (U-0.304, SHGC-0.6), similar to Inline 400 series	148	m2	$1,150.00	$170,200		
3	Extra over for operable units, assumed	148	m2	$250.00	$37,000		
4	Caulking, and sealing	1	LS	$6,000.00	$6,000		
	Subtotal 1				$251,200		
5	Prime Contractor's General Requirements	1	LS	$38,000	$38,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$1,800	$1,800		
8	Labour & Material and Performance bonding	1	LS	$2,500	$2,500		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$15,000	$15,000		5.0%
	Subtotal 2				$308,500		
11	Design Contingency	1	LS	$62,000	$62,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$37,000	$37,000		10.0%
	Total for Window Upgrade (Commercial)				**$407,500**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Window Upgrade (Commercial)						
	ML-6 Low - Double-glazed, fibreglass (U-0.35, SHGC-0.60); 40% FDWR						
	Architectural					$251,200	
1	Equipment rentals, including:						
1.1	- crane, assumed 1 @ 3 weeks	1	NO	$30,000.00	$30,000		
1.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$8,000.00	$8,000		
2	Fiberglass framed double glazed window units, low-e coating (U-0.35, SHGC-0.60), similar to Inline 400 series	148	m2	$1,150.00	$170,200		
3	Extra over for operable units, assumed	148	m2	$250.00	$37,000		
4	Allowance for caulking, and sealing	1	LS	$6,000.00	$6,000		
	Subtotal 1				$251,200		
5	Prime Contractor's General Requirements	1	LS	$38,000	$38,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$1,800	$1,800		
8	Labour & Material and Performance bonding	1	LS	$2,500	$2,500		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$15,000	$15,000		5.0%
	Subtotal 2				$308,500		
11	Design Contingency	1	LS	$62,000	$62,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$37,000	$37,000		10.0%
	Total for Window Upgrade (Commercial)				**$407,500**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Window Upgrade (Commercial)						
1	*Double glazed, fibreglass (U-0.30, SHGC-0.60); 20% FDWR*						
	Architectural					$125,750	
2	Equipment rentals, including:						
2.1	- crane, assumed 1 @ 3 weeks	1	NO	$15,000.00	$15,000		
2.2	- telehandler, assumed 1 @ 3 weeks	1	NO	$6,000.00	$6,000		
3	Fiberglass framed triple glazed window units, low-e coating (U-0.30, SHGC-0.60), similar to Inline 400 series	74	m2	$1,125.00	$83,250		
4	Extra over for operable units, assumed	74	m2	$250.00	$18,500		
5	Allowance for caulking, and sealing	1	LS	$3,000.00	$3,000		
	Subtotal 1				$125,750		
6	Prime Contractor's General Requirements	1	LS	$19,000	$19,000		15.0%
7	Building permit				Excluded		
8	General Liability and Builder's Risk insurance	1	LS	$880	$880		
9	Labour & Material and Performance bonding	1	LS	$1,300	$1,300		
10	Miscellaneous Allowances				Excluded		
11	Prime Contractor's Fee	1	LS	$7,000	$7,000		5.0%
	Subtotal 2				$153,930		
12	Design Contingency	1	LS	$31,000	$31,000		20.0%
13	Escalation Contingency				Excluded		0.0%
14	Construction Contingency (Post Contract)	1	LS	$18,000	$18,000		10.0%
	Total for Window Upgrade (Commercial)				**$202,930**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Door Upgrade					
	Base - Opaque doors (U-0.42) Glass doors (U-0.48)					
	Architectural					$11,000
1 1.1	Opaque door in hollow metal frame including installation, hardware and finish: - single door (U-0.42)	1	NO	$4,000.00	$4,000	
2 2.1	Opaque glass door in aluminum frame including installation and finish: - single door (U-0.48)	1	NO	$7,000.00	$7,000	
	Subtotal 1				$11,000	
3	Prime Contractor's General Requirements	1	LS	$1,700	$1,700	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$80	$80	
6	Labour & Material and Performance bonding	1	LS	$110	$110	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$640	$640	5.0%
	Subtotal 2				$13,530	
9	Design Contingency	1	LS	$2,700	$2,700	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$1,600	$1,600	10.0%
	Total for Door Upgrade				**$17,830**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Door Upgrade					
	ML-2 Low - Opaque doors (U-0.42) Glass doors (U-0.48)					
	Architectural					$22,000
1 1.1	Opaque hollow metal door on frame including installation and finish: - single door (U-0.42)	2	NO	$4,000.00	$8,000	
2 2.1	Opaque glass door inaluminum frame including installation and finish: - single door (U-0.48)	2	NO	$7,000.00	$14,000	
	Subtotal 1				$22,000	
3	Prime Contractor's General Requirements	1	LS	$3,300	$3,300	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$150	$150	
6	Labour & Material and Performance bonding	1	LS	$220	$220	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$1,300	$1,300	5.0%
	Subtotal 2				$26,970	
9	Design Contingency	1	LS	$5,000	$5,000	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$3,200	$3,200	10.0%
	Total for Door Upgrade				**$35,170**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Door Upgrade					
	MH-2 High - Opaque doors (U-0.42) Glass doors (U-0.48)					
	Architectural					$22,000
1 1.1	Opaque hollow metal door on frame including installation and finish: - single door (U-0.42)	2	NO	$4,000.00	$8,000	
2 2.1	Opaque glass door inaluminum frame including installation and finish: - single door (U-0.48)	2	NO	$7,000.00	$14,000	
	Subtotal 1				$22,000	
3	Prime Contractor's General Requirements	1	LS	$3,300	$3,300	15.0%
4	Building permit				Excluded	
5	General Liability and Builder's Risk insurance	1	LS	$150	$150	
6	Labour & Material and Performance bonding	1	LS	$220	$220	
7	Miscellaneous Allowances				Excluded	
8	Prime Contractor's Fee	1	LS	$1,300	$1,300	5.0%
	Subtotal 2				$26,970	
9	Design Contingency	1	LS	$5,000	$5,000	20.0%
10	Escalation Contingency				Excluded	0.0%
11	Construction Contingency (Post Contract)	1	LS	$3,200	$3,200	10.0%
	Total for Door Upgrade				**$35,170**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Infiltration Reduction					
	Base - 1.5 L/s/m2 @ 75 Pa (0.48 L/s/m2 @ 5 Pa)					
	Architectural					$76,000
1	Allowance for infiltration reduction of building envelope including envelope reviews and site	1	LS	$76,000.00	$76,000	
	Subtotal 1				$76,000	
2	Prime Contractor's General Requirements	1	LS	$11,000	$11,000	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$530	$530	
5	Labour & Material and Performance bonding	1	LS	$760	$760	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$4,400	$4,400	5.0%
	Subtotal 2				$92,690	
8	Design Contingency	1	LS	$19,000	$19,000	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$11,000	$11,000	10.0%
	Total for Infiltration Reduction				**$122,690**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Infiltration Reduction					
	ML-3 Low - 1.25 L/s/m2 @ 75 Pa (0.4 L/s/m2 @ 5 Pa) - Recommend adding 5% to total envelope construction cost to account for increased QAQC, envelope reviews, and site testing.					
	Architectural					$80,000
1	Allowance for infiltration reduction of building envelope including envelope reviews and site	1	LS	$80,000.00	$80,000	
	Subtotal 1				$80,000	
2	Prime Contractor's General Requirements	1	LS	$12,000	$12,000	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$560	$560	
5	Labour & Material and Performance bonding	1	LS	$800	$800	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$4,700	$4,700	5.0%
	Subtotal 2				$98,060	
8	Design Contingency	1	LS	$20,000	$20,000	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$12,000	$12,000	10.0%
	Total for Infiltration Reduction				**$130,060**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Infiltration Reduction					
	MH-3 High - 0.50 L/s/m2 @ 75 Pa (0.16 L/s/m2 @ 5 Pa) Recommend adding 5% to total envelope construction cost to account for increased QAQC, envelope reviews, and site testing.					
	Architectural					$90,000
1	Allowance for infiltration reduction of building envelope including envelope reviews and site	1	LS	$90,000.00	$90,000	
	Subtotal 1				$90,000	
2	Prime Contractor's General Requirements	1	LS	$14,000	$14,000	15.0%
3	Building permit				Excluded	
4	General Liability and Builder's Risk insurance	1	LS	$630	$630	
5	Labour & Material and Performance bonding	1	LS	$900	$900	
6	Miscellaneous Allowances				Excluded	
7	Prime Contractor's Fee	1	LS	$5,000	$5,000	5.0%
	Subtotal 2				$110,530	
8	Design Contingency	1	LS	$22,000	$22,000	20.0%
9	Escalation Contingency				Excluded	0.0%
10	Construction Contingency (Post Contract)	1	LS	$13,000	$13,000	10.0%
	Total for Infiltration Reduction				**$145,530**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Heating/Cooling plant					
	Base - heating: natural gas condensing boiler serving central hot water loop (90% eff.)(2@ 400MBh boilers; 2@ 40gpm boiler pumps; 2@ 62gpm lead/lag secondary pumps); cooling: distributed split-AC integrated into FCUs in suites					
	Architectural					$16,500
1	Allowance for builders works					
1.1	- service pads	1	LS	$10,500.00	$10,500	
1.2	- gas boiler vents service penetrations including sealing and fire stopping	2	NO	$2,000.00	$4,000	
1.3	- louvers for boiler room ventilation	1	LS	$2,000.00	$2,000	
	Mechanical					$253,875
2	Allowance for central hydronic plant including:					
2.1	- condensing boilers, 60% peak heating capacity - 400 MBH	2	NO	$33,000.00	$66,000	
2.2	- boiler circulators, 40 gpm	2	NO	$5,000.00	$10,000	
2.3	- heating water distribution pumps, 62 gpm	2	NO	$8,500.00	$17,000	
2.4	- plant appurtenances including air/expansion control devices and chemical treatment	1	LS	$7,000.00	$7,000	
3	Allowance for hydronic piping					
3.1	- main/plant room piping ~ 65mm dia.	75	m	$369.00	$27,675	
3.2	- risers/distribution to terminal units, assume part of base construction				Info Only	
3.3	- miscellaneous line valves and piping components	1	LS	$4,200.00	$4,200	
3.4	- hook-up connections assemblies:					
3.5	- boilers	2	NO	$3,500.00	$7,000	
3.6	- heating water pumps	4	NO	$3,500.00	$14,000	
3.7	- plant appurtenances	1	LS	$3,750.00	$3,750	
4	General allowance					
4.1	- noise and vibration isolation	1	LS	$500.00	$500	
4.2	- starters, VFD and mechanical wiring	1	LS	$2,000.00	$2,000	
4.3	- TAB work	1	LS	$4,000.00	$4,000	
4.4	- basic start-up and contractor's commissioning	1	LS	$4,000.00	$4,000	
4.5	- flushing, cleaning, purging	1	LS	$750.00	$750	
4.6	- boiler ventilation system including flue vent	1	LS	$12,000.00	$12,000	
4.7	- natural gas services	1	LS	$4,500.00	$4,500	
4.8	- make-up water connection	1	NO	$2,500.00	$2,500	
5	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$28,000.00	$28,000	
6	Allowance for BAS plant controls (assume main plant control through DDC controls)					
6.1	- boiler	2	NO	$6,000.00	$12,000	
6.2	- hydronic pumps	4	NO	$4,000.00	$16,000	
6.3	- plant appurtenances	1	LS	$3,000.00	$3,000	
6.4	- miscellaneous field devices, control wiring and commissioning	1	LS	$8,000.00	$8,000	
	Electrical					$9,652
7	New breakers for power connections below	1	LS	$2,010.00	$2,010	
8	Power connection including line & load side wiring and disconnect switch for boiler	2	NO	$950.00	$1,900	
9	Power connection including line & load side wiring and disconnect switch for pump	4	NO	$1,080.00	$4,320	
10	General Requirements including:					$1,422
10.1	- Supervision	1	LS	$674.00	$674	
10.2	- Premium time, etc.				N/A	
10.3	- Job set-up, etc.	1	LS	$440.00	$440	
10.4	- Rentals, small tools, etc.	1	LS	$176.00	$176	
10.5	- Permits & inspections	1	LS	$114.00	$114	
10.6	- Insurance	1	LS	$18.00	$18	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$280,027	
11	Prime Contractor's General Requirements	1	LS	$42,000	$42,000	15.0%
12	Building permit				Excluded	
13	General Liability and Builder's Risk insurance	1	LS	$2,000	$2,000	
14	Labour & Material and Performance bonding	1	LS	$2,800	$2,800	
15	Miscellaneous Allowances				Excluded	
16	Prime Contractor's Fee	1	LS	$16,000	$16,000	5.0%
	Subtotal 2				$342,827	
17	Design Contingency	1	LS	$69,000	$69,000	20.0%
18	Escalation Contingency				Excluded	0.0%
19	Construction Contingency (Post Contract)	1	LS	$41,000	$41,000	10.0%
	Total for Heating/Cooling plant				**$452,827**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Heating/Cooling plant						
	ML-14 Low - Heating & cooling: cold climate air-source heat pumps (VRF switch-over) with 3x central outdoor unit, 3 VRF Headers and connected to VRF coils in MAU, commercial RTUs and in-suite units; supplemental electric baseboards for perimeter heating.						
	Architectural					$3,000	
1	Allowance for new structural steel framing to support VRF outdoor units, galvanized	2	NO	$1,500.00	$3,000		
2	Allowance for condensate/refrigerant risers/service penetrations included in base contract cost				Info Only		
	Mechanical					$142,000	
3	Allowance for ASHP VRF plant including:	28	TN	$3,500.00	$98,000		
3.1	- air source heat pump condensing units ~ 14 Tons (per mechanical selection, TBD)	2	NO		included		
3.2	- headers and branch joints	1	LS		included		
3.3	- premium for VRF heat recovery system and branch controller to commercial space (assume commercial space require simultaneous heating and cooling)	1	LS	$15,000.00	$15,000		
4	General allowance						
4.1	- Noise and vibration isolation	1	LS	$2,000.00	$2,000		
4.2	- Mechanical wiring				Included		
4.3	- TAB work				n/a		
4.4	- Basic start-up and contractor's commissioning	1	LS	$3,000.00	$3,000		
4.5	- condensate drains	1	LS	$3,000.00	$3,000		
5	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$18,000.00	$18,000		
6	Allowance for VRF system controller	1	LS	$3,000.00	$3,000		
	Electrical					$7,903	
7	New breakers for power connection below	1	LS	$3,800.00	$3,800		
8	Power connection with line and load side wiring including disconnect switch for air source heat pump condensing unit	2	NO	$1,590.00	$3,180		
9	General Requirements including:					$923	
9.1	- Supervision	1	LS	$289.00	$289		
9.2	- Premium time, etc.				N/A		
9.3	- Job set-up, etc.	1	LS	$373.00	$373		
9.4	- Rentals, small tools, etc.	1	LS	$149.00	$149		
9.5	- Permits & inspections	1	LS	$97.00	$97		
9.6	- Insurance	1	LS	$15.00	$15		
	Subtotal 1				$152,903		
10	Prime Contractor's General Requirements	1	LS	$23,000	$23,000		15.0%
11	Building permit				Excluded		
12	General Liability and Builder's Risk insurance	1	LS	$1,100	$1,100		
13	Labour & Material and Performance bonding	1	LS	$1,500	$1,500		
14	Miscellaneous Allowances				Excluded		
15	Prime Contractor's Fee	1	LS	$9,000	$9,000		5.0%
	Subtotal 2				$187,503		
16	Design Contingency	1	LS	$38,000	$38,000		20.0%
17	Escalation Contingency				Excluded		0.0%
18	Construction Contingency (Post Contract)	1	LS	$23,000	$23,000		10.0%
	Total for Heating/Cooling plant				**$248,503**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Heating/Cooling plant					
	MH-15 High - Geo-exchange field with vertical boreholes(256 MBH) , serving ground-connected central riser/ambient loop 2@ 15 gpm boiler pumps; 2@ 26 gpm lead/lag secondary pumps; water-cooled VRF units connected to ground-loop, serving terminals/coils on each floor					
	Architectural					$12,000
1	Allowance for builders works, including:					
1.1	- foundation sleeves including puddle flanges and link seal assemblies to accommodate geo loop	1	LS	$3,000.00	$3,000	
1.2	- service pads	1	LS	$9,000.00	$9,000	
2	Additional mechanical space for geothermal plant room, assumed part of base building				Info Only	
3	Site work associated with geothermal scope, assumed part of site development				Info Only	
	Mechanical					$553,500
4	Allowance for central hydronic plant including:					
4.1	- geothermal heat exchanger - 256MBH	1	LS	$8,500.00	$8,500	
4.2	- supplemental condensing boilers (assume not required, does not show in the mechanical selection details)				info only	
4.3	- geothermal field circulator, 26 gpm	2	NO	$6,000.00	$12,000	
4.4	- heat exchanger circulating pumps, 15 gpm	2	NO	$4,000.00	$8,000	
4.5	- plant appurtenances including air/expansion control devices and chemical treatment	1	LS	$14,000.00	$14,000	
5	Allowance for hydronic piping					
5.1	- main/plant room piping ~ 80mm dia.	100	m	$420.00	$42,000	
5.2	- miscellaneous line valves and piping components	1	LS	$6,300.00	$6,300	
5.3	- hook-up connections assemblies:					
5.4	- boilers				n/a	
5.5	- heat exchanger	1	NO	$9,000.00	$9,000	
5.6	- condenser water pumps	4	NO	$2,500.00	$10,000	
5.7	- plant appurtenances	1	LS	$7,500.00	$7,500	
5.8	- heat pump units including lateral piping	2	NO	$9,000.00	$18,000	
6	Allowance for heat pump plant - water source VRF heat pump units including:	28	TN	$2,400.00	$67,200	
6.1	- water source heat pump condensing units ~ 14 Tons	2	NO		included	
6.2	- headers and branch joints	1	LS		included	
6.3	- premium for VRF heat recovery system and branch controller to commercial space (assume commercial space require simultaneous heating and cooling)	1	LS	$15,000.00	$15,000	
7	General allowance					
7.1	- noise and vibration isolation	1	LS	$3,500.00	$3,500	
7.2	- starters, VFD and mechanical wiring	1	LS	$2,000.00	$2,000	
7.3	- TAB work	1	LS	$4,500.00	$4,500	
7.4	- basic start-up and contractor's commissioning	1	LS	$12,000.00	$12,000	
7.5	- flushing, cleaning, purging and glycol top-up for the geothermal side plant	1	LS	$2,000.00	$2,000	
7.6	- make-up water connection	1	NO	$6,000.00	$6,000	
7.7	- condensate drains	1	LS	$2,000.00	$2,000	
8	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$37,000.00	$37,000	
9	Allowance for vertical GHX heat exchanger loop including drilling, loop installation, tie-in loop and commissioning - 600' deep	10	NO	$23,000.00	$230,000	
10	Thermal conductivity test				excluded	
11	Allowance for BAS plant controls (assume main plant control through DDC controls)					
11.1	- boiler	0	NO	$6,000.00	$0	
11.2	- hydronic pumps	4	NO	$4,000.00	$16,000	
11.3	- plant appurtenances	1	LS	$6,000.00	$6,000	
11.4	- geothermal heat exchanger	1	LS	$6,000.00	$6,000	
11.5	- VRF system controls	1	LS	$2,000.00	$2,000	
11.6	- miscellaneous field devices, control wiring and commissioning	1	LS	$7,000.00	$7,000	
	Electrical					$10,713
12	New breakers for power connection below	1	LS	$4,050.00	$4,050	
13	Power connection with line and load side wiring including disconnect switch for hydronic pump	4	NO	$1,310.00	$5,240	
14	General Requirements including:					$1,423
14.1	- Supervision	1	LS	$578.00	$578	
14.2	- Premium time, etc.				N/A	
14.3	- Job set-up, etc.	1	LS	$497.00	$497	
14.4	- Rentals, small tools, etc.	1	LS	$199.00	$199	
14.5	- Permits & inspections	1	LS	$129.00	$129	
14.6	- Insurance	1	LS	$20.00	$20	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$576,213	
15	Prime Contractor's General Requirements	1	LS	$86,000	$86,000	15.0%
16	Building permit				Excluded	
17	General Liability and Builder's Risk insurance	1	LS	$4,000	$4,000	
18	Labour & Material and Performance bonding	1	LS	$5,800	$5,800	
19	Miscellaneous Allowances				Excluded	
20	Prime Contractor's Fee	1	LS	$34,000	$34,000	5.0%
	Subtotal 2				$706,013	
21	Design Contingency	1	LS	$141,000	$141,000	20.0%
22	Escalation Contingency				Excluded	0.0%
23	Construction Contingency (Post Contract)	1	LS	$85,000	$85,000	10.0%
	Total for Heating/Cooling plant				**$932,013**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	HVAC Distribution - Decentralized heating, cooling and ventilation					
	Base - 2 ton in-suite FCU w/ integral ERV (65% eff.) and multi-stage ECM control, with hydronic heating coils and split-AC cooling (SEER 13)					
	Architectural					$125,000
1	Allowance for architectural enclosure to accommodate new vertical stack AHUs	25	NO	$1,000.00	$25,000	
2	Allowance for floor coring for riser pipes included in base contract cost				Info Only	
3	Allowance for drop ceiling/bulkhead to run horizontal ductwork	250	m	$250.00	$62,500	
4	Create opening in exterior wall for new fresh air and exhaust including sealant and fire stopping	50	NO	$750.00	$37,500	
5	Commercial space interior ceilings and partitions, including service penetrations and final finishes, are part of the base construction scope and are not required				Info Only	
	Mechanical					$1,028,582
6	Allowance for hybrid vertical stack fan coil units with integral hydronic heating, DX cooling with remote condensing unit and ERV c/w riser kits and trims					
	- serving suites ~ 2 Tons	25	NO	$11,600.00	$290,000	
6.1	- serving commercial space - unit type TBD	8	NO	$17,000.00	$136,000	
7	Allowance for air distribution including:					
7.1	- sheet metal ductwork to SMACNA standards of construction and gauges assumed max. 8 - 10m supply ductwork to each suite	4,000	KG	$25.00	$100,000	
7.2	- thermal insulation, assume ductwork passing through the conditioned space and no insulation is not required				Info Only	
7.3	- air diffusion devices	1	LS	$15,000.00	$15,000	
7.4	- ERV Ductwork fresh air and exhaust - Insulated ductwork	1	LS	$8,000.00	$8,000	
7.5	- exhaust and fresh air louvers c/w wall sleeves and collar	50	NO	$200.00	$10,000	
7.6	- miscellaneous ductwork components	1	LS	$7,000.00	$7,000	
8	Allowance for hydronic piping including:					
8.1	- plant room piping				Included in HVAC plant	
8.2	- distribution mains and risers to terminal FCUs *(assume one ring mains with multiple risers serving stacked apartment, the riser package is included with the vertical stack terminal units. Only include hydronic heating piping, no condenser water piping is include in the estimate)*	2,351	m2	$35.00	$82,285	
8.3	- branches to retail space heat pump units *(only include hydronic heating piping, no condenser water piping is included in the estimate)*	784	m2	$50.00	$39,183	
8.4	- line valves including isolation and balancing valves	1	LS	$10,000.00	$10,000	
8.5	- hook-up connection assemblies					
8.6	- FCU hydronic hook-up	33	NO	$2,500.00	$82,500	
9	General allowance					
9.1	- Noise and vibration isolation	1	LS	$2,500.00	$2,500	
9.2	- Mechanical wiring				Included	
9.3	- TAB work	1	LS	$9,700.00	$9,700	
9.4	- Basic start-up and contractor's commissioning	1	LS	$11,000.00	$11,000	
9.5	- condensate drains, risers included in the vertical stack unit, new condensate drain to horizontal HPs, mains and branches in the in the lower floor terminated to nearest drain.	2,351	m2	$14.00	$32,914	
10	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$125,000.00	$125,000	
11	Allowance for standalone thermostatic controls to FCUs	25	NO	$1,500.00	$37,500	
12	Allowance for DDC controls to FCUs in commercial space	8	NO	$3,750.00	$30,000	
	Electrical					$29,145
13	New breakers for power connection below	1	LS	$2,310.00	$2,310	
14	Power connection with line & load side wiring for FCUs	33	NO	$670.00	$22,110	
15	General Requirements including:					$4,725
15.1	- Supervision	1	LS	$2,504.00	$2,504	
15.2	- Premium time, etc.				N/A	
15.3	- Job set-up, etc.	1	LS	$1,306.00	$1,306	
15.4	- Rentals, small tools, etc.	1	LS	$523.00	$523	
15.5	- Permits & inspections	1	LS	$340.00	$340	
15.6	- Insurance	1	LS	$52.00	$52	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$1,182,727	
16	Prime Contractor's General Requirements	1	LS	$177,000	$177,000	15.0%
17	Building permit				Excluded	
18	General Liability and Builder's Risk insurance	1	LS	$8,000	$8,000	
19	Labour & Material and Performance bonding	1	LS	$11,800	$11,800	
20	Miscellaneous Allowances				Excluded	
21	Prime Contractor's Fee	1	LS	$69,000	$69,000	5.0%
	Subtotal 2				$1,448,527	
22	Design Contingency	1	LS	$290,000	$290,000	20.0%
23	Escalation Contingency				Excluded	0.0%
24	Construction Contingency (Post Contract)	1	LS	$174,000	$174,000	10.0%
	Total for HVAC Distribution - Decentralized heating, cooling and ventilation				**$1,912,527**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	HVAC Distribution - Decentralized heating, cooling and ventilation					
	ML-8 Low - 2 ton in-suite VRF terminal units w/ integrated ERV (75% eff.)					
	Architectural					$125,000
1	Allowance for architectural enclosure to accommodate new vertical stack AHUs	25	NO	$1,000.00	$25,000	
2	Allowance for floor coring for riser pipes included in base contract cost				Info Only	
3	Allowance for drop ceiling/bulkhead to run horizontal ductwork	250	m	$250.00	$62,500	
4	Create opening in exterior wall for new fresh air and exhaust including sealant and fire stopping	50	NO	$750.00	$37,500	
5	Commercial space interior ceilings and partitions, including service penetrations and final finishes, are part of the base construction scope and are not required				Info Only	
	Mechanical					$742,443
6	Allowance for VRF indoor systems	1	LS	$340,500.00	$340,500	
6.1	- multi position AHUs - 2 Tons	25	NO		included	
6.2	- cassette units	8	NO		included	
6.3	- refrigerant piping c/w thermal insulation, line valves, control wiring and accessories including refrigerant charge				included	
6.4	- condensing units			included in plant measure		
7	*Note: It is assumed that the majority of the refrigerant piping will run horizontally to the indoor units on each level.*				*Info Only*	
8	Allowance in-suite ERV units equal to Fantec ATMO 150H	25	NO	$2,000.00	$50,000	
9	Allowance for supplemental electric baseboard heating (scope as per measure matrix)	33	NO	$1,500.00	$49,500	
10	Allowance for air distribution including					
10.1	- sheet metal ductwork to SMACNA standards of construction and gauges assumed max. 8 - 10m supply ductwork to each suite	1,900	KG	$25.00	$47,500	
10.2	- thermal insulation, assume ductwork passing through the conditioned space and no insulation is not required				Info Only	
10.3	- air diffusion devices	1	NO	$300.00	$300	
10.4	- ERV Ductwork fresh air and exhaust - Insulated ductwork	1	LS	$18,000.00	$18,000	
10.5	- exhaust and fresh air louvers c/w wall sleeves and collar	50	NO	$200.00	$10,000	
10.6	- miscellaneous ductwork components	1	LS	$3,325.00	$3,325	
11	General allowance					
11.1	- Noise and vibration isolation	1	LS	$3,500.00	$3,500	
11.2	- Mechanical wiring				Included	
11.3	- TAB work	1	LS	$13,750.00	$13,750	
11.4	- Basic start-up and contractor's commissioning	1	LS	$15,000.00	$15,000	
11.5	- new condensate drains network including risers and mains and branches indirectly terminating to nearest drain in the lower floor	2,351	m2	$18.00	$42,318	
12	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$89,000.00	$89,000	
13	Allowance for VRF system controls, thermostat and interlock wiring	25	NO	$1,750.00	$43,750	
14	Allowance for commercial space VRF terminal units	8	NO	$2,000.00	$16,000	
	Electrical					$75,343
15	New breakers for power connections below	1	LS	$2,000.00	$2,000	
16	Power connection with line & load side wiring for terminal units	66	NO	$670.00	$44,220	
17	Power connection with line & load side wiring for ERVs	25	NO	$670.00	$16,750	
18	General Requirements including:					$12,373
18.1	- Supervision	1	LS	$6,645.00	$6,645	
18.2	- Premium time, etc.				N/A	
18.3	- Job set-up, etc.	1	LS	$3,369.00	$3,369	
18.4	- Rentals, small tools, etc.	1	LS	$1,348.00	$1,348	
18.5	- Permits & inspections	1	LS	$876.00	$876	
18.6	- Insurance	1	LS	$135.00	$135	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$942,786	
19	Prime Contractor's General Requirements	1	LS	$141,000	$141,000	15.0%
20	Building permit				Excluded	
21	General Liability and Builder's Risk insurance	1	LS	$7,000	$7,000	
22	Labour & Material and Performance bonding	1	LS	$9,400	$9,400	
23	Miscellaneous Allowances				Excluded	
24	Prime Contractor's Fee	1	LS	$55,000	$55,000	5.0%
	Subtotal 2				$1,155,186	
25	Design Contingency	1	LS	$231,000	$231,000	20.0%
26	Escalation Contingency				Excluded	0.0%
27	Construction Contingency (Post Contract)	1	LS	$139,000	$139,000	10.0%
	Total for HVAC Distribution - Decentralized heating, cooling and ventilation				**$1,525,186**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	HVAC Distribution - Decentralized heating, cooling and ventilation					
	MH-9 High - 1 ton commercial, and 2 ton residential in-suite VRF cassette-style terminals					
	Architectural					$87,500
1	Allowance for architectural enclosure to accommodate new vertical stack AHUs	25	NO	$1,000.00	$25,000	
2	Allowance for floor coring for riser pipes included in base contract cost				Info Only	
3	Allowance for drop ceiling/bulkhead to run horizontal ductwork	250	m	$250.00	$62,500	
	Mechanical					$646,193
4	Allowance for VRF indoor systems	1	LS	$340,500.00	$340,500	
4.1	- multi position AHUs - 2 Tons	25	NO		included	
4.2	- cassette units	8	NO		included	
4.3	- refrigerant piping c/w thermal insulation, line valves, control wiring and accessories including refrigerant charge				included	
4.4	- condensing units				included in plant measure	
5	*Note: It is assumed that the majority of the refrigerant piping will run horizontally to the indoor units on each level.*				*Info Only*	
6	In-suite ERV				central DOAS system	
7	Allowance for supplemental electric baseboard heating (scope as per measure matrix)	33	NO	$1,500.00	$49,500	
8	Allowance for air distribution including					
8.1	- sheet metal ductwork to SMACNA standards of construction and gauges assumed max. 8 - 10m supply ductwork to each suite	1,900	KG	$25.00	$47,500	
8.2	- thermal insulation, assume ductwork passing through the conditioned space and no insulation is not required				Info Only	
8.3	- air diffusion devices	1	NO	$300.00	$300	
8.4	- miscellaneous ductwork components	1	LS	$3,325.00	$3,325	
9	General allowance					
9.1	- Noise and vibration isolation	1	LS	$3,500.00	$3,500	
9.2	- Mechanical wiring				Included	
9.3	- TAB work	1	LS	$13,750.00	$13,750	
9.4	- Basic start-up and contractor's commissioning	1	LS	$15,000.00	$15,000	
9.5	- new condensate drains network including risers and mains and branches indirectly terminating to nearest drain in the lower floor	2,351	m2	$18.00	$42,318	
10	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$77,000.00	$77,000	
11	Allowance for VRF system controls, thermostat and interlock wiring	25	NO	$1,500.00	$37,500	
12	Allowance for commercial space VRF terminal units	8	NO	$2,000.00	$16,000	
	Electrical					$55,280
13	New breakers for power connections below	1	LS	$1,950.00	$1,950	
14	Power connection with line & load side wiring for terminal units	66	NO	$670.00	$44,220	
15	General Requirements including:					$9,110
15.1	- Supervision	1	LS	$4,911.00	$4,911	
15.2	- Premium time, etc.				N/A	
15.3	- Job set-up, etc.	1	LS	$2,470.00	$2,470	
15.4	- Rentals, small tools, etc.	1	LS	$988.00	$988	
15.5	- Permits & inspections	1	LS	$642.00	$642	
15.6	- Insurance	1	LS	$99.00	$99	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$788,973	
16	Prime Contractor's General Requirements	1	LS	$118,000	$118,000	15.0%
17	Building permit				Excluded	
18	General Liability and Builder's Risk insurance	1	LS	$6,000	$6,000	
19	Labour & Material and Performance bonding	1	LS	$7,900	$7,900	
20	Miscellaneous Allowances				Excluded	
21	Prime Contractor's Fee	1	LS	$46,000	$46,000	5.0%
	Subtotal 2				$966,873	
22	Design Contingency	1	LS	$193,000	$193,000	20.0%
23	Escalation Contingency				Excluded	0.0%
24	Construction Contingency (Post Contract)	1	LS	$116,000	$116,000	10.0%
	Total for HVAC Distribution - Decentralized heating, cooling and ventilation				**$1,275,873**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	HVAC Distribution - Residential Space Central Ventilation and Pressurization					
	Base - MAU serving corridors, with hydronic heating and DX cooling					
	Architectural					$0
1	No work required					
	Mechanical					$104,750
2	Allowance for DX MAU c/w hydronic coil, indoor mounted - 420 cfm	1	NO	$27,000.00	$27,000	
3	Allowance for air distribution including					
3.1	- sheet metal ductwork to SMACNA standards of construction and gauges c/w thermal insulation	500	KG	$34.00	$17,000	
3.2	- fresh air intake and exhaust louvers c/w dampers	2	NO	$1,000.00	$2,000	
3.3	- air diffusion devices serving corridor	1	LS	$2,000.00	$2,000	
3.4	- fire dampers - static fire damper c/w sleeves and retaining angle assembly	1	LS	$1,000.00	$1,000	
3.5	- miscellaneous ductwork components	1	LS	$1,000.00	$1,000	
4	Allowance for hydronic plant including glycol package, heat exchanger, and associated piping serving MAU	1	LS	$26,000.00	$26,000	
5	General allowance					
5.1	- Noise and vibration isolation	1	LS	$1,000.00	$1,000	
5.2	- Starters, VFD and mechanical wiring	1	LS	$1,000.00	$1,000	
5.3	- TAB work	1	LS	$3,000.00	$3,000	
5.4	- Basic start-up and contractor's commissioning	1	LS	$2,000.00	$2,000	
5.5	- Condensate drain	1	NO	$1,250.00	$1,250	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$13,000.00	$13,000	
7	Allowance for BAS plant controls c/w field devices, control wiring, programming, graphics and commissioning	1	NO	$7,500.00	$7,500	
	Electrical					$3,346
8	New breaker for below power connection	1	LS	$1,650.00	$1,650	
9	Power connection with line and load side wiring including disconnect switch for DX MAU	1	NO	$1,330.00	$1,330	
10	General Requirements including:					$366
10.1	- Supervision	1	LS	$96.00	$96	
10.2	- Premium time, etc.				N/A	
10.3	- Job set-up, etc.	1	LS	$159.00	$159	
10.4	- Rentals, small tools, etc.	1	LS	$64.00	$64	
10.5	- Permits & inspections	1	LS	$41.00	$41	
10.6	- Insurance	1	LS	$6.00	$6	
	Subtotal 1				$108,096	
11	Prime Contractor's General Requirements	1	LS	$16,000	$16,000	15.0%
12	Building permit				Excluded	
13	General Liability and Builder's Risk insurance	1	LS	$760	$760	
14	Labour & Material and Performance bonding	1	LS	$1,100	$1,100	
15	Miscellaneous Allowances				Excluded	
16	Prime Contractor's Fee	1	LS	$6,000	$6,000	5.0%
	Subtotal 2				$131,956	
17	Design Contingency	1	LS	$26,000	$26,000	20.0%
18	Escalation Contingency				Excluded	0.0%
19	Construction Contingency (Post Contract)	1	LS	$16,000	$16,000	10.0%
	Total for HVAC Distribution - Residential Space Central Ventilation and Pressurization				**$173,956**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	HVAC Distribution - Residential Space Central Ventilation and Pressurization						
	ML-9 Low - MAU serving corridors, with VRF heating/cooling coils						
	Architectural					$1,500	
1	No work required	1	NO	$1,500.00	$1,500		
	Mechanical					$124,750	
2	Allowance for indoor mounted AHU c/w energy recovery section (80% efficiency) and remote VRF heat pump and controls integration kit, refrigerant piping - 420 cfm	1	NO	$71,000.00	$71,000		
3	Allowance for air distribution including						
3.1	- sheet metal ductwork to SMACNA standards of construction and gauges c/w thermal insulation	500	KG	$34.00	$17,000		
3.2	- fresh air intake and exhaust louvers c/w dampers	2	NO	$1,000.00	$2,000		
3.3	- air diffusion devices serving corridor	1	LS	$2,000.00	$2,000		
3.4	- fire dampers - static fire damper c/w sleeves and retaining angle assembly	1	LS	$1,000.00	$1,000		
3.5	- miscellaneous ductwork components	1	LS	$1,000.00	$1,000		
4	General allowance						
4.1	- Noise and vibration isolation	1	LS	$1,000.00	$1,000		
4.2	- Starters, VFD and mechanical wiring	1	LS	$1,000.00	$1,000		
4.3	- TAB work	1	LS	$3,000.00	$3,000		
4.4	- Basic start-up and contractor's commissioning	1	LS	$2,000.00	$2,000		
4.5	- Condensate drain	1	NO	$1,250.00	$1,250		
5	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$15,000.00	$15,000		
6	Allowance for BAS plant controls c/w field devices, control wiring, programming, graphics and commissioning	1	NO	$7,500.00	$7,500		
	Electrical					$4,197	
7	New breaker for below power connection	1	LS	$1,650.00	$1,650		
8	Power connection with line and load side wiring including disconnect switch for DX MAU	1	NO	$2,020.00	$2,020		
9	General Requirements including:					$527	
9.1	- Supervision	1	LS	$193.00	$193		
9.2	- Premium time, etc.				N/A		
9.3	- Job set-up, etc.	1	LS	$196.00	$196		
9.4	- Rentals, small tools, etc.	1	LS	$79.00	$79		
9.5	- Permits & inspections	1	LS	$51.00	$51		
9.6	- Insurance	1	LS	$8.00	$8		
	Subtotal 1				$130,447		
10	Prime Contractor's General Requirements	1	LS	$20,000	$20,000		15.0%
11	Building permit				Excluded		
12	General Liability and Builder's Risk insurance	1	LS	$910	$910		
13	Labour & Material and Performance bonding	1	LS	$1,300	$1,300		
14	Miscellaneous Allowances				Excluded		
15	Prime Contractor's Fee	1	LS	$8,000	$8,000		5.0%
	Subtotal 2				$160,657		
16	Design Contingency	1	LS	$32,000	$32,000		20.0%
17	Escalation Contingency				Excluded		0.0%
18	Construction Contingency (Post Contract)	1	LS	$19,000	$19,000		10.0%
	Total for HVAC Distribution - Residential Space Central Ventilation and Pressurization				**$211,657**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	HVAC Distribution - Residential Space Central Ventilation and Pressurization					
	MH-10 High - DOAS with central reverse-flow ERV (90% eff.) serving all corridor spaces and residential units					
	Architectural					$0
1	No work required					
	Mechanical					$290,350
2	Allowance for reverse flow DOAS unit c/w VRF heat pump and controls integration kit, refrigerant piping -1,484 cfm	1	NO	$126,000.00	$126,000	
3	Allowance for air distribution including					
3.1	- sheet metal ductwork to SMACNA standards of construction and gauges c/w thermal insulation	1,900	KG	$34.00	$64,600	
3.2	- air diffusion devices serving corridor	1	LS	$2,000.00	$2,000	
3.3	- fire dampers - static fire damper c/w sleeves and retaining angle assembly	1	LS	$9,000.00	$9,000	
3.4	- miscellaneous ductwork components	1	LS	$3,000.00	$3,000	
4	Allowance for condenser water piping serving MAU condensing unit	1	LS	$25,000.00	$25,000	
5	General allowance					
5.1	- Noise and vibration isolation	1	LS	$2,500.00	$2,500	
5.2	- Starters, VFD and mechanical wiring	1	LS	$2,000.00	$2,000	
5.3	- TAB work	1	LS	$4,000.00	$4,000	
5.4	- Basic start-up and contractor's commissioning	1	LS	$3,000.00	$3,000	
5.5	- Condensate drain	1	NO	$1,250.00	$1,250	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$36,000.00	$36,000	
7	Allowance for BAS plant controls c/w field devices, control wiring, programming, graphics and commissioning	1	NO	$12,000.00	$12,000	
	Electrical					$4,197
8	New breaker for below power connection	1	LS	$1,650.00	$1,650	
9	Power connection with line and load side wiring including disconnect switch for DOAS	1	NO	$2,020.00	$2,020	
10	General Requirements including:					$527
10.1	- Supervision	1	LS	$193.00	$193	
10.2	- Premium time, etc.				N/A	
10.3	- Job set-up, etc.	1	LS	$196.00	$196	
10.4	- Rentals, small tools, etc.	1	LS	$79.00	$79	
10.5	- Permits & inspections	1	LS	$51.00	$51	
10.6	- Insurance	1	LS	$8.00	$8	
	Subtotal 1				$294,547	
11	Prime Contractor's General Requirements	1	LS	$44,000	$44,000	15.0%
12	Building permit				Excluded	
13	General Liability and Builder's Risk insurance	1	LS	$2,100	$2,100	
14	Labour & Material and Performance bonding	1	LS	$2,900	$2,900	
15	Miscellaneous Allowances				Excluded	
16	Prime Contractor's Fee	1	LS	$17,000	$17,000	5.0%
	Subtotal 2				$360,547	
17	Design Contingency	1	LS	$72,000	$72,000	20.0%
18	Escalation Contingency				Excluded	0.0%
19	Construction Contingency (Post Contract)	1	LS	$43,000	$43,000	10.0%
	Total for HVAC Distribution - Residential Space Central Ventilation and Pressurization				**$475,547**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	HVAC Distribution - Commercial Space Ventilation					
	Base - RTU serving each commercial space; including hot water coils and DX cooling, and integrated heat recovery (50% eff.)					
	Architectural					$0
1	No work required					
	Mechanical					$914,140
2	ERV outdoor unit c/w hot water coil and DX cooling, 50% efficiency *(TBD - inputs are based on the measure matrix, with assumptions for equipment type, number of zones, and a total of 8 commercial spaces, each requiring a dedicated ERV)* - 350 cfm (equipment type TBD)	8	NO	$50,000.00	$400,000	
3	Allowance for ductwork including:					
3.1	- ventilation air ductwork directly to individual retail spaces, exhaust ductwork from washroom/storage, and general exhaust/return through open ended duct in the ceiling - assume unit is indoor ceiling mounted	3,360	KG	$40.00	$134,400	
3.2	- manual control/balancing dampers serving in-floor ventilation zones (no zone VAVs are accounted estimate)				included below	
3.3	- fire/smoke dampers	1	LS	$4,000.00	$4,000	
3.4	- miscellaneous sheetmetal items such as zone balancing dampers, access doors, turning vanes, etc.	1	LS	$13,440.00	$13,440	
4	Allowance for hydronic plant including glycol package, heat exchanger, and associated piping serving MAU	1	LS	$100,000.00	$100,000	
5	General allowance					
5.1	- noise and vibration isolation	1	LS	$2,800.00	$2,800	
5.2	- starters/VFDs and mechanical wiring	1	LS	$2,500.00	$2,500	
5.3	- TAB work	1	LS	$15,000.00	$15,000	
5.4	- basic start-up and contractor's commissioning	1	LS	$17,000.00	$17,000	
5.5	- condensate drainage	1	LS	$12,000.00	$12,000	
5.6	- humidification (electric duct mounted), TBD	1	LS	$36,000.00	$36,000	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$111,000.00	$111,000	
7	Allowance for BAS controls					
7.1	- ERV unit controls c/w field devices and integration	8	NO	$5,000.00	$40,000	
7.2	- humidifier	8	NO	$2,500.00	$20,000	
7.3	- miscellaneous field devices, control wiring and commissioning	1	NO	$6,000.00	$6,000	
	Electrical					$7,242
8	New breakers for power connections below	1	LS	$660.00	$660	
9	Power connection with line & load side wiring for ERV	8	NO	$670.00	$5,360	
10	General Requirements including:					$1,222
10.1	- Supervision	1	LS	$674.00	$674	
10.2	- Premium time, etc.				N/A	
10.3	- Job set-up, etc.	1	LS	$322.00	$322	
10.4	- Rentals, small tools, etc.	1	LS	$129.00	$129	
10.5	- Permits & inspections	1	LS	$84.00	$84	
10.6	- Insurance	1	LS	$13.00	$13	
	Subtotal 1				$921,382	
11	Prime Contractor's General Requirements	1	LS	$138,000	$138,000	15.0%
12	Building permit				Excluded	
13	General Liability and Builder's Risk insurance	1	LS	$6,000	$6,000	
14	Labour & Material and Performance bonding	1	LS	$9,200	$9,200	
15	Miscellaneous Allowances				Excluded	
16	Prime Contractor's Fee	1	LS	$54,000	$54,000	5.0%
	Subtotal 2				$1,128,582	
17	Design Contingency	1	LS	$226,000	$226,000	20.0%
18	Escalation Contingency				Excluded	0.0%
19	Construction Contingency (Post Contract)	1	LS	$135,000	$135,000	10.0%
	Total for HVAC Distribution - Commercial Space Ventilation				**$1,489,582**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	HVAC Distribution - Commercial Space Ventilation					
	ML-10 Low - Commercial terminal RTU units with DCV/economizer control serving each commercial space, with improved heat recovery (80% eff.)					
	Architectural					$0
1	No work required					
	Mechanical					$1,009,140
2	ERV outdoor unit c/w remote airsource VRF heat pump condensing unit and controls integration, 80% efficiency*TBD - inputs are based on the measure matrix, with assumptions for equipment type, number of zones, and a total of 8 commercial spaces, each requiring a dedicated ERV) - 350 cfm* (equipment type TBD)	8	NO	$63,000.00	$504,000	
3	Allowance for refrigerant piping c/w refrigerant charge	1	LS	$60,000.00	$60,000	
4	Allowance for ductwork including:					
4.1	- ventilation air ductwork directly to individual retail spaces, exhaust ductwork from washroom/storage, and general exhaust/return through open ended duct in the ceiling - assume unit is indoor ceiling mounted	3,360	KG	$40.00	$134,400	
4.2	- manual control/balancing dampers serving in-floor ventilation zones (no zone VAVs are accounted estimate)				included below	
4.3	- fire/smoke dampers	1	LS	$4,000.00	$4,000	
4.4	- miscellaneous sheetmetal items such as zone balancing dampers, access doors, turning vanes, etc.	1	LS	$13,440.00	$13,440	
5	General allowance					
5.1	- noise and vibration isolation	1	LS	$2,800.00	$2,800	
5.2	- starters/VFDs and mechanical wiring	1	LS	$2,500.00	$2,500	
5.3	- TAB work	1	LS	$15,000.00	$15,000	
5.4	- basic start-up and contractor's commissioning	1	LS	$17,000.00	$17,000	
5.5	- condensate drainage	1	LS	$12,000.00	$12,000	
5.6	- humidification (electric duct mounted), TBD	1	LS	$36,000.00	$36,000	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$120,000.00	$120,000	
7	Allowance for BAS controls					
7.1	- ERV unit controls with DCV c/w field devices and integration	8	NO	$7,500.00	$60,000	
7.2	- humidifier	8	NO	$2,500.00	$20,000	
7.3	- miscellaneous field devices, control wiring and commissioning	1	NO	$8,000.00	$8,000	
	Electrical					$7,242
8	New breakers for power connections below	1	LS	$660.00	$660	
9	Power connection with line & load side wiring for ERV	8	NO	$670.00	$5,360	
10	General Requirements including:					$1,222
10.1	- Supervision	1	LS	$674.00	$674	
10.2	- Premium time, etc.				N/A	
10.3	- Job set-up, etc.	1	LS	$322.00	$322	
10.4	- Rentals, small tools, etc.	1	LS	$129.00	$129	
10.5	- Permits & inspections	1	LS	$84.00	$84	
10.6	- Insurance	1	LS	$13.00	$13	
	Subtotal 1				$1,016,382	
11	Prime Contractor's General Requirements	1	LS	$152,000	$152,000	15.0%
12	Building permit				Excluded	
13	General Liability and Builder's Risk insurance	1	LS	$7,000	$7,000	
14	Labour & Material and Performance bonding	1	LS	$10,200	$10,200	
15	Miscellaneous Allowances				Excluded	
16	Prime Contractor's Fee	1	LS	$59,000	$59,000	5.0%
	Subtotal 2				$1,244,582	
17	Design Contingency	1	LS	$249,000	$249,000	20.0%
18	Escalation Contingency				Excluded	0.0%
19	Construction Contingency (Post Contract)	1	LS	$149,000	$149,000	10.0%
	Total for HVAC Distribution - Commercial Space Ventilation				**$1,642,582**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	HVAC Distribution - Commercial Space Ventilation						
	MH-11 High - Commercial RTU units with DCV/economizer control serving each commercial space, with reverse-flow heat recovery (90% eff.)						
	Architectural					$0	
1	No work required						
	Mechanical					$1,183,160	
2	ERV outdoor unit c/w remote water source VRF heat pump condensing unit and controls integration, 90% efficiency *(TBD - inputs are based on the measure matrix, with assumptions for equipment type, number of zones, and a total of 8 commercial spaces, each requiring a dedicated ERV) - 280 cfm* (equipment type TBD)	8	NO	$73,000.00	$584,000		
3	Allowance for refrigerant piping c/w refrigerant charge	1	LS	$96,000.00	$96,000		
4	Allowance for ductwork including:						
4.1	- ventilation air ductwork directly to individual retail spaces, exhaust ductwork from washroom/storage, and general exhaust/return through open ended duct in the ceiling - assume unit is indoor ceiling mounted	2,690	KG	$40.00	$107,600		
4.2	- manual control/balancing dampers serving in-floor ventilation zones (no zone VAVs are accounted estimate)				included below		
4.3	- fire/smoke dampers	1	LS	$4,000.00	$4,000		
4.4	- miscellaneous sheetmetal items such as zone balancing dampers, access doors, turning vanes, etc.	1	LS	$10,760.00	$10,760		
5	Allowance for condenser water piping serving MAU	1	LS	$82,000.00	$82,000		
6	General allowance						
6.1	- noise and vibration isolation	1	LS	$2,800.00	$2,800		
6.2	- starters/VFDs and mechanical wiring	1	LS	$2,500.00	$2,500		
6.3	- TAB work	1	LS	$15,000.00	$15,000		
6.4	- basic start-up and contractor's commissioning	1	LS	$17,000.00	$17,000		
6.5	- condensate drainage	1	LS	$12,000.00	$12,000		
6.6	- humidification (electric duct mounted), TBD	1	LS	$36,000.00	$36,000		
7	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$145,000.00	$145,000		
8	Allowance for BAS controls						
8.1	- ERV unit controls with DCV c/w field devices and integration	8	NO	$7,500.00	$60,000		
8.2	- humidifier	1	NO	$2,500.00	$2,500		
8.3	- miscellaneous field devices, control wiring and commissioning	1	NO	$6,000.00	$6,000		
	Electrical					$9,696	
9	New breakers for power connections below	1	LS	$2,430.00	$2,430		
10	Power connection with line & load side wiring for ERV	8	NO	$730.00	$5,840		
11	General Requirements including:					$1,426	
11.1	- Supervision	1	LS	$674.00	$674		
11.2	- Premium time, etc.				N/A		
11.3	- Job set-up, etc.	1	LS	$442.00	$442		
11.4	- Rentals, small tools, etc.	1	LS	$177.00	$177		
11.5	- Permits & inspections	1	LS	$115.00	$115		
11.6	- Insurance	1	LS	$18.00	$18		
	Subtotal 1				$1,192,856		
12	Prime Contractor's General Requirements	1	LS	$179,000	$179,000		15.0%
13	Building permit				Excluded		
14	General Liability and Builder's Risk insurance	1	LS	$8,000	$8,000		
15	Labour & Material and Performance bonding	1	LS	$11,900	$11,900		
16	Miscellaneous Allowances				Excluded		
17	Prime Contractor's Fee	1	LS	$70,000	$70,000		5.0%
	Subtotal 2				$1,461,756		
18	Design Contingency	1	LS	$292,000	$292,000		20.0%
19	Escalation Contingency				Excluded		0.0%
20	Construction Contingency (Post Contract)	1	LS	$175,000	$175,000		10.0%
	Total for HVAC Distribution - Commercial Space Ventilation				**$1,928,756**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DHW Plant					
	Base - Natural gas storage (95% eff., 230 GPH, 250 MBH)					
	Architectural					$1,000
1	Mechanical room space included as part of base building construction					
2	Allowance for service penetrations serving DHW venting	1	LS	$1,000.00	$1,000	
	Mechanical					$37,150
2	Allowance for domestic hot water plant including:					
2.1	- High efficiency condensing water heater, 250MBH	1	NO	$12,500.00	$12,500	
2.2	- Domestic hot recirculating pump and expansion tank	1	LS	$2,500.00	$2,500	
3	Allowance for distribution piping including:					
3.1	- DHW plant room piping	25	m	$300.00	$7,500	
3.2	- Line valves and piping accessories	1	LS	$400.00	$400	
4	General allowance					
4.1	- Basic start-up and contractor's commissioning	1	LS	$1,000.00	$1,000	
4.2	- System condensate/drains/neutralization kits	1	LS	$1,000.00	$1,000	
4.3	- System ventilation	1	LS	$1,500.00	$1,500	
4.4	- Natural gas services	1	LS	$3,750.00	$3,750	
5	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$5,000.00	$5,000	
6	Allowance for DHW plant controls including field devices, sensors and wiring	1	LS	$2,000.00	$2,000	
	Electrical					$2,310
7	New breakers for power connections below	1	LS	$600.00	$600	
8	Power connection with line & load side wiring for water heater and pump	2	NO	$670.00	$1,340	
9	General Requirements including:					$370
9.1	- Supervision	1	LS	$193.00	$193	
9.2	- Premium time, etc.				N/A	
9.3	- Job set-up, etc.	1	LS	$104.00	$104	
9.4	- Rentals, small tools, etc.	1	LS	$42.00	$42	
9.5	- Permits & inspections	1	LS	$27.00	$27	
9.6	- Insurance	1	LS	$4.00	$4	
	Subtotal 1				$40,460	
10	Prime Contractor's General Requirements	1	LS	$6,000	$6,000	15.0%
11	Building permit				Excluded	
12	General Liability and Builder's Risk insurance	1	LS	$280	$280	
13	Labour & Material and Performance bonding	1	LS	$400	$400	
14	Miscellaneous Allowances				Excluded	
15	Prime Contractor's Fee	1	LS	$2,400	$2,400	5.0%
	Subtotal 2				$49,540	
16	Design Contingency	1	LS	$10,000	$10,000	20.0%
17	Escalation Contingency				Excluded	0.0%
18	Construction Contingency (Post Contract)	1	LS	$6,000	$6,000	10.0%
	Total for DHW Plant				**$65,540**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DHW Plant					
	ML-12 Low - Air Source Heat Pump (230 GPH, 250 MBH) with electric top-up					
	Architectural					$10,500
1	Mechanical room space included as part of base building construction					
2	Allowance for service pads/supports	1	LS	$10,500.00	$10,500	
	Mechanical					$521,900
2	Allowance for domestic hot water plant including:					
2.1	- ASHP water heaters equal to Lync Aegis A 250 c/w heat exchanger module and hydronic package including primary and secondary circulating pumps and hydronic plant appurtenances	1	NO	$314,000.00	$314,000	
2.2	- Storage tank, ASME vertical glass lined insulated stratified storage tank suitable for heat pump application ~ 400 gallon	1	NO	$32,000.00	$32,000	
2.3	- Electric storage tanks heater - 150 gallon, 250MBH	1	NO	$40,000.00	$40,000	
2.4	- Glycol fill-in unit c/w glycol charge	1	LS	$9,000.00	$9,000	
2.5	- Secondary side hydronic devices including circulation pump and expansion tank	1	LS	$6,000.00	$6,000	
2.6	- DHW loop pumps, mixing valve and expansion tank	1	LS	$6,750.00	$6,750	
2.7	- Domestic hot recirculating pump and expansion tank	1	LS	$2,500.00	$2,500	
3	Allowance for distribution piping including:					
3.1	- Glycol piping c/w thermal insulation and weatherproof jacketing, 32mm dia.	50	m	$225.00	$11,250	
3.2	- DHW plant room piping	25	m	$300.00	$7,500	
3.3	- Line valves and piping accessories	1	LS	$900.00	$900	
3.4	- Hook-up connection assemblies					
3.5	- ASHPs c/w secondary circuit heat exchanger	1	NO	$5,250.00	$5,250	
3.6	- circulating pumps	1	NO	$1,250.00	$1,250	
3.7	- heating water plant appurtenances				included above	
4	General allowance					
4.1	- Noise and vibration isolation	1	LS	$1,000.00	$1,000	
4.2	- Starters, VFD and mechanical wiring	1	LS	$1,000.00	$1,000	
4.3	- TAB work	1	LS	$2,000.00	$2,000	
4.4	- Basic start-up and contractor's commissioning	1	LS	$3,000.00	$3,000	
4.5	- System condensate/drains	1	LS	$3,750.00	$3,750	
4.6	- Make-up water connection, extend existing services c/w BFP assemblies	1	LS	$2,750.00	$2,750	
5	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$67,000.00	$67,000	
6	Allowance for DHW plant controls including field devices, sensors and wiring	1	NO	$5,000.00	$5,000	
	Electrical					$14,283
7	New breakers for power connections below	1	LS	$4,660.00	$4,660	
8	Power connection with line and load side wiring including disconnect switch for ASHP water heater	1	NO	$6,960.00	$6,960	
9	Power connection with line and load side wiring for electric storage tank heater	1	NO	$1,030.00	$1,030	
10	General Requirements including:					$1,633
10.1	- Supervision	1	LS	$482.00	$482	
10.2	- Premium time, etc.				N/A	
10.3	- Job set-up, etc.	1	LS	$677.00	$677	
10.4	- Rentals, small tools, etc.	1	LS	$271.00	$271	
10.5	- Permits & inspections	1	LS	$176.00	$176	
10.6	- Insurance	1	LS	$27.00	$27	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$546,683	
11	Prime Contractor's General Requirements	1	LS	$82,000	$82,000	15.0%
12	Building permit				Excluded	
13	General Liability and Builder's Risk insurance	1	LS	$3,800	$3,800	
14	Labour & Material and Performance bonding	1	LS	$5,500	$5,500	
15	Miscellaneous Allowances				Excluded	
16	Prime Contractor's Fee	1	LS	$32,000	$32,000	5.0%
	Subtotal 2				$669,983	
17	Design Contingency	1	LS	$134,000	$134,000	20.0%
18	Escalation Contingency				Excluded	0.0%
19	Construction Contingency (Post Contract)	1	LS	$80,000	$80,000	10.0%
	Total for DHW Plant				**$883,983**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DHW Plant					
	MH-13 High - Air Source Heat Pump (230 GPH, 250 MBH) with electric top-up					
	Architectural					$10,500
1	Mechanical room space included as part of base building construction					
2	Allowance for service pads	1	LS	$10,500.00	$10,500	
	Mechanical					$521,900
2	Allowance for domestic hot water plant including:					
2.1	- ASHP water heaters equal to Lync Aegis A 250 c/w heat exchanger module and hydronic package including primary and secondary circulating pumps and hydronic plant appurtenances	1	NO	$314,000.00	$314,000	
2.2	- Storage tank, ASME vertical glass lined insulated stratified storage tank suitable for heat pump application ~ 400 gallon	1	NO	$32,000.00	$32,000	
2.3	- Electric storage tanks heater - 150 gallon, 250MBH	1	NO	$40,000.00	$40,000	
2.4	- Glycol fill-in unit c/w glycol charge	1	LS	$9,000.00	$9,000	
2.5	- Secondary side hydronic devices including circulation pump and expansion tank	1	LS	$6,000.00	$6,000	
2.6	- DHW loop pumps, mixing valve and expansion tank	1	LS	$6,750.00	$6,750	
2.7	- Domestic hot recirculating pump and expansion tank	1	LS	$2,500.00	$2,500	
3	Allowance for distribution piping including:					
3.1	- Glycol piping c/w thermal insulation and weatherproof jacketing, 32mm dia.	50	m	$225.00	$11,250	
3.2	- DHW plant room piping	25	m	$300.00	$7,500	
3.3	- Line valves and piping accessories	1	LS	$900.00	$900	
3.4	- Hook-up connection assemblies					
3.5	- ASHPs c/w secondary circuit heat exchanger	1	NO	$5,250.00	$5,250	
3.6	- circulating pumps	1	NO	$1,250.00	$1,250	
3.7	- heating water plant appurtenances				included above	
4	General allowance					
4.1	- Noise and vibration isolation	1	LS	$1,000.00	$1,000	
4.2	- Starters, VFD and mechanical wiring	1	LS	$1,000.00	$1,000	
4.3	- TAB work	1	LS	$2,000.00	$2,000	
4.4	- Basic start-up and contractor's commissioning	1	LS	$3,000.00	$3,000	
4.5	- System condensate/drains	1	LS	$3,750.00	$3,750	
4.6	- Make-up water connection, extend existing services c/w BFP assemblies	1	LS	$2,750.00	$2,750	
5	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$67,000.00	$67,000	
6	Allowance for DHW plant controls including field devices, sensors and wiring	1	NO	$5,000.00	$5,000	
	Electrical					$14,283
7	New breakers for power connections below	1	LS	$4,660.00	$4,660	
8	Power connection with line and load side wiring including disconnect switch for ASHP water heater	1	NO	$6,960.00	$6,960	
9	Power connection with line and load side wiring for electric storage tank heater	1	NO	$1,030.00	$1,030	
10	General Requirements including:					$1,633
10.1	- Supervision	1	LS	$482.00	$482	
10.2	- Premium time, etc.				N/A	
10.3	- Job set-up, etc.	1	LS	$677.00	$677	
10.4	- Rentals, small tools, etc.	1	LS	$271.00	$271	
10.5	- Permits & inspections	1	LS	$176.00	$176	
10.6	- Insurance	1	LS	$27.00	$27	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				$546,683	
11	Prime Contractor's General Requirements	1	LS	$82,000	$82,000	15.0%
12	Building permit				Excluded	
13	General Liability and Builder's Risk insurance	1	LS	$3,800	$3,800	
14	Labour & Material and Performance bonding	1	LS	$5,500	$5,500	
15	Miscellaneous Allowances				Excluded	
16	Prime Contractor's Fee	1	LS	$32,000	$32,000	5.0%
	Subtotal 2				$669,983	
17	Design Contingency	1	LS	$134,000	$134,000	20.0%
18	Escalation Contingency				Excluded	0.0%
19	Construction Contingency (Post Contract)	1	LS	$80,000	$80,000	10.0%
	Total for DHW Plant				**$883,983**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	DHW Plant						
	Option - Air-to-Water hybrid heat pump						
	Architectural					$6,000	
1	Mechanical room space included as part of base building construction						
2	Allowance for service pads	1	LS	$6,000.00	$6,000		
	Mechanical					$127,500	
3	Allowance for domestic hot water plant including:						
3.1	- HP commercial hybrid DHW heater with 12kW electric heating equal to AO smith CHP 120. ASHP - 120 Gallon	3	NO	$30,000.00	$90,000		
3.2	- Storage tank, integrated to heat pump unit above				n/a		
3.3	- Back-up electric storage tanks heater				n/a		
3.7	- Domestic hot recirculating pump, mixing valve and expansion tank	1	LS	$6,750.00	$6,750		
4	Allowance for distribution piping including:						
4.2	- DHW plant room piping	25	m	$300.00	$7,500		
4.3	- Line valves and piping accessories	1	LS	$1,500.00	$1,500		
5	General allowance						
5.4	- Basic start-up and contractor's commissioning	1	LS	$1,000.00	$1,000		
5.5	- System condensate/drains	1	LS	$1,000.00	$1,000		
1	Mechanical space services including air conditioning units are as part of base building construction				Info Only		
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$16,000.00	$16,000		
7	Allowance for DHW plant controls including field devices, sensors and wiring	3	NO	$1,250.00	$3,750		
	Electrical					$14,283	
7	New breakers for power connections below	1	LS	$4,660.00	$4,660		
8	Power connection with line and load side wiring including disconnect switch for ASHP water heater	1	NO	$6,960.00	$6,960		
9	Power connection with line and load side wiring for electric storage tank heater	1	NO	$1,030.00	$1,030		
10	General Requirements including:					$1,633	
10.1	- Supervision	1	LS	$482.00	$482		
10.2	- Premium time, etc.				N/A		
10.3	- Job set-up, etc.	1	LS	$677.00	$677		
10.4	- Rentals, small tools, etc.	1	LS	$271.00	$271		
10.5	- Permits & inspections	1	LS	$176.00	$176		
10.6	- Insurance	1	LS	$27.00	$27		
	Subtotal 1				$147,783		
11	Prime Contractor's General Requirements	1	LS	$22,000	$22,000		15.0%
12	Building permit				Excluded		
13	General Liability and Builder's Risk insurance	1	LS	$1,000	$1,000		
14	Labour & Material and Performance bonding	1	LS	$1,500	$1,500		
15	Miscellaneous Allowances				Excluded		
16	Prime Contractor's Fee	1	LS	$9,000	$9,000		5.0%
	Subtotal 2				$181,283		
17	Design Contingency	1	LS	$36,000	$36,000		20.0%
18	Escalation Contingency				Excluded		0.0%
19	Construction Contingency (Post Contract)	1	LS	$22,000	$22,000		10.0%
	Total for DHW Plant				**$239,283**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	DWHRS					
	ML-13 Low - Passive Drain Water Heat Recovery System					
	Architectural					$0
1	No work required					
	Mechanical					$28,000
2	Allowance for passive horizontal heat recovery heat exchanger and associated domestic water piping ~ 15m length	15	m	$1,600.00	$24,000	
3	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$4,000.00	$4,000	
	Electrical					$0
4	No work required					
5	General Requirements including:					$0
5.1	- Supervision	1	LS	$0.00	$0	
5.2	- Premium time, etc.				N/A	
5.3	- Job set-up, etc.	1	LS	$0.00	$0	
5.4	- Rentals, small tools, etc.	1	LS	$0.00	$0	
5.5	- Permits & inspections	1	LS	$0.00	$0	
5.6	- Insurance	1	LS	$0.00	$0	
	Subtotal 1				$28,000	
6	Prime Contractor's General Requirements	1	LS	$4,200	$4,200	15.0%
7	Building permit				Excluded	
8	General Liability and Builder's Risk insurance	1	LS	$200	$200	
9	Labour & Material and Performance bonding	1	LS	$280	$280	
10	Miscellaneous Allowances				Excluded	
11	Prime Contractor's Fee	1	LS	$1,600	$1,600	5.0%
	Subtotal 2				$34,280	
12	Design Contingency	1	LS	$7,000	$7,000	20.0%
13	Escalation Contingency				Excluded	0.0%
14	Construction Contingency (Post Contract)	1	LS	$4,100	$4,100	10.0%
	Total for DWHRS				**$45,380**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	DWHRS						
	MH-14 High - Passive Drain Water Heat Recovery System						
	Architectural					$0	
1	No work required						
	Mechanical					$28,000	
2	Allowance for passive horizontal heat recovery heat exchanger and associated domestic water piping ~ 15m length	15	m	$1,600.00	$24,000		
3	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	$4,000.00	$4,000		
	Electrical					$0	
4	No work required			$0.00	$0		
5	General Requirements including:					$0	
5.1	- Supervision	1	LS	$0.00	$0		
5.2	- Premium time, etc.	1	LS	$0.00	$0		
5.3	- Job set-up, etc.	1	LS	$0.00	$0		
5.4	- Rentals, small tools, etc.	1	LS	$0.00	$0		
5.5	- Permits & inspections	1	LS	$0.00	$0		
5.6	- Insurance	1	LS	$0.00	$0		
5.7	- Performance bond	1	LS	$0.00	$0		
5.8	- Labour & material bond	1	LS	$0.00	$0		
5.9	- Contingency	1	LS	$0.00	$0		
	Subtotal 1				$28,000		
6	Prime Contractor's General Requirements	1	LS	$4,200	$4,200		15.0%
7	Building permit				Excluded		
8	General Liability and Builder's Risk insurance	1	LS	$200	$200		
9	Labour & Material and Performance bonding	1	LS	$280	$280		
10	Miscellaneous Allowances				Excluded		
11	Prime Contractor's Fee	1	LS	$1,600	$1,600		5.0%
	Subtotal 2				$34,280		
12	Design Contingency	1	LS	$7,000	$7,000		20.0%
13	Escalation Contingency				Excluded		0.0%
14	Construction Contingency (Post Contract)	1	LS	$4,100	$4,100		10.0%
	Total for DWHRS				**$45,380**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Solar PV					
	MH-16 High - 65 kW PV System					
	Architectural					$0
1	No work required					
	Mechanical					$0
2	No work required					
	Electrical					$202,539
3	Supply and installation of 65kW roof-mounted photovoltaic system c/w associated Infrastructure for roof mounted photovoltaic system	1	LS	$185,300.00	$185,300	
4	General Requirements including:					$17,239
4.1	- Supervision	1	LS	$385.00	$385	
4.2	- Premium time, etc.				N/A	
4.3	- Job set-up, etc.	1	LS	$9,914.00	$9,914	
4.4	- Rentals, small tools, etc.	1	LS	$3,965.00	$3,965	
4.5	- Permits & inspections	1	LS	$2,578.00	$2,578	
4.6	- Insurance	1	LS	$397.00	$397	
	Subtotal 1				$202,539	
5	Prime Contractor's General Requirements	1	LS	$30,000	$30,000	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$1,400	$1,400	
8	Labour & Material and Performance bonding	1	LS	$2,000	$2,000	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$12,000	$12,000	5.0%
	Subtotal 2				$247,939	
11	Design Contingency	1	LS	$50,000	$50,000	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$30,000	$30,000	10.0%
	Total for Solar PV				**$327,939**	

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Lighting						
	Base - Commercial Lighting - Office: 0.61 W/ft2 Resturant (for cafeteria/fast food dining): 0.40 W/ft2 *Retail (Sales Area): 1.05 W/ft2*						
	Architectural					$0	
1	No work required						
	Mechanical					$0	
2	No work required						
	Electrical					$181,694	
3	Supply and installation of energy efficient lighting consisting of the following:	784	m2	$205.00	$160,720		
3.1	- Office program supporting a 0.61 W/SF requirement						
3.2	- Restaurant program supporting a 0.40 W/SF requirement						
3.3	- Retail program supporting a 1.05 W/SF requirement						
4	General Requirements including:					$20,974	
4.1	- Supervision	1	LS	$6,356.00	$6,356		
4.2	- Premium time, etc.				N/A		
4.3	- Job set-up, etc.	1	LS	$8,599.00	$8,599		
4.4	- Rentals, small tools, etc.	1	LS	$3,439.00	$3,439		
4.5	- Permits & inspections	1	LS	$2,236.00	$2,236		
4.6	- Insurance	1	LS	$344.00	$344		
	Subtotal 1				$181,694		
5	Prime Contractor's General Requirements	1	LS	$27,000	$27,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$1,300	$1,300		
8	Labour & Material and Performance bonding	1	LS	$1,800	$1,800		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$11,000	$11,000		5.0%
	Subtotal 2				$222,794		
11	Design Contingency	1	LS	$45,000	$45,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$27,000	$27,000		10.0%
	Total for Lighting				**$294,794**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Lighting						
	ML-7 Low - Office: 0.43 W/ft2 Restaurant (for cafeteria/fast food dining): 0.28 W/ft2 Retail (Sales Area): 0.74 W/ft2						
	Architectural					$0	
1	No work required						
	Mechanical					$0	
2	No work required						
	Electrical					$199,377	
3	Supply and installation of energy efficient lighting consisting of the following:	784	m2	$225.00	$176,400		
3.1	- Office program supporting a 0.43 W/SF requirement						
3.2	- Restaurant program supporting a 0.28 W/SF requirement						
3.3	- Retail program supporting a .74 W/SF requirement						
4	General Requirements including:					$22,977	
4.1	- Supervision	1	LS	$6,934.00	$6,934		
4.2	- Premium time, etc.				N/A		
4.3	- Job set-up, etc.	1	LS	$9,437.00	$9,437		
4.4	- Rentals, small tools, etc.	1	LS	$3,775.00	$3,775		
4.5	- Permits & inspections	1	LS	$2,454.00	$2,454		
4.6	- Insurance	1	LS	$377.00	$377		
	Subtotal 1				$199,377		
5	Prime Contractor's General Requirements	1	LS	$30,000	$30,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$1,400	$1,400		
8	Labour & Material and Performance bonding	1	LS	$2,000	$2,000		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$12,000	$12,000		5.0%
	Subtotal 2				$244,777		
11	Design Contingency	1	LS	$49,000	$49,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$29,000	$29,000		10.0%
	Total for Lighting				**$322,777**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total	
	Lighting						
	MH-8 High - Office: 0.24 W/ft2 Restaurant (for cafeteria/fast food dining): 0.16 W/ft2 Retail (Sales Area): 0.42 W/ft2						
	Architectural					$0	
1	No work required						
	Mechanical					$0	
2	No work required						
	Electrical					$52,319	
3	Supply and installation of energy efficient lighting consisting of the following:	178	m2	$260.00	$46,280		
3.1	- Office program supporting a 0.24 W/SF requirement						
3.2	- Restaurant program supporting a 0.16 W/SF requirement						
3.3	- Retail program supporting a 0.42 W/SF requirement						
4	General Requirements including:					$6,039	
4.1	- Supervision	1	LS	$1,830.00	$1,830		
4.2	- Premium time, etc.				N/A		
4.3	- Job set-up, etc.	1	LS	$2,476.00	$2,476		
4.4	- Rentals, small tools, etc.	1	LS	$990.00	$990		
4.5	- Permits & inspections	1	LS	$644.00	$644		
4.6	- Insurance	1	LS	$99.00	$99		
	Subtotal 1				$52,319		
5	Prime Contractor's General Requirements	1	LS	$8,000	$8,000		15.0%
6	Building permit				Excluded		
7	General Liability and Builder's Risk insurance	1	LS	$370	$370		
8	Labour & Material and Performance bonding	1	LS	$520	$520		
9	Miscellaneous Allowances				Excluded		
10	Prime Contractor's Fee	1	LS	$3,100	$3,100		5.0%
	Subtotal 2				$64,309		
11	Design Contingency	1	LS	$13,000	$13,000		20.0%
12	Escalation Contingency				Excluded		0.0%
13	Construction Contingency (Post Contract)	1	LS	$8,000	$8,000		10.0%
	Total for Lighting				**$85,309**		

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Commercial Lighting Controls					
	MH-7 High - Commercial Lighting Controls					
	Architectural					$0
1	No work required					
	Mechanical					$0
2	No work required					
	Electrical					$3,980
3	Lighting control system consisting of panels, equipment, conduits, and wires	178	m2	$20.00	$3,560	
4	General Requirements including:					$420
4.1	- Supervision	1	LS	$96.00	$96	
4.2	- Premium time, etc.				N/A	
4.3	- Job set-up, etc.	1	LS	$190.00	$190	
4.4	- Rentals, small tools, etc.	1	LS	$76.00	$76	
4.5	- Permits & inspections	1	LS	$50.00	$50	
4.6	- Insurance	1	LS	$8.00	$8	
	Subtotal 1				$3,980	
5	Prime Contractor's General Requirements	1	LS	$600	$600	15.0%
6	Building permit				Excluded	
7	General Liability and Builder's Risk insurance	1	LS	$30	$30	
8	Labour & Material and Performance bonding	1	LS	$40	$40	
9	Miscellaneous Allowances				Excluded	
10	Prime Contractor's Fee	1	LS	$230	$230	5.0%
	Subtotal 2				$4,880	
11	Design Contingency	1	LS	$980	$980	20.0%
12	Escalation Contingency				Excluded	0.0%
13	Construction Contingency (Post Contract)	1	LS	$590	$590	10.0%
	Total for Commercial Lighting Controls				**$6,450**	

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