

City of Toronto Maximum Indoor Temperature By-law

COMPLIANCE ANALYSIS REPORT

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1 Executive Summary

The City of Toronto is considering a maximum indoor temperature requirement of 26°C for rental housing in response to growing heat risk and the disproportionate impacts of extreme heat on tenants in buildings without mechanical cooling. A future maximum indoor temperature by-law must be:

- practical to administer,
- technically achievable across a wide range of building typologies and conditions,
- and sensitive to the risk that capital upgrades could result in higher housing costs for tenants.

This compliance analysis study gives City staff and Council a clearer understanding of the potential building upgrades, operating changes, costs, and implementation timelines that may be required for different rental housing types to meet a 26°C maximum indoor temperature standard.

Systems

A range of approaches to providing mechanical cooling were explored, with the study focusing on the systems most likely to be broadly applied to the rental housing stock in Toronto. These systems are:

Integrated Systems: Permanently installed systems providing cooling throughout a dwelling unit, like multi-splits, packaged terminal systems, or duct-installed cooling systems.

Individual Air Conditioning (AC): Standalone units, such as window or portable air conditioners, that can be installed in one or multiple rooms in a dwelling unit.

While this analysis compares the different system options as tools to meet the maximum indoor temperature requirements, it must be stressed that integrated systems offer several advantages for livability compared to individual AC units, such as providing more even thermal comfort throughout the dwelling unit, operating more quietly, preserving window access and light, and taking up less space within a dwelling unit. Additionally, integrated systems offer heat pump options that could deliver decarbonization advantages not available with individual ACs, which may further support their adoption in a context where City-led thermal safety requirements and policy tools co-exist with other energy/climate priorities.

Building Archetypes

This compliance analysis evaluated differences between different residential buildings as it relates to feasibility of cooling retrofits based on available data, such as age of building, heating system configuration and fuel, and presence of balconies, all of which will influence the system options available to add cooling. To capture a broad range of scenarios, the following building archetypes were evaluated:

- *High-Rise Multi-Unit Residential Building (MURB) with integrated systems and with individual ACs:* This is intended to represent mid- to high-rise MURBs that are: apartments or condos, of any age, that may or may not have balconies, and that may or may not require electric upgrades
- *Low-Rise MURB with integrated systems and with individual ACs:* This is intended to represent low-rise MURBs that are: apartments or condos, of any age, and that may or may not require electric upgrades. Integrated systems from this archetype can also represent single family homes, row houses, townhouses, and multiplexes when no forced-air furnace is existing
- *Single-Family Dwelling with integrated systems and with individual ACs:* This is intended to represent buildings that are: single family homes, row houses, townhouses, and multiplexes when a forced-air furnace is existing

Proposed cooling retrofit approaches were assigned to each of the building archetypes, resulting in a total of eight unique approaches to full dwelling unit cooling. Additionally, two different individual air conditioning (AC)

systems were applied to the building archetypes both as full dwelling unit cooling and as one room cooling, resulting in an additional twelve scenarios.

Overheating Risks

Individual ACs applied to one room only will not necessarily be able to maintain the temperature of a whole dwelling unit to under 26°C. However, when sufficiently sized, they can keep one room under 26°C.

Simulations indicate that no-cost passive measures such as keeping bedroom doors open at night¹ and closing blinds to reduce solar gain reduces overheating in the adjacent, non-cooled room. This demonstrates the value of pursuing passive measures even while adding mechanical cooling. These results also outline how implementing restricted cooling setpoints may contribute to overheating in adjacent rooms and reduce safety and habitability for occupants, while occupant behaviour such as cooking can also contribute to overheating. Careful selection of individual AC unit capacity will be required to maintain safe conditions, and occupant safety will be enhanced by education and engagement with owners and occupants about passive measures.

Capital and Life Cycle Costs

Individual AC systems offer the lowest capital cost opportunities to meet the maximum indoor temperature requirements. Capital cost analysis across a representative range of building archetypes indicates that providing full dwelling unit cooling with integrated systems costs approximately seven to twelve times more than doing so using individual AC units, and nineteen to thirty times more than providing cooling to a single room per dwelling unit with individual ACs.

Individual ACs are less efficient and result in higher operational energy costs, however cooling demand in Toronto is relatively low and the difference between most efficient and least efficient cooling is only \$60-100 per year.

Individual ACs are installed at the beginning of each cooling season and removed in the fall to avoid heat loss and moisture issues in winter which increases life cycle costs. In addition, they can reasonably be expected to last half as long as an integrated system – 10 years instead of 20.

After accounting for the noted life cycle costs over a 20-year timeframe, individual ACs installed in one room per dwelling unit remain the least expensive option at approximately one-fourth to one-third the life cycle cost of integrated systems. However, the delta has reduced significantly compared to the capital cost-only comparison. Individual ACs installed in all rooms to provide full cooling to the dwelling unit result in approximately half the life cycle cost of integrated systems, which suggests that individual ACs remain the lowest cost option to meet the maximum indoor temperature requirement. However, this conclusion could change in a context where, in addition to meeting the maximum indoor temperature requirements, mechanical system interventions include upgrades of the heating system (potentially resulting from efficiency or decarbonization motivations/requirements). In this report, operational and life cycle costs for full dwelling unit cooling using heat pumps do not account for the avoided costs of heating retrofits or the avoided operational costs of the replaced heating system. Insight into these factors would contribute meaningfully to planning for cooling retrofits using heat pumps in a broader context.

Emissions

The lowest emissions pathway from a cooling-only perspective is the smallest individual AC system with the lowest refrigerant leakage possible that can maintain safe and habitable conditions. However, emissions from this potential mechanical cooling system represent a very small fraction of the emissions of the building stock.

Thinking more broadly about emissions of existing buildings, the potential emissions savings of heat pumps are anticipated to exceed the net increase from refrigerant emissions and cooling energy use by a significant margin,

¹ Keeping doors open between living spaces may not be reasonable in shared living arrangements

and therefore that approach will result in the lowest life cycle emissions while still providing safe and habitable conditions, and efforts should be made to make this approach the default over the longer term where interventions meet both thermal safety and decarbonization goals.

Market Concerns

The market is expected to experience some challenges in responding to accelerated need for cooling, depending on the details of the by-law requirements. Individual AC units applied to a single room are not anticipated to require building electrical upgrades, which reduces project complexity. Full dwelling unit cooling options are expected to require some level of electrical capacity upgrades in most MURBs that are currently heated using natural gas (approximately 92% of all MURBs). Bottlenecks in the electrical upgrade process are expected to result in extended retrofit timelines of around three years per building which could push the timeline for full compliance across all buildings to significantly longer than that, although specifics are not known. The pace of uptake of different types of mechanical cooling systems will also be partly driven by access to funding or financing, which is within the area of control/influence of the City.

Conclusions

Individual AC units are a lower-cost, rapidly deployable option for providing safe conditions to dwelling units compared to integrated systems. Despite the performance and comfort benefits of integrated systems, their higher cost and installation bottlenecks mean that widespread deployment of such systems could significantly delay compliance timelines.

When installed in only one room, individual AC units are not expected to provide full-dwelling unit cooling. While they can generally prevent overheating in the conditioned room, adjacent rooms may still overheat. Dwelling units with more bedrooms are at greater risk of uneven temperatures and reduced overall thermal safety, as a single unit is less able to serve the entire space. However, increasing AC unit size or adding more AC units may not be possible without expensive electrical upgrades, which would re-introduce delays and complexities into the compliance timeline.

Installing one individual AC per dwelling unit can avoid unsafe temperatures and associated health impacts. These systems can be deployed quickly at a low capital cost and may serve as an effective interim solution while full-dwelling unit cooling is carefully planned and implemented over time, potentially aligned with other City priorities such as decarbonization of the building sector.

Table 1: Summary of findings

Parameter	One Individual AC Per Dwelling unit	One Individual AC Per Room	Integrated System Approach
Capital Cost per Dwelling Unit	\$850 to \$1,150	\$2,700 to \$3,400	\$16,087 to \$36,473
Operational Cost per Dwelling Unit per Year*	\$135 to \$181	\$134 to \$203	\$94 to \$226
20-year Emissions (t CO2e)*	1.31 to 1.80	1.62 to 2.35	1.79 to 8.79
20-year Life Cycle Cost	\$7,692 to \$8,615	\$16,983 to \$17,567	\$25,517 to \$31,883
Overheating Risk	Potential for non-cooled rooms to exceed 26°C	Limited risk	Limited risk

Building Electrical Upgrade	Should not be required	May be required	May be required
Installation Timeline	Rapid	Depends on whether electric upgrade is required	2-3 years per building where electrical upgrades are required. Installer market growth anticipated to handle the number of MURBs requiring retrofits. Lag here may slow down uptake or increase costs due to busy installers.
Livability Considerations	Continuously running (noise) Requires occupant to manage passive measures to improve thermal safety (e.g. closing blinds) High impact on views and daylight	Noise distributed to more spaces. Minimal requirement for occupant to manage loads to reduce overheating. Considerable impact on views and daylight	Low impact from noise. Minimal requirement for occupant to manage loads to reduce overheating. No impacts on views and daylight.
Decarbonization Opportunity	None with current technology	None with current technology. Window mounted heat pumps may be able to provide partial or full decarbonization at higher costs, pending further analysis	Significant opportunity to align with City decarbonization efforts by using heat pumps instead of cooling only systems. Capital costs already account for heat pumps.

*Operational costs and life cycle emissions do not consider costs and emissions related to heating or avoided emissions from decarbonization of heating for heat pumps. Emissions saved through decarbonization using heat pumps are expected to exceed the increase in cooling emissions by a significant margin.

2 Purpose and Policy Context

Since 2015, City of Toronto staff have been exploring ways to support thermal safety such as addressing the impacts of excessive heat in multi-unit residential buildings. This has included exploring a health-based maximum indoor temperature standard for rental units.

Implementing this requirement is expected to entail significant building upgrades for some rental housing providers that do not currently provide mechanical cooling equipment.

On December 16 and 17, 2025, City Council directed the Executive Director, Municipal Licensing and Standards to report back to the appropriate Committee no later than May 2026 with a proposed maximum temperature by-law for rental units, considering varying building infrastructure, mechanisms to prevent above guideline rent increases passed on to tenants and informed by a compliance analysis study.

This report also responded to Council's December 2024 endorsement of a maximum indoor temperature standard of 26°C for leased residential premises.

The compliance analysis study must provide City staff a clear idea of costs and timelines for different rental housing types to meet compliance with an indoor maximum temperature standard of 26°C.

Findings will be used to 1) illustrate the potential implications of this temperature standard to City Council, and 2) refine the proposed associated by-law, currently under development for May 2026.

3 Scope, Terminology, and Limitations

This study focused on the selection of representative building archetypes and proposed cooling retrofit approaches. Proposed cooling retrofit approaches were assigned to each of the building archetypes spanning low-rise Single Family Dwellings (SFDs) to high-rise Multi-Unit Residential Buildings (MURBs), resulting in a total of eight unique approaches to full dwelling unit cooling. Additionally, two different individual air conditioning (AC) systems were applied to the building archetypes both as full dwelling unit cooling and as one room cooling, resulting in an additional twelve scenarios after eliminating redundant scenarios. Each of these scenarios were costed by independent quantity surveyors to determine capital costs, while Introba modelled operational costs and overheating risks. The results present a fair evaluation of possible approaches that rental housing providers could take, in scenarios where steps are needed to meet compliance with a maximum indoor temperature by-law.

The following external parties supported Introba with the analysis contained within this report:

- Bondi Energy Corp. – Retrofit approaches and constructability, costing review, market capacity commentary
- A.W. Hooker Quantity Surveyors – Capital cost analysis

3.1.1 One Cooled Room vs. All Bedrooms and Living Rooms

The compliance analysis looked at both the full dwelling unit cooling and one cooled room in order to understand differences in costs and implementation time, helping to inform the impact of by-law scoping.

3.1.2 Context with Other Driving Forces

The intent of the proposed maximum indoor temperature by-law is for indoor temperatures to be safe for tenants and protective of human health. Two additional considerations are decarbonization and housing affordability.

In terms of decarbonization, many cooling systems function as heat pumps, and in many cases, a relatively small incremental upfront cost allows for the installation of a system that provides both heating and cooling, rather than cooling only. Selecting a heat pump system at the outset can avoid significant future costs, as these systems will be required to meet the City's building sector decarbonization and overall net zero goals.

Where feasible, the more complex retrofit scenarios analyzed in this study assume the use of heat pump systems by default.

3.1.3 Terminology

For clarity, this report uses simplified terminology to distinguish between full dwelling unit cooling systems and individual AC units. The following terms and definitions apply throughout:

- Full dwelling unit cooling/full cooling: Variations of this term are used throughout this report to refer to the provision of cooling to all bedrooms and living rooms. Does not include bathrooms, kitchen, or circulation/storage spaces.
- Integrated Systems: Permanently installed systems providing cooling throughout a dwelling unit, like multi-splits, packaged terminal systems, or duct-installed cooling systems.
- Individual Air Conditioning (AC): Standalone units, such as window or portable air conditioners, that can be installed in one or multiple rooms in a dwelling unit

3.1.4 Limitations

This study uses building archetypes to represent the building stock within the policy context. Due to constraints on timeline and available data, it was not feasible to select and model specific buildings. The archetypes were

developed to broadly align with typical characteristics of the stock; however, individual building conditions may vary significantly.

Operational cost and overheating analysis were based on a single representative dwelling unit. Key parameters such as orientation, glazing ratio, occupant behaviour, and internal gains (sources of heat within a dwelling unit, such as lighting, appliances, computers, cooking, as well as people) were held constant. As a result, the analysis does not capture the full range of variability across dwelling units, including those with higher solar exposure (e.g. those with south and/or west-facing windows) or varying usage patterns (e.g., high levels of cooking throughout the day).

Cost estimates are based on high-level assumptions and indicative system configurations rather than detailed design. They do not account for building-specific conditions such as layout, location, or constructability constraints. Electrical infrastructure requirements represent a major source of uncertainty; the extent of required service upgrades, distribution modifications, and associated costs can only be determined through building-specific assessment.

Market capacity considerations such as perceived bottlenecks in the supply and install chain are informed by professional experience and limited stakeholder engagement. These are intended to provide contextual insight only and should not be interpreted as a comprehensive assessment of economic or market impacts. Market capacity analysis and strategies to accelerate the increase in capacity may warrant further study, especially as it related to decarbonization goals.

Life cycle cost and emissions estimates exclude embodied carbon (the greenhouse gas emissions associated with the manufacture, installation, replacement, and end-of-life of the proposed equipment), and broader system interactions related to decarbonization. These factors may be material to overall policy outcomes and warrant further study.

Accordingly, results should be interpreted as indicative of relative performance and order-of-magnitude impacts rather than precise predictions at the building level.

4 Compliance Pathways Assessed

4.1 Approaches to Mechanical Cooling Retrofits in Residential Buildings

There are 5 broad categories of mechanical cooling retrofit approaches:

1. Ductless Mini-split/Multi-split Air Conditioners
2. Packaged Terminal Air Conditioners
3. Window/Portable Air Conditioners
4. Central Forced-Air Split Cooling
5. Central Ventilative Cooling

4.1.1 Ductless Mini-Split/Multi-Split Air Conditioners

Description

An outdoor condensing unit with a fan and compressor and one or more indoor units with small fans, typically wall mounted. Small refrigerant lines exchange heat from the indoor units and the outdoor unit. A one indoor unit-to-one outdoor condensing unit system is referred to as a mini-split whereas multiple indoor units connected to one outdoor condensing unit is called a multi-split. A multi-split system is typically a more cost-effective approach than multiple mini-splits for cooling a single dwelling unit.



Figure 1: Left: Outdoor condensing unit portion of multi-/mini-split. Right: Wall mounted example of indoor portion of multi-/mini-split.

Image sources: [The Atmospheric Fund](#), [Airtek](#)


Overview

Livability	Some visual impact of the indoor unit mounted on wall and outdoor unit outside; however, windows maintain full views, daylight, and ability to open. Relatively low noise impact inside with compressor located outdoors.
Exterior impact	Condenser (noise and look) will be noticeable. Exterior routing of condensate lines to grade.
Location	Installation is highly flexible; however, line length limitations restrict the distance between the outdoor and indoor units. Typically, they would require a nearby balcony for a high-rise building dwelling unit, but for low rise they could be installed at/near grade or on the roof.
System Capacity	A multi-split system with multiple indoor heads is capable of fully cooling a residential dwelling unit. A mini-split provides cooling to one room only and may not be able to maintain 26°C in all living spaces in a dwelling unit.
Condensate Management	Indoor units produce condensate during cooling that needs to be drained.
Decarbonization	High cooling efficiency. A cooling-only model can be swapped for a cold-climate heat pump model to provide low emissions heating.
Electrical Power	Expected to require electrical upgrades to dwelling unit and building power except where electric baseboards provide space heating.

Installer Capacity	Common technology produced by many manufacturers. Requires electricians and HVAC skilled trades. Contractor training and capacity building required for large MURBs.
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4.1.2 Packaged Terminal Air Conditioners

Description

<p>A packaged, single-zone system with a fan and compressor, wall mounted on an exterior wall. Modern units called All-in-Ones use small ducts cored through the exterior wall to exhaust heat to outside. Packaged terminal air conditioner is often shortened to PTAC or PTHP (where a heat pump option is used).</p>	 <p data-bbox="816 705 1437 753"><i>Figure 2: Left: All-in-one PTAC installed in space, Right: Exterior view of small holes used by the PTAC to exchange air.</i></p> <p data-bbox="816 783 1317 804">Image sources: Alder Plumbing & Heating, Appliances Direct</p>
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Overview

Livability	Some visual impact, however, windows maintain full views, daylight, and ability to open. Some noise impact with compressor located in the dwelling unit.
Exterior impact	Some impact due to exterior holes cut into building for air exchange.
Location	Installation is somewhat flexible; however, the units must always be installed on an exterior wall. They do not require a balcony which means they are a suitable option for buildings with or without balconies.
System Capacity	A single unit can cool a single room, and with sufficient capacity may be able to cool adjacent rooms provided doors are open between rooms. Unit noise may become a greater concern. Multiple units may be required for large dwelling units to provide full cooling.
Condensate Management	Units produce condensate that is drained to the exterior in vapour form.
Decarbonization	Efficient options for cooling. A cooling-only model can be swapped for a cold-climate heat pump model to provide low emissions heating.
Electrical Power	Expected to require electrical upgrades to dwelling unit and building power except where electric baseboards provide space heating.
Installer Capacity	Efficient all-in-ones are a newer technology with fewer manufacturers to choose from. May require electricians where electrical upgrades are required, otherwise skilled trades may not be required. Contractor training and capacity building required for large MURBs.

4.1.3 Window/Portable Air Conditioners

Description

A packaged, single-zone system with a fan and compressor, mounted in a window opening. Window units are installed directly in the window, while portable air conditioners sit on the floor and connect to the outside using one intake duct and one exhaust duct, each typically 100-125mm in diameter. A window unit is fixed in place, while a portable unit can be moved from room to room to follow where cooling is needed.



Figure 3: Left: Window air conditioner, Right: Portable air conditioner.

Image sources: [Ferguson](#), [Better Homes & Gardens](#)

Overview

Livability	Notable visual impact with units blocking portions of the window and most types restricting the ability to open the window. Highest noise impact with compressor located in the indoor unit and typically less sound insulation in the unit resulting in higher sound levels.
Exterior impact	Some impact due to installation of AC units in window.
Location	Units must always be installed on an exterior window. Window air conditioners typically require a slider window, while portable air conditioners can accommodate a wider variety of window opening types (e.g. slider, casement, awning) using a window insert sealing kit. They do not require a balcony which means they are a suitable option for buildings with or without balconies.
System Capacity	A single unit can cool a single room, and with sufficient capacity may be able to cool adjacent rooms provided doors are open between rooms. Unit noise may become a greater concern. Multiple units may be required for large dwelling units to provide full cooling.
Condensate Management	Units produce condensate that may be evaporated to the outside or drained to the exterior.
Decarbonization	Often low efficiency, particularly in the case of portable units which have half to two-thirds the efficiency of window units. If units remain installed through winter rather than being uninstalled at the end of the cooling season, this may increase heating loads due to air leakage resulting in greater emissions during the heating season. Conventionally, no opportunity for heat pump options to decarbonize heating; however, recent window mounted heat pump product releases ² have added heating at added equipment and installation expense. Further study for suitability in the Toronto region is recommended.
Electrical Power	This system is not expected to require dwelling unit electrical upgrades. Some dwelling units may be limited in the available size of unit that can be installed and therefore be only able to keep one room cool.
Installer Capacity	Common technology produced by many manufacturers. Contractor training and capacity building may be required for coordinated installation across large MURBs.

² Emerging products include Midea’s Packaged Window Heat Pump. Further analysis is recommended to evaluate their capacity to provide heating in Toronto winters.

4.1.4 Central Forced-Air Split Cooling

Description

An outdoor condensing unit with a fan and compressor and a cooling coil mounted in a forced-air furnace system. Small refrigerant lines exchange heat from the indoor cooling coil and the outdoor unit. Ductwork distributes cooling throughout the dwelling unit. In this case, it is assumed that this system applies as a retrofit to buildings that already have ductwork used for heating.

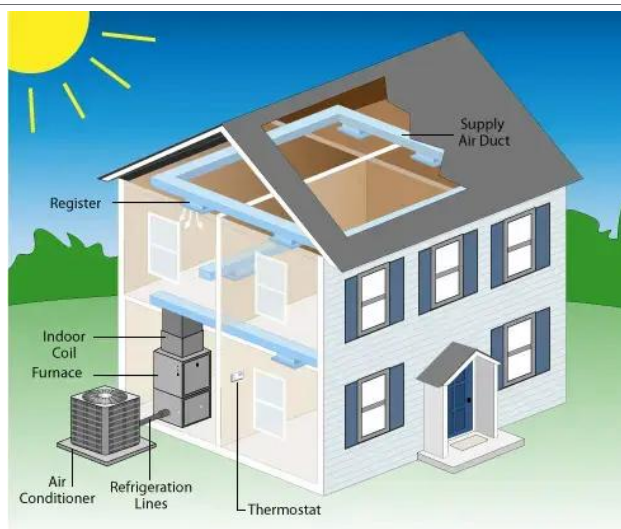


Figure 4: Schematic of forced-air cooling system

Image source: [AHRI \(Air-Conditioning, Heating, and Refrigeration Institute\)](https://www.ahri.org/)

Forced-air furnace systems are common in single unit buildings, and uncommon in multi-unit low- and high-rise buildings. A forced-air system in larger buildings will typically have hot water coils in what is referred to as a fan coil unit, which typically also run chilled water for cooling. Some buildings may exist with hot water coils and no ability to provide chilled water; these are expected to be uncommon but providing cooling centrally can be done by adding a central chiller. Due to the rareness of this combination, this has been excluded from this analysis; however, it is expected to be cheaper and less invasive than other approaches and therefore from a compliance feasibility standpoint is still covered.

Overview

Livability	Typically, no visual changes inside after installation. Windows maintain full views, daylight, and ability to open. Relatively low noise impact indoors with compressor located outdoors.
Exterior impact	Condensing unit is installed outdoors with associated visual and sound impacts.
Location	High flexibility of installation, however there are line length limitations on the distance between the outdoor and indoor coil. Typically, they would require a nearby balcony for a high-rise building dwelling unit, but for low rise they could be installed at/near grade or on the roof.
System Capacity	A single unit can be sized to cool a whole dwelling unit or house. Existing ductwork designed for heating may not be balanced to provide full cooling to all living spaces which will need to be evaluated on a case-by-case basis.
Condensate Management	Units produce condensate that must be drained indoors to a nearby drain.
Decarbonization	Variety of efficiency options for cooling. Straightforward opportunity to swap cooling only units for heat pumps to decarbonize heating.

Electrical Power	This system is not expected to require electrical upgrades. Some buildings may require or benefit from load management devices to temporarily prioritize loads such as kitchen appliances and delay cooling or heating until sufficient electrical capacity is available.
Installer Capacity	Common technology produced by many manufacturers. Projects are typically one-off with many competing contractors and no special training required.

4.1.5 Central Ventilative Cooling

Description

Add cooling to existing central ventilation shafts or add new cooling ducts from a central air handler.

This is an option for some buildings; however, it is a comparatively highly engineered option that will apply differently to each building. Depending on the parameters it may be challenging to engineer, highly disruptive or not possible to install without displacing occupants, and ultimately may be more appropriate for more unique, apartment conversion and adaptive re-use projects. Therefore, it was deemed not appropriate to evaluate as an option that could be costed and applied with any degree of certainty to many buildings.

4.2 Electrical Upgrade Assumptions

Adding mechanical cooling typically involves adding machines to each dwelling unit and these machines require power for fans and compressors. The power required depends on the size and mechanical efficiency of the machine; some smaller machines like individual ACs are designed specifically to be powered from a regular wall plug, whereas larger integrated systems require more power than is available from a wall plug, requiring a power feed similar to what an electric oven requires.

Adding this new electrical load on to the dwelling unit’s existing electrical panel may or may not exceed the limit of that panel, depending on the size of that panel which will vary from building to building based on a variety of factors such as age and size of dwelling unit. The new electrical load can also exceed the limit of the building’s existing main electrical system, and/or can exceed the limit of the existing electrical feed from the power utility to the building. Depending on which of these is exceeded, it will impact the engineered approach to providing sufficient power throughout the building and the resulting cost of the electrical upgrade.

Due to the specific differences between buildings, a few simplifying assumptions were made for the purposes of this analysis when evaluating full dwelling unit cooling approaches:

1. When the building has electric baseboard heat, there is sufficient power for cooling without building level upgrades. The high electrical demands of the existing heat system mean that cooling equipment can be powered without dwelling unit-level upgrades since power demands for cooling do not occur simultaneously with those for heating. This also applies when heat pumps are used in place of cooling-only systems since the baseboards can be limited to backup heat usage, set to operate only when the heat pump cannot.
2. When the building has a heating system that uses natural gas, it is expected that there is insufficient power for cooling both at the dwelling unit level and at the building level. The result is that building power feed and main electrical switch gear upgrades are expected. The downstream approach is then to run those new electrical feeds directly to the new equipment, bypassing the need for individual dwelling unit electrical panel upgrades and associated costs. This method of powering new equipment can still be sub-metered for distributing usage and associated operational costs to tenants. Note that the assumption that natural gas heating results in the need for comprehensive electrical upgrades is a conservative assumption as the reality will depend on each buildings’ specifics.

4.3 Simplifying Assumptions Regarding Cooling Retrofit Approaches

A few simplifying assumptions can be made about the system options to help assign feasible cooling options to the different building archetypes.

1. cursory research and professional experience indicate that the window/portable AC system would be the least expensive option to provide cooling to a single room. Therefore, it is not likely that a mini-split cooling-only system would be installed in cases where it is only cooling one room. Thus, only a multi-split needs to be considered.
2. Since a multi-split cooling-only system would likely necessitate an electrical upgrade within a dwelling unit and building, it is assumed that this expense would be best combined with a heat pump retrofit. Otherwise, the expense for a future heat pump retrofit would still be required at far higher total cost when doing this work individually rather than combined. Note that the heat pumps in this analysis have not necessarily been sized for full heating capacity, and some supplemental heat from the existing system may be required – this analysis is outside the scope of this study.
3. Similar logic is applied for the packaged terminal system, where if applied only to a single room it is expected to be significantly more expensive than a window AC while having only modest livability and efficiency improvements. Instead, it is assumed that the packaged terminal system is a heat pump system and is applied to each room for full cooling as well as partial decarbonization impacts. Similar to the multi-split heat pump, these have not necessarily been sized for full heating capacity, and some supplemental heat from the existing system may be required.
4. A forced-air split cooling approach is expected to be the least expensive for any building that has an existing forced-air system, which are assumed to be present in low-rise single family and similar type buildings such as row house, townhouse, semi-detached, and multiplex buildings. For any of these that do not have an existing forced-air furnace, the multi-split or individual AC approach will apply.

4.4 Determining Representative Building Archetypes

Introba filtered through a variety of data to select representative archetypes of buildings that would capture all the necessary combinations of building types to provide a comprehensive overview of the range of potential scenarios where steps may be needed to comply with the proposed maximum indoor temperature by-law.

4.4.1 Background Analysis of Rental Data

Below is an amalgamation of Toronto housing stock composition collected from Statistics Canada, CMHC, and others which indicates that 86.5% of rental dwelling units are in large multi-unit residential buildings with the remaining 13.5% in low-rise single detached houses, duplexes, rowhouses, and semi-detached houses. 46% are purpose-built rental buildings, while the remainder are a combination of ownership types classified as secondary.

Table 2: Summary of Toronto’s building stock

PARAMETER	HOUSING UNITS	PERCENTAGE
RENTAL HOUSING STOCK³	557,970	48%
By building type		
Multi-unit residential building with 5 or more stories	364,135	65%
Multi-unit residential building with 4 or less stories	119,738	21%
Single detached house	26,570	5%
Duplex	19,170	3%

³ City of Toronto Housing Data Book. (2023). Available: <https://www.toronto.ca/city-government/data-research-maps/toronto-housing-data-hub/toronto-housing-data-book/>

PARAMETER	HOUSING UNITS	PERCENTAGE
Row house	19,090	3%
Semi-detached house	9,370	2%
Other	875	0.2%
RENTAL APARTMENT BUILDING VINTAGE PROFILE⁴ (RentSafeTO registered buildings only)		
Pre 1970 - # buildings	2,585	72%
1970-1999 - # buildings	826	23%
2000 or later - # buildings	160	4%
ENERGY SOURCES IN MULTIFAMILY BUILDINGS⁵		
Natural gas	n/a	64%
Electricity	n/a	36%
RENTAL APARTMENT BUILDING COOLING ACCESS⁶ (RentSafeTO registered buildings only)		
Has AC equipment - # buildings	558	16%
Central system - # buildings	248	7%
Individual unit - # buildings	310	9%
Has a cooling room - # buildings	542	15%

4.4.2 Background Analysis of Summer Heat Project Data

RentSafeTO registered building data that was collected as part of the Summer Heat Project in 2024 by the City of Toronto was provided to Introba to further assist in selection of appropriate building archetypes. RentSafeTO buildings are all purpose-built apartment buildings in Toronto with three or more storeys or 10 or more units. Condo buildings, townhomes, or units in a private home are not part of RentSafeTO. Introba analyzed this data to identify trends relevant to the retrofit of cooling equipment in the variety of rental buildings and dwelling units throughout Toronto.

Existing Cooling System

Building age and cooling system was compared to see if recent construction could be excluded from the analysis, which is typically characterized by larger expanses of glass and a higher risk of overheating, but also by the presence of mechanical cooling.

⁴ RentSafeTO: Apartment Building Standards. (2024). Available: <https://www.toronto.ca/community-people/housing-shelter/rental-housing-tenant-information/rental-housing-standards/apartment-building-standards/>

⁵ The City of Toronto's Net Zero Existing Buildings Strategy. (2021). Available: <https://www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-168402.pdf>

⁶ Ibid, 2.

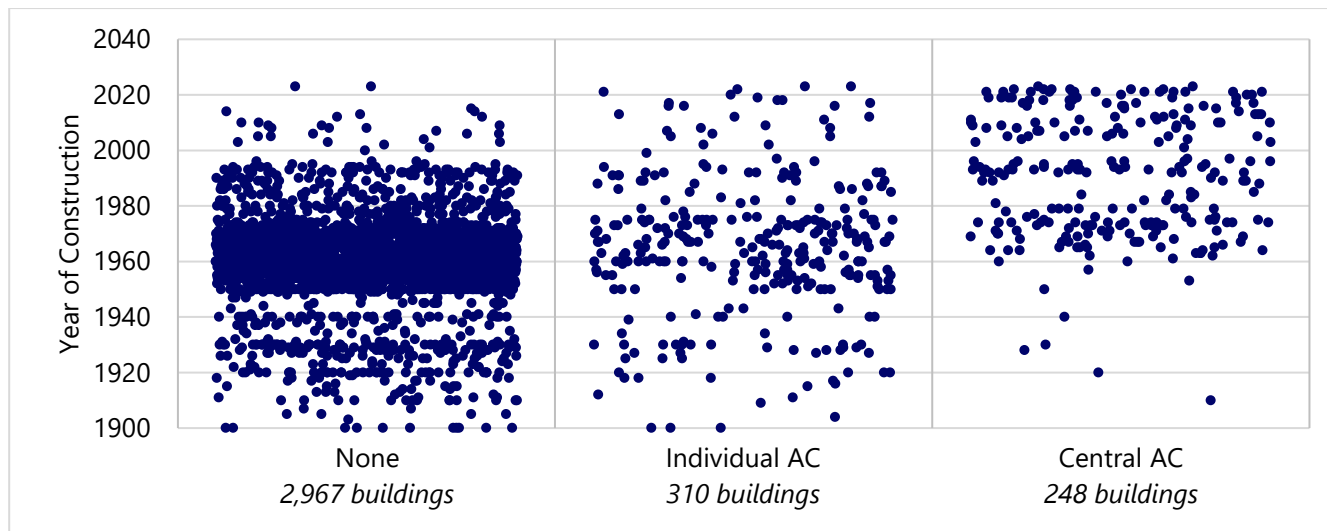


Figure 5: Cluster chart of cooling system by year of construction

Buildings built in the post-2000s era without air conditioning did not align with conventional logic of current construction – a subsequent spot check of these buildings using addresses in the data and online searches indicated that these buildings were either older than the data indicated, or that the buildings likely had air conditioning (identified by presence of e.g. cooling towers on Google Earth).

Otherwise, the data aligns with Toronto Housing Stock data summarized in section 4.3.1:

- The majority of rental buildings were built in the 1950s to 1970s
- The majority of these rental buildings do not have air conditioning
- Newer buildings have central air conditioning systems
- There are individual AC systems scattered across all ages of the building stock

Heating System

The current heating energy source in existing buildings is important because it roughly indicates the capacity to add the electrical load of mechanical cooling both at the dwelling unit and building level.

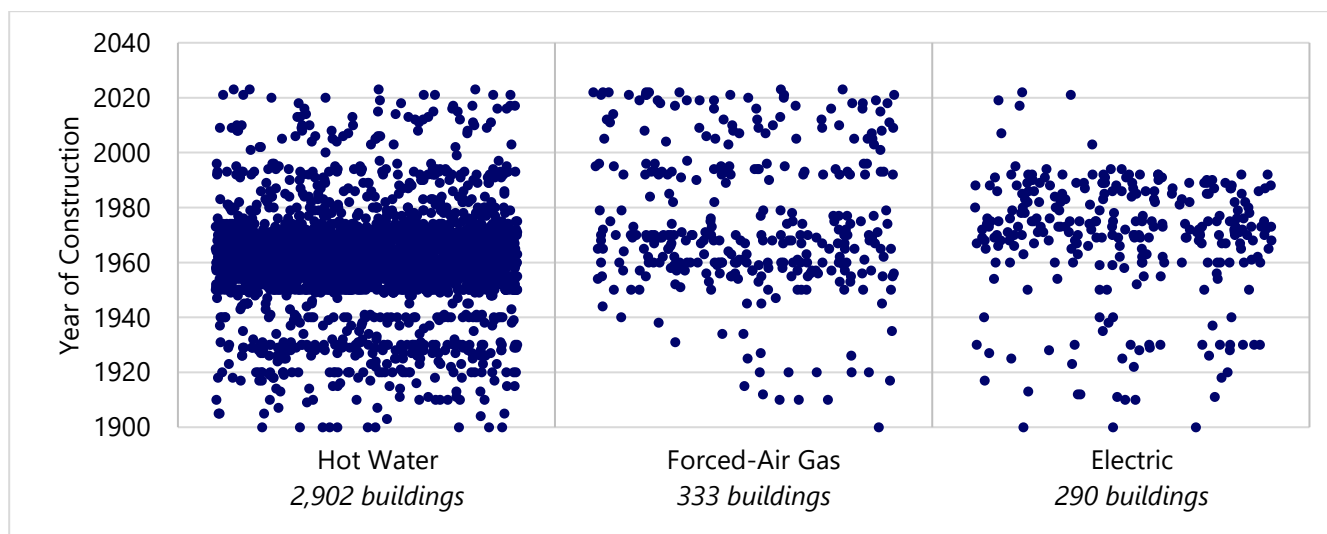


Figure 6: Cluster chart of heating system type by year of construction

The classifications of Hot Water and Forced-Air Gas may have caused confusion in those responding to the survey as many buildings have both hot water circulation and rely on fossil fuel combustion for heating that hot water. Most of the older buildings are expected to have hot water radiators, while some will have fan coils with hot water coils – in both cases they are heated by central fossil fuel combustion boilers, representing 92% of the evaluated buildings. The remainder of the buildings (about 8%) have electric heat, typically electric baseboard heaters.

This is different from the data presented in Table 2: Summary of Toronto’s building stock which indicates that only 64% of residential buildings rely on natural gas heating. The source for that data indicates it is for all residential buildings – it may mean that RentSafeTO buildings have a different proportion of heating system fuel. Resolving this discrepancy is not possible within the limits of this study, so the 92% value will be used as a conservative representation of buildings that rely on natural gas heating.

Balconies

Whether a building has balconies or not affects the type of mechanical cooling systems that can be installed in the dwelling unit.

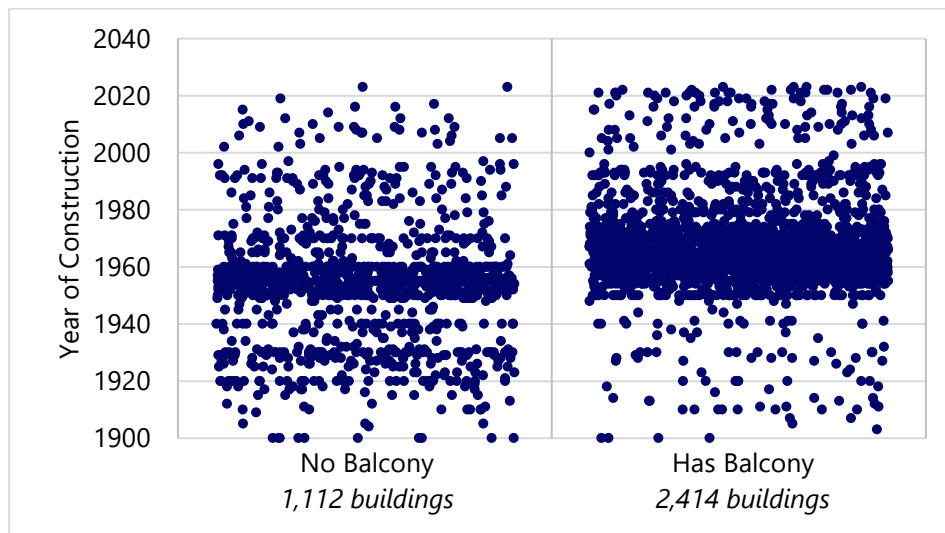


Figure 7: Cluster chart of presence of balconies by year of construction

In general, after 1960 most building have balconies and before 1960 fewer do. There is a likely correlation between building height and presence of balconies, with shorter buildings being less likely to have balconies and new, taller buildings to be more likely to have balconies, however, this cannot be confirmed as the data does not include building height, nor can it be confirmed that every dwelling unit in a building classified as “Has Balconies” has their own balcony.

4.5 Synthesis of Cooling Approaches and Selected Building Archetypes

Based on the findings from the review of mechanical cooling approaches and background building data, a minimum number of archetypes were defined that maximized representation of buildings within the Toronto housing stock as it relates to cooling retrofit feasibility.

Some helpful simplifications are possible:

1. High-Rise MURBs with balconies are similar to low-rise MURBs with balconies from a cooling retrofit standpoint in terms of technological approach. Therefore, no need to separately evaluate a low-rise MURB with balcony.
2. Rental dwelling units within condo buildings cannot expect to undergo timely electric upgrades in order to comply with by-law requirements as this will affect communal spaces and to be cost effective would

require all condo owners to sign on. Any building that requires an electric upgrade to provide cooling will be complicated by a condo ownership model, and therefore only individual AC systems are expected for that type.

3. Single family dwellings (SFDs) will have mechanical approaches that are similar for single family homes, row houses, townhouses, and multiplexes when a forced-air furnace is existing (scenario 7 in the table below). When no forced-air furnace is existing, the mechanical cooling interventions can take the form of multi-splits or individual ACs. Therefore, the costs and implications of these approaches are captured reasonably well by the MURB archetype (scenario 2) and the individual AC approaches (scenario 8 and 9).

The possible mechanical systems and building data were synthesized into several archetypes, as follows:

Table 3: Summary of selected building archetypes

No.	Description	Proposed Cooling System	Comments
1	High-Rise MURB, w/Balcony, with Gas Heat	Multi-Split	Electric upgrade included
2	High-Rise MURB, w/Balcony, with Electric Heat	Multi-Split	No electric upgrade
3	High-Rise MURB, No Balcony, with Gas Heat	Packaged Terminal	Electric upgrade included
4	High-Rise MURB, No Balcony, with Electric Heat	Packaged Terminal	No electric upgrade
5	Low-Rise MURB, w/Balcony, with Gas Heat	Multi-Split	Electric upgrade included
6	Low-Rise MURB, w/Balcony, with Electric Heat	Packaged Terminal	No electric upgrade
7	SFD, No Balcony, Forced-Air Furnace	Forced-Air Split	No electric upgrade
8	Each of the above archetypes	One window or portable AC per room	No electric upgrade
9	Each of the above archetypes	One window or portable AC per dwelling unit	No electric upgrade

The three building typologies evaluated were further defined, as follows:

- High-Rise MURB:
 - 15-storey building with 10 dwelling units per floor for 150 total dwelling units.
 - Assumed mix of dwelling units: 20% 3-bed, 30% 2-bed, 50% 1-bed
- Low-Rise MURB:
 - 4-storey building with 10 dwelling units per floor for 40 total dwelling units.
 - Assumed mix of dwelling units: 20% 3-bed, 30% 2-bed, 50% 1-bed
- Single-Family Dwelling:
 - 2-storeys, 1 dwelling unit, 3 bedrooms

While data about building height and size was not included in the data, this breakdown was selected based on Introba’s prior experience to be representative of the building stock. Individual buildings will differ from this exact makeup, and their specifics may result in different costs and operational performance.

5 Findings

5.1 Capital Costs

Capital costs for each of the building archetypes were evaluated by A.W. Hooker Quantity Surveyors based on retrofit briefs developed by Introba with input from Bondi Energy. Capital costs are Class D estimates which is intended to be representative of a concept design, which is slightly higher detail than order of magnitude with a cost estimate accuracy of +/- 30%.

Capital costs for each of the described scenarios are outlined in the tables below. The costing briefs and the cost reports are included in Appendix A with complete descriptions of inclusions and exclusions.

Costs reported in 2026 dollars and include equipment, materials, design and permitting, building electrical upgrades (where applicable), installation labour and equipment rentals. Costs assume that dwelling units remain occupied throughout the installation, with only temporary disruption to a dwelling unit when the physical equipment is installed in that unit.

Costs for MURBs assume installation by a specialized residential retrofit on a per-building basis. Costs for single family dwellings assume residential contractor for integrated systems and owner-contracted installation for individual ACs. These assumptions align with the most typical contractual structures expected for cooling projects in privately-owned buildings with rental units. Larger projects and contracts requiring a general contractor and multiple subcontractors would result in higher overall costs (approximately 50% higher). Costing reports assuming a general contractor approach to delivery are provided in Appendix A but are not used in the main analysis.

Electrical service upgrade costs at the utility level are excluded from the cost data provided by the cost consultant due to significant variability. These have been added afterwards based on preliminary data collection from Toronto Hydro that indicates typical upgrade costs range from \$250,000 to \$500,000, while some scenarios may have costs that are much lower (e.g., \$50,000) and others much higher (e.g. \$1M+). For the purposes of this analysis, the lower end of the typical range is used for the low-rise MURB, and the high end of the typical range is used for the high-rise MURB. Note that the cost of installing individual ACs in multiple rooms in a dwelling unit does not include any costs for electrical changes and may not be possible in all buildings due to dwelling unit-level electrical capacity limitations.

Design costs have also been excluded from the costing. These have been added afterwards, adapted by Introba based on Bondi’s experience for contracts delivered using a specialized residential retrofit contractor at \$60,000 for the high-rise MURB and \$45,000 for the low-rise MURB, with a 20% increase where electrical upgrades are required. These costs are estimates only and may change where the construction contract is different.

Table 4: Selected archetype capital cost summary using integrated systems

No.	Description	Integrated System Approach	Cost per Building	Cost per Dwelling unit
1	High-Rise MURB, w/Balcony, with Gas Heat	Multi-Split	\$4,378,358	\$29,189
2	High-Rise MURB, w/Balcony, with Electric Heat	Multi-Split	\$3,110,005	\$20,733
3	High-Rise MURB, No Balcony, with Gas Heat	Packaged Terminal	\$4,379,245	\$29,195
4	High-Rise MURB, No Balcony, with Electric Heat	Packaged Terminal	\$2,846,409	\$18,976
5	Low-Rise MURB, w/Balcony, with Gas Heat	Multi-Split	\$1,458,910	\$36,473
6	Low-Rise MURB, No Balcony, with Electric Heat	Packaged Terminal	\$888,133	\$22,203

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7	SFD, No Balcony, with Forced-Air Furnace	Forced-Air Split AC	\$16,087	\$16,087
8	SFD, No Balcony, with Forced-Air Furnace	Forced-Air Split Heat Pump	\$20,992	\$20,992

Table 5: Selected archetype capital cost summary using individual ACs with one AC in each room

No.	Description	Individual AC Approach	Cost per Building	Cost per Dwelling unit
1	High-Rise MURB (405 rooms, 150 dwelling units)	1 Window AC/room	\$465,750	\$3,105
2	High-Rise MURB (405 rooms, 150 dwelling units)	1 Portable AC/room	\$405,000	\$2,700
5	Low-Rise MURB (108 rooms, 40 dwelling units)	1 Window AC/room	\$124,200	\$3,105
6	Low-Rise MURB (108 rooms, 40 dwelling units)	1 Portable AC/room	\$108,000	\$2,700
9	SFD (4 rooms, 1 dwelling unit)	1 Window AC/room	\$4,000	\$4,000
10	SFD (4 rooms, 1 dwelling unit)	1 Portable AC/room	\$3,400	\$3,400

Table 6: Selected archetype capital cost summary using individual ACs with one AC per dwelling unit

No.	Description	Individual AC Approach	Cost per Building	Cost per Dwelling unit
3	High-Rise MURB (405 rooms, 150 dwelling units)	1 Window AC/dwelling unit	\$172,500	\$1,150
4	High-Rise MURB (405 rooms, 150 dwelling units)	1 Portable AC/dwelling unit	\$150,000	\$1,000
7	Low-Rise MURB (108 rooms, 40 dwelling units)	1 Window AC/dwelling unit	\$46,000	\$1,150
8	Low-Rise MURB (108 rooms, 40 dwelling units)	1 Portable AC/dwelling unit	\$40,000	\$1,000
11	SFD (4 rooms, 1 dwelling unit)	1 Window AC/dwelling unit	\$1,000	\$1,000
12	SFD (4 rooms, 1 dwelling unit)	1 Portable AC/dwelling unit	\$850	\$850

Costs for these systems are generally at the high end of the expected range. Available cost data from past retrofits and studies suggests that complete install of multi-split heat pumps are on the order of \$15,000 to \$20,000 per dwelling unit (excluding electric upgrade). Costs may vary due to the composition of units where in past reference projects a greater proportion of studio and 1 bedroom dwelling units reduces the per dwelling unit cost compared to the assumed composition of dwelling unit sizes in the archetypes. Costs are also affected by the comparative lack of information provided to the cost consultant for this study since this is generic and not for a specific building.

Individual AC approaches are also at the high end of the expected range based on a simple search for Window AC and Portable AC units on the web. The costs shown here include for a larger cooling capacity, contracted installation with a sealing kit, as well as for seasonal removal. In situations where seasonal removal is not anticipated and/or the owner self-installs (e.g., an owner of a single rental house), costs will reduce accordingly.

Although absolute costs may vary, these estimates provide a reasonable basis for comparing different approaches. Integrated systems that provide full-dwelling unit cooling are approximately seven times more expensive than using individual AC units without electrical upgrades, and ten to twelve times more expensive

when electrical upgrades are required for the integrated system approach. When comparing to a single AC unit in one room per dwelling unit, integrated systems are approximately nineteen times more expensive, or around thirty times as expensive when electrical upgrades are required.

5.2 Installation Timelines

The following timelines have been provided by Bondi Energy, an experienced contractor in the Toronto region specializing in decarbonization and cooling retrofits in MURBs. The following are typical project timelines in the Toronto context for a mid-sized MURBs using integrated systems (Multi-splits or PTHPs).

Installation timelines for individual ACs have not been analyzed in detail – these are expected to be straightforward as there is no design, permitting, or skilled labour requirement.

5.2.1 Procurement

Planning begins at project award, with overall schedule largely driven by equipment lead times. Major components include:

- Engineering and permitting: 6-12 Weeks
- Mechanical cooling equipment: 3-4 months; up to 6 months for certain product lines
- Basic electrical materials (cable, disconnects, breakers): Approximately 3 weeks

When power upgrade is required:

- Switchgear: Typically, 18-36 months. This is the critical path item on any project requiring a service upgrade, although timelines may be reduced through careful design coordination using readily available, off-the-shelf equipment.
- Dedicated panels: 4-6 weeks standard; 6-12 months custom
- Main cables: 4-5 weeks

5.2.2 Installation

Without Power Upgrades

Multi-splits: For multi-splits, each HVAC crew can typically install one outdoor unit with up to three indoor units (“heads”) per day, including linesets, controls, and drainage. Electrical installation work – typically consisting of surface-mounted cabling from the dwelling unit panel and a wall-mounted disconnect for the outdoor unit – can be completed at a rate of approximately 3–4 dwelling units per day.

Because electrical work proceeds faster than HVAC installation, HVAC work should be sequenced first to avoid electrical crews being delayed.

PTHPs: These systems are factory pre-charged and do not require field refrigerant work. Installation, including electrical connection, typically proceeds at a rate of 2 to 3 units per crew per day.

With Power Upgrades

HVAC installation rates remain similar to the no-upgrade scenario. However, the electrical scope becomes more complex, typically involving a central panel feeding risers, with a branch box serving each dwelling unit.

Exterior electrical distribution typically takes 2 to 6 weeks, depending on building size. Electrical work within a dwelling unit can then proceed faster at a rate of approximately 5 to 6 dwelling units per day.

Overall project duration is governed by switchgear procurement, which remains the critical path.

Summary

For a typical mid-rise building (100-150 dwelling units) without a power upgrade, the expected timeline from project award to substantial completion is approximately 6 to 9 months, assuming 2 to 3 HVAC crews and 1 electrical crew.

Where an electrical service upgrade is required, total project duration increases to approximately 24 to 30 months, driven primarily by switchgear procurement timelines. As a result, buildings requiring electrical upgrades should be expected to have multi-year project timelines. This also outlines the importance of early planning to find alignment with equipment life cycle replacement.

5.3 Market Capacity Considerations

A detailed analysis of the market's ability to adapt to a regulatory change which may lead to a widespread uptake of mechanical cooling in rental residential building is beyond the scope of this report. However, some guiding thoughts are provided below that may inform policy or future studies.

5.3.1 Manufacturer and Distributor Capacity

Cooling equipment suppliers are major global operations that have been scaling to meet growing air conditioning demand globally, with production in the coming decade estimated at 120 million units annually⁷, so the number of dwelling units in Toronto that may require cooling equipment is a fraction of a percent of the annual production. Their Canadian distribution networks are already scaling to meet growing heat pump demand. Heat pump adoption has been climbing steadily across the residential and light commercial sector, and manufacturers have been investing in product lines and local distribution accordingly. Therefore, cooling equipment availability is not expected to be a significant structural barrier.

However, it is expected that a regulatory change will still induce a short-term demand spike that will increase lead times and can raise costs. A phased compliance approach and effective external communication can reduce the impact. Firm policy that allows companies to confidently invest in their operations and supply chains will help support smooth manufacturer and distributor supply capacity.

5.3.2 Labour Availability

More contractors are entering the heat pump space as the revenue opportunity grows. Apprenticeship registrations in the HVACR (heating, ventilation, air conditioning, and refrigeration) trade are increasing, and new entrants are entering the market specifically because electrification work is expanding. Contractors invest in training and growing their operations when they can see the steady work pipeline, which can be solidified with firm policy and effective external communication and engagement with contractors and colleges/training academies.

Likewise, engineers providing technical direction to the specific challenges will grow with sustained policy direction. Engineering costs for full-dwelling unit cooling are likely to reduce quickly as familiarity with the typical challenges that these projects present become more commonly known.

A firm policy provides a steady demand signal that allows for the market to respond effectively. Policy that is not expected to remain in place or that is not clear will mean that companies will not invest in their operations to respond to associated growth in demand for cooling and/or heat pump retrofits. The policy must still provide enough lead time for the market to staff up ahead of compliance deadlines. Additional guidance from the City can help outline the market opportunity.

Window and portable AC installation does not typically require engineering or skilled trades involvement, which significantly reduces the impact of labour availability on compliance when using these system types.

5.3.3 Electrical Upgrade Capacity

Most of Toronto's multi-unit residential buildings lack the electrical infrastructure to provide cooling using integrated systems today, which introduces the additional potential bottleneck of electrical capacity upgrades at the grid level as well as electrical equipment manufacturers.

⁷ Data interpolated from International Energy Agency (IEA) 2018 report and summarized by Rocky Mountain Institute (RMI) here: https://rmi.org/wp-content/uploads/2018/11/Global_Cooling_Challenge_Report_2018.pdf

Utility-Level Upgrades

Toronto Hydro indicated that most building electrical power feed upgrades take 1-2 years, although some can be shorter or longer depending on the specifics of the upgrade. It is not yet known how those timelines could be affected by policy changes.

The specifics can include the size of the new feed, as well as factors outside of a building’s control, like if the available power capacity in the immediate vicinity of the building was just used up by another building, requiring further upgrades upstream before new downstream capacity can be added. Engaging Toronto Hydro early for a non-binding estimate is important for each situation to understand the cost and timelines specific to that situation.⁸

There are no anticipated limitations from the grid level in terms of electricity generation – the grid operator is already anticipating and responding to increased demand due to broad scale electrification and population growth.

Electrical Manufacturer Capacity

Where building-level switchgear replacement is required, procurement already takes 18+ months for custom equipment and could inflate further if there is a sudden rush. Custom equipment may be required because of space constraints in electrical rooms in existing buildings.

Demands for electrical equipment is increasing due to structural demand growth across several sectors, including data centre construction, electric vehicle charging, as well as general decarbonization. In addition, electrical equipment has a heavy reliance on copper, which is constrained globally. Buildings compete with these sectors which often have higher tolerance for high prices, meaning they move up the manufacturing priority chain.

Addressing electrical equipment manufacturer bottlenecks is expected to be the critical path to providing timely and affordable power upgrades to buildings. This is recommended as an area for further study.

5.3.4 Capital Funding Availability

Based on the total number of rental units as outlined in *Table 2: Summary of Toronto’s building stock* and assuming an even distribution of existing cooling systems (16% of buildings) across the dwelling unit types, the total cost range to provide mechanical cooling has been estimated. The upfront capital costs are estimated at \$500 million for one individual AC system per dwelling unit and ranging up to \$14 billion for full dwelling unit cooling combined with heat pump retrofits using integrated systems. It is not known if this total cost can be accommodated by the private market. Further study is recommended.

Table 7: Estimated rental market capital cost of compliance using different active cooling approaches

Parameter	Dwelling Unit Count	Integrated System		Ind. AC per Room		Ind. AC per Dwelling Unit	
		Cost per Dwelling unit	Total Cost (\$M)	Cost per Dwelling unit	Total Cost (\$M)	Cost per Dwelling unit	Total Cost (\$M)
Apartment bldg. requiring electrical upgrade	373,937	\$31,619	\$11,823	\$2,903	\$1,085	\$1,075	\$402
Apartment bldg. not requiring electrical upgrade	32,516	\$20,638	\$671	\$2,903	\$94	\$1,075	\$35
Single detached house, duplex, row house, or semi-detached	63,063	\$18,540	\$1,169	\$3,700	\$233	\$925	\$58
Total rental housing stock	469,516	-	\$13,664	-	\$1,413	-	\$495

⁸ To receive a non-binding service connection assessment, email climateaction@torontohydro.com.

The cost per dwelling unit for individual ACs is expected to be outside the range of typical annual capital expenditure per dwelling unit but may be able to be absorbed at a rate of \$11/month per AC unit assuming a 10-year amortization and 5% interest rate, scaling up linearly based on the number of AC units installed in a dwelling unit (e.g., two AC units would approximately double the capital cost). Note that for an owner of several buildings, the one-time expense could run into the millions and therefore the costs of a loan may need to be added to the cost of compliance.

The cost per dwelling unit for integrated systems is well outside the range of typical annual capital expenditures per dwelling unit, and paying off the capital cost over ten years could translate into \$200-350/month per dwelling unit assuming a 10-year amortization and 5% interest rate, with variation depending on requirement of electrical upgrades and size of unit. Owners of several buildings may struggle to obtain financing to pay for simultaneous upgrades to multiple buildings, depending on their existing financial obligations and ability to increase their debt load.

It is expected that certain upgrades will result in increases in building value due to the improved thermal comfort and safety provided in the dwelling units. Where no or limited rent increases are permitted, this may impact the value added to the building by the retrofit.

Heat pumps can contribute to building value by reducing exposure to costs associated with fossil fuel heating, which include both the fluctuating cost of the fuel as well as potential future emissions-related fines. By reducing the operating costs, the net operating income can be increased, thereby increasing the value of the building.

Further study is recommended.

5.3.5 Market Capacity Conclusions

Requiring full-dwelling unit cooling will require many buildings to undergo electrical upgrades. The above-mentioned challenges with electric upgrades are likely to result in multi-year timelines for individual buildings. For buildings that do not require electric upgrades, it is reasonable to assume that scaling timelines for labour training and capacity-building would still require several years to achieve compliance.

Potential timelines for compliance are indicated below:

- Buildings with existing cooling equipment: operational compliance only; near-term deadline is appropriate
- Buildings needing new equipment, no electrical upgrade: 3 to 5 years
- Buildings requiring electrical service upgrades: 7 to 10 years
- Providing individual AC in one room per dwelling unit is more straightforward and can likely be implemented in 2-3 years.

Risks:

- The ability of the market to procure the necessary funding or financing for cooling and heat pump retrofits is not well understood at this time and could affect compliance timelines.
- The speed of building power feed upgrades appears to be a major hurdle and may require further study to understand timelines for full electrification power upgrades to be rolled out across Toronto. This is only expected to affect full dwelling cooling approaches.

5.4 Operational Performance and Overheating Risk

Introba modelled a representative west-facing one-bedroom unit to estimate cooling electricity demand and costs as well as to test whether a single air-conditioning unit located in the living room could keep the dwelling unit compliant during hot weather – particularly the bedroom where no dedicated cooling was provided. The analysis also examined the effect of occupant behaviour, including leaving the bedroom door open and using internal blinds, using both 2020s and 2050s Toronto future-weather files assuming a high-emissions, high-risk future.

There are several thousand combinations of dwelling unit orientation, constructions, and internal gains that could result in materially different results when then combined with external factors such as cooling system options and weather files. Modelling this is neither feasible nor helpful, so a single representative dwelling unit was chosen which was then analyzed under the following scenarios:

Table 8: Modelled scenario descriptions

Scenario	2020s Baseline	2050s Baseline	2020s with open doors	2050s with open doors	2020s open doors + blinds	2050s open doors + blinds
Weather File (Toronto CWEC CMIP5)	2020s	2050s	2020s	2050s	2020s	2050s
Bedroom-to-Living door	Closed at night	Closed at night	Open 24/7	Open 24/7	Open 24/7	Open 24/7
Internal blinds	None	None	None	None	Used during high solar gains	Used during high solar gains

5.4.1 Cooling Energy and Operational Cost

An estimate of cooling costs with full dwelling unit cooling and individual AC in living spaces only is shown below for a one-bedroom dwelling unit. Energy use and operational cost would scale roughly with unit size.

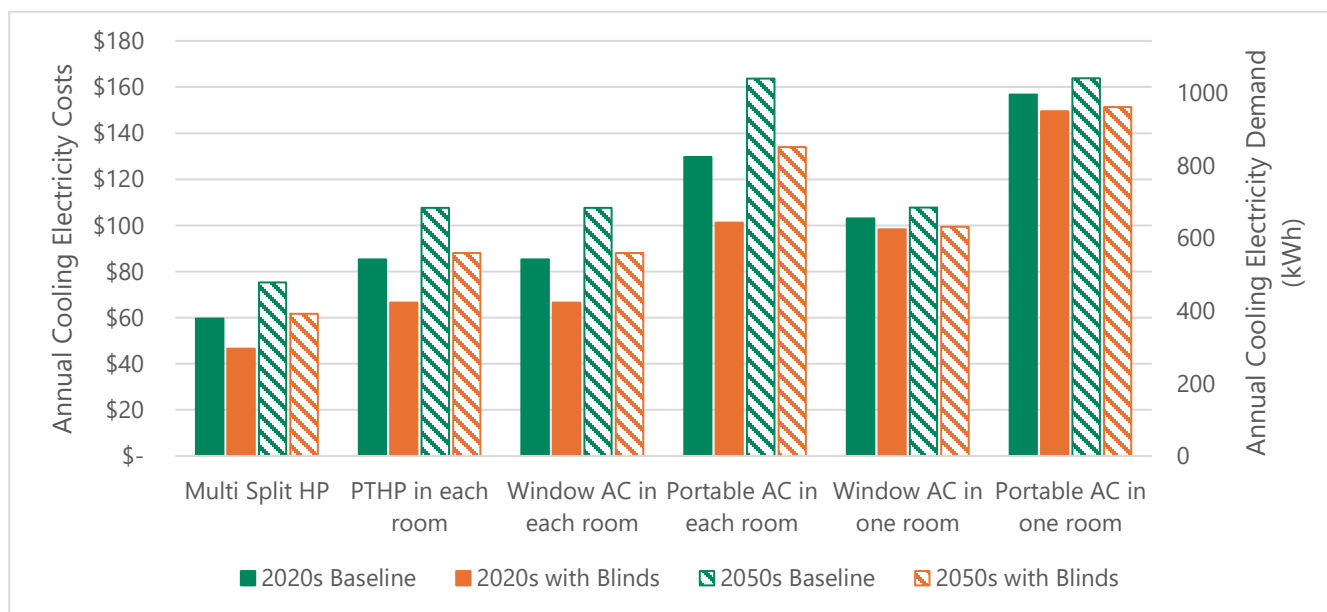


Figure 8 Annual Cooling Electricity Costs by Mechanical System

At the whole-unit level, the modelled annual cooling electricity demand and cost remain relatively modest compared to typical heating costs. Cooling increases under hotter future conditions, but use of internal blinds can reduce annual cooling demand by approximately an equivalent amount, demonstrating the value of no- or low-cost passive measures to mitigate cooling demand increases in a warming climate.

The difference between 2020s and 2050s cooling demand and the associated impact of blinds appears to be lower where AC is provided in only one room, but that is because the single AC is expected to run nearly continuously through the cooling season to mitigate overheating in adjacent rooms anyway. The impact of

blinds will be noticed primarily in terms of reducing overheating in adjacent uncooled spaces in the dwelling unit.

In all cases, operational costs can be borne by the tenant. For individual AC, this would require that the tenant electrical panel be metered individually. For integrated systems requiring electric upgrades, meters can be included for the new feeds powering the cooling equipment.

5.4.2 Overheating Performance

When an integrated system or individual AC in every room is installed, it is expected that the system would be sized to meet full cooling requirements. However, if only one individual AC unit is installed in a living room, the unit will be stretched to provide sufficient cooling throughout dwelling unit. This is expected to result in hours where setpoint is unable to be met, and some level of overheating will be experienced.

5.4.2.1 Peak-Day Temperatures

On the modelled peak day, the living room/kitchen where the cooling was installed with a setpoint of 24°C remained below the proposed 26 °C threshold in all scenarios for both the current and 2050s weather files. Peak temperatures occurred in the early evening, reflecting the selected west-facing orientation and the lag between solar gains and indoor air-temperature response. When the door to the bedroom is opened, it raises the temperature in the living room slightly because of increased load. Closing the blind when there is direct solar gain eliminates this effect.

In the absence of dedicated bedroom cooling, peak-day temperatures in the bedroom exceeded 26°C under all conditions. They were highest in the baseline scenario, peaking at 31°C in the 2020s and 32°C in the 2050s.

Leaving the bedroom door open overnight materially lowered peak bedroom temperatures, keeping maximum temperatures to 28°C in 2020s and 29°C in 2050s, and the use of internal blinds further improved performance by reducing solar gains, with a maximum temperature of approximately 27°C in both the 2020s and 2050s.

Table 9: Peak temperatures attained in living room and bedroom of modelled dwelling unit with a cooling unit installed in living room only

Space name	2020s outdoor temp. (ref)	2050s outdoor temp. (ref)	2020s baseline	2050s baseline	2020s with open doors	2050s with open doors	2020s open doors + blinds	2050s open doors + blinds
Living Room	35.6	37.7	24.8	26.1	24.7	25.9	24.2	24.3
Bedroom	35.6	37.7	31.0	32.0	28.0	29.1	26.7	27.0

These peak-day results are important because they show that the cooled living area and the uncooled sleeping area do not perform the same way. They also demonstrate the value of passive strategies such as closing blinds to keep out solar gains that contribute significantly to overheating.

5.4.2.2 Seasonal Overheating Hours

A single living-room window AC unit is sufficient to keep the living area below 26°C for essentially the full summer in all cases. Only one hour between 26°C and 28°C occurred in the 2050s baseline case, and no living-room hours exceeded 28°C in any scenario.

As summarized below there are a significant number of hours above 26°C with the bedroom door closed over night and no internal blinds. Opening the bedroom door reduces total overheating hours by approximately 60%. The combined scenario of opening the bedroom door to the living room and use of internal blinds performs best, reducing overheating hours by roughly 90%. However, this strategy relies on consistent occupant behaviour and should therefore be considered a behavioural mitigation measure rather than a guaranteed compliance solution.

Overall, with cooling installed only in the living room in a 1-bedroom unit, bedroom temperatures could exceed 26°C for 32% of the summer period, depending on occupant behavior and the frequency and intensity of extreme heat events in Toronto.

Table 10: Number of summer hours (June-August) within each temperature band in bedroom

Indoor temperature band	2020s outdoor temp. (ref)	2050s outdoor temp. (ref)	2020s baseline	2050s baseline	2020s with open doors	2050s with open doors	2020s open doors + blinds	2050s open doors + blinds
26 to 28°C	171	267	524	703	247	334	43	86
28 to 30°C	89	169	74	153	2	11	11	0
30°C+	99	187	9	17	0	0	0	0

5.4.3 Additional Operational Considerations

5.4.3.1 System Size

Systems that are undersized compared to the cooling needs of a dwelling unit will cost less initially and have lower emissions but can run more frequently and may require increased maintenance and/or have a shortened equipment lifespan. They also may not be able to keep up during extreme circumstances, resulting in increased risk of overheating.

Systems that are oversized will cost more initially and have higher emissions but may run less, possibly extending equipment lifespan.

5.4.3.2 Setpoint Restrictions

Oversized units provide tenants with the opportunity to overcool their dwelling unit, a scenario which would increase usage and associated operating cost of the cooling system and possibly negatively impact lifespan and maintenance. One response to this might be restricting setpoints, particularly in scenarios where the landlord/owner pays for utilities. However, caution is advised as restricted setpoints in a scenario without full cooling could mean that portions of the dwelling unit without active cooling could overheat, and overcooling one space might be a reasonable strategy to provide some cooling throughout a dwelling unit.

5.4.3.3 Occupant Behaviour

Higher internal gains (such as cooking a large meal) and insufficient solar control could also cause a dwelling unit to overheat despite having a full cooling system installed.

These challenges indicate the importance of occupant and owner education, and of boundaries and responsibilities that may need to sit with each party when it comes to enforcing safe and habitable conditions.

5.4.4 Emissions and Decarbonization Considerations

Annual emissions will vary based on a number of factors, including the emissions associated with electricity generation, as well as the emissions from refrigerant leakage from the cooling units, and the emissions emitted to manufacture and install the cooling equipment and enabling infrastructure (e.g., electrical upgrades). At this time, only the emissions associated with electricity use for cooling and refrigerant leakage are estimated.

The grid-level emissions change over time due to the fuel sources used for electricity generation and the fact that cooling demand increases with a warming climate.

The calculation of refrigerant emissions has significant uncertainty. However, even an uncertain calculation provides some indication of the relative impact, which is important to better understand the impacts of policy

decisions. Refrigerant leakage is estimated using ASHRAE TM65NA guideline, which assumes the following annual leakage rates: 3% for multi-split, 1% for PTHP, 5% for forced-air split, and 2% for individual AC systems. Other sources⁹ indicate that leakage for Window AC units is much lower – around 0.1-0.2% annually – which could significantly affect the total emissions of associated scenarios.

Table 11: Average annual cooling electricity usage emissions and refrigerant leakage emissions per dwelling unit

	Multi Split HP	PTHP in each room	Forced-Air Split HP (SFD)	Window AC in each room	Portable AC in each room	Window AC in one room	Portable AC in one room
Average Annual Cooling Electricity Emissions (kgCO2e)	40	58	96	58	88	57	79
Average Annual Refrigerant Leakage Emissions (kgCO2e)	49	30	338	23	30	9	11

Emissions reductions associated with heat pump options that would displace natural gas heating have not been evaluated in detail this study. However, previous analysis by Introba suggests that GHG emissions reductions resulting from replacing gas-fired heating equipment with heat pump technologies are up to two (2) orders of magnitude larger than the emissions resulting from the additional mechanical cooling. Therefore, from an emissions perspective, system recommendations should prioritize system alternatives that align with a potential phased transition to low carbon systems for heating.

The option to decarbonize heating does not apply to cooling-only options, whether applied to a single room or to a full dwelling unit. Since these will contribute to a net increase in emissions, selecting the smallest system with the lowest refrigerant leakage possible that is capable of maintaining safe and habitable conditions until a full heat pump retrofit can be carried out will help minimize life cycle emissions.

Recent product releases of window heat pump systems show initial promise for contributing to lower cost decarbonization at scale and should be studied further for the specific Toronto context.

5.5 Life Cycle Cost and Emissions Analysis

The following assumptions have been made for the life cycle cost analysis:

1. 20-year evaluation period
2. Capital costs use per dwelling unit cost data from Scenario 1, 3, 8 in Table 4 for integrated systems and the relevant per dwelling unit costs in Table 5 for individual ACs.
3. Utility escalation rate, inflation rate, and discount rate are all equivalent
4. Equipment lifespans: 10 years for individual AC, 20 years for integrated systems
5. Performance degradation: 1% of nominal performance lost per year for integrated systems, 2% for individual systems installed in all rooms in a dwelling unit, 3% for individual AC installed in one room only (higher degradation due to higher number of hours of usage per year).
6. Cooling demand rises year over year linearly to account for the warming climate, assuming that the 2050s performance reported above corresponds to 2055.
7. Refrigerant leakage follows ASHRAE TM65NA guideline, with the following annual loss rates: 3% for multi-split, 1% for PTHP, 5% for forced-air split, and 2% for individual AC. R32 refrigerant is used for all.

The results of the analysis are summarized separately for MURBs and SFDs in the tables below and in Figure 9.

⁹ https://www.energymaine.com/docs/EMT_Refrigerants_Report_FINAL_2022-3-14.pdf

Table 12: 20-year Life Cycle Emissions and Cost Estimates for Selected Cooling Approaches for MURBs

	Multi Split HP	PTHP in each room	Window AC in each room	Portable AC in each room	Window AC in one room	Portable AC in one room
Cooling Electricity Emissions	0.81	1.35	1.16	1.76	1.14	1.58
Refrigerant Leakage Emissions	0.98	0.59	0.46	0.59	0.17	0.22
Elec. + Refr. Leakage Emissions	1.79*	1.94*	1.62	2.35	1.31	1.80
Operational Cost	\$1,882	\$3,137	\$2,673	\$4,067	\$2,692	\$3,615
Capital Cost	\$29,189	\$29,195	\$6,210	\$5,400	\$2,300	\$2,000
Seasonal Installation, Removal	\$0	\$0	\$8,100	\$8,100	\$3,000	\$3,000
Total Life Cycle Cost	\$31,071	\$31,883	\$16,983	\$17,567	\$7,992	\$8,615

Table 13: 20-year Life Cycle Emissions and Cost Estimates for Selected Cooling Approaches for Single Family Dwellings

	Forced-Air Split HP	Window AC in one room	Portable AC in one room
Cooling Electricity Emissions	1.93	1.14	1.58
Refrigerant Leakage Emissions	6.77	0.17	0.22
Elec. + Refr. Leakage Emissions	8.69	1.31	1.80
Operational Cost	\$4,525	\$2,692	\$3,615
Capital Cost	\$20,992	\$2,000	\$1,700
Seasonal Installation, Removal	\$0	\$3,000	\$3,000
Total Life Cycle Cost	\$25,517	\$7,692	\$8,315

As outlined in section 5.1, capital costs for the integrated systems are much higher than those for individual AC approaches. Although integrated systems are more efficient, the operational cost component is so much smaller than the capital cost that it does not impact the life cycle cost substantially. However, the seasonal installation and removal of individual ACs at a rate of \$150/year/AC unit adds to the life cycle cost substantially, particularly where multiple AC units are installed in a single dwelling. This may not be carried out in all installations in reality – however, it is important to note that where ACs are left installed through winter it may contribute to increased heating costs (and associated emissions), can risk damage to the unit, and can allow moisture ingress that can damage the unit and/or window frame during freeze-thaw cycles. Costs for this alternate scenario have not been evaluated.

After accounting for the noted life cycle costs, individual ACs remain the least expensive option at approximately one-fourth the life cycle cost of multi-splits or PTHPs, and one-third the cost of forced-air split heat pumps. There is little difference between window and portable AC from the perspective of life cycle cost.

Emissions from electricity use correlate to cooling system efficiency and usage, with the most efficient multi-split having the lowest electricity emissions. However, when accounting for refrigerant leakage, emissions for “window AC in one room” are the lowest, due to the small refrigerant charge and lowest leakage risk, and better efficiency than the otherwise comparable portable AC option. The forced-air split option for single family dwellings has the highest emissions primarily due to increased demand – a larger dwelling unit size results in increased cooling demand, which drives up energy consumption accordingly. When accounting for refrigerant emissions, this is further exacerbated by the higher leakage rate and the higher refrigerant charge that a larger capacity unit requires.

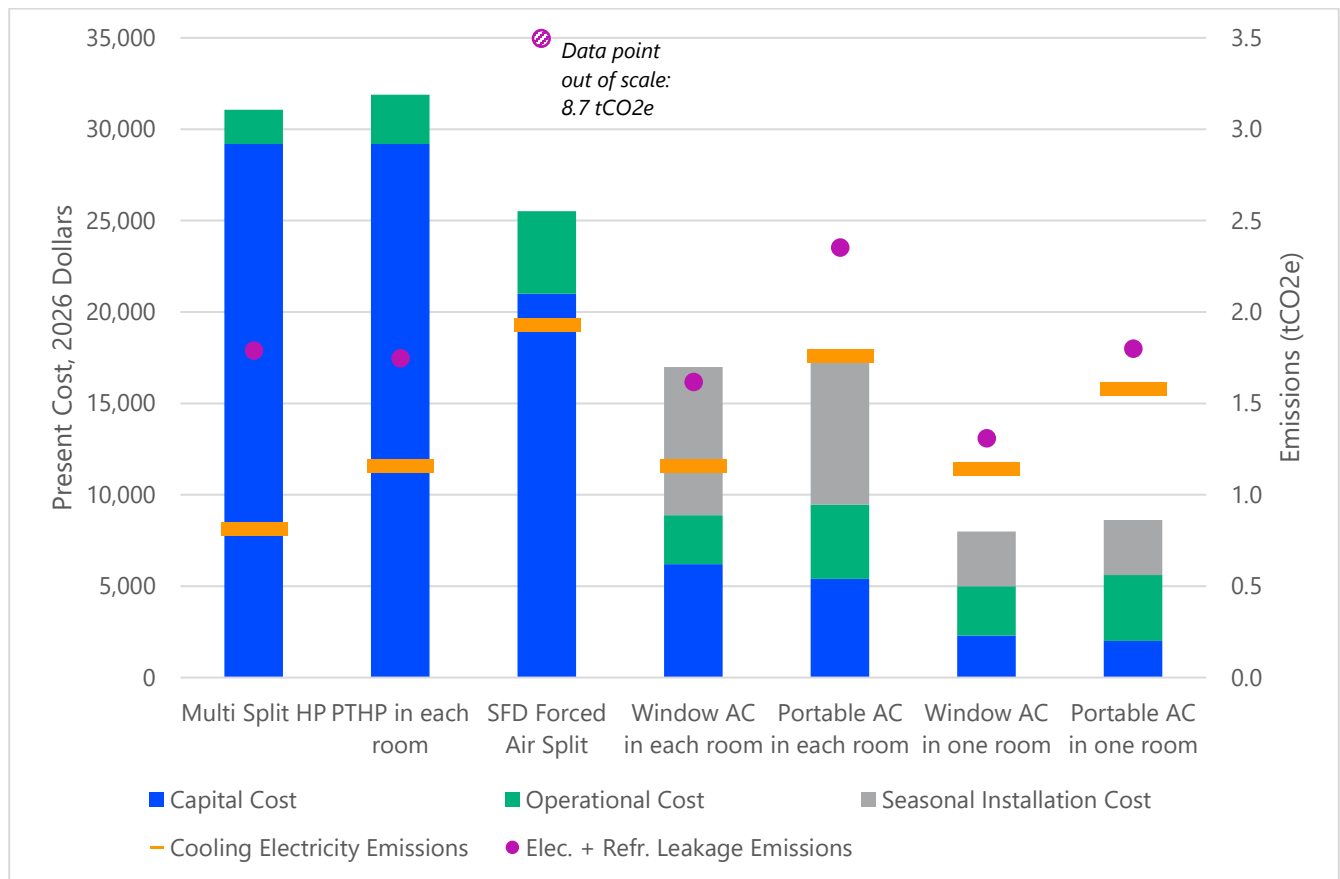


Figure 9: 20-year Life Cycle Cost and Emissions for selected cooling approaches in MURBs and SFDs

It is important to note again that emissions associated with existing natural gas heating in these retrofit scenarios that can be reduced by installing heat pumps instead of cooling-only systems have not been included in this analysis. Therefore, systems that are presented here as having higher emissions (i.e. forced-air split heat pump) should not be disregarded – they will have drastically lower emissions than the status quo.

6 Conclusions and Recommendations

6.1 Conclusions

Systems

A number of approaches to providing cooling were explored, focused on the systems able to be broadly applied to the rental housing stock in Toronto. These systems are:

- Individual Air Conditioning (AC) Units: Standalone units, such as window or portable air conditioners, that can be installed in one or multiple rooms in a dwelling unit.
- Integrated Systems: Permanently installed systems providing cooling throughout a dwelling unit, like multi-splits, packaged terminal systems, or duct-installed cooling systems.

Integrated systems provide a number of livability benefits over individual AC approaches, including reduced noise, preservation of daylight and views, and reduced interior space impacts. They also have heat pump options, which can provide decarbonization benefits that individual ACs cannot.

System approaches that provide full dwelling unit cooling (all bedrooms and living room) are compared to those that only provide cooling to one room directly.

Overheating Risks

Individual ACs applied to one room only will not necessarily be able to cool a whole dwelling unit, however when sufficiently sized they can keep one room cooled to under 26°C. With AC installed in a living room window only and with bedroom doors are closed at night, bedrooms can overheat. To mitigate these risks, bedroom doors would need to be kept open overnight, and blinds need to be drawn whenever sun is shining into the dwelling unit to help limit overheating. Even then, careful selection of individual AC unit capacity will be required to maintain safe conditions. Limiting setpoint control in dwelling units with only one AC unit installed may result in increased risk of overheating in portions of the dwelling unit that do not have active cooling.

Costs

Capital costs across a representative range of building archetypes indicate that integrated systems that provide full-dwelling unit cooling are approximately seven times more expensive than using individual AC units without electrical upgrades, and ten to twelve times more expensive when electrical upgrades are required for the integrated system approach. When comparing to a single AC unit in one room per dwelling unit, integrated systems are approximately nineteen times more expensive, or around thirty times as expensive when electrical upgrades are required.

Individual ACs are less efficient and result in higher operational energy costs, however cooling demand in Toronto is relatively low and the difference is only around \$60-100 per year. Individual ACs are installed at the beginning of each cooling season and removed in the fall to avoid heat loss and moisture issues in winter which also increases life cycle costs. In addition, they can reasonably be expected to last half as long as an integrated system – 10 years instead of 20.

After accounting for the noted life cycle costs over a 20-year timeframe, individual ACs installed in one room per dwelling unit remain the least expensive option at approximately one-fourth to one-third the life cycle cost of integrated systems. Individual ACs installed in all rooms to provide full cooling at approximately half the life cycle cost of integrated systems.

A major benefit of the integrated system approach is that they can decarbonize heating. However, the operational cost implications of this have not been studied here.

Emissions

Emissions associated with cooling energy use and refrigerant leakage emissions have been estimated and indicate that the lowest emissions pathway from a cooling-only perspectives means selecting the smallest system with the lowest refrigerant leakage possible that is capable of maintaining safe and habitable conditions.

Emissions saved by deploying heat pumps have not been studied in detail here, but previous analysis indicate that the emissions savings potential of heat pumps exceed the net increase from refrigerant emissions and cooling energy use by a significant margin. Pursuing cooling retrofits that enable decarbonization of existing heating system will result in the lowest life cycle emissions while providing safe and habitable conditions.

Market Concerns

The market is expected to have some challenges in responding to cooling mandates, depending on what the mandate requires. Individual AC units applied to a single room are not anticipated to require building electrical upgrades, which simplifies the process and allows for an accelerated timeline. Full dwelling unit cooling options are expected to require some level of electrical upgrades in buildings which are currently heated using natural gas, which is approximately 92% of all buildings. Bottlenecks in the electrical upgrade process are expected to result in extended retrofit timelines of around three years per building which could push full compliance across all building to significantly longer than that. Constraints to the deployment of capital required for both full cooling and single individual AC approaches are not well understood at this time.

6.2 Recommendations

Individual AC units are a less expensive pathway to providing cooling to dwelling units than integrated systems. In spite of all the benefits of integrated systems, their cost and timeline to install would result in likely a decade before cooling systems are broadly installed. Within the category of individual ACs, window ACs are generally superior to portable ACs with respect to noise and efficiency, however not all existing operable windows may be able to accommodate the installation of window AC.

Individual AC units are not expected to provide full cooling to a dwelling unit when installed in only one room. They can generally keep that one room from overheating, but attached bedrooms can still overheat. Increasing numbers of bedrooms in a dwelling unit will mean a higher likelihood of overheating in spite of the AC unit and reduced ability to provide comfortable conditions to the whole dwelling unit. The risk of overheating will increase as the climate warms.

However, individual ACs are quick to deploy and can provide a stop-gap solution for a longer phased installation of phased full cooling, which should be carried out in coordination with other City priorities such as decarbonization due to the significant cost and opportunity this presents. Passive approaches such as reducing internal gains and controlling solar gains also help limit overheating and should be communicated to owners and occupants.

6.3 Opportunities for Future Study

This study outlined areas where policies may benefit from further study. These are summarized below:

- Additional capital cost modelling; engaging with owners and contractors to narrow down the range of costs using example buildings as case studies.
- Enhanced analysis of electric upgrade pathways and alignment with in-building electric vehicle charging infrastructure.
- Additional sizing and enforcement analysis, for example determining a cooling capacity checklist approach that can contribute to evaluating compliance where a unit is reported to be overheating but no active measurements indicate overheating.
- Additional market capacity research, including:

- How to reduce bottlenecks in manufacturing of components to reduce lead times
- Ability of market to bear costs
- Impact of retrofits on building valuations
- Expanded modelling of life cycle cost modelling to include impact on heating costs, and to ultimately seek alignment of full dwelling unit cooling options with heating decarbonization efforts over a longer time period.
- Expanded modelling of passive features and differences between buildings (e.g., orientation, constructions) to better understand passive impacts on costs and overheating risks, and to support tenant education and/or modelling of impacts of passive interventions over the entire building stock.
- Expanded modelling of occupant behaviours, such as sensitivity of overheating to cooking, occupancy rates, or other factors.
- Impact of cooling setpoint on operational cost.
- Analysis of the impact of thermal safety policy on decarbonization and emissions reduction goals (e.g. capturing the avoided heating emissions and operational costs of heat pump approaches compared to strictly cooling systems).
- Pathway analysis for the City to explore how building stock transformation maps out over time to provide safe, low carbon habitability while accounting for equity and other concerns.

7 Appendix A

City of Toronto Maximum Indoor Temperature By-law

APPENDIX A: COSTING BRIEFS AND COSTING REPORTS

March 2026

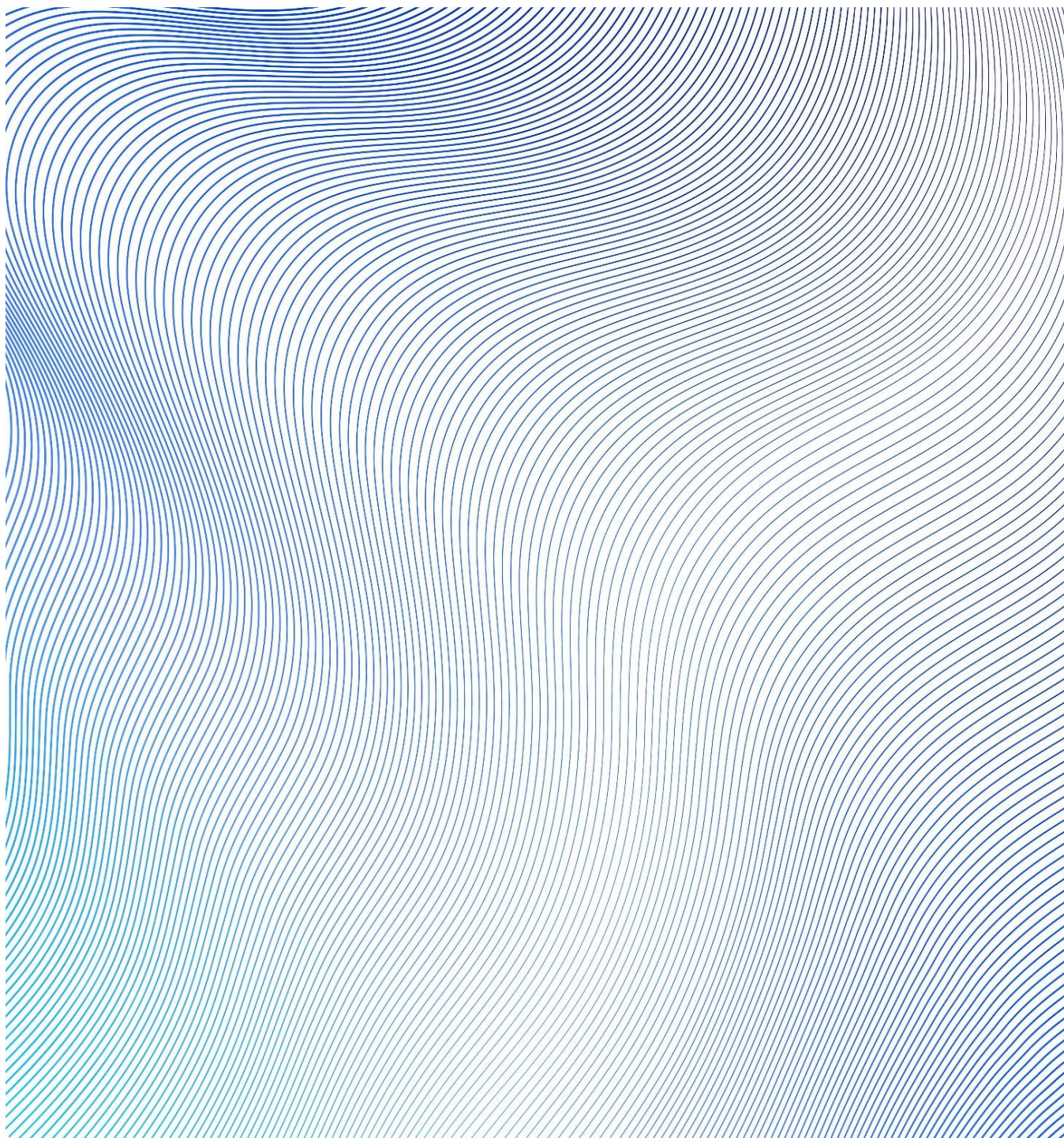


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1 Summary of Archetypes

Archetype	Cooling Approach	Electric Upgrade
1. High-rise MURB w/ balcony, natural gas boiler	Multi Split HP	Yes
2. High-rise MURB w/ balcony, electric baseboards	Multi Split HP	No
3. High-rise MURB w/out balcony, natural gas boiler	PTHP	Yes
4. High-rise MURB w/out balcony, electric baseboards	PTHP	No
5. Low-rise MURB w/out balcony, natural gas boiler	Multi Split HP	Yes
6. Low-rise MURB w/out balcony, electric baseboards	PTHP	No
7. Single-family dwelling w/out balcony, forced air furnace	Forced air Split AC	No, cost for load management
8. Add generic unit cost for Portable AC, with professional installation		No
9. Add generic unit cost for Window AC, with professional installation		No

Two costing reports have been provided:

1. Assuming installation by a specialized decarbonization/cooling retrofit contractor for MURBs and owner-contracted installation for single family dwellings.
2. Assuming installation by a general contractor with subcontractors for relevant scopes (mechanical, electrical).

2 Archetype 1: High Rise MURB w/Balcony and Central Natural Gas Heating

2.1 Building Information

- Assume a 15-storey building with 10 dwelling units per floor for 150 total dwelling units.
 - Assume a mix of 1, 2, and 3 bed dwelling units: 20% 3-bed, 30% 2-bed, 50% 1-bed
- Assume 1960-1970s era construction if relevant

2.2 Mechanical Description

- Multi-split cold-climate heat pump:
 - one outdoor condensing unit mounted on the balcony + one wall mounted head per bedroom (0.75-ton) plus one additional head for living room (1-ton)
 - Summary:
 - 1 Bed: Qty (75) 1.5-ton multi-split CU, Qty (75) 1.0-ton wall mounted head, Qty (75) 0.75-ton wall mounted head
 - 2 Bed: Qty (45) 2.25-ton multi-split CU, Qty (45) 1.0-ton wall mounted head, Qty (90) 0.75-ton wall mounted head
 - 3 Bed: Qty (30) 3.0-ton multi-split CU, Qty (30) 1.0-ton wall mounted head, Qty (90) 0.75-ton wall mounted head
 - One remote thermostat per head
 - One power disconnect per outdoor unit
- Insulated refrigerant piping to be run indoors
- Installation to be completed while tenants occupy space – account for associated increase in difficulty

2.3 Electrical Description

- Assume new feed to building is required to provide sufficient capacity for cooling/heat pumps
- Assume building distribution is 208Y/120 V 3-phase 4-wire and dwelling unit HVAC loads are served as single-phase 208 V branch circuits derived from that system
- No dwelling unit panel upgrades. Provide new dedicated HVAC feeders from main electrical room to new semi-decentralized distribution panels (one per floor). Provide new branch circuits from those panels to each dwelling unit multi-split with local disconnects.
- New pad mounted transformer at grade provided by Toronto Hydro. Enabling works by owner.

Component	Calculated Size/Qty (Proposed size in brackets)
New Transformer	397 kVA (500kVA Pad Mounted)
New Main switchboard	1314 A (1600 A)
New 3-ph Riser	1314 A (1600 A)
New Per-floor feeder	88 A (15x 100 A)
New Per-floor HVAC panelboard	25 kVA with 10 breakers (15x with soft-start/sequencer in nearby enclosure)
New 208V-1ph branch circuit from new panelboard	75x 25A 45x 35A 30x 50A

New Disconnect	150x 30A avg.
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Include allowances for the following:

- Civil Work for New Electrical Service
 - Trenching and Conduit: All costs associated with trenching from the property line to the building's main electrical room.
 - Site Restoration: Costs for restoring any landscaping, asphalt, or concrete surfaces affected by the trenching work.
 - Utility Coordination: Fees and coordination efforts with the local electrical utility for the new service connection.
- Pre-coring scanning, Coring, and Fire Stopping
- Contingency for electrical room modifications and feeder routing
- Metering of each feed to pass costs to tenant

3 Archetype 2: High Rise MURB w/Balcony and Electric Heating

3.1 Building Information

- Assume a 15-storey building with 10 dwelling units per floor for 150 total dwelling units.
 - Assume a mix of 1, 2, and 3 bed dwelling units: 20% 3-bed, 30% 2-bed, 50% 1-bed
- Assume 1960-1970s era construction if relevant

3.2 Mechanical Description

- Multi-split cold-climate heat pump:
 - one outdoor condensing unit mounted on the balcony + one wall mounted head per bedroom (0.75-ton) plus one additional head for living room (1-ton)
 - Summary:
 - 1 Bed: Qty (75) 1.5-ton multi-split CU, Qty (75) 1.0-ton wall mounted head, Qty (75) 0.75-ton wall mounted head
 - 2 Bed: Qty (45) 2.25-ton multi-split CU, Qty (45) 1.0-ton wall mounted head, Qty (90) 0.75-ton wall mounted head
 - 3 Bed: Qty (30) 3.0-ton multi-split CU, Qty (30) 1.0-ton wall mounted head, Qty (90) 0.75-ton wall mounted head
 - One remote thermostat per head
 - One power disconnect per outdoor unit
- Insulated refrigerant piping to be run indoors
- Installation to be completed while tenants occupy space

3.3 Electrical Description

- Assume existing dwelling unit panel is sufficient for new AC/heat pump
- Run new 208V/1ph wire to outdoor unit

Component	Required for Heat Pump
New 208V/1ph branch circuit from existing dwelling unit panel	75x 25A 45x 35A 30x 50A
New Disconnect	150x
Soft start/sequencer allowance	No
Contingency for electrical room modifications and busduct routing	No

4 Archetype 3: High Rise MURB w/o Balcony and Central Natural Gas Heating

4.1 Building Information

- Assume a 15-storey building with 10 dwelling units per floor for 150 total dwelling units.
 - Assume a mix of 1, 2, and 3 bed dwelling units: 20% 3-bed, 30% 2-bed, 50% 1-bed
- Assume 1960-1970s era construction if relevant

4.2 Mechanical Description

- Packaged Terminal Heat Pump (All-in-one systems):
 - One PTHP per room per dwelling unit – 0.75 ton/bedroom and 1.0 ton/living room
 - Summary:
 - 1 Bed: Qty (75) 1.0-ton PTHP, Qty (75) 0.75-ton PTHP
 - 2 Bed: Qty (45) 1.0-ton PTHP, Qty (90) 0.75-ton PTHP
 - 3 Bed: Qty (30) 1.0-ton PTHP, Qty (90) 0.75-ton PTHP
 - One remote thermostat per head
 - One local power disconnect per PTHP
- Installation to be completed while tenants occupy space

4.3 Electrical Description

- Assume new feed to building is required to provide sufficient capacity for cooling/heat pumps
- Assume building distribution is 208Y/120 V 3-phase 4-wire and dwelling unit HVAC loads are served as single-phase 208 V branch circuits derived from that system
- No dwelling unit panel upgrades. Provide new dedicated HVAC feeders from main electrical room to new semi-decentralized distribution panels (one per floor). Provide new branch circuits from those panels to each dwelling unit HVAC unit with local disconnects.
- New pad mounted transformer at grade provided by Toronto Hydro. Enabling works by owner.

Component	Calculated Size/Qty (Proposed size in brackets)
New Transformer	397 kVA (500kVA Pad Mounted)
Main switchboard	1314 A (1600 A)
3-ph Riser	1314 A (1600 A)
Per-floor feeder	88 A (15x 100 A)
Per-floor HVAC panelboard	25 kVA with 27 breakers (15x with soft start/sequencer in nearby enclosure)
208V-1ph branch circuit from new panelboard	405x 25A
Disconnect	405x

Include allowances for the following:

- Civil Work for New Electrical Service

City of Toronto Maximum Indoor Temperature By-law | Appendix A: Costing Briefs and Costing Reports

- Trenching and Conduit: All costs associated with trenching from the property line to the building's main electrical room.
- Site Restoration: Costs for restoring any landscaping, asphalt, or concrete surfaces affected by the trenching work.
- Utility Coordination: Fees and coordination efforts with the local electrical utility for the new service connection.
- Pre-coring scanning, Coring, and Fire Stopping
- Contingency for electrical room modifications and feeder routing
- External swing stage or similar for installation of exterior holes
- Metering of each feed to pass costs to tenant

5 Archetype 4: High Rise MURB w/o Balcony and Electric Heating

5.1 Building Information

- Assume a 15-storey building with 10 dwelling units per floor for 150 total dwelling units.
 - Assume a mix of 1, 2, and 3 bed dwelling units: 20% 3-bed, 30% 2-bed, 50% 1-bed
- Assume 1960-1970s era construction if relevant

5.2 Mechanical Description

- Packaged Terminal Heat Pump (All-in-one systems):
 - One PTHP per room per dwelling unit – 0.75 ton/bedroom and 1.0 ton/living room
 - Summary:
 - 1 Bed: Qty (75) 1.0-ton PTHP, Qty (75) 0.75-ton PTHP
 - 2 Bed: Qty (45) 1.0-ton PTHP, Qty (90) 0.75-ton PTHP
 - 3 Bed: Qty (30) 1.0-ton PTHP, Qty (90) 0.75-ton PTHP
 - One remote thermostat per head
- Installation to be completed while tenants occupy space

5.3 Electrical Description

- Assume existing dwelling unit panel is sufficient for new heat pump
- Each PTHP to plug in to nearby electrical outlet

Component	Calculated Size/Qty (Proposed in brackets)
Second stage thermostat for existing baseboard	405x

Include allowances for the following:

- External swing stage or similar for installation of exterior holes

6 Archetype 5: Low Rise MURB w/o Balcony and Central Natural Gas Heating

6.1 Building Information

- Assume a 4-storey building with 10 dwelling units per floor for 40 total dwelling units.
 - Assume a mix of 1, 2, and 3 bed dwelling units: 20% 3-bed, 30% 2-bed, 50% 1-bed
- Assume 1960-1970s era construction if relevant

6.2 Mechanical Description

- Multi-split cold-climate heat pump:
 - one outdoor condensing unit mounted on the roof and/or ground/wall + one wall mounted head per bedroom (0.75-ton) plus one additional head for living room (1-ton)
 - Summary:
 - 1 Bed: Qty (20) 1.5-ton multi-split CU, Qty (20) 1.0-ton wall mounted head, Qty (20) 0.75-ton wall mounted head
 - 2 Bed: Qty (12) 2.25-ton multi-split CU, Qty (12) 1.0-ton wall mounted head, Qty (24) 0.75-ton wall mounted head
 - 3 Bed: Qty (8) 2.25-ton multi-split CU, Qty (8) 1.0-ton wall mounted head, Qty (24) 0.75-ton wall mounted head
 - One remote thermostat per head
 - One power disconnect per outdoor unit
- Insulated refrigerant piping to be run on the exterior of the building to dwelling unit/indoor unit
- Installation to be completed while tenants occupy space – account for associated increase in difficulty

6.3 Electrical Description

- Assume new feed to building is required to provide sufficient capacity for cooling/heat pumps
- Assume building distribution is 240/120 V 2-phase 3-wire and multi-splits are served by single-phase 240 V branch circuits derived from that system
- No dwelling unit panel upgrades. Provide new dedicated HVAC feeders from main electrical room to new semi-decentralized distribution panels (assume 4). Provide new branch circuits from those panels to each dwelling unit’s HVAC unit with local disconnects. Service/transformer capacity increase and/or new step-down transformer included as required to support added HVAC demand.

Component	Calculated Size/Qty (Proposed size in brackets)
New Transformer	101 kVA (167kVA Pad Mounted)
New Main switchboard	421 A (500 A)
New 3-ph Riser	421 A (500 A)
New feeder	132 A (4x 150 A)
New HVAC panelboards	25 kVA with 10 breakers (4x with soft start/sequencer in nearby enclosure)
New 208V-1ph branch circuit from new panelboard	20x 25A 12x 35A 8x 50A

New Disconnect	40x 30A avg.
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Include allowances for the following:

- Civil Work for New Electrical Service
 - Trenching and Conduit: All costs associated with trenching from the property line to the building's main electrical room.
 - Site Restoration: Costs for restoring any landscaping, asphalt, or concrete surfaces affected by the trenching work.
 - Utility Coordination: Fees and coordination efforts with the local electrical utility for the new service connection.
- Pre-coring scanning, Coring, and Fire Stopping if not running electrical on exterior of building
- Contingency for electrical room modifications and feeder routing
- Metering of each feed to pass costs to tenant

7 Archetype 6: Low Rise MURB w/o Balcony and Electric Heating

7.1 Building Information

- Assume a 4-storey building with 10 dwelling units per floor for 40 total dwelling units.
 - Assume a mix of 1, 2, and 3 bed dwelling units: 20% 3-bed, 30% 2-bed, 50% 1-bed
- Assume 1960-1970s era construction if relevant

7.2 Mechanical Description

- Packaged Terminal Heat Pump (All-in-one systems):
 - One PTHP per room per dwelling unit – 0.75 ton/bedroom and 1.0 ton/living room
 - Summary:
 - 1 Bed: Qty (20) 1.0-ton PTHP, Qty (20) 0.75-ton PTHP
 - 2 Bed: Qty (12) 1.0-ton PTHP, Qty (24) 0.75-ton PTHP
 - 3 Bed: Qty (8) 1.0-ton PTHP, Qty (24) 0.75-ton PTHP
 - One remote thermostat per head
- Installation to be completed while tenants occupy space

7.3 Electrical Description

- Assume existing dwelling unit panel is sufficient for new PTHP
- Each PTHP to plug in to nearby electrical outlet

Component	Calculated Size/Qty (Proposed size in brackets)
Second stage thermostat for existing baseboard	180x

Include allowances for the following:

- Lift/boom truck for installation of exterior holes

8 Archetype 7: Single Family/Rowhouse/Townhouse

8.1 Building Information

- Assume a 2-storey building with 1 dwelling unit and 3 bedrooms.
- Assume 1960-1970s era construction if relevant

8.2 Mechanical Description

- Add Evaporator Coil to Existing Furnace
- Run refrigerant lines to outside
- Install outdoor condensing unit – assume 3-ton
- One new thermostat
- Installation to be completed while tenants occupy space

8.3 Electrical Description

- New 240V/30A feed from existing panel to outdoor unit

If possible, provide alternate price for 3-ton cold climate heat pump with 240V/50A feed and 2-stage thermostat to engage furnace heat as second stage. Add load management device to avoid electrical panel upgrade.

9 Individual AC

9.1 Window AC

- Price for professional installation
- Price for (seasonal) removal
- Power from local plug only
- Size: 6,000-10,000 Btu/hr

9.2 Portable AC

- Price for professional installation
- Price for (seasonal) removal
- Power from local plug only
- Size: 6,000-10,000 Btu/hr

10 Costing Report

City of Toronto Mechanical Cooling Systems

Class D Estimate (Rev.1)



Prepared for:

Inroba

Prepared by:

A.W. HOOKER®
QUANTITY SURVEYORS

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April 13, 2026

Introba
380 Wellington St W. Toronto,
ON M5V 1E3

Attn: Eric Campbell, P.Eng., Associate

Re: City of Toronto Mechanical Cooling Systems – Class D Estimates (R0)

Dear Eric,

Please find enclosed our Class D Estimate for the above project. The estimate is based on design drawings and information provided by Introba received on March 06, 2026 along with the subsequent comments.

This estimate is based on feedback from a vertically integrated, small specialty contractor approach used for similar retrofit work, rather than the usual prime contractor-led model with broader competitive tendering. Accordingly, the estimate may have market-related cost implications that are not fully captured, and we cannot guarantee these costs fully achievable under all procurement conditions, and final costs may vary depending on contractor availability, coordination requirements, and site-specific execution constraints.

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



Bineesh Susamma, PMP, PQS
Associate (Mechanical)

Sincerely,
A.W. Hooker Associates Ltd



Greg Babiak, PQS
Principal (Mechanical)

Encl. (Class D Estimate – April 13, 2026)

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1. Introduction to the Estimate

1.1 Project Description

This study involves a retrofit analysis of seven (7) existing building archetypes across the following three categories, with the objective of identifying the most effective strategies for incorporating mechanical cooling systems. This report focuses specifically on mechanical scopes:

1. Single Family Dwelling
2. High Rise MURB
3. Low Rise MURB

1.2 Type of Estimate

This Class D Estimate is intended to establish a realistic elemental estimate of the hard construction costs based on the level of design information provided. Detailed quantities have been measured from drawings where possible for the proposed building (excluding site). This estimate reflects our opinion as to the fair market value for the hard construction of this project.

The accuracy of the estimate is based on the documentation provided and design stage is intended to be +/- 30%-50%. This accuracy is based on the definition for Estimate Classifications (Order of Magnitude, Class 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.

Cost Estimate Classification Systems					
Nomenclature	Order of Magnitude	Concept Design	Schematic Design	Design Development	Pre-Tender/Tender
AACE *(1)	Class 5	Class 4	Class 3	Class 2	Class 1
DND *(2)			Indicative	Substantive	
RAIC *(3)	OME	Sketch Design	Design Development	Contract Documents	Tender Documents
CIQS / PSPC *(4)	OME	Class D	Class C	Class B	Class A
		↓	↓	↓	↓
Design Documentation % Complete					
	1% - 5%	5% - 12.5%	12.5% - 25%	25% - 95%	95% - 100%
Cost Estimate Accuracy (+ or - Percentage)					
	+/- 30%-50%	+/- 20%-30%	+/- 15%-20%	+/- 10%-15%	+/- 5%-10%

Legend

*(1) AACE Association for the Advancement Of Cost Engineering

*(2) DND Department of National Defense

*(3) RAIC Royal Architectural Institute Of Canada

*(4) Canadian Institute of Quantity Surveyors / Public Services and Procurement Canada

*Reference: <https://cacqs.ca/wp-content/uploads/2024/10/best-practices-guide-2024.pdf>

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 Toronto, Ontario.

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 are included as percentage of the hard construction cost. However, this allowance has been reduced to reflect the specified retrofit scope. It is assumed that the building owners will directly engage equipment suppliers and vertically integrated specialty contractors rather than a large prime mechanical contractor. Accordingly, site overheads such as supervision, site supervision and labour, access to the site, site accommodations, site protection, temporary utilities, clean up, equipment, and other miscellaneous project requirements are minimized and/or incorporated within individual contractor scopes.

The Fee element similarly reflect this approach, resulting in a lower overall cost compared to a traditional prime contractor - led delivery model

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 is assumed that the work will be procured directly by building owners through equipment suppliers and vertically integrated specialty contractors, rather than tendered as a single lump sum contract to large prequalified mechanical contractors. Pricing is therefore based on a simplified, trade-driven procurement approach, which may benefit from lower costs due to reduced overheads and streamlined installation scope, but may vary depending on contractor availability and level of coordination by the owner.

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

The design and pricing contingency has been excluded from the estimate. This contingency, when included, is meant to cover design and pricing unknowns in the preparation of an estimate to reflect the incomplete nature of the design information provided at the time the estimate is prepared.

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 excludes a contingency for the construction phase of the project. This contingency, when included, is meant to cover the potential cost of post contract changes that may occur after the project is tendered.

As the contingency is excluded from the estimate, we recommend that at a minimum the owner retain a 3-5% contingency for new construction and a 5-7% contingency for renovation. Where a project is of a complex nature these contingencies should be increased to reflect the risk of changes 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)
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. Building Permit
8. Abatement and handling of asbestos and other hazardous materials
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
13. Direct or indirect impacts of global uncertainty, or related events whether known or unknown at the time of the estimate

5.2 List of Assumptions

Architectural / Structural / Landscaping:

1. Work is assumed to be completed in one continuous phase.
2. We have assumed the relocation of any existing loose furniture prior to demolition (chairs, tables, desks, filing cabinets, etc.) is to be by Owner.
3. Contractor will clean up daily to general housekeeping standards.
4. We have assumed that designated areas with public spaces would be hoarded off from the public to provide construction access for the contractors.
5. No allowance has been included for the removal and reinstatement of existing ceilings to accommodate the proposed AC installation. It is assumed that services will be surface-run and concealed within architectural covers.

Mechanical:

6. Work will be conducted by fair wage contractors.
7. 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.
8. The accuracy of the estimates depends on the information provided. Please note that the cost of mechanical equipment can vary significantly based on factors such as the manufacturer, efficiency, and specifications.
9. Third party tests, certifications etc. are excluded.
10. The estimate includes standard localized thermostatic controls. Facility operator controls and monitoring systems are excluded.
11. Condensate drainage for mini-split systems is assumed to connect to multiple exterior drain risers serving stacked apartments. For PTHP units, condensate is assumed to discharge directly to the building façade.

Electrical:

12. Work will be performed by fair wage labor and during regular hours.
13. Allowance of \$50,000.00 for utility connection for HR MURB, has been included in the estimate.
14. Allowance of \$30,000.00 for utility connection for LR MURB, has been included in the estimate.
15. 1600A 120/208V new main switchboard in HR MURB has been included in the estimate.
16. 600A 120/208V new main switchboard in LR MURB has been included in the estimate.
17. Updating grounding system has been included in the estimate.

18. Rental of 300kW 120/208V diesel generator during power shutdown for HR MURB has been included in the estimate.
19. Rental of 100kW 120/208V diesel generator during power shutdown for LR MURB has been included in the estimate.
20. Refer to the estimate for additional scope specific assumptions.

General:

21. 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.
22. The estimate excludes any premium to account for work in occupied suites/spaces
23. Access control, coordination and escort requirements are excluded.
24. General work related to protection of suites, finishes, hoarding, etc., is included under the prime contractor's general requirements.

6. Documentation Received

Drawings and design documentation were prepared by Introba:

Pages	Documentation	Documentation Received
8 Pages	Costing Brief	March 06,2026
	Emails	Various

MULTIPLE ESTIMATE SUMMARY
COT MECHANICAL COOLING SYSTEM - HR MURB
 Class D Estimate
 APRIL 13, 2026

Estimate Breakdown	Multi Split HP/NG Heating	Multi Split HP/Electric Heating	PTHP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
Construction Costs						
1 Multi Split Heat Pump System	\$3,806,358	\$3,050,005				
Architectural	\$603,600	\$603,600				
Mechanical	\$1,864,500	\$1,864,500				
Electrical	\$897,558	\$228,905				
General Conditions & Requirements	\$440,700	\$353,000				
Contingencies	\$0	\$0				
2 Packaged Terminal Heat Pump System			\$3,807,245	\$2,786,409		
Architectural			\$362,450	\$362,450		
Mechanical			\$1,954,550	\$1,954,550		
Electrical			\$1,049,545	\$146,809		
General Conditions & Requirements			\$440,700	\$322,600		
Contingencies			\$0	\$0		
Total Estimated Construction Costs (nearest ,000)	\$3,806,000	\$3,050,000	\$3,807,000	\$2,786,000		

Construction Costs	Multi Split HP/NG Heating	Multi Split HP/Electric Heating	PTHP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
Hard Costs						
Architectural	\$603,600	\$603,600	\$362,450	\$362,450		
Mechanical	\$1,864,500	\$1,864,500	\$1,954,550	\$1,954,550		
Electrical	\$897,558	\$228,905	\$1,049,545	\$146,809		
General Conditions & Requirements	\$440,700	\$353,000	\$440,700	\$322,600		
Subtotal - Hard Costs	\$3,806,358	\$3,050,005	\$3,807,245	\$2,786,409		
Contingencies						
Design & Pricing	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded
Escalation	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded
Construction	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded
Subtotal - Contingencies						
Hard Costs including Contingencies (nearest ,000)	\$3,806,000	\$3,050,000	\$3,807,000	\$2,786,000		

Separate Options	Multi Split HP/NG Heating	Multi Split HP/Electric Heating	PTHP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
1 Seasonal Cooling, Option1					\$1,300	
Architectural					\$200	
Mechanical					\$950	
Electrical					\$0	
General Conditions & Requirements					\$150	
Contingencies					\$0	
2 Seasonal Cooling, Option2						\$1,130
Architectural						\$0
Mechanical						\$1,000
Electrical						\$0
General Conditions & Requirements						\$130
Contingencies						\$0

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Multi Split Heat Pump System						
<i>Architectural</i>						\$603,600
1	Create opening in exterior wall c/w sleeves, sealant and fireproofing for M&E services	405	NO	\$320.00	\$129,600	
2	Create opening in interior wall for refrigerant piping	255	NO	\$250.00	\$63,750	
3	Allowance for wall blocking to accommodate new indoor split units	405	NO	\$400.00	\$162,000	
4	Allowance for wall bracket to support outdoor units to exterior wall, galvanized	150	NO	\$500.00	\$75,000	
5	Allowance for minor wall surface repair/painting where affected	405	NO	\$50.00	\$20,250	
6	Allowance for surface mounted PVC line set cover/architectural trunking for M&E services	1	LS	\$73,000.00	\$73,000	
7	Allowance for exterior condensate risers, assumed 10 risers total, PVC sch.40 piping	10	NO	\$7,500.00	\$75,000	
8	Temporary working platform, swing stage - assumed one month	1	LS	\$5,000.00	\$5,000	
<i>Mechanical</i>						\$1,864,500
9	Allowance for multi-zone heat pump	1	LS	\$1,433,000.00	\$1,433,000	
9.1	- indoor units, wall mounted - 9,000 BTU/HR	255	NO			included
9.2	- indoor units, wall mounted - 12,000 BTU/HR	150	NO			included
9.3	- Condensing units - 1.5 Tons	75	NO			included
9.4	- Condensing units - 2.25 Tons	45	NO			included
9.5	- Condensing units - 3 Tons	30	NO			included
9.6	- refrigerant piping c/w thermal insulation, line valves, control wiring and accessories including refrigerant charge	1	LS			included
10	Outdoor unit weather proof covers					excluded
11	Common area cooling/heating units are not included					Info Only
12	Existing supplemental heating units, if applicable to remain without any modification					Info Only
13	General allowance					
13.1	- Noise and vibration isolation	1	LS	\$37,500.00	\$37,500	
13.2	- TAB work					N/A
13.3	- Basic start-up and contractor's commissioning	1	LS	\$19,000.00	\$19,000	
13.4	- Rigging, hoisting and material handling	1	LS	\$25,000.00	\$25,000	
13.5	- Condensate drains, scop TBD, assymed PVC drains including:					
13.6	- In-suite evaporator condensate drains c/w traps including connection to new building exterior condensate risers	1	LS	\$120,000.00	\$120,000	
13.7	- Outdoor unit condensate removal c/w drain pan, electric heat tracing and connection to risers	1	LS	\$130,000.00	\$130,000	
13.8	- It is assumed that condensate drains from both indoor/outdoor units will be tied into common riser exterior to building facade discharge at grade					Info Only
14	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.					Included under GC
15	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$100,000.00	\$100,000	
<i>Electrical</i>						\$897,558
16	Utility connection fee					Excluded
17	Transformer concrete pad and grounding	1	NO	\$15,111.90	\$15,112	
18	4-103mm PVC concrete encased ductbank for primary power	20	m	\$640.10	\$12,802	
19	6-103mm PVC concrete encased ductbank for secondary power	30	m	\$913.20	\$27,396	
20	#500 rwu90 secondary conductor	640	m	\$70.20	\$44,928	
21	#2/0 rwu90 secondary ground conductor	160	m	\$21.80	\$3,488	
22	1600A 120/208V main switchboard	1	NO	\$115,400.00	\$115,400	
23	100A 120/208V distribution panel in every floor	15	NO	\$3,000.00	\$45,000	
24	100A feeder	900	m	\$101.05	\$90,945	
25	50A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 3 Tons	30	NO	\$1,150.00	\$34,500	
26	35A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 2.25 Tons	45	NO	\$970.00	\$43,650	
27	25A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 1.5 Tons	75	NO	\$920.00	\$69,000	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
28	Power connection for indoor units	405	NO	\$220.00	\$89,100	
29	Metering system for new feed	150	NO	\$360.00	\$54,000	
30	Remedial work to existing-to-remain equipment, cabling, and supports to accommodate new work	1	LS	\$10,000.00	\$10,000	
31	Update building grounding system	1	LS	\$5,900.00	\$5,900	
32	Rental of 300kW 120/208V diesel generator during power shutdown c/w associated feeders and fuel (14 days assumed)	1	LS	\$97,400.00	\$97,400	
33	Disconnect and remove existing redundant electrical equipment c/w associated feeders	1	LS	\$11,500.00	\$11,500	
34	General Requirements including:					\$127,437
34.1	- Supervision	1	LS	\$42,531.00	\$42,531	
34.3	- Job set-up, etc.	1	LS	\$56,604.00	\$56,604	
34.4	- Rentals, small tools, etc.	1	LS	\$16,173.00	\$16,173	
34.5	- Permits & inspections	1	LS	\$10,512.00	\$10,512	
34.6	- Insurance	1	LS	\$1,617.00	\$1,617	
	Subtotal 1				\$3,365,658	
35	Prime Contractor's General Requirements	1	LS	\$202,000	\$202,000	6.0%
36	Building permit				Excluded	
37	General Liability and Builder's Risk insurance	1	LS	\$24,000	\$24,000	
38	Labour & Material and Performance bonding	1	LS	\$33,700	\$33,700	
39	Miscellaneous Allowances, premium for loss of productivity				Excluded	
40	Prime Contractor's Fee	1	LS	\$181,000	\$181,000	5.0%
	Subtotal 2				\$3,806,358	
41	Design & Pricing Contingency				Excluded	0.0%
42	Escalation Contingency				Excluded	0.0%
43	Construction Contingency (Post Contract)				Excluded	0.0%
	Total for Multi Split Heat Pump System				\$3,806,358	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Multi Split Heat Pump System						
<i>Architectural</i>						\$603,600
1	Create opening in exterior wall c/w sleeves, sealant and fireproofing for M&E services	405	NO	\$320.00	\$129,600	
2	Create opening in interior wall for refrigerant piping	255	NO	\$250.00	\$63,750	
3	Allowance for wall blocking to accommodate new indoor split units	405	NO	\$400.00	\$162,000	
4	Allowance for wall bracket to support outdoor units to exterior wall, galvanized	150	NO	\$500.00	\$75,000	
5	Allowance for minor wall surface repair/painting where affected	405	NO	\$50.00	\$20,250	
6	Allowance for surface mounted PVC line set cover/architectural trunking for M&E services	1	LS	\$73,000.00	\$73,000	
7	Allowance for exterior condensate risers, assumed 10 risers total, PVC sch.40 piping	10	NO	\$7,500.00	\$75,000	
8	Temporary working platform, swing stage - assumed one month	1	LS	\$5,000.00	\$5,000	
<i>Mechanical</i>						\$1,864,500
9	Allowance for multi-zone heat pump	1	LS	\$1,433,000.00	\$1,433,000	
9.1	- indoor units, wall mounted - 9,000 BTU/HR	255	NO			included
9.2	- indoor units, wall mounted - 12,000 BTU/HR	150	NO			included
9.3	- Condensing units - 1.5 Tons	75	NO			included
9.4	- Condensing units - 2.25 Tons	45	NO			included
9.5	- Condensing units - 3 Tons	30	NO			included
9.6	- refrigerant piping c/w thermal insulation, line valves, control wiring and accessories including refrigerant charge	1	LS			included
10	Outdoor unit weather proof covers					excluded
11	Common area cooling/heating units are not included					Info Only
12	Existing supplemental heating units, if applicable to remain without any modification					Info Only
13	General allowance					
13.1	- Noise and vibration isolation	1	LS	\$37,500.00	\$37,500	
13.2	- TAB work					N/A
13.3	- Basic start-up and contractor's commissioning	1	LS	\$19,000.00	\$19,000	
13.4	- Rigging, hoisting and material handling	1	LS	\$25,000.00	\$25,000	
13.5	- Condensate drains, scop TBD, assymed PVC drains including:					
13.6	- In-suite evaporator condensate drains c/w traps including connection to new building exterior condensate risers	1	LS	\$120,000.00	\$120,000	
13.7	- Outdoor unit condensate removal c/w drain pan, electric heat tracing and connection to risers	1	LS	\$130,000.00	\$130,000	
13.8	- It is assumed that condensate drains from both indoor/outdoor units will be tied into common riser exterior to building facade discharge at grade					Info Only
14	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.					Included under GC
15	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$100,000.00	\$100,000	
<i>Electrical</i>						\$228,905
16	Remedial work to existing suite panels including adding breakers and updating directories	150	NO	\$250.00	\$37,500	
17	50A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 3 Tons	30	NO	\$620.00	\$18,600	
18	35A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 2.25 Tons	45	NO	\$370.00	\$16,650	
19	25A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 1.5 Tons	75	NO	\$360.00	\$27,000	
20	Power connection for indoor units	405	NO	\$220.00	\$89,100	
21	General Requirements including:					\$40,055
21.1	- Supervision	1	LS	\$19,234.00	\$19,234	
21.3	- Job set-up, etc.	1	LS	\$13,880.00	\$13,880	
21.4	- Rentals, small tools, etc.	1	LS	\$3,966.00	\$3,966	
21.5	- Permits & inspections	1	LS	\$2,578.00	\$2,578	
21.6	- Insurance	1	LS	\$397.00	\$397	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Subtotal 1					\$2,697,005	
22	Prime Contractor's General Requirements	1	LS	\$162,000	\$162,000	6.0%
23	Building permit				Excluded	
24	General Liability and Builder's Risk insurance	1	LS	\$19,000	\$19,000	
25	Labour & Material and Performance bonding	1	LS	\$27,000	\$27,000	
26	Miscellaneous Allowances, premium for loss of productivity				Excluded	
27	Prime Contractor's Fee	1	LS	\$145,000	\$145,000	5.0%
Subtotal 2					\$3,050,005	
28	Design & Pricing Contingency				Excluded	0.0%
29	Escalation Contingency				Excluded	0.0%
30	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Multi Split Heat Pump System					\$3,050,005	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Packaged Terminal Heat Pump System						
<i>Architectural</i>						\$362,450
1	Allowance for exterior wall core drilling for PTHPs including fireproofing and sealing, 2 x 6" core drill opening per PTHP	810	NO	\$320.00	\$259,200	
2	PTHP is assumed to be surface mounted on drywall to wood studs, hence not requiring any modifications to surface to accommodate these units					Info Only
3	Allowance for minor wall surface repair/painting where affected	405	NO	\$50.00	\$20,250	
4	Allowance for surface mounted PVC line set cover/architectural trunking for electrical service	1	LS	\$73,000.00	\$73,000	
5	Temporary working platform, swing stage - assumed two month	1	LS	\$10,000.00	\$10,000	
<i>Mechanical</i>						\$1,954,550
6	Allowance for PTHPs equal to Innova 12HP					
6.1	- 1 bedroom units	150	NO	\$4,310.00	\$646,500	
6.2	- 2 bedroom units	135	NO	\$4,310.00	\$581,850	
6.3	- 3 bedroom units	120	NO	\$4,310.00	\$517,200	
7	Common area cooling/heating units are not included					Info Only
8	Existing supplemental heating units, if applicable to remain without any modification					Info Only
9	General allowance					
9.1	- TAB work					N/A
9.2	- Basic start-up and contractor's commissioning	1	LS	\$14,000.00	\$14,000	
9.3	- Rigging, hoisting and material handling	1	LS	\$14,000.00	\$14,000	
9.4	- Condensate drains, heat traced drain tube	405	NO	\$200.00	\$81,000	
10	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.					Included under GC
11	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$100,000.00	\$100,000	
<i>Electrical</i>						\$1,049,545
12	Utility connection fee					Excluded
13	Transformer concrete pad and grounding	1	NO	\$15,111.90	\$15,112	
14	4-103mm PVC concrete encased ductbank for primary power	20	m	\$640.10	\$12,802	
15	6-103mm PVC concrete encased ductbank for secondary power	30	m	\$913.20	\$27,396	
16	#500 rwu90 secondary conductor	640	m	\$70.20	\$44,928	
17	#2/0 rwu90 secondary ground conductor	160	m	\$21.80	\$3,488	
18	1600A 120/208V main switchboard	1	NO	\$115,400.00	\$115,400	
19	100A 120/208V distribution panel in every floor	15	NO	\$3,600.00	\$54,000	
20	100A feeder	900	m	\$101.05	\$90,945	
21	25A 208V power connection with line and load side wiring and disconnect switch for PTHP	405	NO	\$870.00	\$352,350	
22	Metering system for new feed	150	NO	\$360.00	\$54,000	
23	Remedial work to existing-to-remain equipment, cabling, and supports to accommodate new work	1	LS	\$10,000.00	\$10,000	
24	Update building grounding system	1	LS	\$5,900.00	\$5,900	
25	Rental of 300kW 120/208V diesel generator during power shutdown c/w associated feeders and fuel (14 days assumed)	1	LS	\$97,400.00	\$97,400	
26	Disconnect and remove existing redundant electrical equipment c/w associated feeders	1	LS	\$11,500.00	\$11,500	
27	General Requirements including:					\$154,324
27.1	- Supervision	1	LS	\$55,625.00	\$55,625	
27.3	- Job set-up, etc.	1	LS	\$65,799.00	\$65,799	
27.4	- Rentals, small tools, etc.	1	LS	\$18,800.00	\$18,800	
27.5	- Permits & inspections	1	LS	\$12,220.00	\$12,220	
27.6	- Insurance	1	LS	\$1,880.00	\$1,880	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Subtotal 1					\$3,366,545	
28	Prime Contractor's General Requirements	1	LS	\$202,000	\$202,000	6.0%
29	Building permit				Excluded	
30	General Liability and Builder's Risk insurance	1	LS	\$24,000	\$24,000	
31	Labour & Material and Performance bonding	1	LS	\$33,700	\$33,700	
32	Miscellaneous Allowances				Excluded	
33	Prime Contractor's Fee	1	LS	\$181,000	\$181,000	5.0%
Subtotal 2					\$3,807,245	
34	Design & Pricing Contingency				Excluded	0.0%
35	Escalation Contingency				Excluded	0.0%
36	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Packaged Terminal Heat Pump System					\$3,807,245	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Packaged Terminal Heat Pump System						
<i>Architectural</i>						\$362,450
1	Allowance for exterior wall core drilling for PTHPs including fireproofing and sealing, 2 x 6" core drill opening per PTHP	810	NO	\$320.00	\$259,200	
2	PTHP is assumed to be surface mounted on drywall to wood studs, hence not requiring any modifications to surface to accommodate these units				Info Only	
3	Allowance for minor wall surface repair/painting where affected	405	NO	\$50.00	\$20,250	
4	Allowance for surface mounted PVC line set cover/architectural trunking for electrical service	1	LS	\$73,000.00	\$73,000	
5	Temporary working platform, swing stage - assumed two month	1	LS	\$10,000.00	\$10,000	
<i>Mechanical</i>						\$1,954,550
6	Allowance for PTHPs equal to Innova 12HP					
6.1	- 1 bedroom units	150	NO	\$4,310.00	\$646,500	
6.2	- 2 bedroom units	135	NO	\$4,310.00	\$581,850	
6.3	- 3 bedroom units	120	NO	\$4,310.00	\$517,200	
7	Common area cooling/heating units are not included				Info Only	
8	Existing supplemental heating units, if applicable to remain without any modification				Info Only	
9	General allowance					
9.1	- TAB work				N/A	
9.2	- Basic start-up and contractor's commissioning	1	LS	\$14,000.00	\$14,000	
9.3	- Rigging, hoisting and material handling	1	LS	\$14,000.00	\$14,000	
9.4	- Condensate drains, heat traced drain tube	405	NO	\$200.00	\$81,000	
10	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.				Included under GC	
11	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$100,000.00	\$100,000	
<i>Electrical</i>						\$146,809
12	Remedial work to existing suite panels including adding breakers and updating directories	150	NO	\$210.00	\$31,500	
13	Power connection for PTHP	405	NO	\$220.00	\$89,100	
14	General Requirements including:					\$26,209
14.1	- Supervision	1	LS	\$12,913.00	\$12,913	
14.3	- Job set-up, etc.	1	LS	\$8,864.00	\$8,864	
14.4	- Rentals, small tools, etc.	1	LS	\$2,533.00	\$2,533	
14.5	- Permits & inspections	1	LS	\$1,646.00	\$1,646	
14.6	- Insurance	1	LS	\$253.00	\$253	
Subtotal 1					\$2,463,809	
15	Prime Contractor's General Requirements	1	LS	\$148,000	\$148,000	6.0%
16	Building permit				Excluded	
17	General Liability and Builder's Risk insurance	1	LS	\$17,000	\$17,000	
18	Labour & Material and Performance bonding	1	LS	\$24,600	\$24,600	
19	Miscellaneous Allowances				Excluded	
20	Prime Contractor's Fee	1	LS	\$133,000	\$133,000	5.0%
Subtotal 2					\$2,786,409	
21	Design & Pricing Contingency				Excluded	0.0%
22	Escalation Contingency				Excluded	0.0%
23	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Packaged Terminal Heat Pump System					\$2,786,409	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option1						
<i>Architectural</i>						
						\$200
1	Allowance for mounting hardware including sleeve and sealing kit	1	NO	\$200.00	\$200	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						
						\$950
3	Allowance for Window AC unit c/w mounting bracket, 6,000-10,000 Btu/hr	1	NO	\$700.00	\$700	
4	Seasonal removal	1	NO	\$150.00	\$150	
5	General allowance					
5.1	- Rigging, hoisting and material handling	1	LS	\$100.00	\$100	
5.2	- Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.				Included under GC	
<i>Electrical</i>						
						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$1,150	
8	Prime Contractor's General Requirements	1	LS	\$70	\$70	6.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	\$10	\$10	
11	Labour & Material and Performance bonding	1	LS	\$10	\$10	
12	Miscellaneous Allowances, premium for loss of productivity				Excluded	
13	Prime Contractor's Fee	1	LS	\$60	\$60	5.0%
Subtotal 2					\$1,300	
14	Design & Pricing Contingency				Excluded	0.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Seasonal Cooling, Option1					\$1,300	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option2						
<i>Architectural</i>						\$0
1	Allowance for sleeve and sealing kit (included in the cost)				Info Only	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						\$1,000
3	Allowance for portable AC unit c/w vent and sealing kit, hose, 6,000-10,000 Btu/hr	1	NO	\$900.00	\$900	
4	Seasonal removal	1	NO	\$100.00	\$100	
5	Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.				Included under GC	
<i>Electrical</i>						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$1,000	
8	Prime Contractor's General Requirements	1	LS	\$60	\$60	6.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	\$10	\$10	
11	Labour & Material and Performance bonding	1	LS	\$10	\$10	
12	Miscellaneous Allowances, premium for loss of productivity				Excluded	
13	Prime Contractor's Fee	1	LS	\$50	\$50	5.0%
Subtotal 2					\$1,130	
14	Design & Pricing Contingency				Excluded	0.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Seasonal Cooling, Option2					\$1,130	

MULTIPLE ESTIMATE SUMMARY
COT MECHANICAL COOLING SYSTEM - LR MURB
 Class D Estimate
 APRIL 13, 2026

Estimate Breakdown Construction Costs	Multi Split HP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
1 Multi Split Heat Pump System	\$1,154,910			
Architectural	\$154,160			
Mechanical	\$494,000			
Electrical	\$373,550			
General Conditions & Requirements	\$133,200			
Contingencies	\$0			
2 Packaged Terminal Heat Pump System		\$843,133		
Architectural		\$103,520		
Mechanical		\$525,080		
Electrical		\$43,133		
General Conditions & Requirements		\$171,400		
Contingencies		\$0		
Total Estimated Construction Costs (nearest ,000)	\$1,155,000	\$843,000		

Construction Costs	Multi Split HP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
Hard Costs				
Architectural	\$154,160	\$103,520		
Mechanical	\$494,000	\$525,080		
Electrical	\$373,550	\$43,133		
General Conditions & Requirements	\$133,200	\$171,400		
Subtotal - Hard Costs	\$1,154,910	\$843,133		
Contingencies				
Design & Pricing	Excluded	Excluded	Excluded	Excluded
Escalation	Excluded	Excluded	Excluded	Excluded
Construction	Excluded	Excluded	Excluded	Excluded
Subtotal - Contingencies				
Hard Costs including Contingencies (nearest ,000)	\$1,155,000	\$843,000		

Separate Options	Multi Split HP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
1 Seasonal Cooling, Option1			\$1,300	
Architectural			\$200	
Mechanical			\$950	
Electrical			\$0	
General Conditions & Requirements			\$150	
Contingencies			\$0	
2 Seasonal Cooling, Option2				\$1,130
Architectural				\$0
Mechanical				\$1,000
Electrical				\$0
General Conditions & Requirements				\$130
Contingencies				\$0

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Multi Split Heat Pump System						
<i>Architectural</i>						\$154,160
1	Create opening in exterior wall c/w sleeves, sealant and fireproofing for M&E services	108	NO	\$320.00	\$34,560	
2	Create opening in interior wall for refrigerant piping	68	NO	\$250.00	\$17,000	
3	Allowance for wall blocking to accommodate new indoor split units	108	NO	\$400.00	\$43,200	
4	Allowance for wall bracket to support outdoor units to exterior wall, galvanized	20	NO	\$500.00	\$10,000	
5	Allowance for minor wall surface repair/painting where affected	108	NO	\$50.00	\$5,400	
6	Allowance for surface mounted PVC line set cover/architectural trunking for M&E services	1	LS	\$19,000.00	\$19,000	
7	Allowance for exterior condensate risers, assumed 10 risers total, PVC sch.40 piping	10	NO	\$2,000.00	\$20,000	
8	Temporary working platform, swing stage - assumed one month	1	LS	\$5,000.00	\$5,000	
<i>Mechanical</i>						\$494,000
9	Allowance for multi-zone heat pump	1	LS	\$382,000.00	\$382,000	
9.1	- indoor units, wall mounted - 9,000 BTU/HR	68	NO			included
9.2	- indoor units, wall mounted - 12,000 BTU/HR	40	NO			included
9.3	- Condensing units - 1.5 Tons	20	NO			included
9.4	- Condensing units - 2.25 Tons	12	NO			included
9.5	- Condensing units - 3 Tons	8	NO			included
9.6	- refrigerant piping c/w thermal insulation, line valves, control wiring and accessories including refrigerant charge	1	LS			included
10	Outdoor unit weather proof covers					excluded
11	Common area cooling/heating units are not included					Info Only
12	Existing supplemental heating units, if applicable to remain without any modification					Info Only
13	General allowance					
13.1	- Noise and vibration isolation	1	LS	\$10,000.00	\$10,000	
13.2	- TAB work					N/A
13.3	- Basic start-up and contractor's commissioning	1	LS	\$5,000.00	\$5,000	
13.4	- Rigging, hoisting and material handling	1	LS	\$7,000.00	\$7,000	
13.5	- Condensate drains, scop TBD, assumed PVC drains including:					
13.6	- In-suite evaporator condensate drains c/w traps including connection to new building exterior condensate risers	1	LS	\$30,000.00	\$30,000	
13.7	- Outdoor unit condensate removal c/w drain pan, electric heat tracing and connection to risers	1	LS	\$30,000.00	\$30,000	
13.8	- It is assumed that condensate drains from both indoor/outdoor units will be tied into common riser exterior to building facade discharge at grade					Info Only
14	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.					Included under GC
15	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$30,000.00	\$30,000	
<i>Electrical</i>						\$373,550
16	Utility connection fee					Excluded
17	Transformer concrete pad and grounding	1	NO	\$10,700.00	\$10,700	
18	2-103mm PVC concrete encased ductbank for primary power	20	m	\$386.70	\$7,734	
19	3-103mm PVC concrete encased ductbank for secondary power	30	m	\$511.60	\$15,348	
20	#350 rwu90 secondary conductor	640	m	\$49.10	\$31,424	
21	#1/0 rwu90 secondary ground conductor	160	m	\$18.00	\$2,880	
22	600A 120/208V main switchboard	1	NO	\$71,500.00	\$71,500	
23	150A 120/208V distribution panel in every floor	4	NO	\$3,400.00	\$13,600	
24	150A feeder	130	m	\$123.38	\$16,039	
25	50A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 3 Tons	8	NO	\$1,150.00	\$9,200	
26	35A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 2.25 Tons	12	NO	\$970.00	\$11,640	
27	25A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 1.5 Tons	20	NO	\$920.00	\$18,400	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
28	Power connection for indoor units	108	NO	\$220.00	\$23,760	
29	Metering system for new feed	40	NO	\$360.00	\$14,400	
30	Remedial work to existing-to-remain equipment, cabling, and supports to accommodate new work	1	LS	\$2,500.00	\$2,500	
31	Update building grounding system	1	LS	\$1,800.00	\$1,800	
32	Rental of 100kW 120/208V diesel generator during power shutdown c/w associated feeders and fuel (14 days assumed)	1	LS	\$66,400.00	\$66,400	
33	Disconnect and remove existing redundant electrical equipment c/w associated feeders	1	LS	\$7,500.00	\$7,500	
34	General Requirements including:					\$48,725
34.1	- Supervision	1	LS	\$12,913.00	\$12,913	
34.3	- Job set-up, etc.	1	LS	\$23,875.00	\$23,875	
34.4	- Rentals, small tools, etc.	1	LS	\$6,821.00	\$6,821	
34.5	- Permits & inspections	1	LS	\$4,434.00	\$4,434	
34.6	- Insurance	1	LS	\$682.00	\$682	
	Subtotal 1				\$1,021,710	
35	Prime Contractor's General Requirements	1	LS	\$61,000	\$61,000	6.0%
36	Building permit				Excluded	
37	General Liability and Builder's Risk insurance	1	LS	\$7,000	\$7,000	
38	Labour & Material and Performance bonding	1	LS	\$10,200	\$10,200	
39	Miscellaneous Allowances, premium for loss of productivity				Excluded	
40	Prime Contractor's Fee	1	LS	\$55,000	\$55,000	5.0%
	Subtotal 2				\$1,154,910	
41	Design & Pricing Contingency				Excluded	0.0%
42	Escalation Contingency				Excluded	0.0%
43	Construction Contingency (Post Contract)				Excluded	0.0%
	Total for Multi Split Heat Pump System				\$1,154,910	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Packaged Terminal Heat Pump System						
<i>Architectural</i>						\$103,520
1	Allowance for exterior wall core drilling for PTHPs including fireproofing and sealing, 2 x 6" core drill opening per PTHP	216	NO	\$320.00	\$69,120	
2	PTHP is assumed to be surface mounted on drywall to wood studs, hence not requiring any modifications to surface to accommodate these units				Info Only	
3	Allowance for minor wall surface repair/painting where affected	108	NO	\$50.00	\$5,400	
4	Allowance for surface mounted PVC line set cover/architectural trunking for electrical service	1	LS	\$19,000.00	\$19,000	
5	Temporary working platform, swing stage - assumed two month	1	LS	\$10,000.00	\$10,000	
<i>Mechanical</i>						\$525,080
6	Allowance for PTHPs equal to Innova 12HP					
6.1	- 1 bedroom units	40	NO	\$4,310.00	\$172,400	
6.2	- 2 bedroom units	36	NO	\$4,310.00	\$155,160	
6.3	- 3 bedroom units	32	NO	\$4,310.00	\$137,920	
7	Common area cooling/heating units are not included				Info Only	
8	Existing supplemental heating units, if applicable to remain without any modification				Info Only	
9	General allowance					
9.1	- TAB work				N/A	
9.2	- Basic start-up and contractor's commissioning	1	LS	\$4,000.00	\$4,000	
9.3	- Rigging, hoisting and material handling	1	LS	\$4,000.00	\$4,000	
9.4	- Condensate drains, heat traced drain tube	108	NO	\$200.00	\$21,600	
10	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.				Included under GC	
11	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$30,000.00	\$30,000	
<i>Electrical</i>						\$43,133
12	Remedial work to existing suite panels including adding breakers and updating directories	40	NO	\$300.00	\$12,000	
13	Power connection for PTHP	108	NO	\$220.00	\$23,760	
14	General Requirements including:					\$7,373
14.1	- Supervision	1	LS	\$3,431.00	\$3,431	
14.3	- Job set-up, etc.	1	LS	\$2,628.00	\$2,628	
14.4	- Rentals, small tools, etc.	1	LS	\$751.00	\$751	
14.5	- Permits & inspections	1	LS	\$488.00	\$488	
14.6	- Insurance	1	LS	\$75.00	\$75	
Subtotal 1					\$671,733	
15	Prime Contractor's General Requirements	1	LS	\$40,000	\$40,000	6.0%
16	Building permit				Excluded	
17	General Liability and Builder's Risk insurance	1	LS	\$4,700	\$4,700	
18	Labour & Material and Performance bonding	1	LS	\$6,700	\$6,700	
19	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$80,000.00	\$80,000	
20	Prime Contractor's Fee	1	LS	\$40,000	\$40,000	5.0%
Subtotal 2					\$843,133	
21	Design & Pricing Contingency				Excluded	0.0%
22	Escalation Contingency				Excluded	0.0%
23	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Packaged Terminal Heat Pump System					\$843,133	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option1						
<i>Architectural</i>						
						\$200
1	Allowance for sleeve and sealing kit	1	NO	\$200.00	\$200	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						
						\$950
3	Allowance for Window AC unit c/w mounting bracket, 6,000-10,000 Btu/hr	1	NO	\$700.00	\$700	
4	Seasonal removal	1	NO	\$150.00	\$150	
5	General allowance					
5.1	- Rigging, hoisting and material handling	1	LS	\$100.00	\$100	
5.2	- Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.				Included under GC	
<i>Electrical</i>						
						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$1,150	
8	Prime Contractor's General Requirements	1	LS	\$70	\$70	6.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	\$10	\$10	
11	Labour & Material and Performance bonding	1	LS	\$10	\$10	
12	Miscellaneous Allowances, premium for loss of productivity				Excluded	
13	Prime Contractor's Fee	1	LS	\$60	\$60	5.0%
Subtotal 2					\$1,300	
14	Design & Pricing Contingency				Excluded	0.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Seasonal Cooling, Option1					\$1,300	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option2						
<i>Architectural</i>						\$0
1	Allowance for sleeve and sealing kit (included in the cost)				Info Only	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						\$1,000
3	Allowance for portable AC unit c/w vent and sealing kit, hose, 6,000-10,000 Btu/hr	1	NO	\$900.00	\$900	
4	Seasonal removal	1	NO	\$100.00	\$100	
5	Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.				Included under GC	
<i>Electrical</i>						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$1,000	
8	Prime Contractor's General Requirements	1	LS	\$60	\$60	6.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	\$10	\$10	
11	Labour & Material and Performance bonding	1	LS	\$10	\$10	
12	Miscellaneous Allowances, premium for loss of productivity				Excluded	
13	Prime Contractor's Fee	1	LS	\$50	\$50	5.0%
Subtotal 2					\$1,130	
14	Design & Pricing Contingency				Excluded	0.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Seasonal Cooling, Option2					\$1,130	

MULTIPLE ESTIMATE SUMMARY
COT MECHANICAL COOLING SYSTEM - SINGLE
FAMILY/ROWHOUSE/TOWNHOUSE
 Class D Estimate
 APRIL 13, 2026



Estimate Breakdown	Furnace w/ central AC unit	Furnace w/ central ASHP	Window AC	Portable AC
Construction Costs				
1 Retrofit Existing System w/ NG Heating and Electric Cooling, Evaporator Coil to Existing Furnace	\$16,087			
Architectural	\$820			
Mechanical	\$14,200			
Electrical	\$1,067			
General Conditions & Requirements	\$0			
Contingencies	\$0			
2 Retrofit Existing System w/ Electric Heating/Cooling and Second Stage NG Heating, Evaporator Coil to Existing Furnace		\$20,992		
Architectural		\$820		
Mechanical		\$18,550		
Electrical		\$1,622		
General Conditions & Requirements		\$0		
Contingencies		\$0		
Total Estimated Construction Costs (nearest ,000)	\$16,000	\$21,000		

MULTIPLE ESTIMATE SUMMARY
COT MECHANICAL COOLING SYSTEM - SINGLE
FAMILY/ROWHOUSE/TOWNHOUSE
 Class D Estimate
 APRIL 13, 2026



Estimate Breakdown	Furnace w/ central AC unit	Furnace w/ central ASHP	Window AC	Portable AC
Construction Costs				
Construction Costs				
Hard Costs				
Architectural	\$820	\$820		
Mechanical	\$14,200	\$18,550		
Electrical	\$1,067	\$1,622		
General Conditions & Requirements	\$0	\$0		
Subtotal - Hard Costs	\$16,087	\$20,992		
Contingencies				
Design & Pricing	Excluded	Excluded	Excluded	Excluded
Escalation	Excluded	Excluded	Excluded	Excluded
Construction	Excluded	Excluded	Excluded	Excluded
Subtotal - Contingencies				
Hard Costs including Contingencies (nearest ,000)	\$16,000	\$21,000		
Separate Options				
1 Seasonal Cooling, Option1			\$1,150	
Architectural			\$200	
Mechanical			\$950	
Electrical			\$0	
General Conditions & Requirements			\$0	
Contingencies			\$0	
2 Seasonal Cooling, Option2				\$1,000
Architectural				\$0
Mechanical				\$1,000
Electrical				\$0
General Conditions & Requirements				\$0
Contingencies				\$0

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Retrofit Existing System w/ NG Heating and Electric Cooling, Evaporator Coil to Existing Furnace						
<i>Architectural</i>						\$820
1	Exterior wall service penetration for M&E services including fireproofing and sealant	1	NO	\$320.00	\$320	
2	New supports for condensing units	1	NO	\$500.00	\$500	
3	Assumed unfinished basement				Info Only	
<i>Mechanical</i>						\$14,200
4	Allowance for modification of existing air conditioning system including:	1	NO	\$11,000.00	\$11,000	
4.1	- out door condensing unit					
4.2	- duct mounted evaporator coil					
4.3	- refrigerant line, accessories and refrigerant charge ~ 8m - 10m refrigerant line					
4.4	- existing furnace unit to remain as a second stage heating				Info Only	
5	Allowance for air distribution including					
5.1	- sheet metal modification to the existing system	40	KG	\$30.00	\$1,200	
5.2	- thermal insulation				assume not required	
5.3	- air diffusion devices				existing to remain	
5.4	- miscellaneous ductwork components	1	LS	\$100.00	\$100	
6	Allowance for demolition of obsolete duct work to suit	1	LS	\$150.00	\$150	
7	General allowance					
7.1	- noise and vibration isolation	1	LS	\$250.00	\$250	
7.2	- TAB work	1	LS	\$150.00	\$150	
7.3	- basic start-up and contractor's commissioning	1	LS	\$100.00	\$100	
7.4	- rigging, hoisting and material handling	1	LS	\$250.00	\$250	
7.5	- condensate/relief/system drains terminated to existing drain	1	LS	\$250.00	\$250	
8	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.				Included under GC	
9	Allowance for thermostatic controls/interlock wiring and staging	1	LS	\$750.00	\$750	
<i>Electrical</i>						\$1,067
10	Remedial work to existing suite panels including adding breakers and updating directories	2	NO	\$120.00	\$240	
11	30A 240V power connection for outdoor unit	2	NO	\$320.00	\$640	
12	General Requirements including:					\$187
12.1	- Supervision	1	LS	\$90.00	\$90	
12.3	- Job set-up, etc.	1	LS	\$65.00	\$65	
12.4	- Rentals, small tools, etc.	1	LS	\$18.00	\$18	
12.5	- Permits & inspections	1	LS	\$12.00	\$12	
12.6	- Insurance	1	LS	\$2.00	\$2	
Subtotal 1						\$16,087
13	Prime Contractor's General Requirements				Included	
14	Building permit				Excluded	
15	General Liability and Builder's Risk insurance				Included	
16	Labour & Material and Performance bonding				Included	
17	Miscellaneous Allowances, premium for loss of productivity				Excluded	
18	Prime Contractor's Fee				Included	
Subtotal 2						\$16,087
19	Design & Pricing Contingency				Excluded	0.0%
20	Escalation Contingency				Excluded	0.0%
21	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Retrofit Existing System w/ NG Heating and Electric Cooling, Evaporator Coil to Existing Furnace						\$16,087

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Retrofit Existing System w/ Electric Heating/Cooling and Second Stage NG Heating, Evaporator Coil to Existing Furnace						
<i>Architectural</i>						\$820
1	Exterior wall service penetration for M&E services including fireproofing and sealant	1	NO	\$320.00	\$320	
2	New supports for condensing units	1	NO	\$500.00	\$500	
3	Assumed unfinished basement				Info Only	
<i>Mechanical</i>						\$18,550
4	Allowance for modification of existing air conditioning system including:	1	NO	\$14,500.00	\$14,500	
4.1	- new cold climate heat pump condensing unit					
4.2	- duct mounted evaporator coil					
4.3	- refrigerant line, accessories and refrigerant charge ~ 8m - 10m refrigerant line					
4.4	- existing furnace unit to remain as a second stage heating				Info Only	
5	Allowance for air distribution including					
5.1	- sheet metal modification to the existing system	40	KG	\$30.00	\$1,200	
5.2	- thermal insulation				assume not required	
5.3	- air diffusion devices				existing to remain	
5.4	- miscellaneous ductwork components	1	LS	\$100.00	\$100	
6	Allowance for demolition of obsolete duct work to suit	1	LS	\$150.00	\$150	
7	General allowance					
7.1	- noise and vibration isolation	1	LS	\$250.00	\$250	
7.2	- TAB work	1	LS	\$150.00	\$150	
7.3	- basic start-up and contractor's commissioning	1	LS	\$200.00	\$200	
7.4	- rigging, hoisting and material handling	1	LS	\$250.00	\$250	
7.5	- condensate/relief/system drains terminated to existing drain	1	LS	\$250.00	\$250	
8	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.				Included under GC	
9	Allowance for thermostatic controls/interlock wiring and staging	1	LS	\$1,500.00	\$1,500	
<i>Electrical</i>						\$1,622
10	Remedial work to existing suite panels including adding breakers and updating directories	2	NO	\$150.00	\$300	
11	50A 240V power connection for heat pump	2	NO	\$540.00	\$1,080	
12	General Requirements including:					\$242
12.1	- Supervision	1	LS	\$90.00	\$90	
12.3	- Job set-up, etc.	1	LS	\$101.00	\$101	
12.4	- Rentals, small tools, etc.	1	LS	\$29.00	\$29	
12.5	- Permits & inspections	1	LS	\$19.00	\$19	
12.6	- Insurance	1	LS	\$3.00	\$3	
Subtotal 1					\$20,992	
13	Prime Contractor's General Requirements				Included	
14	Building permit				Excluded	
15	General Liability and Builder's Risk insurance				Included	
16	Labour & Material and Performance bonding				Included	
17	Miscellaneous Allowances, premium for loss of productivity				Excluded	
18	Prime Contractor's Fee				Included	
Subtotal 2					\$20,992	
19	Design & Pricing Contingency				Excluded	0.0%
20	Escalation Contingency				Excluded	0.0%
21	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Retrofit Existing System w/ Electric Heating/Cooling and Second Stage NG Heating, Evaporator Coil to Existing Furnace					\$20,992	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option1						
<i>Architectural</i>						
						\$200
1	Allowance for sleeve and sealing kit	1	NO	\$200.00	\$200	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						
						\$950
3	Allowance for Window AC unit c/w mounting bracket, 6,000-10,000 Btu/hr	1	NO	\$700.00	\$700	
4	Seasonal removal	1	NO	\$150.00	\$150	
5	General allowance					
5.1	- Rigging, hoisting and material handling	1	LS	\$100.00	\$100	
5.2	- Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.				Included under GC	
<i>Electrical</i>						
						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$1,150	
8	Prime Mechanical Contractor's General Requirements				Included	
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance				Included	
11	Labour & Material and Performance bonding				Included	
12	Miscellaneous Allowances, premium for loss of productivity				Excluded	
13	Prime Contractor's Fee				Included	
Subtotal 2					\$1,150	
14	Design & Pricing Contingency				Excluded	0.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Seasonal Cooling, Option1					\$1,150	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option2						
<i>Architectural</i>						\$0
1	Allowance for sleeve and sealing kit (included in the cost)				Info Only	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						\$1,000
3	Allowance for portable AC unit c/w vent and sealing kit, hose, 6,000-10,000 Btu/hr	1	NO	\$900.00	\$900	
4	Seasonal removal	1	NO	\$100.00	\$100	
5	Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.				Included under GC	
<i>Electrical</i>						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$1,000	
8	Prime Mechanical Contractor's General Requirements				Included	
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance				Included	
11	Labour & Material and Performance bonding				Included	
12	Miscellaneous Allowances, premium for loss of productivity				Excluded	
13	Prime Contractor's Fee				Included	
Subtotal 2					\$1,000	
14	Design & Pricing Contingency				Excluded	0.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)				Excluded	0.0%
Total for Seasonal Cooling, Option2					\$1,000	

City of Toronto Mechanical Cooling Systems

Class D Estimate (Rev.0)



Prepared for:
Inroba

Prepared by:

A.W. HOOKER®
QUANTITY SURVEYORS

2904 South Sheridan Way, Suite 202
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March 24, 2026

Introba
380 Wellington St W. Toronto,
ON M5V 1E3

Attn: Eric Campbell, P.Eng., Associate

Re: City of Toronto Mechanical Cooling Systems – Class D Estimates (R0)

Dear Eric,

Please find enclosed our Class D Estimate for the above project. The estimate is based on design drawings and information provided by Introba received on March 06, 2026.

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



Bineesh Susamma, PMP, PQS
Associate (Mechanical)

Sincerely,
A.W. Hooker Associates Ltd



Greg Babiak, PQS
Principal (Mechanical)

Encl. (Class D Estimate – March 24, 2026)

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1. Introduction to the Estimate

1.1 Project Description

This study involves a retrofit analysis of seven (7) existing building archetypes across the following three categories, with the objective of identifying the most effective strategies for incorporating mechanical cooling systems. This report focuses specifically on mechanical scopes:

1. Single Family Dwelling
2. High Rise MURB
3. Low Rise MURB

1.2 Type of Estimate

This Class D Estimate is intended to establish a realistic elemental estimate of the hard construction costs based on the level of design information provided. Detailed quantities have been measured from drawings where possible for the proposed building (excluding site). This estimate reflects our opinion as to the fair market value for the hard construction of this project.

The accuracy of the estimate is based on the documentation provided and design stage is intended to be +/- 30%-50%. This accuracy is based on the definition for Estimate Classifications (Order of Magnitude, Class 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.

Cost Estimate Classification Systems					
Nomenclature	Order of Magnitude	Concept Design	Schematic Design	Design Development	Pre-Tender/Tender
AACE *(1)	Class 5	Class 4	Class 3	Class 2	Class 1
DND *(2)			Indicative	Substantive	
RAIC *(3)	OME	Sketch Design	Design Development	Contract Documents	Tender Documents
CIQS / PSPC *(4)	OME	Class D	Class C	Class B	Class A
		↓	↓	↓	↓
Design Documentation % Complete					
	1% - 5%	5% - 12.5%	12.5% - 25%	25% - 95%	95% - 100%
Cost Estimate Accuracy (+ or - Percentage)					
	+/- 30%-50%	+/- 20%-30%	+/- 15%-20%	+/- 10%-15%	+/- 5%-10%

Legend

*(1) AACE Association for the Advancement Of Cost Engineering

*(2) DND Department of National Defense

*(3) RAIC Royal Architectural Institute Of Canada

*(4) Canadian Institute of Quantity Surveyors / Public Services and Procurement Canada

*Reference: <https://cacqs.ca/wp-content/uploads/2024/10/best-practices-guide-2024.pdf>

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 Toronto, Ontario.

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 Prime Mechanical 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 Prime Mechanical Contractor.

The Fee element of the estimate is meant to cover the Prime Mechanical 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 Prime Mechanical 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			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.
Architectural	-	20%	
Structural	-	20%	
Mechanical	-	20%	
Electrical	-	20%	
Siteworks	-	N/A	

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)
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. Building Permit
8. Abatement and handling of asbestos and other hazardous materials
9. Handling and removal of contaminated soils
10. Special foundation systems such as caissons or pile foundations
11. Premium for construction management or alternate approaches to procurement
12. Sole sourced equipment or control systems
13. Consumption costs for any utilities used during construction (gas, water, hydro etc.)
14. Tariffs and risks of potential additional tariffs due to geopolitical uncertainty
15. Direct or indirect impacts of global uncertainty, or related events whether known or unknown at the time of the estimate

5.2 List of Assumptions

Architectural / Structural / Landscaping:

1. Work is assumed to be completed in one continuous phase.
2. We have assumed the relocation of any existing loose furniture prior to demolition (chairs, tables, desks, filing cabinets, etc.) is to be by Owner.
3. Contractor will clean up daily to general housekeeping standards.
4. We have assumed that designated areas with public spaces would be hoarded off from the public to provide construction access for the contractors.
5. No allowance has been included for the removal and reinstatement of existing ceilings to accommodate the proposed AC installation. It is assumed that services will be surface-run and concealed within architectural covers.

Mechanical:

6. Work will be conducted by union or fair wage contractors.
7. 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.

8. The accuracy of the estimates depends on the information provided. Please note that the cost of mechanical equipment can vary significantly based on factors such as the manufacturer, efficiency, and specifications.
9. Third party tests, certifications etc. are excluded.
10. The estimate includes standard localized thermostatic controls. Facility operator controls and monitoring systems are excluded.
11. Condensate drainage for mini-split systems is assumed to connect to multiple exterior drain risers serving stacked apartments. For PTHP units, condensate is assumed to discharge directly to the building façade.

Electrical:

12. Work will be performed by fair wage labor and during regular hours.
13. Allowance of \$50,000.00 for utility connection for HR MURB, has been included in the estimate.
14. Allowance of \$30,000.00 for utility connection for LR MURB, has been included in the estimate.
15. 1600A 120/208V new main switchboard in HR MURB has been included in the estimate.
16. 600A 120/208V new main switchboard in LR MURB has been included in the estimate.
17. Updating grounding system has been included in the estimate.
18. Rental of 300kW 120/208V diesel generator during power shutdown for HR MURB has been included in the estimate.
19. Rental of 100kW 120/208V diesel generator during power shutdown for LR MURB has been included in the estimate.
20. Refer to the estimate for additional scope specific assumptions.

General:

21. 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.
22. The estimate includes a premium to account for work in occupied suites/spaces
23. Access control, coordination and escort requirements are excluded.
24. General work related to protection of suites, finishes, hoarding, etc., is included under the prime contractor's general requirements.

6. Documentation Received

Drawings and design documentation were prepared by Introba:

Pages	Documentation	Documentation Received
8 Pages	Costing Brief	March 06,2026
	Emails	Various

MULTIPLE ESTIMATE SUMMARY
COT MECHANICAL COOLING SYSTEM - HR MURB
 Class D Estimate
 MARCH 24, 2026

Estimate Breakdown	Multi Split HP/NG Heating	Multi Split HP/Electric Heating	PTHP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
Construction Costs						
1 Multi Split Heat Pump System	\$7,295,478	\$6,050,912				
Architectural	\$892,500	\$892,500				
Mechanical	\$2,229,500	\$2,229,500				
Electrical	\$1,021,078	\$259,112				
General Conditions & Requirements	\$1,384,400	\$1,202,800				
Contingencies	\$1,768,000	\$1,467,000				
2 Packaged Terminal Heat Pump System			\$7,539,452	\$6,024,197		
Architectural			\$913,250	\$913,250		
Mechanical			\$2,288,550	\$2,288,550		
Electrical			\$1,082,852	\$161,797		
General Conditions & Requirements			\$1,427,800	\$1,199,600		
Contingencies			\$1,827,000	\$1,461,000		
Total Estimated Construction Costs (nearest ,000)	\$7,295,000	\$6,051,000	\$7,539,000	\$6,024,000		

Construction Costs	Multi Split HP/NG Heating	Multi Split HP/Electric Heating	PTHP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
Hard Costs						
Architectural	\$892,500	\$892,500	\$913,250	\$913,250		
Mechanical	\$2,229,500	\$2,229,500	\$2,288,550	\$2,288,550		
Electrical	\$1,021,078	\$259,112	\$1,082,852	\$161,797		
General Conditions & Requirements	\$1,384,400	\$1,202,800	\$1,427,800	\$1,199,600		
Subtotal - Hard Costs	\$5,527,478	\$4,583,912	\$5,712,452	\$4,563,197		
Contingencies						
Design & Pricing	\$1,105,000	\$917,000	\$1,142,000	\$913,000	Excluded	Excluded
Escalation	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded
Construction	\$663,000	\$550,000	\$685,000	\$548,000	Excluded	Excluded
Subtotal - Contingencies	\$1,768,000	\$1,467,000	\$1,827,000	\$1,461,000		
Hard Costs including Contingencies (nearest ,000)	\$7,295,000	\$6,051,000	\$7,539,000	\$6,024,000		

Separate Options	Multi Split HP/NG Heating	Multi Split HP/Electric Heating	PTHP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
1 Seasonal Cooling, Option1					\$3,980	
Architectural					\$500	
Mechanical					\$1,710	
Electrical					\$0	
General Conditions & Requirements					\$810	
Contingencies					\$960	
2 Seasonal Cooling, Option2						\$3,290
Architectural						\$500
Mechanical						\$1,360
Electrical						\$0
General Conditions & Requirements						\$630
Contingencies						\$800

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Multi Split Heat Pump System						
<i>Architectural</i>						\$892,500
1	Create opening in exterior wall c/w sleeves, sealant and fireproofing for M&E services	405	NO	\$800.00	\$324,000	
2	Create opening in interior wall for refrigerant piping	255	NO	\$250.00	\$63,750	
3	Allowance for wall blocking to accommodate new indoor split units	405	NO	\$400.00	\$162,000	
4	Allowance for wall bracket to support outdoor units to exterior wall, galvanized	150	NO	\$500.00	\$75,000	
5	Allowance for minor wall surface repair/painting where affected	405	NO	\$50.00	\$20,250	
6	Allowance for surface mounted PVC line set cover/architectural trunking for M&E services	1	LS	\$73,000.00	\$73,000	
7	Allowance for exterior condensate risers, assumed 15 risers total, PVC sch.40 piping	15	NO	\$11,300.00	\$169,500	
8	Temporary working platform, swing stage - assumed one month	1	LS	\$5,000.00	\$5,000	
<i>Mechanical</i>						\$2,229,500
9	Allowance for multi-zone heat pump	1	LS	\$1,433,000.00	\$1,433,000	
9.1	- indoor units, wall mounted - 9,000 BTU/HR	255	NO			included
9.2	- indoor units, wall mounted - 12,000 BTU/HR	150	NO			included
9.3	- Condensing units - 1.5 Tons	75	NO			included
9.4	- Condensing units - 2.25 Tons	45	NO			included
9.5	- Condensing units - 3 Tons	30	NO			included
9.6	- refrigerant piping c/w thermal insulation, line valves, control wiring and accessories including refrigerant charge	1	LS			included
10	Outdoor unit weather proof covers					excluded
11	Common area cooling/heating units are not included					Info Only
12	Existing supplemental heating units, if applicable to remain without any modification					Info Only
13	General allowance					
13.1	- Noise and vibration isolation	1	LS	\$37,500.00	\$37,500	
13.2	- TAB work					N/A
13.3	- Basic start-up and contractor's commissioning	1	LS	\$19,000.00	\$19,000	
13.4	- Rigging, hoisting and material handling	1	LS	\$65,000.00	\$65,000	
13.5	- Condensate drains, scop TBD, assymed PVC drains including:					
13.6	- In-suite evaporator condensate drains c/w traps including connection to new building exterior condensate risers	1	LS	\$120,000.00	\$120,000	
13.7	- Outdoor unit condensate removal c/w drain pan, electric heat tracing and connection to risers	1	LS	\$130,000.00	\$130,000	
13.8	- It is assumed that condensate drains from both indoor/outdoor units will be tied into common riser exterior to building facade discharge at grade					Info Only
14	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$325,000.00	\$325,000	
15	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$100,000.00	\$100,000	
<i>Electrical</i>						\$1,021,078
16	Utility connection fee	1	LS	\$50,000.00	\$50,000	
17	Transformer concrete pad and grounding	1	NO	\$15,111.90	\$15,112	
18	4-103mm PVC concrete encased ductbank for primary power	20	m	\$640.10	\$12,802	
19	6-103mm PVC concrete encased ductbank for secondary power	30	m	\$913.20	\$27,396	
20	#500 rwu90 secondary conductor	640	m	\$70.20	\$44,928	
21	#2/0 rwu90 secondary ground conductor	160	m	\$21.80	\$3,488	
22	1600A 120/208V main switchboard	1	NO	\$115,400.00	\$115,400	
23	100A 120/208V distribution panel in every floor	15	NO	\$3,000.00	\$45,000	
24	100A feeder	900	m	\$101.05	\$90,945	
25	50A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 3 Tons	30	NO	\$1,150.00	\$34,500	
26	35A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 2.25 Tons	45	NO	\$970.00	\$43,650	
27	25A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 1.5 Tons	75	NO	\$920.00	\$69,000	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
28	Power connection for indoor units	405	NO	\$360.00	\$145,800	
29	Metering system for new feed	150	NO	\$360.00	\$54,000	
30	Remedial work to existing-to-remain equipment, cabling, and supports to accommodate new work	1	LS	\$10,000.00	\$10,000	
31	Update building grounding system	1	LS	\$5,900.00	\$5,900	
32	Rental of 300kW 120/208V diesel generator during power shutdown c/w associated feeders and fuel (14 days assumed)	1	LS	\$97,400.00	\$97,400	
33	Disconnect and remove existing redundant electrical equipment c/w associated feeders	1	LS	\$11,500.00	\$11,500	
34	General Requirements including:					\$144,257
34.1	- Supervision	1	LS	\$47,588.00	\$47,588	
34.3	- Job set-up, etc.	1	LS	\$64,446.00	\$64,446	
34.4	- Rentals, small tools, etc.	1	LS	\$18,413.00	\$18,413	
34.5	- Permits & inspections	1	LS	\$11,969.00	\$11,969	
34.6	- Insurance	1	LS	\$1,841.00	\$1,841	
	Subtotal 1				\$4,143,078	
35	Prime Contractor's General Requirements	1	LS	\$621,000	\$621,000	15.0%
36	Building permit				Excluded	
37	General Liability and Builder's Risk insurance	1	LS	\$29,000	\$29,000	
38	Labour & Material and Performance bonding	1	LS	\$41,400	\$41,400	
39	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$430,000.00	\$430,000	
40	Prime Contractor's Fee	1	LS	\$263,000	\$263,000	5.0%
	Subtotal 2				\$5,527,478	
41	Design & Pricing Contingency	1	LS	\$1,105,000	\$1,105,000	20.0%
42	Escalation Contingency				Excluded	0.0%
43	Construction Contingency (Post Contract)	1	LS	\$663,000	\$663,000	10.0%
	Total for Multi Split Heat Pump System				\$7,295,478	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Multi Split Heat Pump System						
<i>Architectural</i>						\$892,500
1	Create opening in exterior wall c/w sleeves, sealant and fireproofing for M&E services	405	NO	\$800.00	\$324,000	
2	Create opening in interior wall for refrigerant piping	255	NO	\$250.00	\$63,750	
3	Allowance for wall blocking to accommodate new indoor split units	405	NO	\$400.00	\$162,000	
4	Allowance for wall bracket to support outdoor units to exterior wall, galvanized	150	NO	\$500.00	\$75,000	
5	Allowance for minor wall surface repair/painting where affected	405	NO	\$50.00	\$20,250	
6	Allowance for surface mounted PVC line set cover/architectural trunking for M&E services	1	LS	\$73,000.00	\$73,000	
7	Allowance for exterior condensate risers, assumed 15 risers total, PVC sch.40 piping	15	NO	\$11,300.00	\$169,500	
8	Temporary working platform, swing stage - assumed one month	1	LS	\$5,000.00	\$5,000	
<i>Mechanical</i>						\$2,229,500
9	Allowance for multi-zone heat pump	1	LS	\$1,433,000.00	\$1,433,000	
9.1	- indoor units, wall mounted - 9,000 BTU/HR	255	NO		included	
9.2	- indoor units, wall mounted - 12,000 BTU/HR	150	NO		included	
9.3	- Condensing units - 1.5 Tons	75	NO		included	
9.4	- Condensing units - 2.25 Tons	45	NO		included	
9.5	- Condensing units - 3 Tons	30	NO		included	
9.6	- refrigerant piping c/w thermal insulation, line valves, control wiring and accessories including refrigerant charge	1	LS		included	
10	Outdoor unit weather proof covers				excluded	
11	Common area cooling/heating units are not included				Info Only	
12	Existing supplemental heating units, if applicable to remain without any modification				Info Only	
13	General allowance					
13.1	- Noise and vibration isolation	1	LS	\$37,500.00	\$37,500	
13.2	- TAB work				N/A	
13.3	- Basic start-up and contractor's commissioning	1	LS	\$19,000.00	\$19,000	
13.4	- Rigging, hoisting and material handling	1	LS	\$65,000.00	\$65,000	
13.5	- Condensate drains, scop TBD, assymed PVC drains including:					
13.6	- In-suite evaporator condensate drains c/w traps including connection to new building exterior condensate risers	1	LS	\$120,000.00	\$120,000	
13.7	- Outdoor unit condensate removal c/w drain pan, electric heat tracing and connection to risers	1	LS	\$130,000.00	\$130,000	
13.8	- It is assumed that condensate drains from both indoor/outdoor units will be tied into common riser exterior to building facade discharge at grade				Info Only	
14	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$325,000.00	\$325,000	
15	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$100,000.00	\$100,000	
<i>Electrical</i>						\$259,112
16	Remedial work to existing suite panels including adding breakers and updating directories	150	NO	\$420.00	\$63,000	
17	50A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 3 Tons	30	NO	\$620.00	\$18,600	
18	35A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 2.25 Tons	45	NO	\$370.00	\$16,650	
19	25A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 1.5 Tons	75	NO	\$360.00	\$27,000	
20	Power connection for indoor units	405	NO	\$220.00	\$89,100	
21	General Requirements including:					\$44,762
21.1	- Supervision	1	LS	\$21,130.00	\$21,130	
21.3	- Job set-up, etc.	1	LS	\$15,755.00	\$15,755	
21.4	- Rentals, small tools, etc.	1	LS	\$4,501.00	\$4,501	
21.5	- Permits & inspections	1	LS	\$2,926.00	\$2,926	
21.6	- Insurance	1	LS	\$450.00	\$450	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
	Subtotal 1				\$3,381,112	
22	Prime Contractor's General Requirements	1	LS	\$507,000	\$507,000	15.0%
23	Building permit				Excluded	
24	General Liability and Builder's Risk insurance	1	LS	\$24,000	\$24,000	
25	Labour & Material and Performance bonding	1	LS	\$33,800	\$33,800	
26	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$420,000.00	\$420,000	
27	Prime Contractor's Fee	1	LS	\$218,000	\$218,000	5.0%
	Subtotal 2				\$4,583,912	
28	Design & Pricing Contingency	1	LS	\$917,000	\$917,000	20.0%
29	Escalation Contingency				Excluded	0.0%
30	Construction Contingency (Post Contract)	1	LS	\$550,000	\$550,000	10.0%
	Total for Multi Split Heat Pump System				\$6,050,912	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Packaged Terminal Heat Pump System						
<i>Architectural</i>						\$913,250
1	Allowance for exterior wall core drilling for PTHPs including fireproofing and sealing, 2 x 6" core drill opening per PTHP	810	NO	\$800.00	\$648,000	
2	Allowance for reworking existing drywall to facilitate new recessed PTHP installation	405	NO	\$400.00	\$162,000	
3	Allowance for minor wall surface repair/painting where affected	405	NO	\$50.00	\$20,250	
4	Allowance for surface mounted PVC line set cover/architectural trunking for electrical service	1	LS	\$73,000.00	\$73,000	
5	Temporary working platform, swing stage - assumed two month	1	LS	\$10,000.00	\$10,000	
<i>Mechanical</i>						\$2,288,550
6	Allowance for PTHPs equal to Innova 12HP					
6.1	- 1 bedroom units	150	NO	\$4,310.00	\$646,500	
6.2	- 2 bedroom units	135	NO	\$4,310.00	\$581,850	
6.3	- 3 bedroom units	120	NO	\$4,310.00	\$517,200	
7	Common area cooling/heating units are not included					Info Only
8	Existing supplemental heating units, if applicable to remain without any modification					Info Only
9	General allowance					
9.1	- TAB work					N/A
9.2	- Basic start-up and contractor's commissioning	1	LS	\$14,000.00	\$14,000	
9.3	- Rigging, hoisting and material handling	1	LS	\$14,000.00	\$14,000	
9.4	- Condensate drains, heat traced drain tube	405	NO	\$200.00	\$81,000	
10	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$334,000.00	\$334,000	
11	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$100,000.00	\$100,000	
<i>Electrical</i>						\$1,082,852
12	Utility connection fee	1	LS	\$30,000.00	\$30,000	
13	Transformer concrete pad and grounding	1	NO	\$15,111.90	\$15,112	
14	4-103mm PVC concrete encased ductbank for primary power	20	m	\$640.10	\$12,802	
15	6-103mm PVC concrete encased ductbank for secondary power	30	m	\$913.20	\$27,396	
16	#500 rwu90 secondary conductor	640	m	\$70.20	\$44,928	
17	#2/0 rwu90 secondary ground conductor	160	m	\$21.80	\$3,488	
18	1600A 120/208V main switchboard	1	NO	\$115,400.00	\$115,400	
19	100A 120/208V distribution panel in every floor	15	NO	\$3,600.00	\$54,000	
20	100A feeder	900	m	\$101.05	\$90,945	
21	25A 208V power connection with line and load side wiring and disconnect switch for PTHP	405	NO	\$870.00	\$352,350	
22	Metering system for new feed	150	NO	\$360.00	\$54,000	
23	Remedial work to existing-to-remain equipment, cabling, and supports to accommodate new work	1	LS	\$10,000.00	\$10,000	
24	Update building grounding system	1	LS	\$5,900.00	\$5,900	
25	Rental of 300kW 120/208V diesel generator during power shutdown c/w associated feeders and fuel (14 days assumed)	1	LS	\$97,400.00	\$97,400	
26	Disconnect and remove existing redundant electrical equipment c/w associated feeders	1	LS	\$11,500.00	\$11,500	
27	General Requirements including:					\$157,631
27.1	- Supervision	1	LS	\$55,625.00	\$55,625	
27.3	- Job set-up, etc.	1	LS	\$68,004.00	\$68,004	
27.4	- Rentals, small tools, etc.	1	LS	\$19,430.00	\$19,430	
27.5	- Permits & inspections	1	LS	\$12,629.00	\$12,629	
27.6	- Insurance	1	LS	\$1,943.00	\$1,943	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Subtotal 1					\$4,284,652	
28	Prime Contractor's General Requirements	1	LS	\$643,000	\$643,000	15.0%
29	Building permit				Excluded	
30	General Liability and Builder's Risk insurance	1	LS	\$30,000	\$30,000	
31	Labour & Material and Performance bonding	1	LS	\$42,800	\$42,800	
32	Miscellaneous Allowances	1	LS	\$440,000.00	\$440,000	
33	Prime Contractor's Fee	1	LS	\$272,000	\$272,000	5.0%
Subtotal 2					\$5,712,452	
34	Design & Pricing Contingency	1	LS	\$1,142,000	\$1,142,000	20.0%
35	Escalation Contingency				Excluded	0.0%
36	Construction Contingency (Post Contract)	1	LS	\$685,000	\$685,000	10.0%
Total for Packaged Terminal Heat Pump System					\$7,539,452	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Packaged Terminal Heat Pump System						
<i>Architectural</i>						\$913,250
1	Allowance for exterior wall core drilling for PTHPs including fireproofing and sealing, 2 x 6" core drill opening per PTHP	810	NO	\$800.00	\$648,000	
2	Allowance for reworking existing drywall to facilitate new recessed PTHP installation	405	NO	\$400.00	\$162,000	
3	Allowance for minor wall surface repair/painting where affected	405	NO	\$50.00	\$20,250	
4	Allowance for surface mounted PVC line set cover/architectural trunking for electrical service	1	LS	\$73,000.00	\$73,000	
5	Temporary working platform, swing stage - assumed two month	1	LS	\$10,000.00	\$10,000	
<i>Mechanical</i>						\$2,288,550
6	Allowance for PTHPs equal to Innova 12HP					
6.1	- 1 bedroom units	150	NO	\$4,310.00	\$646,500	
6.2	- 2 bedroom units	135	NO	\$4,310.00	\$581,850	
6.3	- 3 bedroom units	120	NO	\$4,310.00	\$517,200	
7	Common area cooling/heating units are not included					Info Only
8	Existing supplemental heating units, if applicable to remain without any modification					Info Only
9	General allowance					
9.1	- TAB work					N/A
9.2	- Basic start-up and contractor's commissioning	1	LS	\$14,000.00	\$14,000	
9.3	- Rigging, hoisting and material handling	1	LS	\$14,000.00	\$14,000	
9.4	- Condensate drains, heat traced drain tube	405	NO	\$200.00	\$81,000	
10	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$334,000.00	\$334,000	
11	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$100,000.00	\$100,000	
<i>Electrical</i>						\$161,797
12	Remedial work to existing suite panels including adding breakers and updating directories	150	NO	\$300.00	\$45,000	
13	Power connection for PTHP	405	NO	\$220.00	\$89,100	
14	General Requirements including:					\$27,697
14.1	- Supervision	1	LS	\$12,913.00	\$12,913	
14.3	- Job set-up, etc.	1	LS	\$9,856.00	\$9,856	
14.4	- Rentals, small tools, etc.	1	LS	\$2,816.00	\$2,816	
14.5	- Permits & inspections	1	LS	\$1,830.00	\$1,830	
14.6	- Insurance	1	LS	\$282.00	\$282	
Subtotal 1					\$3,363,597	
15	Prime Contractor's General Requirements	1	LS	\$505,000	\$505,000	15.0%
16	Building permit					Excluded
17	General Liability and Builder's Risk insurance	1	LS	\$24,000	\$24,000	
18	Labour & Material and Performance bonding	1	LS	\$33,600	\$33,600	
19	Miscellaneous Allowances	1	LS	\$420,000.00	\$420,000	
20	Prime Contractor's Fee	1	LS	\$217,000	\$217,000	5.0%
Subtotal 2					\$4,563,197	
21	Design & Pricing Contingency	1	LS	\$913,000	\$913,000	20.0%
22	Escalation Contingency					Excluded 0.0%
23	Construction Contingency (Post Contract)	1	LS	\$548,000	\$548,000	10.0%
Total for Packaged Terminal Heat Pump System					\$6,024,197	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option1						
<i>Architectural</i>						
						\$500
1	Allowance for sleeve and sealing kit	1	LS	\$500.00	\$500	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						
						\$1,710
3	Allowance for Window AC unit c/w mounting bracket, 6,000-10,000 Btu/hr	1	NO	\$1,200.00	\$1,200	
4	Seasonal removal	1	NO	\$150.00	\$150	
5	General allowance					
5.1	- Rigging, hoisting and material handling	1	LS	\$100.00	\$100	
5.2	- Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$260.00	\$260	
<i>Electrical</i>						
						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$2,210	
8	Prime Contractor's General Requirements	1	LS	\$330	\$330	15.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	\$20	\$20	
11	Labour & Material and Performance bonding	1	LS	\$20	\$20	
12	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$300.00	\$300	
13	Prime Contractor's Fee	1	LS	\$140	\$140	5.0%
Subtotal 2					\$3,020	
14	Design & Pricing Contingency	1	LS	\$600	\$600	20.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)	1	LS	\$360	\$360	10.0%
Total for Seasonal Cooling, Option1					\$3,980	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option2						
<i>Architectural</i>						
						\$500
1	Allowance for sleeve and sealing kit	1	LS	\$500.00	\$500	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						
						\$1,360
3	Allowance for portable AC unit c/w vent and sealing kit, hose, 6,000-10,000 Btu/hr	1	NO	\$1,000.00	\$1,000	
4	Seasonal removal	1	NO	\$150.00	\$150	
5	Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$210.00	\$210	
<i>Electrical</i>						
						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$1,860	
8	Prime Contractor's General Requirements	1	LS	\$280	\$280	15.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	\$10	\$10	
11	Labour & Material and Performance bonding	1	LS	\$20	\$20	
12	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$200.00	\$200	
13	Prime Contractor's Fee	1	LS	\$120	\$120	5.0%
Subtotal 2					\$2,490	
14	Design & Pricing Contingency	1	LS	\$500	\$500	20.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)	1	LS	\$300	\$300	10.0%
Total for Seasonal Cooling, Option2					\$3,290	

MULTIPLE ESTIMATE SUMMARY
COT MECHANICAL COOLING SYSTEM - LR MURB
 Class D Estimate
 MARCH 24, 2026

Estimate Breakdown Construction Costs	Multi Split HP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
1 Multi Split Heat Pump System	\$2,166,399			
Architectural	\$231,000			
Mechanical	\$589,000			
Electrical	\$424,999			
General Conditions & Requirements	\$396,400			
Contingencies	\$525,000			
2 Packaged Terminal Heat Pump System		\$1,618,713		
Architectural		\$250,400		
Mechanical		\$614,080		
Electrical		\$43,133		
General Conditions & Requirements		\$319,100		
Contingencies		\$392,000		
Total Estimated Construction Costs (nearest ,000)	\$2,166,000	\$1,619,000		

Construction Costs	Multi Split HP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
Hard Costs				
Architectural	\$231,000	\$250,400		
Mechanical	\$589,000	\$614,080		
Electrical	\$424,999	\$43,133		
General Conditions & Requirements	\$396,400	\$319,100		
Subtotal - Hard Costs	\$1,641,399	\$1,226,713		
Contingencies				
Design & Pricing	\$328,000	\$245,000	Excluded	Excluded
Escalation	Excluded	Excluded	Excluded	Excluded
Construction	\$197,000	\$147,000	Excluded	Excluded
Subtotal - Contingencies	\$525,000	\$392,000		
Hard Costs including Contingencies (nearest ,000)	\$2,166,000	\$1,619,000		

Separate Options	Multi Split HP/NG Heating	PTHP/Electric Heating	Window AC	Portable AC
1 Seasonal Cooling, Option1			\$3,980	
Architectural			\$500	
Mechanical			\$1,710	
Electrical			\$0	
General Conditions & Requirements			\$810	
Contingencies			\$960	
2 Seasonal Cooling, Option2				\$3,290
Architectural				\$500
Mechanical				\$1,360
Electrical				\$0
General Conditions & Requirements				\$630
Contingencies				\$800

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Multi Split Heat Pump System						
<i>Architectural</i>						\$231,000
1	Create opening in exterior wall c/w sleeves, sealant and fireproofing for M&E services	108	NO	\$800.00	\$86,400	
2	Create opening in interior wall for refrigerant piping	68	NO	\$250.00	\$17,000	
3	Allowance for wall blocking to accommodate new indoor split units	108	NO	\$400.00	\$43,200	
4	Allowance for wall bracket to support outdoor units to exterior wall, galvanized	20	NO	\$500.00	\$10,000	
5	Allowance for minor wall surface repair/painting where affected	108	NO	\$50.00	\$5,400	
6	Allowance for surface mounted PVC line set cover/architectural trunking for M&E services	1	LS	\$19,000.00	\$19,000	
7	Allowance for exterior condensate risers, assumed 15 risers total, PVC sch.40 piping	15	NO	\$3,000.00	\$45,000	
8	Temporary working platform, swing stage - assumed one month	1	LS	\$5,000.00	\$5,000	
<i>Mechanical</i>						\$589,000
9	Allowance for multi-zone heat pump	1	LS	\$382,000.00	\$382,000	
9.1	- indoor units, wall mounted - 9,000 BTU/HR	68	NO		included	
9.2	- indoor units, wall mounted - 12,000 BTU/HR	40	NO		included	
9.3	- Condensing units - 1.5 Tons	20	NO		included	
9.4	- Condensing units - 2.25 Tons	12	NO		included	
9.5	- Condensing units - 3 Tons	8	NO		included	
9.6	- refrigerant piping c/w thermal insulation, line valves, control wiring and accessories including refrigerant charge	1	LS		included	
10	Outdoor unit weather proof covers				excluded	
11	Common area cooling/heating units are not included				Info Only	
12	Existing supplemental heating units, if applicable to remain without any modification				Info Only	
13	General allowance					
13.1	- Noise and vibration isolation	1	LS	\$10,000.00	\$10,000	
13.2	- TAB work				N/A	
13.3	- Basic start-up and contractor's commissioning	1	LS	\$5,000.00	\$5,000	
13.4	- Rigging, hoisting and material handling	1	LS	\$17,000.00	\$17,000	
13.5	- Condensate drains, scop TBD, assumed PVC drains including:					
13.6	- In-suite evaporator condensate drains c/w traps including connection to new building exterior condensate risers	1	LS	\$30,000.00	\$30,000	
13.7	- Outdoor unit condensate removal c/w drain pan, electric heat tracing and connection to risers	1	LS	\$30,000.00	\$30,000	
13.8	- It is assumed that condensate drains from both indoor/outdoor units will be tied into common riser exterior to building facade discharge at grade				Info Only	
14	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$85,000.00	\$85,000	
15	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$30,000.00	\$30,000	
<i>Electrical</i>						\$424,999
16	Utility connection fee	1	LS	\$30,000.00	\$30,000	
17	Transformer concrete pad and grounding	1	NO	\$10,700.00	\$10,700	
18	2-103mm PVC concrete encased ductbank for primary power	20	m	\$386.70	\$7,734	
19	3-103mm PVC concrete encased ductbank for secondary power	30	m	\$511.60	\$15,348	
20	#350 rwu90 secondary conductor	640	m	\$49.10	\$31,424	
21	#1/0 rwu90 secondary ground conductor	160	m	\$18.00	\$2,880	
22	600A 120/208V main switchboard	1	NO	\$71,500.00	\$71,500	
23	150A 120/208V distribution panel in every floor	4	NO	\$3,400.00	\$13,600	
24	150A feeder	130	m	\$123.38	\$16,039	
25	50A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 3 Tons	8	NO	\$1,150.00	\$9,200	
26	35A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 2.25 Tons	12	NO	\$970.00	\$11,640	
27	25A 208V power connection with line and load side wiring and W/P disconnect switch for condensing units - 1.5 Tons	20	NO	\$920.00	\$18,400	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
28	Power connection for indoor units	108	NO	\$360.00	\$38,880	
29	Metering system for new feed	40	NO	\$360.00	\$14,400	
30	Remedial work to existing-to-remain equipment, cabling, and supports to accommodate new work	1	LS	\$2,500.00	\$2,500	
31	Update building grounding system	1	LS	\$1,800.00	\$1,800	
32	Rental of 100kW 120/208V diesel generator during power shutdown c/w associated feeders and fuel (14 days assumed)	1	LS	\$66,400.00	\$66,400	
33	Disconnect and remove existing redundant electrical equipment c/w associated feeders	1	LS	\$7,500.00	\$7,500	
34	General Requirements including:					\$55,054
34.1	- Supervision	1	LS	\$14,267.00	\$14,267	
34.3	- Job set-up, etc.	1	LS	\$27,191.00	\$27,191	
34.4	- Rentals, small tools, etc.	1	LS	\$7,769.00	\$7,769	
34.5	- Permits & inspections	1	LS	\$5,050.00	\$5,050	
34.6	- Insurance	1	LS	\$777.00	\$777	
	Subtotal 1				\$1,244,999	
35	Prime Contractor's General Requirements	1	LS	\$187,000	\$187,000	15.0%
36	Building permit				Excluded	
37	General Liability and Builder's Risk insurance	1	LS	\$9,000	\$9,000	
38	Labour & Material and Performance bonding	1	LS	\$12,400	\$12,400	
39	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$110,000.00	\$110,000	
40	Prime Contractor's Fee	1	LS	\$78,000	\$78,000	5.0%
	Subtotal 2				\$1,641,399	
41	Design & Pricing Contingency	1	LS	\$328,000	\$328,000	20.0%
42	Escalation Contingency				Excluded	0.0%
43	Construction Contingency (Post Contract)	1	LS	\$197,000	\$197,000	10.0%
	Total for Multi Split Heat Pump System				\$2,166,399	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Packaged Terminal Heat Pump System						
<i>Architectural</i>						\$250,400
1	Allowance for exterior wall core drilling for PTHPs including fireproofing and sealing, 2 x 6" core drill opening per PTHP	216	NO	\$800.00	\$172,800	
2	Allowance for reworking existing drywall to facilitate new recessed PTHP installation	108	NO	\$400.00	\$43,200	
3	Allowance for minor wall surface repair/painting where affected	108	NO	\$50.00	\$5,400	
4	Allowance for surface mounted PVC line set cover/architectural trunking for electrical service	1	LS	\$19,000.00	\$19,000	
5	Temporary working platform, swing stage - assumed two month	1	LS	\$10,000.00	\$10,000	
<i>Mechanical</i>						\$614,080
6	Allowance for PTHPs equal to Innova 12HP					
6.1	- 1 bedroom units	40	NO	\$4,310.00	\$172,400	
6.2	- 2 bedroom units	36	NO	\$4,310.00	\$155,160	
6.3	- 3 bedroom units	32	NO	\$4,310.00	\$137,920	
7	Common area cooling/heating units are not included				Info Only	
8	Existing supplemental heating units, if applicable to remain without any modification				Info Only	
9	General allowance					
9.1	- TAB work				N/A	
9.2	- Basic start-up and contractor's commissioning	1	LS	\$4,000.00	\$4,000	
9.3	- Rigging, hoisting and material handling	1	LS	\$4,000.00	\$4,000	
9.4	- Condensate drains, heat traced drain tube	108	NO	\$200.00	\$21,600	
10	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$89,000.00	\$89,000	
11	Allowance for heat adaptor and relay including control/interlock wiring for external heater	1	LS	\$30,000.00	\$30,000	
<i>Electrical</i>						\$43,133
12	Remedial work to existing suite panels including adding breakers and updating directories	40	NO	\$300.00	\$12,000	
13	Power connection for PTHP	108	NO	\$220.00	\$23,760	
14	General Requirements including:					\$7,373
14.1	- Supervision	1	LS	\$3,431.00	\$3,431	
14.3	- Job set-up, etc.	1	LS	\$2,628.00	\$2,628	
14.4	- Rentals, small tools, etc.	1	LS	\$751.00	\$751	
14.5	- Permits & inspections	1	LS	\$488.00	\$488	
14.6	- Insurance	1	LS	\$75.00	\$75	
Subtotal 1					\$907,613	
15	Prime Contractor's General Requirements	1	LS	\$136,000	\$136,000	15.0%
16	Building permit				Excluded	
17	General Liability and Builder's Risk insurance	1	LS	\$6,000	\$6,000	
18	Labour & Material and Performance bonding	1	LS	\$9,100	\$9,100	
19	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$110,000.00	\$110,000	
20	Prime Contractor's Fee	1	LS	\$58,000	\$58,000	5.0%
Subtotal 2					\$1,226,713	
21	Design & Pricing Contingency	1	LS	\$245,000	\$245,000	20.0%
22	Escalation Contingency				Excluded	0.0%
23	Construction Contingency (Post Contract)	1	LS	\$147,000	\$147,000	10.0%
Total for Packaged Terminal Heat Pump System					\$1,618,713	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option1						
<i>Architectural</i>						
						\$500
1	Allowance for sleeve and sealing kit	1	LS	\$500.00	\$500	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						
						\$1,710
3	Allowance for Window AC unit c/w mounting bracket, 6,000-10,000 Btu/hr	1	NO	\$1,200.00	\$1,200	
4	Seasonal removal	1	NO	\$150.00	\$150	
5	General allowance					
5.1	- Rigging, hoisting and material handling	1	LS	\$100.00	\$100	
5.2	- Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$260.00	\$260	
<i>Electrical</i>						
						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$2,210	
8	Prime Contractor's General Requirements	1	LS	\$330	\$330	15.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	\$20	\$20	
11	Labour & Material and Performance bonding	1	LS	\$20	\$20	
12	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$300.00	\$300	
13	Prime Contractor's Fee	1	LS	\$140	\$140	5.0%
Subtotal 2					\$3,020	
14	Design & Pricing Contingency	1	LS	\$600	\$600	20.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)	1	LS	\$360	\$360	10.0%
Total for Seasonal Cooling, Option1					\$3,980	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option2						
<i>Architectural</i>						
						\$500
1	Allowance for sleeve and sealing kit	1	LS	\$500.00	\$500	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						
						\$1,360
3	Allowance for portable AC unit c/w vent and sealing kit, hose, 6,000-10,000 Btu/hr	1	NO	\$1,000.00	\$1,000	
4	Seasonal removal	1	NO	\$150.00	\$150	
5	Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$210.00	\$210	
<i>Electrical</i>						
						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$1,860	
8	Prime Contractor's General Requirements	1	LS	\$280	\$280	15.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	\$10	\$10	
11	Labour & Material and Performance bonding	1	LS	\$20	\$20	
12	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$200.00	\$200	
13	Prime Contractor's Fee	1	LS	\$120	\$120	5.0%
Subtotal 2					\$2,490	
14	Design & Pricing Contingency	1	LS	\$500	\$500	20.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)	1	LS	\$300	\$300	10.0%
Total for Seasonal Cooling, Option2					\$3,290	

MULTIPLE ESTIMATE SUMMARY
COT MECHANICAL COOLING SYSTEM - SINGLE
FAMILY/ROWHOUSE/TOWNHOUSE
 Class D Estimate
 MARCH 24, 2026



Estimate Breakdown	Furnace w/ central AC unit	Furnace w/ central ASHP	Window AC	Portable AC
Construction Costs				
1 Retrofit Existing System w/ NG Heating and Electric Cooling, Evaporator Coil to Existing Furnace	\$33,187			
Architectural	\$1,300			
Mechanical	\$16,200			
Electrical	\$1,067			
General Conditions & Requirements	\$6,620			
Contingencies	\$8,000			
2 Retrofit Existing System w/ Electric Heating/Cooling and Second Stage NG Heating, Evaporator Coil to Existing Furnace		\$41,562		
Architectural		\$1,300		
Mechanical		\$20,550		
Electrical		\$1,622		
General Conditions & Requirements		\$8,290		
Contingencies		\$9,800		
Total Estimated Construction Costs (nearest ,000)	\$33,000	\$42,000		
Construction Costs				
Hard Costs				
Architectural	\$1,300	\$1,300		
Mechanical	\$16,200	\$20,550		
Electrical	\$1,067	\$1,622		
General Conditions & Requirements	\$6,620	\$8,290		
Subtotal - Hard Costs	\$25,187	\$31,762		
Contingencies				
Design & Pricing	\$5,000	\$6,000	Excluded	Excluded
Escalation	Excluded	Excluded	Excluded	Excluded
Construction	\$3,000	\$3,800	Excluded	Excluded
Subtotal - Contingencies	\$8,000	\$9,800		
Hard Costs including Contingencies (nearest ,000)	\$33,000	\$42,000		
Separate Options				
1 Seasonal Cooling, Option1			\$3,980	
Architectural			\$500	
Mechanical			\$1,710	
Electrical			\$0	
General Conditions & Requirements			\$810	
Contingencies			\$960	
2 Seasonal Cooling, Option2				\$3,290
Architectural				\$500
Mechanical				\$1,360
Electrical				\$0
General Conditions & Requirements				\$630
Contingencies				\$800

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Retrofit Existing System w/ NG Heating and Electric Cooling, Evaporator Coil to Existing Furnace						
<i>Architectural</i>						\$1,300
1	Exterior wall service penetration for M&E services including fireproofing and sealant	1	NO	\$800.00	\$800	
2	New supports for condensing units	1	NO	\$500.00	\$500	
3	Assumed unfinished basement				Info Only	
<i>Mechanical</i>						\$16,200
4	Allowance for modification of existing air conditioning system including:	1	NO	\$11,000.00	\$11,000	
4.1	- out door condensing unit					
4.2	- duct mounted evaporator coil					
4.3	- refrigerant line, accessories and refrigerant charge ~ 8m - 10m refrigerant line					
4.4	- existing furnace unit to remain as a second stage heating				Info Only	
5	Allowance for air distribution including					
5.1	- sheet metal modification to the existing system	40	KG	\$30.00	\$1,200	
5.2	- thermal insulation				assume not required	
5.3	- air diffusion devices				existing to remain	
5.4	- miscellaneous ductwork components	1	LS	\$100.00	\$100	
6	Allowance for demolition of obsolete duct work to suit	1	LS	\$150.00	\$150	
7	General allowance					
7.1	- noise and vibration isolation	1	LS	\$250.00	\$250	
7.2	- TAB work	1	LS	\$150.00	\$150	
7.3	- basic start-up and contractor's commissioning	1	LS	\$100.00	\$100	
7.4	- rigging, hoisting and material handling	1	LS	\$250.00	\$250	
7.5	- condensate/relief/system drains terminated to existing drain	1	LS	\$250.00	\$250	
8	Miscellaneous works and general accounts	1	NO	\$2,000.00	\$2,000	
9	Allowance for thermostatic controls/interlock wiring and staging	1	LS	\$750.00	\$750	
<i>Electrical</i>						\$1,067
10	Remedial work to existing suite panels including adding breakers and updating directories	2	NO	\$120.00	\$240	
11	30A 240V power connection for outdoor unit	2	NO	\$320.00	\$640	
12	General Requirements including:					\$187
12.1	- Supervision	1	LS	\$90.00	\$90	
12.3	- Job set-up, etc.	1	LS	\$65.00	\$65	
12.4	- Rentals, small tools, etc.	1	LS	\$18.00	\$18	
12.5	- Permits & inspections	1	LS	\$12.00	\$12	
12.6	- Insurance	1	LS	\$2.00	\$2	
Subtotal 1						\$18,567
13	Prime Contractor's General Requirements	1	LS	\$2,800	\$2,800	15.0%
14	Building permit				Excluded	
15	General Liability and Builder's Risk insurance	1	LS	\$130	\$130	
16	Labour & Material and Performance bonding	1	LS	\$190	\$190	
17	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$2,300.00	\$2,300	
18	Prime Contractor's Fee	1	LS	\$1,200	\$1,200	5.0%
Subtotal 2						\$25,187
19	Design & Pricing Contingency	1	LS	\$5,000	\$5,000	20.0%
20	Escalation Contingency				Excluded	0.0%
21	Construction Contingency (Post Contract)	1	LS	\$3,000	\$3,000	10.0%
Total for Retrofit Existing System w/ NG Heating and Electric Cooling, Evaporator Coil to Existing Furnace						\$33,187

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Retrofit Existing System w/ Electric Heating/Cooling and Second Stage NG Heating, Evaporator Coil to Existing Furnace						
<i>Architectural</i>						\$1,300
1	Exterior wall service penetration for M&E services including fireproofing and sealant	1	NO	\$800.00	\$800	
2	New supports for condensing units	1	NO	\$500.00	\$500	
3	Assumed unfinished basement				Info Only	
<i>Mechanical</i>						\$20,550
4	Allowance for modification of existing air conditioning system including:	1	NO	\$14,500.00	\$14,500	
4.1	- new cold climate heat pump condensing unit					
4.2	- duct mounted evaporator coil					
4.3	- refrigerant line, accessories and refrigerant charge ~ 8m - 10m refrigerant line					
4.4	- existing furnace unit to remain as a second stage heating				Info Only	
5	Allowance for air distribution including					
5.1	- sheet metal modification to the existing system	40	KG	\$30.00	\$1,200	
5.2	- thermal insulation				assume not required	
5.3	- air diffusion devices				existing to remain	
5.4	- miscellaneous ductwork components	1	LS	\$100.00	\$100	
6	Allowance for demolition of obsolete duct work to suit	1	LS	\$150.00	\$150	
7	General allowance					
7.1	- noise and vibration isolation	1	LS	\$250.00	\$250	
7.2	- TAB work	1	LS	\$150.00	\$150	
7.3	- basic start-up and contractor's commissioning	1	LS	\$200.00	\$200	
7.4	- rigging, hoisting and material handling	1	LS	\$250.00	\$250	
7.5	- condensate/relief/system drains terminated to existing drain	1	LS	\$250.00	\$250	
8	Miscellaneous works and general accounts	1	NO	\$2,000.00	\$2,000	
9	Allowance for thermostatic controls/interlock wiring and staging	1	LS	\$1,500.00	\$1,500	
<i>Electrical</i>						\$1,622
10	Remedial work to existing suite panels including adding breakers and updating directories	2	NO	\$150.00	\$300	
11	50A 240V power connection for heat pump	2	NO	\$540.00	\$1,080	
12	General Requirements including:					\$242
12.1	- Supervision	1	LS	\$90.00	\$90	
12.3	- Job set-up, etc.	1	LS	\$101.00	\$101	
12.4	- Rentals, small tools, etc.	1	LS	\$29.00	\$29	
12.5	- Permits & inspections	1	LS	\$19.00	\$19	
12.6	- Insurance	1	LS	\$3.00	\$3	
Subtotal 1					\$23,472	
13	Prime Contractor's General Requirements	1	LS	\$3,500	\$3,500	15.0%
14	Building permit				Excluded	
15	General Liability and Builder's Risk insurance	1	LS	\$160	\$160	
16	Labour & Material and Performance bonding	1	LS	\$230	\$230	
17	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$2,900.00	\$2,900	
18	Prime Contractor's Fee	1	LS	\$1,500	\$1,500	5.0%
Subtotal 2					\$31,762	
19	Design & Pricing Contingency	1	LS	\$6,000	\$6,000	20.0%
20	Escalation Contingency				Excluded	0.0%
21	Construction Contingency (Post Contract)	1	LS	\$3,800	\$3,800	10.0%
Total for Retrofit Existing System w/ Electric Heating/Cooling and Second Stage NG Heating, Evaporator Coil to Existing Furnace					\$41,562	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option1						
<i>Architectural</i>						
						\$500
1	Allowance for sleeve and sealing kit	1	LS	\$500.00	\$500	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						
						\$1,710
3	Allowance for Window AC unit c/w mounting bracket, 6,000-10,000 Btu/hr	1	NO	\$1,200.00	\$1,200	
4	Seasonal removal	1	NO	\$150.00	\$150	
5	General allowance					
5.1	- Rigging, hoisting and material handling	1	LS	\$100.00	\$100	
5.2	- Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$260.00	\$260	
<i>Electrical</i>						
						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$2,210	
8	Prime Contractor's General Requirements	1	LS	\$330	\$330	15.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	\$20	\$20	
11	Labour & Material and Performance bonding	1	LS	\$20	\$20	
12	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$300.00	\$300	
13	Prime Contractor's Fee	1	LS	\$140	\$140	5.0%
Subtotal 2					\$3,020	
14	Design & Pricing Contingency	1	LS	\$600	\$600	20.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)	1	LS	\$360	\$360	10.0%
Total for Seasonal Cooling, Option1					\$3,980	

No.	Description	Quant.	Unit	Rate	Sub Total	Total
Seasonal Cooling, Option2						
<i>Architectural</i>						
						\$500
1	Allowance for sleeve and sealing kit	1	LS	\$500.00	\$500	
2	It is assumed that the unit will be installed in the existing operable window, no allowance has been made for the removal of glass pane				Info Only	
<i>Mechanical</i>						
						\$1,360
3	Allowance for portable AC unit c/w vent and sealing kit, hose, 6,000-10,000 Btu/hr	1	NO	\$1,000.00	\$1,000	
4	Seasonal removal	1	NO	\$150.00	\$150	
5	Condensate drains through evaporation				N/A	
6	Supervision, job set up, clean up, small tools, rentals, permits & inspections, overhead / profit, etc.	1	NO	\$210.00	\$210	
<i>Electrical</i>						
						\$0
7	Existing electrical outlet to be reused				Info Only	
Subtotal 1					\$1,860	
8	Prime Contractor's General Requirements	1	LS	\$280	\$280	15.0%
9	Building permit				Excluded	
10	General Liability and Builder's Risk insurance	1	LS	\$10	\$10	
11	Labour & Material and Performance bonding	1	LS	\$20	\$20	
12	Miscellaneous Allowances, premium for loss of productivity	1	LS	\$200.00	\$200	
13	Prime Contractor's Fee	1	LS	\$120	\$120	5.0%
Subtotal 2					\$2,490	
14	Design & Pricing Contingency	1	LS	\$500	\$500	20.0%
15	Escalation Contingency				Excluded	0.0%
16	Construction Contingency (Post Contract)	1	LS	\$300	\$300	10.0%
Total for Seasonal Cooling, Option2					\$3,290	

8 Appendix B

City of Toronto Maximum Indoor Temperature By-law

APPENDIX B: OPERATIONAL PERFORMANCE MODELLING REPORT

April 2026

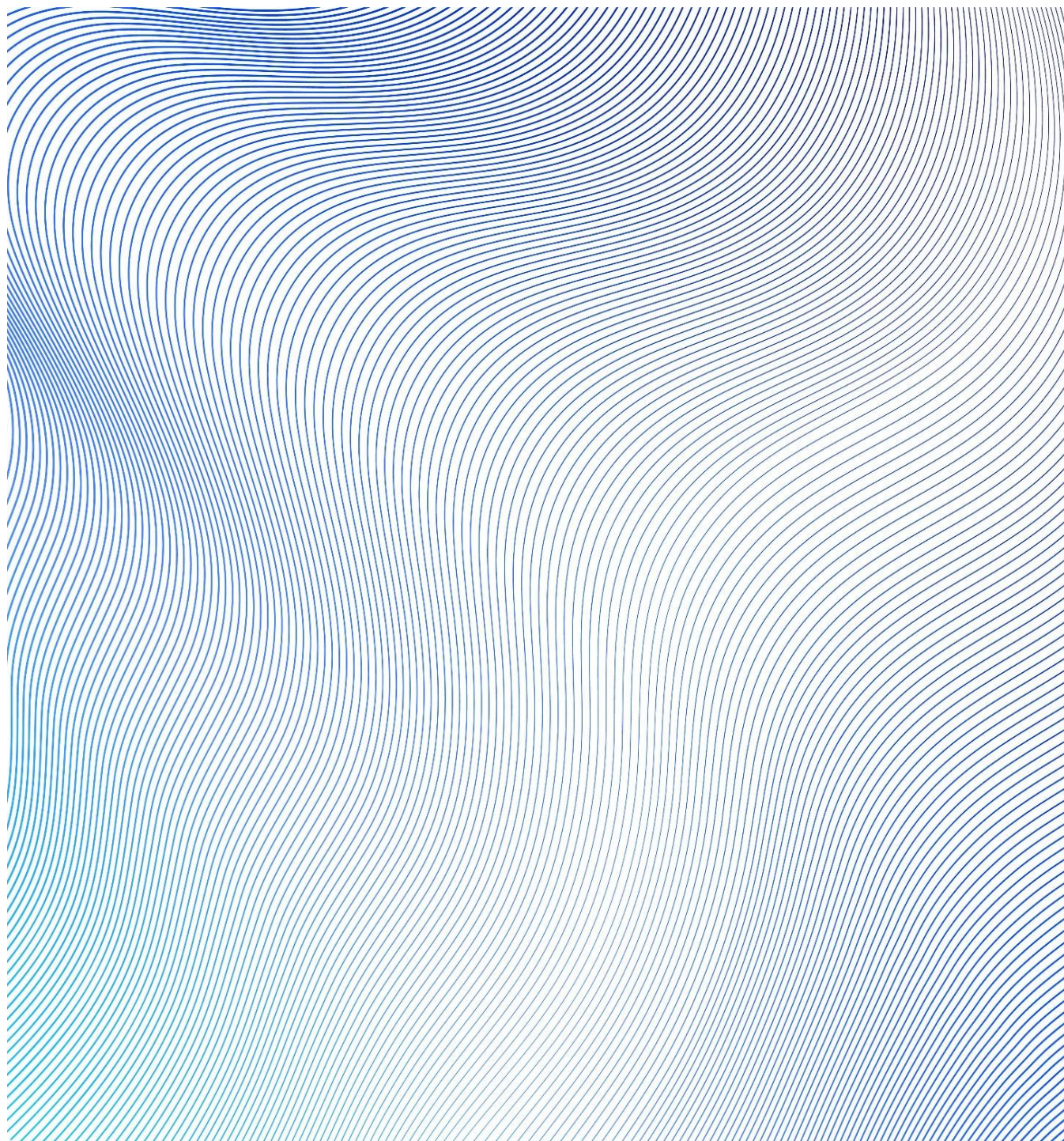


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1 Executive Summary

Since 2015, City of Toronto staff have been exploring measures to improve thermal safety in multi-unit residential buildings, including the potential introduction of a health-based maximum indoor temperature standard. In December 2025, City Council directed staff to report back by May 2026 with a proposed Maximum Temperature By-law for rental units, informed by a compliance analysis study and by Council's earlier endorsement of a 26°C maximum indoor temperature standard for leased residential premises.

To support that work, Introba modelled a representative west-facing one-bedroom unit to estimate cooling electricity demand and costs and to test whether a single 10 kBtu/hr (2.9 kW) window air-conditioning unit located in the living room could keep the suite compliant during hot weather – particularly the bedroom where no dedicated cooling was provided. The analysis also examined the effect of occupant behaviour, including leaving the bedroom door open and using internal blinds, under both 2020s and 2050s Toronto future-weather files.

The modelling indicates that the living room/kitchen can generally remain below 26°C with a single window AC unit. However, the bedroom still overheats materially when cooling is only provided in the living room. Under baseline conditions, the bedroom exceeds 26°C for 607 summer hours in the 2020s weather file and 873 summer hours in the 2050s weather file. Opening the bedroom door reduces overheating substantially, and the combination of an open bedroom door and internal blinds provides the best non-capital improvement, but neither strategy should be assumed to provide a reliable compliance pathway because their effectiveness depends on consistent occupant action and favourable operating conditions.

These findings suggest that relying on a single living-room window AC unit is unlikely to provide robust compliance for all rooms in a one-bedroom unit, particularly as summer conditions intensify over time. The study therefore helps frame both the likely need for additional cooling capacity in some existing buildings and the importance of considering costs, implementation timelines, and tenant-protection measures as the by-law is finalized.

Providing cooling to the full one-bedroom suite results in modest annual electricity use and operating cost relative to typical household electricity consumption, but those costs increase meaningfully under hotter future weather conditions. Higher-efficiency systems, particularly ductless multi-split heat pumps, provide the lowest annual operating cost, while portable air-conditioners have the highest annual operating cost among the options assessed.

Table 1 Modelling Key Findings

Key finding	Summary
Cooling Electricity Demand and Utility Costs	Across the equipment types tested, annual whole-unit cooling electricity demand ranges from about 550 to 1000 kWh. At the assumed electricity rate of \$0.14/kWh, this corresponds to approximately \$78 to \$145 per year. Internal blinds materially reduce both demand and cost, lowering annual whole-unit cooling electricity use by around 25% depending on weather file.
Living room performance	With a 10 kBtu/hr window AC unit in the living/kitchen area, the modelled living space remained below 26°C in all but one hour of the 2050s baseline case, and never exceeded 28°C.
Bedroom overheating risk	Without dedicated bedroom cooling, the bedroom exceeded 26 C for hundreds of summer hours across baseline cases, with the highest overheating occurring in the 2050s baseline scenario.

Key finding	Summary
Effect of occupant behaviour	Opening the bedroom door reduced bedroom overheating hours by about 60%. Opening the door and using internal blinds reduced overheating hours by about 90%.
Policy implication	<p>A single window AC unit serving only the living area should not be assumed to ensure compliance across the whole dwelling, especially for sleeping spaces.</p> <p>From an operating-cost perspective, the draft modelling suggests that maintaining the full unit at a 24°C cooling set point is not prohibitively expensive on an annual basis, but costs vary by equipment efficiency and increase under future climate conditions.</p>

2 Project Context and Study Purpose

The City is considering a maximum indoor temperature requirement for rental housing in response to growing heat risk and the disproportionate impacts of extreme heat on tenants in buildings without mechanical cooling. A future by-law must be practical to administer, technically achievable across a wide range of building conditions, and sensitive to the risk that capital upgrades could result in higher housing costs for tenants.

The compliance analysis study is intended to give City staff and Council a clearer understanding of the building upgrades, operating changes, costs, and timelines that may be required for different rental housing types to meet a 26 C maximum indoor temperature standard. The present modelling forms one component of that broader exercise by testing a representative suite and a simple, lower-cost cooling intervention.

This report focuses on two main questions:

1. In a typical one-bedroom rental unit, can a single window AC unit installed in the living room keep the bedroom thermally safe during hot weather?
2. What would be the electricity demand and associated utility costs to provide cooling to the entire one-bedroom rental unit?

3 Scope of Modelling

The study modelled a representative one-bedroom unit with a west-facing exposure, as shown in Figure 1. This orientation was intentionally selected as a conservative case because west-facing units are subject to elevated afternoon solar gains that can worsen overheating risk.

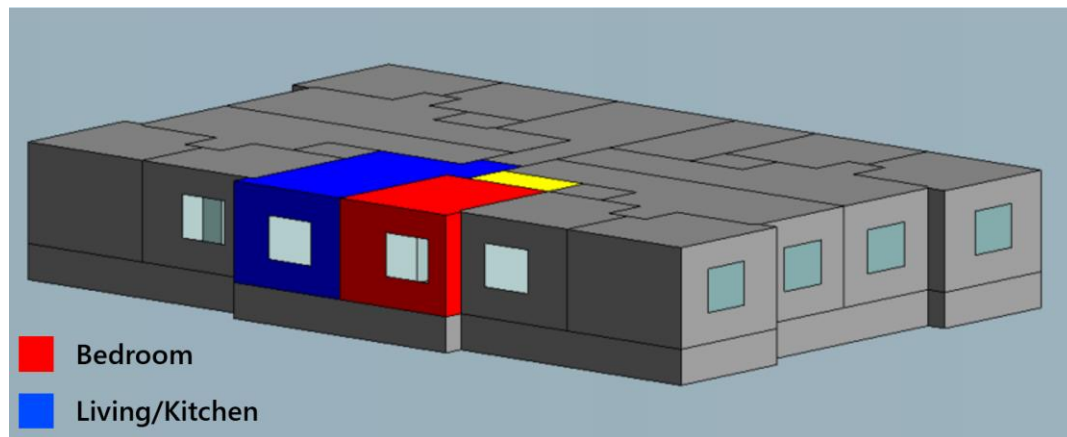


Figure 1 Model of one-bedroom unit with west-facing exposure

The intent was not to characterize every building or every suite type in Toronto. Instead, the analysis provides a focused test case that can help City staff understand potential demand and operational costs and whether a relatively limited intervention, a single room air-conditioner located in the living room, is likely to be sufficient where no dedicated bedroom cooling is provided.

3.1 Methodology and Key Assumptions

The model was developed in IESVE 2023.5.2.0 using a residential floor plate adapted from a previous project with similar characteristics. Cooling was represented by a 10 kBtu/hr (2.9 kW) window air-conditioning unit located in the living room/kitchen area, with a constant 24 C cooling set point applied to the conditioned zone.

A 0.25 m² operable bedroom window was included in all scenarios. The window was assumed to open when the bedroom temperature exceeded 22°C and the outdoor air temperature was at least 3°C cooler than the indoor condition. This represents a simplified but reasonable natural-ventilation control strategy intended to reflect occupant use when outdoor conditions are favourable.

3.1.1 Weather Files

Two weather files were modelled: a Toronto City 2020s SSP5-8.5 CWEC CMIP5 file and a Toronto City 2050s SSP5-8.5 CWEC CMIP5 file. SSP5-8.5 was selected to represent a high emission, high-risk future. Figure 2 presents the cooling season outdoor temperature trends used in the modelling for both scenarios while Figure 3 highlights the outdoor temperature trend on the peak cooling day. The 2050s file shows a 2.1°C increase in maximum outdoor temperature on the peak cooling day compared to the 2020s weather file. Note that the day of peak cooling does not coincide with the maximum outdoor temperature.

This projected warming leads to a substantial increase in overheating risk, with nearly twice as many hours exceeding 30°C in the 2050s weather file compared to the 2020s weather file, going from 99 hours to 187 hours.

It should be noted that CWEC weather files represent typical meteorological conditions and do not capture extreme heat wave events; therefore, actual overheating during a heat wave could be more severe than indicated by these results. Scenario testing also considered how simple operational measures could affect outcomes, including leaving the bedroom door open continuously and using internal blinds during periods of high solar gain.

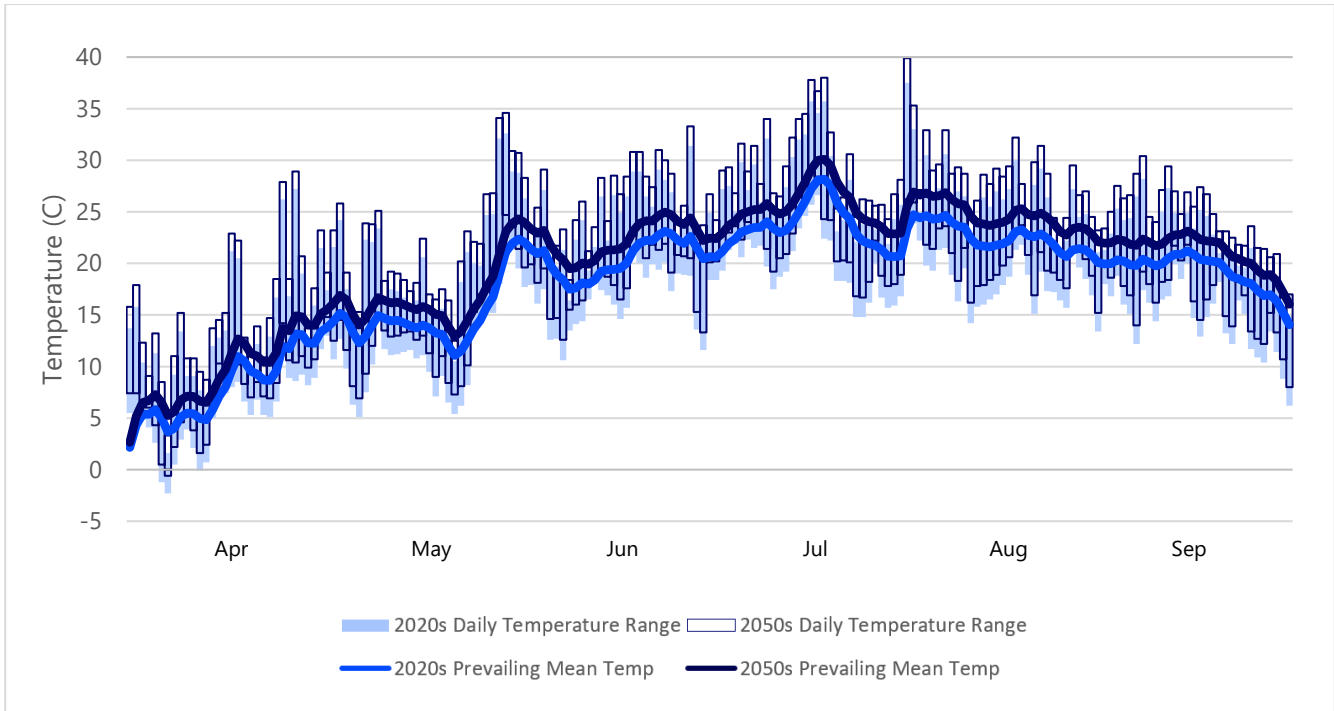


Figure 2: April 1 to Sept 30 temperature profiles for 2020s and 2050s weather files

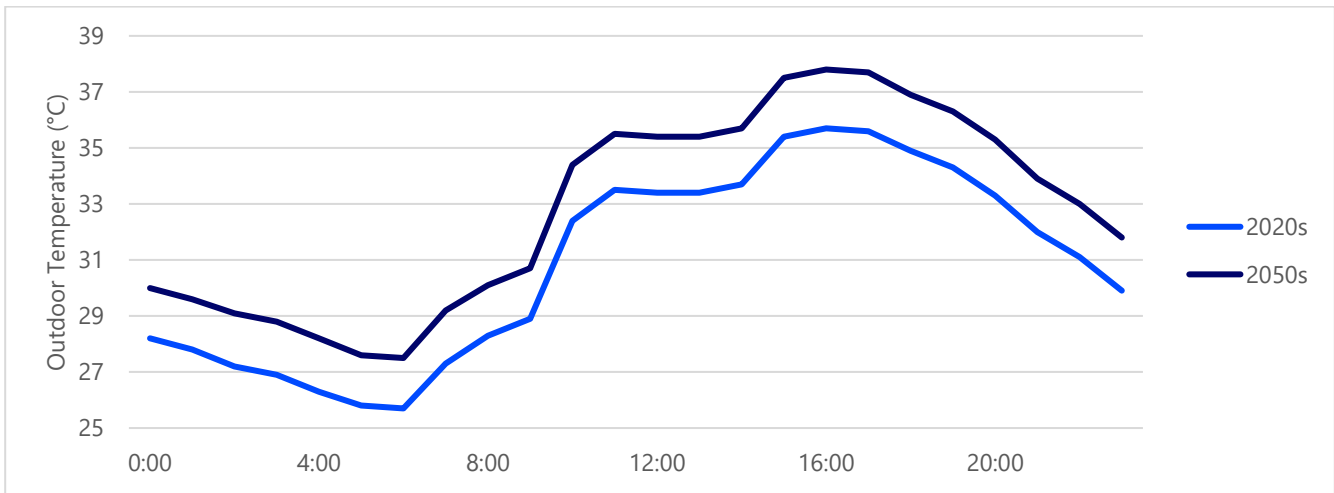


Figure 3: Outdoor temperature trend on peak cooling day, July 17th for 2020s and 2050s weather files.

3.1.2 Internal Gains

Internal gains were based on recognized industry references, including CIBSE and ASHRAE Handbook - Fundamentals. Internal gain assumptions are described in Table 2.

Table 2 Internal gains assumptions

Space name	Occupancy (people)	Lighting (W/m ²)	Equipment (peak W)	Cooking load (W)
Living/Kitchen	1 (70W sensible, 40W latent each)	5.4	80	Sensible: 150; Latent: 70
Bedroom	2 (70W sensible, 40W latent each)	5.4	80	0
Bathroom	0	0	0	0

Envelope assumptions were aligned to prior study benchmarks and are detailed in Table 3.

Table 3 Envelope assumptions

Envelope element	Baseline assumption (effective)
External wall	R-8; drywall interior surface
Roof	R-18; drywall interior surface
In-unit internal partition	R-3; drywall interior surface
Between-unit internal partition	R-9.5; drywall interior surface
Glazing	U-value 0.62 / SHGC 0.55 (Peel Region ExB study)
Infiltration	0.5 L/s/m2 applied to walls and windows, consistent with a relatively leaky existing-building condition

3.2 Modelled Scenarios

The six scenarios in Table 4 were tested to compare current and future weather conditions and to isolate the effect of low-cost operational measures. Operable bedroom windows were included in all scenarios.

Table 4: Description of modelled scenarios

Parameter	Baseline		Open Doors		Open Doors and Blinds	
	2050s	2020s	2020s	2050s	2020s	2020s
Mechanical cooling	10 kBtu/hr window AC	10 kBtu/hr window AC	10 kBtu/hr window AC	10 kBtu/hr window AC	10 kBtu/hr window AC	10 kBtu/hr window AC
Bedroom door	Closed at night	Closed at night	Open 24/7	Open 24/7	Open 24/7	Open 24/7
Internal blinds	None	None	None	None	Used during high solar gains	Used during high solar gains

4 Model Results and Analysis

4.1 Indoor Temperatures on Peak Cooling Day

The results in Figure 4 and Figure 5 illustrate how indoor temperatures vary within the suite during the most demanding summer conditions and show the difference between acceptable performance in the cooled living area and persistent overheating risk in the uncooled bedroom.

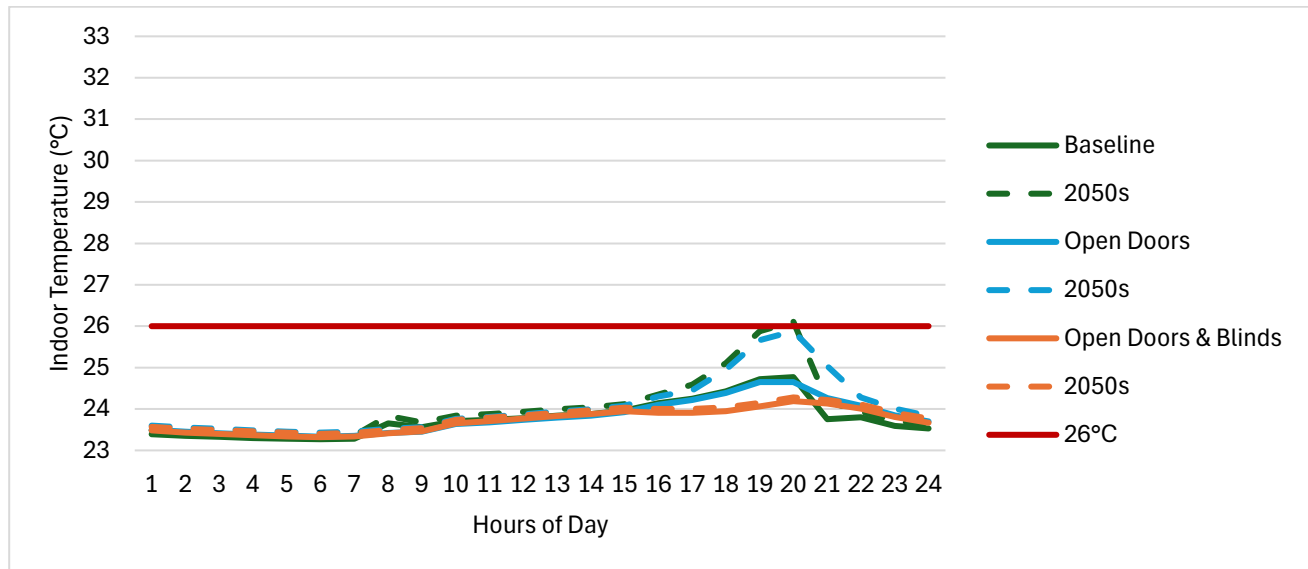


Figure 4 Indoor temperature in living room/kitchen on peak cooling demand day; July 17

On the modelled peak day, the living room/kitchen remained below the proposed 26°C threshold in all scenarios for both the current and 2050s weather files, as shown in Figure 4. Peak temperatures occurred in the early evening, reflecting the selected west-facing orientation and the lag between solar gains and indoor air-temperature response.

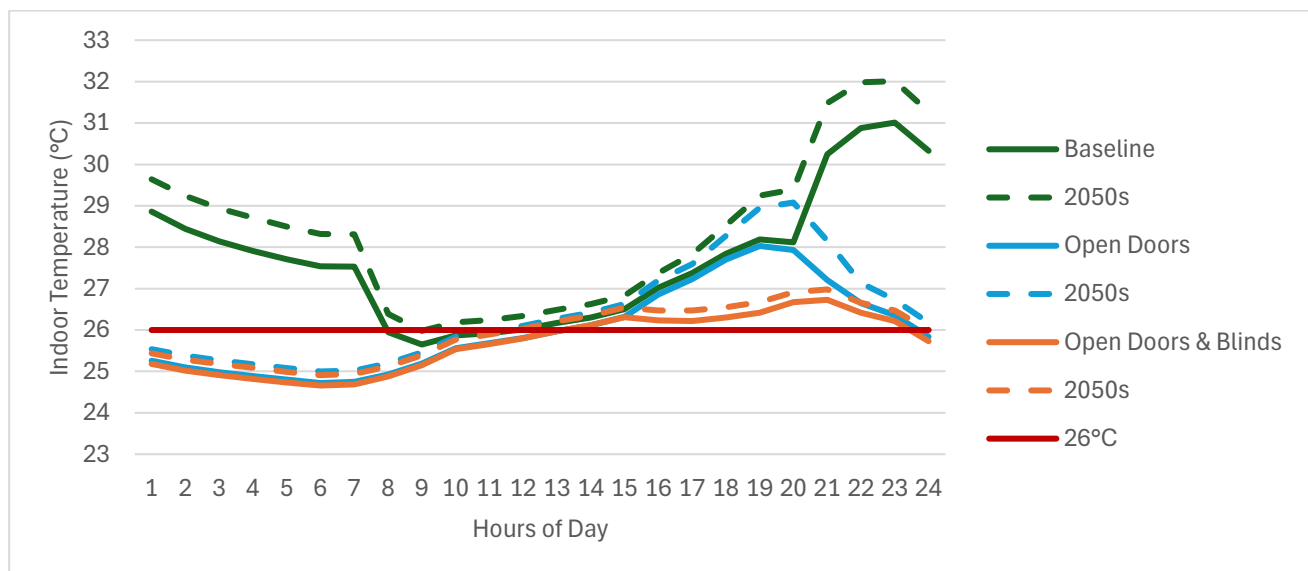


Figure 5 Indoor temperature in bedroom on peak cooling demand day; July 17

In the absence of dedicated bedroom cooling, peak-day temperatures exceeded 26°C under baseline conditions and were highest in the 2050s baseline scenario, as shown in Figure 5. Leaving the bedroom door open overnight materially lowered peak bedroom temperatures, and the addition of internal blinds further improved performance by reducing solar gains.

These peak-day results are directionally important because they show that the cooled living area and the uncooled sleeping area do not perform the same way. A unit can appear broadly cooled while still leaving the bedroom vulnerable to overheating.

4.2 Seasonal hours above 26°C

This section summarizes the number of summer hours (June to August) above the proposed maximum temperature limit, 26 degrees Celsius. For policy purposes, seasonal exceedance hours are more informative than a single peak day because they indicate how often a tenant may be exposed to elevated bedroom temperatures during the cooling season.

4.2.1 Living room/kitchen hours exceeding 26°C

A single living-room window AC unit is sufficient to keep the living area below 26°C for essentially the full summer in all cases. Only one hour between 26°C and 28°C occurred in the 2050s baseline case, and no living-room hours exceeded 28°C in any scenario. Results are summarized in Table 5.

Table 5: Number of summer hours (June-August) exceeding indoor temperature limits in living room/kitchen

Indoor temperature band	Outdoor Temp.		Baseline		Open Doors		Open Doors and Blinds	
	2020s	2020s	2050s	2020s	2020s	2050s	2020s	2050s
26 to 28 °C	171	267	0	1	0	0	0	0
28 to 30 °C	89	169	0	0	0	0	0	0
30+ °C	99	187	0	0	0	0	0	0

4.2.2 Bedroom hours exceeding 26°C without dedicated bedroom cooling

As summarized in Table 6, there are a significant number of hours above 26°C with the bedroom door closed over night and no internal blinds.

Opening the bedroom door reduces total overheating hours by approximately 60%. The combined scenario of opening the bedroom door to the living room and use of internal blinds performs best, reducing overheating by roughly 90%. However, this strategy relies on consistent occupant behaviour and should therefore be considered a behavioural mitigation measure rather than a guaranteed compliance solution.

Overall, bedroom temperatures may exceed 26°C for up to 32% of the summer period, depending on occupant behavior and the frequency and intensity of extreme heat events in Toronto.

Table 6: Number of summer hours (June-August) exceeding indoor temperature limits in bedroom

Indoor temperature band	Outdoor Temp.		Baseline		Open Doors		Open Doors and Blinds	
	2020s	2020s	2050s	2020s	2020s	2050s	2020s	2050s
26 to 28 °C	171	267	524	703	247	334	43	86
28 to 30 °C	89	169	74	153	2	11	11	0
30+ °C	99	187	9	17	0	0	0	0

4.3 Cooling Energy and Operational Cost Considerations

In addition to overheating performance, the study considered the potential operating-cost implications of adding cooling systems to condition the entire 1-bedroom unit. The modelling framework calculated hourly sensible cooling loads over the full year assuming both the living room/kitchen and bedroom were maintained at a 24°C cooling set point. Electricity use and operating cost can then be estimated by dividing the modelled cooling load by the coefficient of performance (COP) of the selected equipment type and applying an electricity cost rate.

For the draft analysis, an effective electricity rate of \$0.14/kWh was assumed, based on Toronto Hydro Tier 1 residential energy charges with HST included. The COP values in Table 7 were used for different cooling system types.

Table 7 Coefficient of Performance of Residential Cooling Equipment

Cooling equipment type	Coefficient of Performance (COP)
Window AC	3.5
Portable AC	2.3
Multi-split heat pump	5
PTHP	3.5

Higher COP values indicate greater efficiency and therefore lower electricity consumption for the same cooling load. Figure 6 shows the annual cooling electricity costs and demand for each cooling equipment type for the current and future weather file and if internal blinds were used. The bedroom door was left open but had no impact in this case as it was assumed that cooling was provided to both the living/kitchen and bedroom.

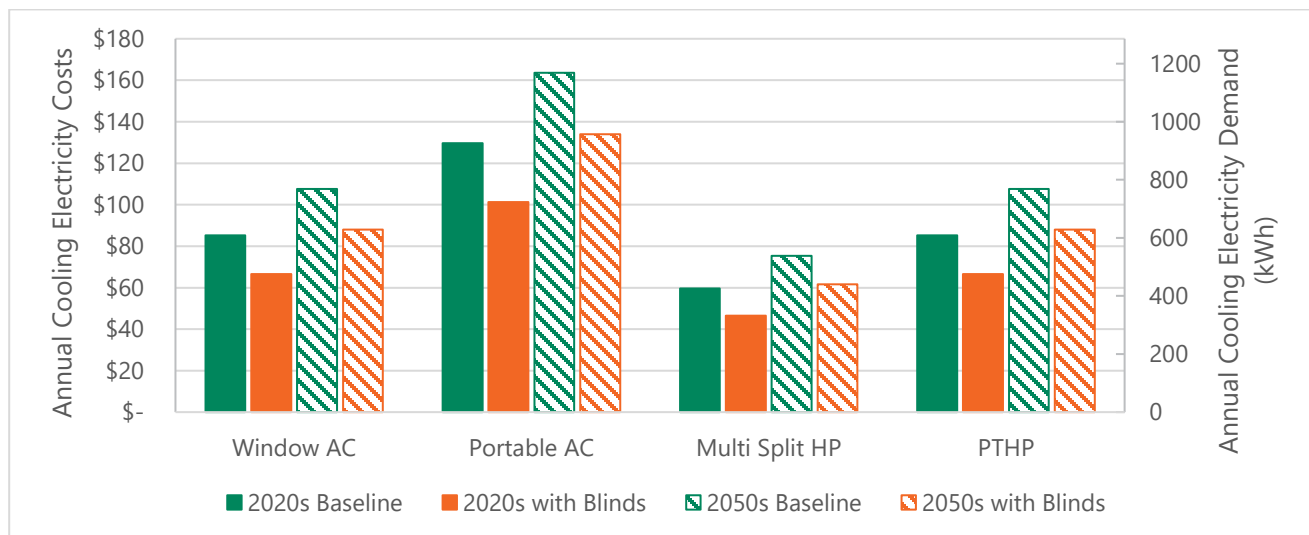


Figure 6 Annual Cooling Electricity Costs and Demand (kWh) by Cooling Equipment Type

At the whole-unit level, the modelled annual cooling electricity demand and cost remain relatively modest, but both increase under hotter future conditions. Internal blinds reduce annual cooling demand and cost across all equipment types. These results suggest that passive solar-control measures can provide meaningful operating-cost benefits even where they are not sufficient on their own to limit overheating in all rooms.

In general, window and portable units may have lower upfront cost but typically use more electricity than a higher-efficiency ductless multi-split heat pump or packaged terminal heat pump. Final cost comparisons could therefore consider both capital and operating cost, together with installation complexity, maintenance responsibility, and the suitability of each option for existing building conditions.

Annual operating costs may appear comparatively low on a whole-season basis, but that should not be mistaken for straightforward compliance. The modelling shows that the principal challenge is not simply the amount of cooling energy required over the year; it is whether cooling reaches vulnerable spaces, particularly bedrooms, during extreme summer conditions. A measure with limited cooling capacity that has minimal annual operating cost may still fail to provide dependable thermal protection.

4.4 Implications for By-law Development

The study highlights an important compliance risk: cooling one room in a dwelling does not necessarily mean that all occupied rooms, particularly bedrooms, will remain within a proposed maximum indoor temperature limit. A by-law framed around whole-unit compliance may require either dedicated cooling in sleeping spaces, better transfer of cooled air between rooms, or an alternative compliance pathway.

The results also illustrate why implementation will likely differ across the existing rental stock. Buildings with no cooling infrastructure may require more than a simple plug-in unit to achieve dependable compliance, especially where suite layouts, façade conditions, electrical capacity, acoustic constraints, or window configurations limit the effectiveness of room air-conditioners.

4.5 Study Limitations

This analysis is intentionally narrow and should be interpreted as a representative test case rather than a census of Toronto rental housing. Only one unit type, one orientation, and one air-conditioning strategy were modelled in detail.

Actual performance in the field will vary based on building age, envelope condition, solar exposure, floor level, air leakage, occupant schedules, plug loads, window operation, shading, and the installed capacity and placement of cooling equipment.

The operating-cost analysis should also be interpreted cautiously because it addresses annual electricity use only. The analysis does not address how costs would be allocated in practice, including whether electricity is tenant-paid or landlord-paid, or whether capital improvements could affect rents or housing affordability over time. As a result, the utility-cost figures are best understood as one component of a broader compliance-cost picture rather than a complete estimate of by-law implementation cost.

Despite these limitations, the study is useful because it tests a realistic low-complexity intervention and demonstrates where that intervention is, and is not, likely to be sufficient.

5 Conclusions

For the representative west-facing one-bedroom suite studied, a single 10 kBtu/hr window AC unit in the living room can keep the living area below 26°C, but it does not reliably prevent the bedroom from overheating when no dedicated bedroom cooling is provided.

Simple behavioural measures such as keeping the bedroom door open and lowering blinds can significantly reduce bedroom overheating, but these measures should not be treated as a fully dependable compliance strategy because they require sustained occupant action and may not be feasible or effective in all situations.

The modelling therefore supports the conclusion that, for at least some existing rental housing types, meeting a 26°C maximum indoor temperature standard may require additional cooling capacity beyond a single living-room window unit.

Where cooling is provided to both the living area and bedroom, the estimated annual electricity demand and operating cost are comparatively modest but not negligible, and they increase under hotter future weather conditions. Depending on equipment type, whole-unit cooling demand ranges from about 550 to 1,000 kWh per year. At the assumed electricity rate, that translates to roughly \$78 to \$145 per year. More efficient systems such as multi-split heat pumps have the lowest operating cost, while portable units have the highest. Internal blinds also reduce annual cooling electricity use and cost by approximately 25%, indicating that envelope and solar-control measures can help limit tenant utility impacts even when additional mechanical cooling is required.

The modelling results can be used to directly inform the City of Toronto Maximum Temperature By-law Compliance Feasibility Report.