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ENERGY STRATEGY REPORT

50 Speers Road, Oakville

September 26, 2022

Prepared for:

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EXECUTIVE SUMMARY

The proposed 50 Speers Road new development project in Oakville, Ontario is a 27-floor residential tower of approximately 25,800 m^2 (GBA) with 314 residential suites. This report explains how the project will address Oakville's Community Energy Strategy (specifically Strategic Direction 1), which focuses on achieving new building efficiency at least 17% better than the Ontario Building Code (OBC).

Recommended baseline energy performance targets for the building are outlined in Section 2 of this report under the following headings: Building Envelope, Interior Lighting Loads, Interior Plug & Process Loads, HVAC Systems, Service Water Heating Systems, Exterior Lighting Loads, Exterior Plug & Process Loads, and Mandatory Provisions of ASHRAE 90.1-2013. These recommendations are provided based on our extensive experience working on other similar buildings and have been developed as a first step toward meeting OBC Part 12 (minimum energy performance) requirements. Note: These recommendations are presented as a starting point only – energy modeling will be necessary to validate and refine our recommendations.

Opportunities to reduce energy usage significantly below OBC Part 12 requirements and to enhance operational resiliency have been identified. These opportunities are discussed in Section 3 of this report under the following headings: Passive Design Strategies, High-Performance HVAC Systems, High-Performance Service Water Heating Systems, Suite-Level Billing Meters, Suite-Level Kill Switch, Onsite Renewable Energy Systems, Shared Energy Infrastructure, and Strategic Back-Up Power Systems. The measures described should be considered as potential upgrades to the baseline design to significantly improve the energy performance of the building and contribute to the Town of Oakville's Community Energy Strategy. These measures will continue to be investigated and evaluated further as the project proceeds through the next phases of the planning and design process.

The following are our key recommendations for enhanced energy performance from Section 3 (to achieve energy performance significantly better than OBC Part 12):

- limit the window-to-wall ratio (WWR) of the exterior walls to no more than 40% on each elevation
- increase the effective thermal resistance value of exterior walls to ≥ R-15 [(h·ft^2·F) / Btu]
- switch the baseline HVAC system (i.e. a four-pipe fan coil system served by boilers and chillers) to a system served primarily by a Ground Source Heat Pump (GSHP)
- limit the flow rate of kitchen faucets to ≤ 5.7 LPM (separate pot filler faucets are excluded), consider drain water heat recovery, and/or pursue alternatives to a natural gas fired water heating (e.g. electric or GSHP)
- consider implementing suite-level billing with separate meters for electricity, thermal energy for space heating, hot water use, and cold water use
- consider implementing a "suite kill switch" that automatically turns off all lighting and other non-essential loads in a suite when occupants are not present

Note: All recommended baseline energy performance targets outlined in Section 2 of this report must also be met for parameters not included in this list. Also, other potential opportunities for the development (such as shared energy infrastructure and back-up power systems exceeding OBC requirements) should also undergo further investigation.

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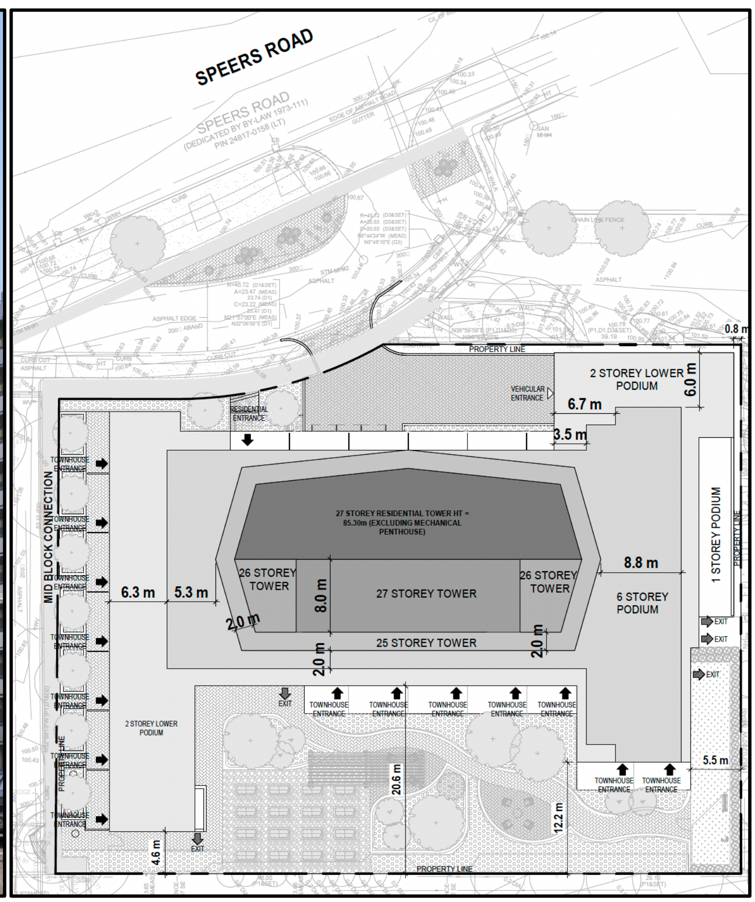
1 INTRODUCTION

1.1 Purpose

The purpose of this report is to identify opportunities to integrate innovative energy solutions into the 50 Speers Road project in Oakville, Ontario to help reduce energy usage, minimize greenhouse gas (GHG) emissions, and enhance operational resiliency over the long term. The findings of this report are preliminary in nature but are intended to introduce viable design options for the project team to consider and further evaluate. This early work is intended to inform future, more detailed energy analyses including those prepared for the OBC Building Energy Modeling Report (at the time of Building Permit Application). The overall goal is to improve upon the minimum energy performance required by the OBC and to contribute to the ≥ 17% savings target of Oakville's Community Energy Strategy.

1.2 Scope

This report applies to the proposed new development project to be located at 50 Speers Road in Oakville, Ontario. The project is envisioned as a 27-floor residential tower of approximately 25,800 m^2 (GBA) with 314 residential suites. There are also three levels of underground parking included in the plans. A preliminary site plan is shown below:



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1.3 Objectives

The specific objectives of this report are:

- to establish preliminary ***baseline performance targets*** that will help position the building to meet the OBC Part 12 (minimum energy performance) requirements,
- to identify ***passive design strategies*** that could be used to enhance the energy performance of the building,
- to identify ***high-performance mechanical/electrical systems*** that could be used to enhance the energy performance of the building,
- to take an initial look at the possibility of using ***onsite renewable energy systems*** (such as solar energy) to satisfy a portion of the energy needs of the new development,
- to take an initial look at the possibility of using ***shared energy infrastructure*** (such as district energy systems) for the new development, and
- to outline options for upgrading ***strategic back-up power systems*** for the new development.

General Notes:

This project is required to meet minimum energy performance thresholds specified by the Ontario Building Code (OBC) Part 12. To demonstrate compliance with these thresholds, the energy performance of the "Proposed Building" will be modeled and comparted to the energy performance of a "Reference Building" at the time of the Building Permit Application. Efforts will be made to exceed the minimum energy performance thresholds of the OBC (where feasible) to contribute to Oakville's Community Energy Strategy.

It is anticipated that the project will demonstrate compliance with OBC minimum energy performance thresholds following the SB-10 "ASHRAE 90.1" compliance path. Following this path, the energy performance characteristics of the "Reference Building" are defined by: ANSI/ASHRAE/IES Standard 90.1-2013 "Energy Standard for Buildings Except Low-Rise Residential Buildings" as modified by Chapter 2 of Division 3.

This report provides recommended energy performance characteristics for the design of the "Proposed Building" based on our preliminary assessment of the project context, early project drawings, overall design intent, and our extensive experience working on other similar buildings. These recommendations may change as more details about the project emerge and project-specific energy modeling is completed.

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2 BASELINE PERFORMANCE TARGETS (FOR OBC PART 12 COMPLIANCE)

The following are our recommended "baseline performance" targets for the building based on our preliminary assessment of the project context, early project drawings, and overall design intent. These building characteristics should be achieved (at a minimum) to position the building for OBC Part 12 compliance.

2.1 Building Envelope

- roofs ≥ R-25 [(h·ft^2·F) / Btu]
- walls ≥ R-5 [(h·ft^2·F) / Btu]
- slab-on-grade floors (if applicable) ≥ R-10 [(h·ft^2·F) / Btu]
- heated slab-on-grade floors (if applicable) ≥ R-15 [(h·ft^2·F) / Btu]
- exposed floors (if applicable) ≥ R-15 [(h·ft^2·F) / Btu]
- window assemblies ≤ U-0.33 [Btu / (h·ft^2·F)] and SHGC ≤ 0.34
- window-to-wall ratio ≤ 50% for each elevation (i.e. North, South, East, West)

Note: All thermal performance values noted above are expressed as overall assembly "effective" values that include all effects of thermal bridging. To evaluate the thermal performance of actual construction assemblies (for comparison to these values), the "nominal" insulation values of assembly components need to be appropriately derated to account for all effects of thermal bridging due to studs, girts, frames, back pans, slab edge details, balconies, etc.

2.2 Interior Lighting Loads

- installed lighting power density for entire residential floor area on average ≤ 0.3 W/ft^2
- installed lighting power densities for common areas ≤ 70% of SB-10 allowances (Table SB 9.6.1–2017) and utilize occupancy/vacancy lighting controls in common areas (controls per ASHRAE 90.1-2013 as a minimum)
- installed lighting power density for underground parking ≤ 0.12 W/ft^2
- utilize daylighting controls in common areas that have access to adequate natural daylight (controls per ASHRAE 90.1-2013 as a minimum)

2.3 Interior Plug & Process Loads

- select ENERGY STAR certified kitchen and laundry appliances and equipment
- identify and improve efficiency of atypical process loads, as applicable

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2.4 HVAC Systems

- ventilation: provide mechanical ventilation in accordance with OBC / ASHRAE 62 requirements – however, do not exceed OBC / ASHRAE 62 ventilation flow rates by more than 5%
- ventilation: provide a dedicated air-to-air energy recovery ventilation unit for each residential suite (i.e. utilize ERVs with a minimum sensible heat-recovery effectiveness of 70% at 0° C plus latent heat recovery); specify similar but separate air-to-air energy recovery ventilation for all common areas
- ventilation: ERV total fan power ≤ 0.85 W/cfm at operating conditions
- heating system: four-pipe fan coil units with three speed fan control (i.e. low for "fan only" ventilation operation, medium for heating mode, and high for cooling mode), electronically commutated fan motors (i.e. total fan power ≤ 0.25 W/cfm at operating conditions), and high-efficiency (>96%) condensing NG boiler plant with VFD pumps and outdoor air reset on supply temperature
- cooling system: four-pipe fan coil units (as above) served by high-efficiency chiller plant (water-cooled, magnetic-bearing, VFD centrifugal chillers) with VFD cooling tower fans and VFD pumps
- control system: 5-2 programmable thermostats in each residential suite that allow for programming of "fan only" ventilation operation, heating setpoints, and cooling setpoints

2.5 Service Water Heating Systems

- low-flow showerheads (5.7 LPM)
- low-flow kitchen faucets (5.7 LPM) and low-flow lavatory faucets (1.9 LPM)
- high-efficiency (>96%) condensing NG service water heating plant

2.6 Exterior Lighting Loads

- design for total installed lighting power densities ≤ 50% of ASHRAE 90.1-2013 allowances

2.7 Exterior Plug & Process Loads

- identify and improve efficiency of atypical process loads, as applicable

2.8 Mandatory Provisions of ASHRAE 90.1-2013

- A/M/E designers to comply with all mandatory provisions of ASHRAE 90.1-2013 and the OBC

Note: ASHRAE 90.1-2013 Mandatory Provisions forms are to be completed and signed by the A/M/E designers.

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3 ENHANCED PERFORMANCE MEASURES (FOR 'BETTER THAN' OBC PART 12 COMPLIANCE)

To improve the energy performance and operational resiliency of the project beyond the minimum energy performance requirements specified by OBC Part 12, the project team should consider several additional opportunities. The following are our recommendations for enhanced performance measures based on our preliminary assessment of the project context, early project drawings, and overall design intent.

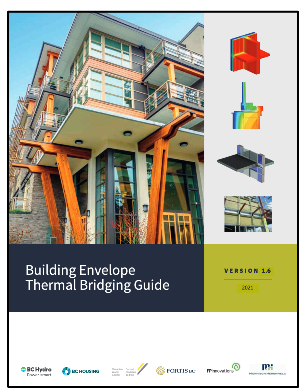
3.1 Passive Design Strategies

Passive design strategies represent one of the most important opportunities to reduce space heating and space cooling loads in a residential building. The idea is to design the building envelope to minimize heat losses in the winter and to minimize heat gains in the summer. Additionally, the geometry of a building can often be designed to avoid solar gains and glare through window glazing in the summer and to potentially allow some solar gains through window glazing in the winter to help provide heat to the space.

The first step is to limit the window-to-wall ratio (WWR) of the exterior walls to no more than 40% on each elevation. This means the transparent glazing area should make up no more than 40% of the overall wall area on each elevation.

The next step is to maximize the insulation properties of the building envelope. The most important measure is to increase the effective thermal resistance value of exterior walls to ≥ R-15 [(h·ft^2·F) / Btu]. Although various strategies exist to achieve better wall insulation in MURBs – most window wall and curtain wall systems in common usage achieve only around R-5 [(h·ft^2·F) / Btu]. To develop a plan to move past these systems, we recommend investigating the following alternatives that could significantly improve wall assembly thermal performance:

- curtain wall options that allow for extra insulation layers inboard of the spandrel panels to improve R-values
- modular wall systems that are specifically designed to improve R-values in high-rise buildings (e.g. Flynn Canada "Speedwall")
- thermally insulated balconies
- thermally insulated slab edges



Note that a full thermal bridging analysis following the Building Envelope Thermal Bridging Guide should eventually be completed to justify the wall assembly thermal resistance values used in the energy model. Also, construction practices should be carefully monitored to ensure a very airtight building envelope is achieved.

In addition to improving the insulation properties of the building envelope, options to control direct solar gains should be investigated. Vertical and/or horizontal solar shading screens can often help achieve significant reductions in space cooling loads and should be used as appropriate.

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3.2 High-Performance HVAC Systems

Selecting an alternative high-performance HVAC system (instead of the baseline four-pipe fan coil system) could lead to very significant reductions in energy use and GHG emissions. The project team should investigate in detail the costs and the potential benefits of switching to one of these high-performance HVAC systems:

Water Loop Heat Pump System: A Water Loop Heat Pump (WLHP) system offers several potential advantages over a four-pipe fan coil system. Space heating energy performance tends to be significantly better, fossil fuel use is decreased, and space cooling energy performance is still very good – without the need for a chiller. There is typically a slight cost premium (relative to the baseline four-pipe fan coil system), however it is usually considered modest in the big picture. As an alternative, a water source VRF system could be considered. These systems are not as common (currently) but could offer performance benefits. Note: Air source VRF systems are not generally considered well-suited for high-rise buildings.

Ground Source Heat Pump System: A Ground Source Heat Pump (GSHP) offers the best overall energy performance. Space heating energy performance is excellent and often fossil fuel use for space heating can be eliminated resulting in dramatic reductions in GHG emissions. Space cooling energy performance is also excellent and typically there is no need for either a chiller or a fluid cooler. The capital costs associated with GSHP systems are high, but the systems generally pay back over time. Some companies are offering Energy-as-a-Service (EaaS) options that would help finance the system and help circumvent the issue of high capital costs.

3.3 High-Performance Service Water Heating Systems

In residential buildings, service water heating is a very significant energy end use. When this load is served by natural gas fired boilers and/or water heaters, it also contributes significantly to GHG emissions. To improve performance, we recommend reducing the flow rate of kitchen faucets as low as possible. Some projects may go to 3.8 LPM kitchen faucets, or lower (especially if separate pot filler faucets are provided). We also recommend that the project team investigate drain water heat recovery systems and alternatives to a natural gas fired service water heating plant. Electric or electric heat pump water heaters should be investigated and evaluated in detail. If a GSHP system is pursued for space heating, it should also be considered for water heating.

Although not an energy saving measure, low-flow cold water fixtures should also be investigated. Regular 6 LPF toilets could be replaced with 4.8 LPF (or lower) toilets to further reduce the burden on water resources.

3.4 Suite-Level Billing Meters

Many studies have proven that when occupants are billed directly for the energy and water they use - they tend to use significantly less. A comprehensive suite-level billing system with separate meters for electricity, thermal energy for space heating, hot water use, and cold water use should be considered.

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3.5 Suite-Level Kill Switch

Often user-controlled loads (such as lights, fans, heating systems, cooling systems, etc.) are inadvertently left on when the user has left the suite. Some apartments, condominiums, and hotels are now implementing advanced controls for residential units that include a "suite kill switch" that automatically turns off all lighting and other non-essential loads when occupants are not present.

3.6 Onsite Renewable Energy Systems

Installing a renewable energy system on the building and/or the surrounding site could satisfy a portion of the energy needs of the new development. The most likely solution for this project would be a solar photovoltaic (PV) system. However, there is limited room on the roof of this building and a system integrated into the south façade would be less cost effective than a roof-mounted array (and realistically, a PV system on a high-rise building like this would only generate a small fraction of the total annual energy use of the building).

3.7 Shared Energy Infrastructure

Based on a brief review of the surrounding development context, the opportunity for waste heat recovery from/to adjacent sites does not appear to be compelling. Furthermore, a shared central plant (i.e. a district energy system) does not fit the development model envisioned for this project. In the design development and detailed design phases of the project, any viable opportunities for shared energy infrastructure should be reevaluated.

3.8 Strategic Back-Up Power Systems

Back-up power is planned for life safety systems in the building, per the requirements of the Ontario Building Code. Emergency lighting, elevators, sump pumps, garage exhaust fans, the fire alarm system, and fire pumps should be fed from natural gas generator(s). With natural gas as the fuel (instead of diesel), the run time of the generator(s) will be virtually unlimited during an emergency situation. Additionally, the design team should look into options to provide heating and cooling to designated common areas in the event of a prolonged power outage. This should be evaluated in detail during the design development and detailed design phases of the project.

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4 CONCLUSIONS AND RECOMMENDATIONS

This project should be able to comply with the OBC Part 12 minimum energy performance requirements by implementing good engineering design and adhering to the baseline performance targets outlined in Section 2.

The energy performance and operational resiliency of the project could be significantly improved beyond the minimum energy performance requirements by implementing the following upgrades to the baseline design:

- limit the window-to-wall ratio (WWR) of the exterior walls to no more than 40% on each elevation
- increase the effective thermal resistance value of exterior walls to ≥ R-15 [(h·ft^2·F) / Btu]
- switch the baseline HVAC system (i.e. a four-pipe fan coil system served by boilers and chillers) to a system served primarily by a Ground Source Heat Pump (GSHP)
- limit the flow rate of kitchen faucets to ≤ 5.7 LPM (separate pot filler faucets are excluded), consider drain water heat recovery, and/or pursue alternatives to a natural gas fired water heating (e.g. electric or GSHP)
- consider implementing suite-level billing with separate meters for electricity, thermal energy for space heating, hot water use, and cold water use
- consider implementing a "suite kill switch" that automatically turns off all lighting and other non-essential loads in a suite when occupants are not present

Note: All recommended baseline energy performance targets outlined in Section 2 of this report must also be met for parameters not included in this list.

Opportunities for shared energy infrastructure should continue to be investigated. However, heat recovery from/to adjacent sites does not appear to be economically feasible and a shared central plant does not fit the development model envisioned for this project.

Opportunities for enhancing the capabilities of back-up power systems should continue to be investigated. Back-up power for this project should be provided by natural gas generators (as opposed to diesel generators) to provide virtually unlimited operation during an emergency situation. Additionally, the design team should investigate options to provide heating and cooling to designated common areas in the event of a prolonged power outage.