

TOWN OF CALEDON
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Healey Gore Secondary Plan Area

Community Energy and Emissions Reduction Plan

Town of Caledon, ON

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Limitations

This report has been prepared by Pratus Group with the purpose of providing energy strategies for the proposed Healey Gore Secondary Plan Area for Solmar Development Corporation under the terms of our agreement. The material herein reflects Pratus Group's best judgement in light of the information available to it at the time of preparation. Any use that a third party makes regarding the information provided within this report including reliance on, or decisions to be made based on it, are the responsibility of such parties. Pratus Group accepts no responsibility for damages, if any, suffered by any party as a result of decisions made or actions taken based on this report.

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1. Executive Summary

Pratus Group Inc. was retained by Alcan Holdings Inc. to develop a Community Energy and Emissions Reduction Plan (CEERP) consistent with Section 5.6.20.14.17(d) of the Region of Peel Official Plan and the Town of Caledon Terms of Reference (TOR) for the Healey Gore Secondary Plan Area located in the Town of Caledon, Ontario.

The purpose of this study was to:

- Assess the anticipated energy requirements for the Secondary Plan Area based on the proposed development pattern and prevailing development requirements for new building construction in the Town of Caledon (termed the **Baseline Scenario**)
- Identify strategies to improve energy conservation and reduce emissions within the Secondary Plan Area in alignment with the Town of Caledon's community-wide emissions reduction objectives (termed the **Near Net Zero Scenario**)
- Assess the viability of community-based energy generation systems for subareas of the proposed Secondary Plan Area
- Outline future actions that would contribute to energy conservation and reduced emissions and promote successful implementation of the strategies proposed in the **Near Net Zero Scenario**

The proposed Healey Gore Secondary Plan Area is expected to consist of 39.4 hectares of land, with 33 hectares of developable land area. The Plan Area as currently envisioned is expected to be primarily low-rise residential. The proposed building mix for the planned community includes street townhouses, single and semi-detached homes with an estimated total gross floor area of approximately 1,670,700 square feet.

Energy simulations were conducted by Pratus Group Inc. to estimate baseline energy use and carbon emissions expected to arise from the Secondary Plan Area based on the building stock meeting the requirements established by the Town of Caledon. From this baseline, additional energy conservation and emissions reduction opportunities were assessed and explored to identify a lower-carbon scenario consistent with the Town and Region decarbonization objectives.

Building Energy Systems Assessed

The **Baseline Scenario** establishes the expected energy consumption based on the proposed development meeting the energy standards in the Town of Caledon communicated in the Town's Green Development Standard. The **Near Net Zero Scenario** was then constructed by evaluating a variety of potential additional low-carbon design strategies and technologies, both at building and district scales. Strategies were selected based on their capacity to achieve energy conservation and emissions reduction strategies, ultimately identifying a prospective pathway to a lower-carbon development approach within the Secondary Plan Area.

Transportation Systems Assessed

The Town of Caledon introduced a Green Development Standard (GDS) in July 2024 for all new development applications. The GDS, at a minimum, requires that all single-family residential dwellings, 50% of multi-unit residential buildings and 20% of all other types of dwellings are equipped with the required infrastructure to be EV-Charger ready. As the Healey Gore Secondary Plan Area consists entirely of residential development, there are no non-residential parking spaces applicable to the analysis conducted.

The requirements of the GDS were used to estimate the energy demand associated with implementing electric vehicle (EV) chargers for the following scenarios:

- **Transportation Case 1** – 25% of residential dwellings install and utilize EV chargers
- **Transportation Case 2** – 50% of residential dwellings install and utilize EV chargers
- **Transportation Case 3** – 100% of residential dwellings, based on the Town of Caledon GDS minimum requirements

Transportation Case 1 was used as a baseline in this analysis to compare other scenarios against.

Archetype Energy and Carbon Results

The relative energy and carbon emissions performance of the building archetypes modeled are illustrated in **Table 1**. In terms of energy performance, like-for-like system efficiencies are comparable whether looking at energy systems on a local or district level as the technologies used for heating, cooling or energy production adhere to the same operating principles. For the purpose of this study, the **Near Net Zero** energy system improvements were modeled as being implemented across the entire site.

Table 1: Energy and Carbon Emission Reduction Savings from Near Net Zero Designs

Category	Archetype	Baseline Design Scenario	Net Zero Design Scenario	% Savings over Baseline	
				Energy	Emissions
Residential 	Single Detached Homes Semi-Detached Homes Street Townhouses	3 season air source heat pump (ASHP) with natural gas backup	Installation of solar photovoltaic panels, geothermal heat pump system for HVAC, and upgradation of domestic hot water to ASHPs with natural gas back up from 100% gas and passive measures	42%	77%

Category	Electric Vehicle	Baseline Design Scenario	Net Zero Design Scenarios	Increase in Energy Consumption	
Transportation 	EV Chargers	Transportation Case 1 25% of residential spaces utilize EV chargers*	Transportation Case 2 50% of residential spaces utilize EV chargers*	100%	2x
			Transportation Case 3 100% of residential and 20% of non-residential spaces utilize EV chargers (Based on the Town of Caledon GDS minimum requirements) *	300%	4x

*Note that the Secondary Plan development is entirely residential, so the commercial requirements were not relevant.

Near Net Zero Scenario

Of the various building systems assessed, geothermal heat pumps, air source heat pump domestic hot water heaters (with a natural gas backup system), and rooftop solar PV systems were considered for the **Near Net Zero Scenario**, based on their potential energy and emissions performance. The energy use and greenhouse gas intensity reduction potential between the scenarios are reported in **Table 2** and **Table 3**, respectively. Values are shown as reductions in comparison to the baseline condition.

Table 2 : Estimated EUI Reduction Potential

Baseline Scenario EUI [kWh/m ²]	Reduction Strategies EUI [kWh/m ²]				Total Reduction Potential EUI [kWh/m ²]	Near Net Zero Scenario EUI [kWh/m ²]
	Geothermal Heat Pump	Solar Rooftop PV	Air Source DHW HP with Gas Backup	Passive Measures		
112.4	-12.1	-26.2	-7.7	-1.1	-46.9	65.5
% of individual reduction	11%	23%	7%	1%	42%	

Table 3: Estimated GHGI Reduction Potential

Baseline Scenario GHGI [kgCO _{2e} / m ²]	Reduction Strategies EUI [kgCO _{2e} /m ²]				Total Reduction Potential GHGI [kgCO _{2e} /m ²]	Near Net Zero Scenario GHGI [kgCO _{2e} / m ²]
	Geothermal Heat Pump	Solar Rooftop PV	Air Source DHW HP with Gas Backup	Passive Measures		
8.4	-1.0	-0.8	-4.5	0.0	-6.4	2.0
% of individual reduction	12%	9%	54%	0%	76%	

The results of the analyses conducted demonstrate that EVs and their associated infrastructure requirements are expected to create a significant additional electricity demand. The estimated overall energy demand associated with the scenarios modelled is summarized in **Table 4**.

Table 4: Estimated EV Charger Demand for the Healey Gore Secondary Plan Area

Scenarios Assessed	Level 2 EV Chargers Residential*	Total EV Chargers Demand [kW]	Total Carbon Emissions [kgCO _{2e}]
Transportation Case 1	209	1,378	69
Transportation Case 2	418	2,756	138
Transportation Case 3	835	5,511	276

*The Secondary Plan development is entirely residential.

Average costs for EV charging stations, installation and infrastructure are approximately \$2,000 per Level 2 charger for single family homes, based on discussions with major suppliers in Canada (ChargePoint, Switch Energy, & Flo). Approximately 35% and 15% of these costs are associated with charging station equipment and installation for residential, respectively, which are to be borne by individual owners in

Caledon. The remainder (~50%) of these costs are associated with the conduits, and electrical cable installation.

To quantify expected costs for EV charging, \$1,300 for Level 2 residential chargers was assumed. Based on the GDS requirements to make buildings EV-Charger ready, the estimated cost to the developer is **\$1,085,500**. Suppliers have communicated that there is a factor of economies of scale for installation that is not reflected in this value. The true cost will vary between suppliers and will be determined at the time of procurement.

Costs for electrical infrastructure upgrades (such as higher capacity transformers and sub-stations) were excluded from these calculations as further analysis will need to be conducted on anticipated usage of the EV chargers and transportation uses in consultation with Ontario Hydro and utility providers which is beyond the scope of this study.

The increased electricity demand posed by the proposed electric vehicle charging scenarios cannot feasibly be met through on-site generation within the Secondary Plan Area and was therefore excluded from the Near Net Zero Scenario.

Table 5, Figure 1, and Figure 2, summarize the results of the **Near Net Zero Scenario** compared to the **Baseline Scenario** and to a building built to the requirements of the Ontario Building Energy Code 2017. The energy requirements of the Town of Caledon's GDS exceed the baseline standard used by other municipalities in Ontario, meaning that the Baseline Scenario already represents energy conservation and emissions reduction that exceeds the provincial Code.

Table 5: Estimated EUI and GHGI Savings over OBC and Baseline Scenarios

Metric	Ontario Building Energy Code	Baseline Scenario	Near Net Zero Scenario	Total Savings over OBC (%)	Total Savings vs. Baseline Scenario (%)
EUI [kWh/m²]	198.0	112.4	65.5	67%	42%
GHGI [kgCO₂e/m²]	26.2	8.4	2.0	93%	77%

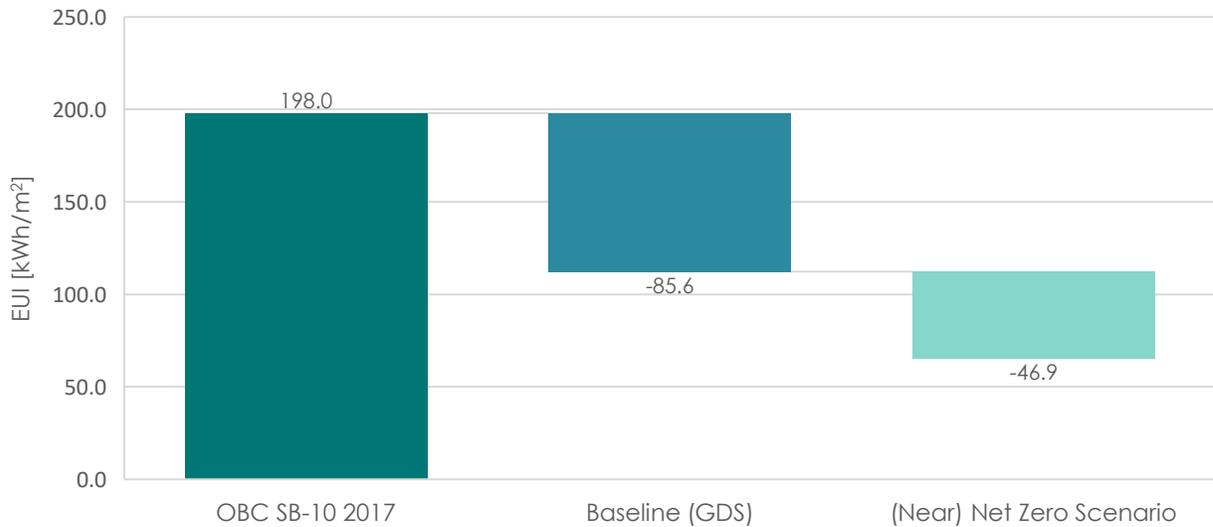


Figure 1: Estimated EUI Reduction Potential Comparison to OBC and Baseline Scenario

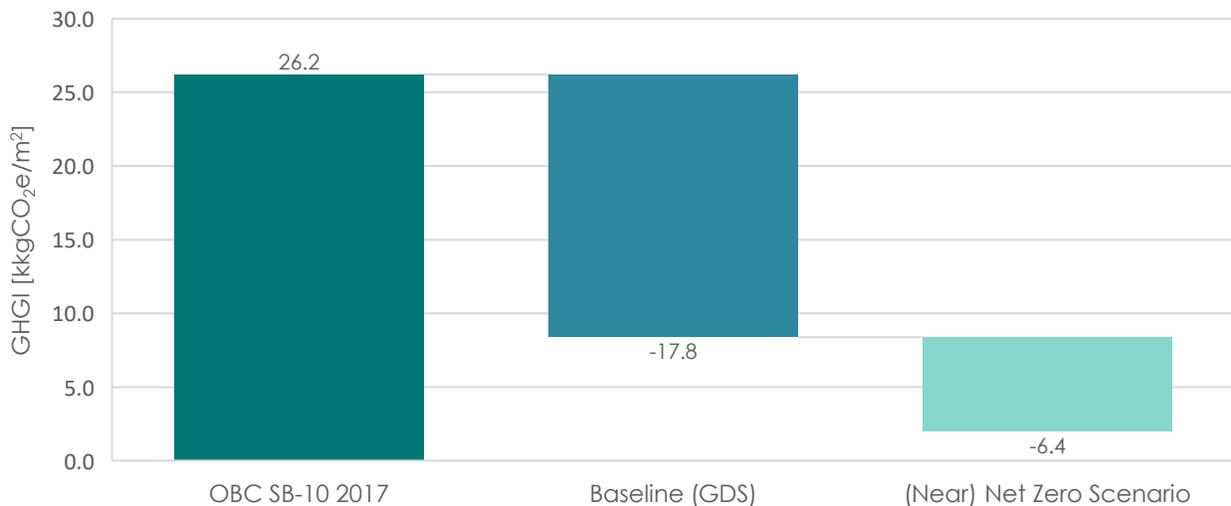


Figure 2: Estimated GHGI Reduction Potential Comparison to OBC and Baseline Scenario

The **Near Net Zero Scenario** identifies a potential pathway to achieving a low-carbon development within the Plan Area that nearly achieves net zero carbon emissions for Healey Gore Secondary Plan Area. This potential roadmap is shown in **Figure 3** and **Figure 4**.

Additional energy and emissions reductions within the Secondary Plan Area can only be achieved by adopting more compact and higher-density development forms, and/or by increasing the scale of on-site renewable energy installations. Grid-based electricity has inherent emissions associated with its consumption which means that the Secondary Plan Area cannot achieve net zero without future action by the Province of Ontario and provincial utilities to achieve a zero-carbon electricity grid.

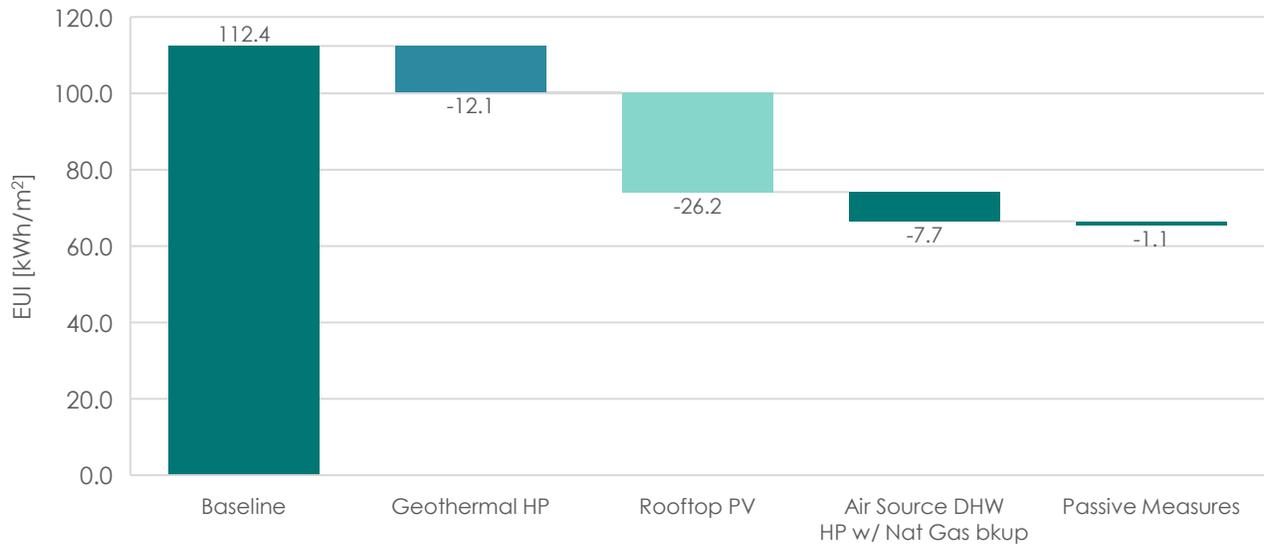


Figure 3: Energy Use Intensity Reduction Roadmap Demonstrating EUI Reduction Potential

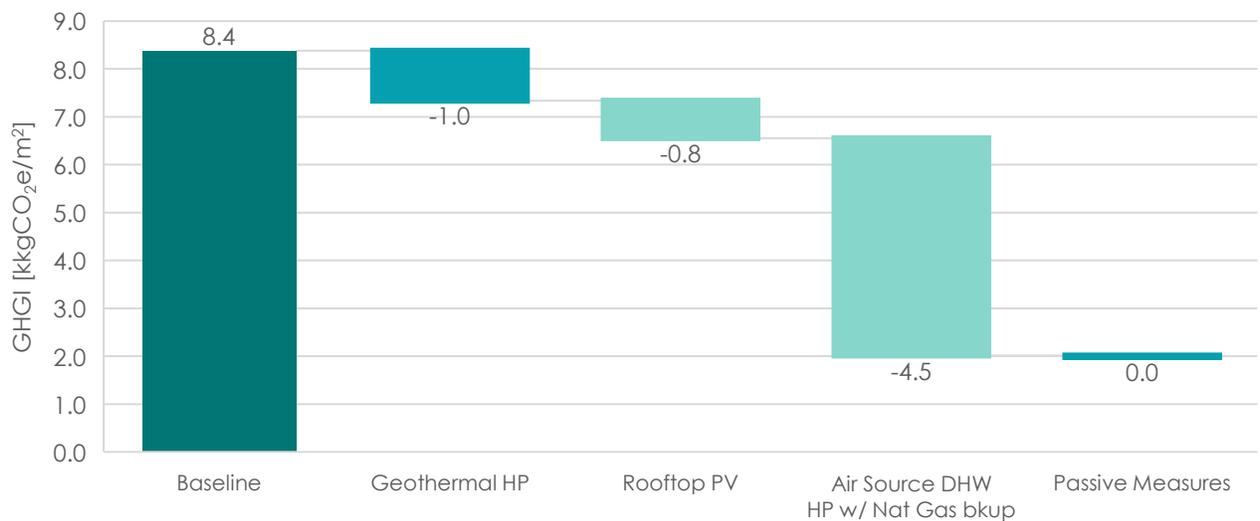


Figure 4: Greenhouse Gas Intensity Reduction Roadmap demonstrating GHGI reduction potential

District Energy System Considerations

District energy systems (DES) are localized networks that use a centralized plant to distribute heating, cooling, and/or hot water to multiple buildings. DES are best suited to service medium to high-density developments. Typically, a threshold greater than one million square feet in total serviceable floor area is preferred by developers of these systems.

DESs are not viable options for low-rise residential buildings due to the extensive infrastructure required to implement DES within such dwellings, leading to additional costs. As the Secondary Plan Area consists solely of low-rise residential buildings, DES is not technically feasible for Healey Gore Secondary Plan Area. There are also no existing energy sources or systems that could be connected to or expanded upon within

or adjacent to this Plan Area. It is possible that neighbouring development areas could introduce a DES, but this information was not available to support the analyses reported here.

1.1. Summary of Findings

- The introduction of building-scale geothermal heat pumps, rooftop solar photovoltaic systems, air-source heat pump domestic hot water systems and passive measures offer a pathway to potentially reducing 77% of the GHG emissions in the Healey Gore Secondary Plan Area.
- The incremental capital cost of implementing these technologies over the requirements of the Town of Caledon Green Development Standard is estimated to be approximately \$195.5 million based on the Class D cost estimate conducted.
- The 20-year net present value (NPV) total cost of implementing the strategies described in the Near Net Zero Scenario is estimated at \$1.0 billion based on the Class D cost estimate conducted, which is approximately \$ 744.4 million greater than the baseline NPV.
- The increased electricity demand posed by the proposed electric vehicle charging requirements cannot feasibly be met through on-site generation within the Secondary Plan Area and was therefore excluded from the Near Net Zero Scenario.
- District-scale energy generation is not feasible based on the proposed development pattern in the Secondary Plan Area which is low-density and the lack of existing systems in close proximity to the site.

2. Introduction and Context

The Healey Gore Secondary Plan Area is a proposed community development located within the boundary of the Town of Caledon, Ontario, a constituent municipality of the Region of Peel. A Community Energy and Emissions Reduction Plan (CEERP) is a required component of the Secondary Plan submission per the requirements of the Region of Peel Official Plan 2051 (November 2022), and the requirements of the Town of Caledon's Terms of Reference.

The purpose of this CEERP is to explore opportunities to achieve significant energy conservation and emissions reduction in comparison to baseline practices for the future community that will be constructed within the Secondary Plan Area. Alternative energy systems and technologies were evaluated to determine how low-emission buildings and transportation strategies could be utilized to achieve low-carbon operating conditions within the Healey Gore Secondary Plan Area. Potential solutions were assessed based on their technical, spatial, and financial viability and their impact on GHG emissions for the proposed community development as it is currently envisioned.

The CEERP also reviews opportunities to implement community-scale energy systems which can maximize GHG reductions within the proposed development, if feasible per the requirements of the Region of Peel's Official Plan and the Town of Caledon's Terms of Reference (TOR).

2.1. Secondary Plan Area

The Healey Gore Secondary Plan Area development is planned for the southwest lands of Town of Caledon, Ontario as shown in **Figure 5**. The site is located to the west of the Town of Bolton, bound by Healey Road to the north, and The Gore Road to the west. Humber Station Road is located to the east, but not immediately adjacent, as depicted in **Figure 6**. The conceptual plan for the proposed Secondary Plan Area includes residential neighbourhoods consisting of street townhouses as well as detached and semi-detached homes.

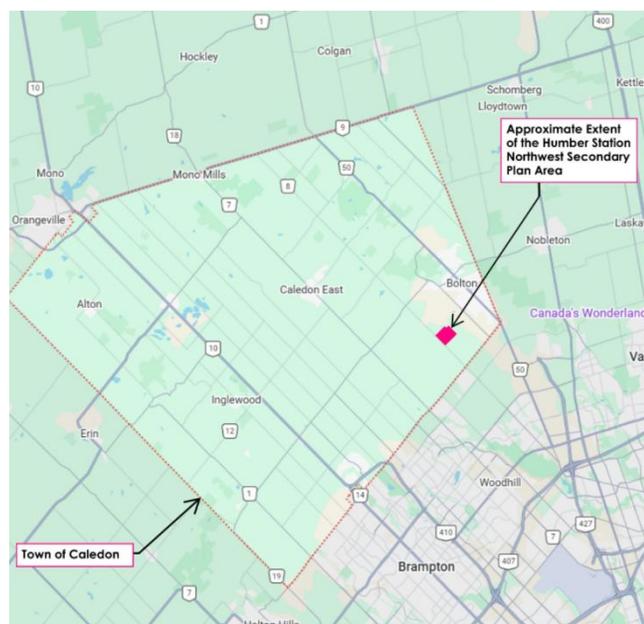


Figure 5: Approximate Extent of the Healey Gore Secondary Plan Area in the Town of Caledon

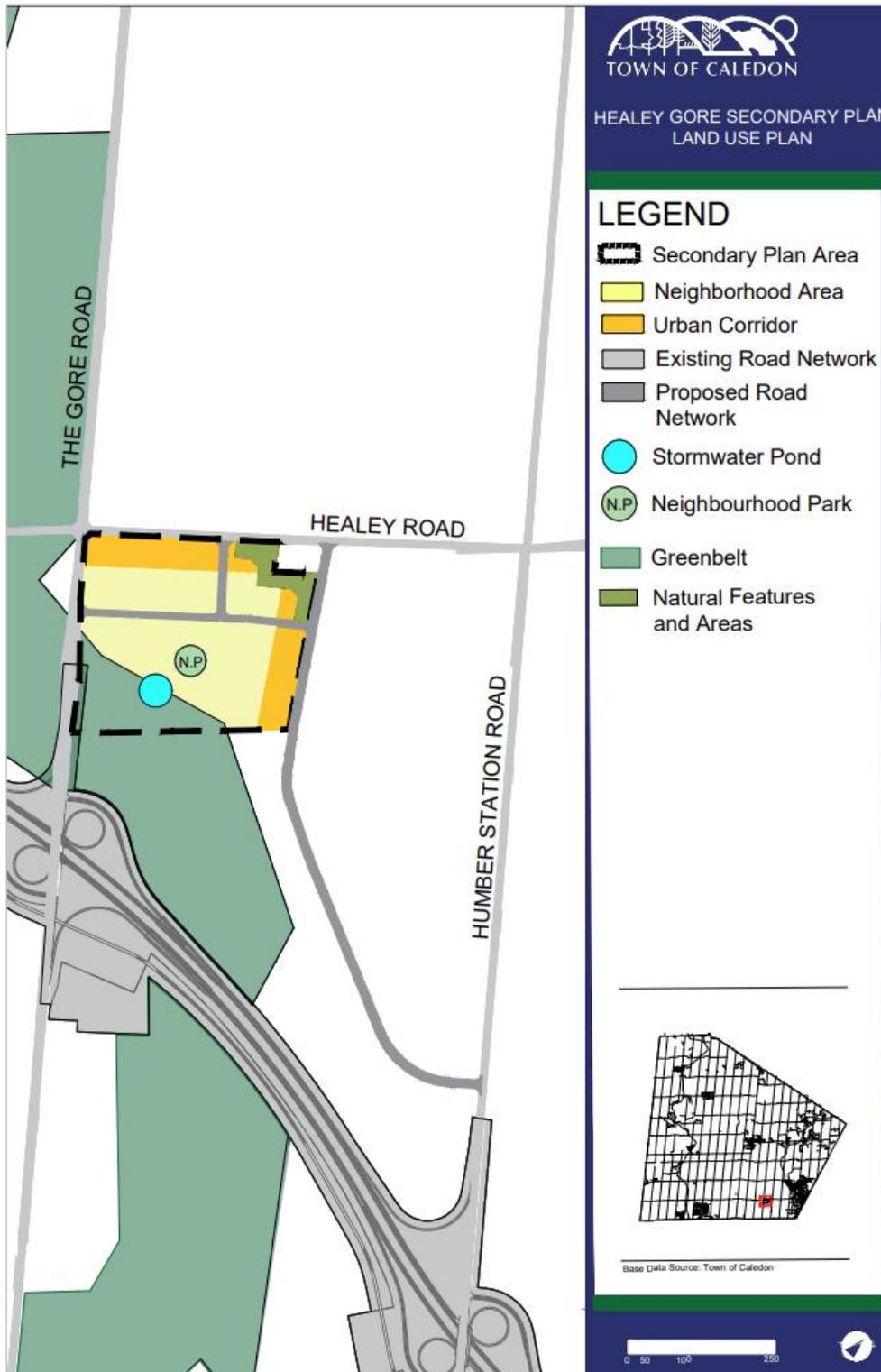


Figure 6: Proposed Land Use Plan for the Healey Gore Secondary Area

(SGL Planning & Design Inc., February 18, 2026)

2.2. Demographics, Site Statistics and Building Types

The proposed Healey Gore Secondary Plan Area is expected to consist of approximately 39.4 hectares of land, with 33 hectares of developable area and 23 hectares allotted for the development of new buildings. The development pattern consists wholly of low-rise residential buildings, with 4.9 hectares of 7.62 lot size street townhomes, identified as medium-density development in Urban Corridors located along the northern and eastern edges of the site. The proposed building mix in the Urban Corridors includes low-density street townhouses, detached and semi-detached homes, and medium-density street townhomes with an estimated total gross floor area of approximately 1,670,700 square feet.

The proposed development also includes the following features:

- A stormwater management pond at the southwest
- A Natural Heritage System area located at the southern edge of the site
- A central neighbourhood park at the centre of the site
- A channel at the northeastern corner of the site

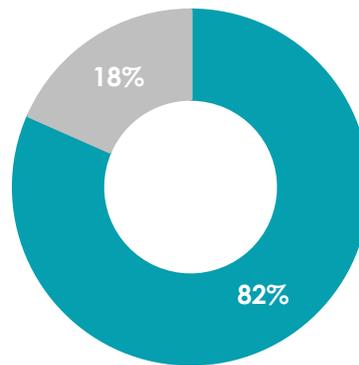
2.2.1 Details per Building Type

In addition to the Land Use Structure Plan, KLM Planning provided a preliminary lotting plan concept (See **Appendix B** for details), including statistics on the building typologies and unit numbers. These building types are listed in **Table 6** for reference. **Figure 7** shows a breakdown of the types of building within the current proposed Secondary Plan Area development by floor area. Note that while the street townhomes are concentrated in the Urban Corridors, some are located within the general Neighbourhood Area.

Table 6: Healey Gore Secondary Plan Area Building Type Descriptions

Residential Building Types – Total 23 ha / 835 units	
Neighbourhood Area (18.1 ha / 636 Units)	Urban Corridor Area (4.9 ha / 199 Units)
	
Low-Density Blocks: 50 units per hectare	Medium-Density Blocks: 70 units per hectare
<ul style="list-style-type: none"> ● Single Detached Homes: 3.6 ha / 124 Units ● Semi-Detached Homes: 8.2 ha / 421 Units ● Street Townhouses: 6.3 ha / 91 Units 	<ul style="list-style-type: none"> ● Street Townhouses: 4.3 ha / 186 Units ● Single/Semi-Detached Homes: 0.55 ha / 13 Units

**Note that the images shown are meant to be representative and may not reflect actual development styles.*



■ Low Density - Residential ■ Medium Density - Residential

Figure 7: Healey Gore Secondary Plan Area Building Type Breakdown (by Gross Floor Area)

2.3. CEERP and Net Zero Targets

The Region of Peel Official Plan, approved on November 4th, 2022, introduced requirements for secondary plan areas to complete a CEERP. Under s.5.6.20.14.17(d) of the Official Plan (Region of Peel, 2022), secondary plan areas are required to address:

- The feasibility, planning and implementation requirements to achieve near Net zero carbon emissions and near Net Zero annual energy usage.
- The feasibility of implementing alternative and renewable energy systems including district energy systems and outlining policy requirements for their implementation in accordance with objectives to be established for each secondary plan area.
- The legal, financing, technical and regulatory requirements necessary to facilitate the implementation of alternative and renewable energy systems.
- A strategy and policy direction to implement Regional and local sustainable development guidelines in community, neighborhood, site and building designs, including implementation and phasing in of the current and future energy performance requirements of the Ontario Building Code; and
- A strategy and policy direction to implement electric vehicle charging infrastructure.

In alignment with the Region's Official Plan requirements, the Town of Caledon implemented a Terms of Reference document in early 2023 outlining similar requirements for secondary plan areas. Caledon Town Council also previously passed a motion declaring a climate change emergency and adopted a community-wide greenhouse gas (GHG) emissions reduction target of net zero emissions by 2050 as well as an interim target of 36% reduction in emissions by 2030 (Town of Caledon, 2021). The Town subsequently developed the Resilient Caledon Community Climate Change Action Plan (Resilient Caledon Plan) which outlines initiatives the Town plans to undertake to prepare for the expected future impacts of climate change. Additional information on the Energy and Carbon Environment can be found in **Appendix C**.

2.4. Policy Context

Town of Caledon Green Development Standard

The Town of Caledon has developed guidance for low-carbon building construction under the Green Development Standard (GDS). The Town of Caledon's GDS was implemented in July 2024 for all new development applications. It establishes a suite of long-term, low-carbon goals and strategies governing building design and construction.

The GDS consists of tiers of performance measures with supporting guidelines that promote sustainable site and building designs. Tier 1 requirements of the GDS are defined as the mandatory requirement for the planning approval process. The GDS outlines absolute targets for planned developments and requirements for EV chargers based on building archetype. The GDS utilizes three energy performance metrics as the basis for quantifying and assessing energy and GHG emissions as follows:

- **TEUI:** Total Energy Use Intensity (kWh/m²·yr). This is the total annual energy use of the building and site divided by the modeled floor area.
- **TEDI:** Thermal Energy Demand Intensity (kWh/m²·yr). The annual heating load that the mechanical systems must provide to the building for space and ventilation heating, divided by the modeled floor area. Note that this is heat that the systems must provide at the terminals, not energy consumed by mechanical equipment to supply the required heating.
- **GHGI:** Greenhouse Gas Intensity (kg/m²·yr). The annual CO₂ equivalent emissions per modeled floor area using utility rate emissions factors.

These metrics mirror standards that have been implemented in most of the municipalities in the Greater Toronto Area. Similar metrics have also been used in various building performance standards such as the Canada Green Building Council's (CAGBC) Zero Carbon standard to establish energy and GHG targets. The current targets for Caledon's GDS are outlined in **Table 7**.

Province of Ontario

The Province of Ontario introduced the *Protect Ontario by Building Faster and Smarter Act, 2025* (Bill 17) (Ontario, Bill 17, *Protect Ontario by Building Faster and Smarter Act, 2025*) in June, 2025. This bill prohibits municipalities from passing by-laws with respect to the construction or demolition of buildings. This was followed by the introduction of the *Fighting Delays, Building Faster Act, 2025* (Bill 60) (Ontario, 2025). This bill provides that a decision of the provincial Minister is not required to be consistent with policy statements issued under the *Planning Act*.

Taken together, this provincial legislation is understood to limit the implementation of green development standards that exceed the provincial Building Code. Therefore, the guidance and recommendations proposed within this report should solely be considered as optional strategies that should be explored by the Landowner and future developers of individual sites for implementation within the Secondary Plan Area.

Table 7: Town of Caledon’s GDS Absolute Performance Targets (Town of Caledon, 2024a)

Building Type	Energy and Carbon Performance Measures			EV Charger-Ready Requirements*
	TEUI [kWh/m ² /yr.]	TEDI [kWh/m ² /yr.]	GHGI [kgCO _{2e} /m ² /yr.]	
Low Rise Residential (<3 storeys)	Energy Star or equivalent OR NBC Tier 3 performance and 20% reduction in GHG emissions from OBC		15	Minimum one charging space per dwelling unit
Multi-unit Residential (>6 storeys)	135	50	15	Minimum 50% of parking spaces are EV-ready
Multi-unit Residential (≤6 storeys)	130	40	15	
Commercial Office	130	30	15	Total of 20% of parking spaces are EV-ready
Commercial Retail	120	40	10	Minimum 5% of spaces to be equipped with EV
Industrial	130	60	15	Supply Equipment (EVSE)

*For all building sites: Encourage dedicated parking spaces for carshare services or carpooling and charging spaces for e-bike and scooters.

2.5. District Energy Systems

District Energy Systems (DES) distribute heating and cooling generated at a centralized plant to provide energy to multiple buildings on a development or neighborhood scale. A DES consists of a heating and/or cooling center, and a thermal network of pipes connecting groups of buildings (City of Toronto, 2023). DES provide access to a low-carbon fuel source, such as electricity generated from renewable sources like solar photovoltaics or wind, with minimal infrastructure required to tie into the piping network. These systems can create economies of scale and energy-sharing opportunities to achieve large-scale, cost-effective GHG reductions.

The feasibility of such systems was explored in this study. Feedback from district energy developers in the Greater Toronto Area suggests that these systems are only viable for medium/high-density service areas that are greater than one million square feet. Consequently, these systems are poorly suited to the Healey Gore Secondary Plan Area, which is primarily low-density and medium density development with a total GFA of approximately 1.6M square feet.



3. Energy Analysis Considerations

3.1. Building Energy Systems

Energy and operational GHG emissions for the entire proposed site in the Healey Gore Secondary Plan Area were estimated using a simulation-based approach which included:

- Establishing baseline energy consumption requirements
- Simulating potential energy conservation and emissions reduction measures
- Analysis and interpretation of modeling results

This approach was used to evaluate how the buildings in the proposed Secondary Plan Area are influenced by a range of potential energy conservation and emissions reduction measures outlined in **Appendix D**.

Potential energy conservation measures were selected based on low-carbon design principles, with the exception that active measures (i.e., HVAC system implementation) were considered prior to passive measures (i.e., enclosure and ventilation considerations). The energy and carbon emission reduction achieved from passive measures are dependent on location and site orientation. These details have not been defined at this early stage of planning and are expected to vary across the Secondary Plan Area.

Table 8 summarizes the technologies that were assessed as part of the development of this study. The technologies include various heat pump system options, where heat pumps are systems that extract or reject heat from one source (air, water, geothermal, etc.) and transfer it to building spaces that require it in the heating or cooling seasons, respectively. This technology saves energy as heat is transferred rather than generated in conventional heating systems. Other technologies that were studied included domestic hot water (DHW) source options in which efficient and low-carbon HVAC options were suggested to serve DHW loads from buildings; a change from traditional natural-gas sources.

Table 8 - Low-Carbon Building Technologies Assessed

Building Strategies and Technologies Assessed		Description
Heat Pumps Options	Geothermal Heat Pumps	Ground source heat exchange or ground source heat pumps use the ground as a heat source in the heating season and a heat sink during the cooling season to extract and reject heat from the building spaces, respectively.
	Air-Source Heat Pumps (ASHP) with Electric Heating	Air source heat pumps extract heat energy from the outside air (and use some energy to re-heat it) in the winter to provide heat to interior spaces and reject heat from the interior spaces to the outside during the summer months.
Domestic Hot Water (DHW) Options	Drain Water Heat Recovery	Drain water heat recovery systems extract heat from wastewater flowing down sanitary drains to preheat incoming water used for DHW loads in the building.



Building Strategies and Technologies Assessed		Description
	ASHP with Electric Backup & Natural Gas Backup	ASHPs (as mentioned above) were considered to service the DHW loads of the buildings with both electric and natural gas backup, if required.
	Solar Water Heaters	Solar water heaters harness solar radiation and heat DHW.
Solar Energy Generation	Solar Photovoltaics (PV)	Rooftop solar photovoltaic panels installed on building roofs convert solar energy into electrical energy.

The following scenarios were developed to guide and inform the analysis as follows:

- **Baseline Scenario** – Based on the Town of Caledon GDS (Refer to **Table 7** in **Section 2.4**)
- **Near Net Zero Scenario** – A potential pathway to near net zero energy and emissions

The Near Net Zero Scenario consists of building-scale energy conservation strategies beyond those required in the baseline. This scenario accomplishes additional TEUI and GHGI reductions, reducing the demand for energy generation.

The evaluation of individual energy systems and technologies for the **Near Net Zero Scenario** was completed based on the following factors:

- Relative energy conservation potential
- Relative GHG reduction potential
- Spatial feasibility
- Relative ease / difficulty of implementation
- Operations and maintenance considerations
- Estimated cost

3.2. Transportation Systems

The GDS, at a minimum, requires that all single-family residential dwellings, 50% of multi-unit residential buildings (MURBs) and 20% of all non-residential spaces are equipped with the required infrastructure to be EV-charger ready, as shown in **Table 7** in **Section 2.4**. To estimate the electrical demand from EV chargers for the Healey Gore Secondary Plan Development, population and employment projections for each type of dwelling were used. **Table 9** summarizes the number of parking spaces required to be EV charger ready for the entire site.

The assumed costs for equipping residential spaces to be EV-charger ready include those associated with electrical infrastructure that can be included at the time of construction such as conduits, and electrical cable runs at each dwelling.

Table 9 - Number of Parking Spaces Required to be EV-Charger Ready

Building Type		Caledon GDS EV Charger-Ready Requirement	# of Level 2 Parking Spaces	Minimum Required EV-Ready Chargers	Total Parking Spaces (Assumed)
Residential	Low Rise Residential (<3 storeys)	Minimum one charging space per dwelling unit	835	835	835

Per the Town of Caledon TOR, the Town's GDS was used to estimate the energy demand associated with implementing electric vehicle chargers for the following scenarios shown in **Table 10**.

Table 10 - Transportation Scenarios Assessed

Transportation Analysis Case	Number of Residential Chargers Utilized*	% of Residential Chargers Utilized
Transportation Case 1	Level 2: 209	25%
Transportation Case 2	Level 2: 418	50%
Transportation Case 3	Level 2: 835	100%

*No non-residential chargers are included, as the Secondary Plan development is entirely residential.

Transportation Case 1 and Case 2 represent scenarios in which 25% and 50% of residential dwellings install and utilize EV chargers. **Transportation Case 3** represents a conservative scenario in which the minimum required chargers are all installed and utilized.

3.3. District Energy System Considerations

Potential district energy systems for medium-density subareas within the Healey Gore Secondary Plan Area are outlined in **Table 11**. Based on the density and square footage of these subareas, they were evaluated for feasibility of district-level energy systems.

District energy systems were evaluated based on factors including spatial feasibility and infrastructure constraints as well as site density and serviceable floor area. A quantitative analysis exploring the feasibility of district energy systems can be found in **Appendix E**.

Table 11- Overview of District Energy Systems Evaluated

System Type	Description
Geothermal Pumps System	Uses ground source heat pumps (that rely on electricity) to harness heat from the ground, with the ground acting as both a heat source (in winter) and heat sink (in summer). <i>*Note that no electrical energy is produced from this system.</i>
*Cogeneration System	Electric or thermal energy production using process waste and/or biofuels.
PV Array	Composite panels that convert solar energy into electricity.



System Type	Description
**Water Source Exchange System	Act as a heating source during the winter season and heat sink during the summer season.
Sewage Waste Heat Recovery	A system of water source heat pumps (that rely on electricity) that harnesses heat from sanitary water flows (i.e., the water body acts as a heat source). <i>*Note that no electrical energy is produced from this system.</i>

**Cogeneration systems require access to co-located industrial processes that can be leveraged to fuel the system. Based on planning documentation provided, it is expected that there will not be any nearby industrial processes or renewable fuel sources that could be accessed to provide a low carbon cogeneration energy source. Therefore, this DES was excluded from consideration.*

***Water source exchange systems require proximity to large water bodies. Based on the planning documentation for the Secondary Plan Area, it was assumed that there are no proximal large water bodies in the Healey Gore Secondary Plan Area and therefore this DES was excluded from consideration.*

District energy developers typically target a payback of 20 years, which aligns with the timeframe used for the NPV analysis for the various HVAC and other systems evaluated in this report. Assumptions regarding pricing and the analysis of these systems have been outlined in **Appendix E**. A summary of this analysis is provided in **Section 4.3**.

3.3.1 Subarea Analysis

Section 2.1 of the report discusses the land use concept plan for the Healey Gore Secondary Plan Area. Subareas selected for district energy analysis within the Secondary Plan Area included two Urban Corridor areas, with one located along Healey Road on the north side and the other on the east side of the site. The remainder of the Secondary Plan Area is expected to consist of Neighbourhood Areas which are envisioned to be predominated by low-rise residential buildings that are poorly suited for district systems. A breakdown of these subareas, their dwelling types, and square footage is shown in **Table 12**.

Table 12 - Overview of the Subareas Within the Secondary Plan Area

Sub-Area	Building Archetypes & Square Footage	Total Dense Areas
Neighbourhood Areas	Low-Density Single Detached Homes – 324,938 ft ²	0 ft ²
	Low-Density Semi-Detached Homes – 657,137 ft ²	
	Low-Density Street Townhomes – 381,558 ft ²	
Urban Corridors	Single/Semi-Detached Homes – 46,166 ft ²	260,900 ft ²
	Medium -Density Street Townhomes – 260,900 ft ²	

3.3.1.1. Urban Corridors

Medium-density development (street townhomes) accounts for less than 16% of the Healey Gore Secondary Plan's total gross floor area, approximately 260,900 ft², and is primarily located within the Urban Corridors. These areas were evaluated for the feasibility of district-level energy systems based on their density and size.

Additionally, the opportunity to share a district energy system (DES) with adjacent developments was evaluated as part of this study. As shown in **Figure 9**, the Bolton West Secondary Plan Area is located to the north and east of the Healey Gore Secondary Plan Area. Energy information related to this proposed Plan Area was not available from the Town of Caledon to support the completion of this study. Therefore, a shared DES with adjacent site is not considered technically feasible for the site due to the low density of the site and the lack of information available on proposed density or planned DES for the Bolton West Secondary Plan Area.

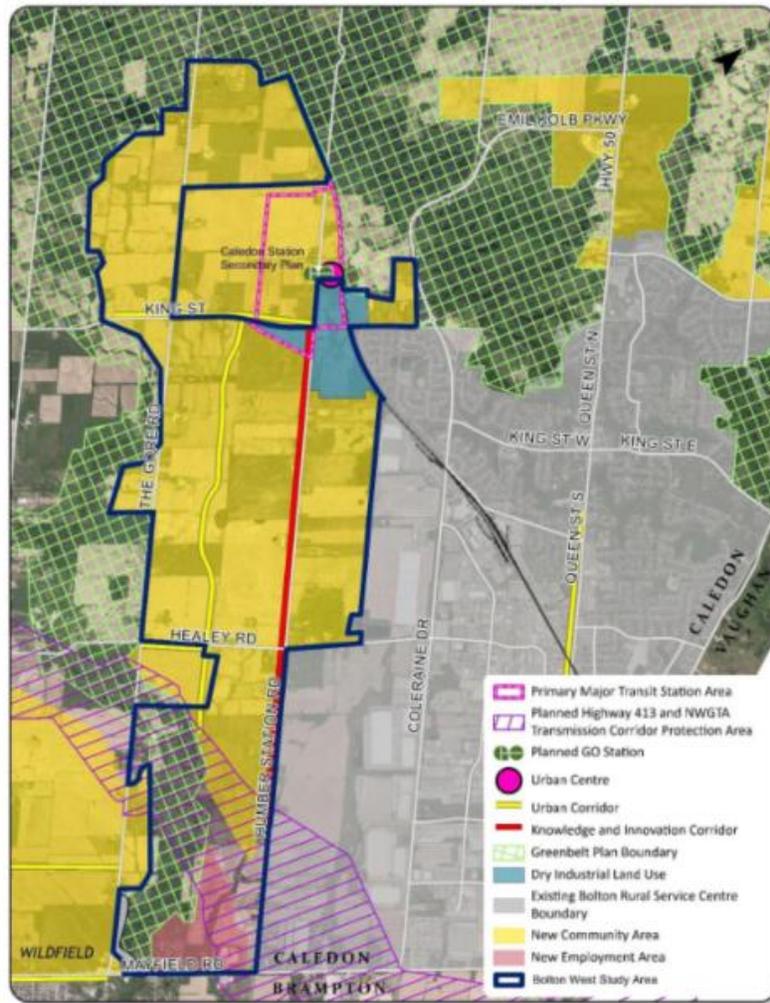


Figure 9: Proposed Land Use Plan for the Bolton West Secondary Area
(Town of Caledon, July 8, 2025)

3.3.1.2. Neighbourhood Area

District systems are generally poorly suited to low-rise residential development patterns due to extensive infrastructure costs and low population density. The Town of Caledon GDS mandates all single-family residential homes to include a 3-season air-source heat pump, which is already highly efficient and negates the value of any district system. These areas of the Secondary Plan Area were therefore excluded

from the analysis conducted. Low-density development represents the majority of the proposed site, accounting for 1.36 million ft², or roughly 82% of the total site gross floor area.

3.4. Potential Policy Barriers and Planning Considerations

Beyond considerations of density and square footage, the Healey Gore Secondary Plan Area presents other potential logistical challenges for implementation of DES. The following policy barriers exist that may negatively impact the feasibility of deployment:

- **Right of Way (ROW) and Utility Design:** The implementation of potential district energy solutions such as geothermal systems will require the Town of Caledon to consider alternative approaches to its existing ROW and utility design standards and directives to create an enabling environment for such technologies to be successfully deployed. New infrastructure requirements may also present competing demands for space with other infrastructure such as stormwater systems.
- **Ownership and Maintenance:** The ownership, maintenance and operations, and management of potential systems modeled was outside the scope of this study. It is expected that the Town of Caledon will need to assess policy, legal, financial, and operational considerations prior to assuming ownership over any district-level energy utility or prior to entering financial and legal partnerships with third parties to operate and maintain such facilities.
- **Timeline:** District energy systems typically require advanced planning with as much as three to five years of economic and engineering, planning, and design to explore various energy sources and options as well as evaluate the financial feasibility of potential systems.
- **Cost:** District systems can be comparable in cost to comparable building-scale systems, however building owners are able to take advantage of financial options to shift capital costs over a much longer period of time. There are options for district-level systems to reduce upfront capital cost requirements, including models where private suppliers cover the capital cost of construction in exchange for long-term contracts.

4. Results

The relative energy and carbon emissions performance of the archetypes modeled for this CEERP are illustrated in **Table 13**. The medium-density development within the Urban Corridors of the Secondary Plan Area discussed in **Section 3.3.1** of the report was evaluated for feasibility of district-level energy systems. In terms of energy performance, like-for-like system efficiencies are comparable whether looking at energy systems on a local or district level as the technologies used for heating, cooling or energy production adhere to the same operating principles. For the purpose of this study, the **Near Net Zero Scenario** energy system improvements were modeled as being implemented across the entire site.

Table 13 - : Energy and Carbon Emission Reduction Savings from Near Net Zero Designs

Category	Archetype	Baseline Design Scenario	Net Zero Design Scenario	% Savings over Baseline	
				Energy	Emissions
Residential 	Single Detached Homes Semi-Detached Homes Street Townhouses	3 season air source heat pump (ASHP) with natural gas backup	Installation of solar photovoltaic panels, geothermal heat pump system for HVAC, and upgradation of domestic hot water to ASHPs with natural gas back up from 100% gas and passive measures	42%	77%

Category	Electric Vehicle	Baseline Design Scenario	Net Zero Design Scenarios	Increase in Energy Consumption	
Transportation 	EV Chargers	Transportation Case 1 25% of residential spaces utilize EV chargers*	Transportation Case 2 50% of residential spaces utilize EV chargers*	100%	2x
			Transportation Case 3 100% of residential and 20% of non-residential spaces utilize EV chargers (Based on the Town of Caledon GDS minimum requirements) *	300%	4x

*Note that the Secondary Plan development is entirely residential, so the commercial requirements were not relevant.

4.1. Secondary Plan Area Results

Although energy use and carbon emissions are correlated, when considering net zero designs, net zero carbon balance is achieved through the adoption of carbon-free energy production (either generated on-site or off-site) in conjunction with the elimination of on-site combustion of fossil fuels, while net zero energy focuses on meeting a net zero energy balance through energy use reduction or generation and is independent of fuel source.

Geothermal and air source (ASHP) with electric heating, were both categorized as low-carbon heat pump options while drain water heat recovery, ASHP domestic hot water heater (with both natural gas and electric backup options), and solar water heaters were considered as low-carbon domestic hot water (DHW) options. These were evaluated against each other, as well as against the other HVAC systems. A summary of the results of the analysis conducted is outlined in the following sections.

The analysis of individual performance for each energy and carbon emission reduction measure on the entire proposed site identifies the most effective strategies to implement in the **Near Net Zero Scenario**. These measures were bundled together to create a comprehensive plan forward to achieving the net zero targets set out by the Town of Caledon. The most efficient active measures were evaluated to be:

- Geothermal heat pumps
- Solar photovoltaic (PV) panels
- Domestic hot water heat pump with natural gas backup

4.1.1 Energy

Figure 8 illustrates the energy use intensities (EUI) of the **Baseline Scenario** and various other energy conservation and greenhouse gas reduction measures. Heating and domestic hot water (DHW) are the primary contributors to energy use and greenhouse gas emissions. Therefore, energy conservation measures targeting heating and DHW were applied to determine the most feasible strategies for reducing emissions and energy use.

Most of the site consists of low-rise residential buildings, which are typically well-insulated wood-framed structures that manage heat loss efficiently. Consequently, the energy consumption associated with space heating was found to be lower than that of domestic hot water (DHW). Three season air-source heat pumps were simulated for space heating in the baseline energy model, further reducing space heating energy demand. As a result, measures aimed at reducing DHW energy consumption were found to be more impactful than those targeting improvements to space heating. Among DHW measures, drain water heat recovery stands out as the most effective, achieving approximately 18% energy savings relative to the baseline scenario. Across all measures evaluated, solar PV panels demonstrate the highest overall impact, achieving approximately 23% energy savings relative to the baseline scenario.

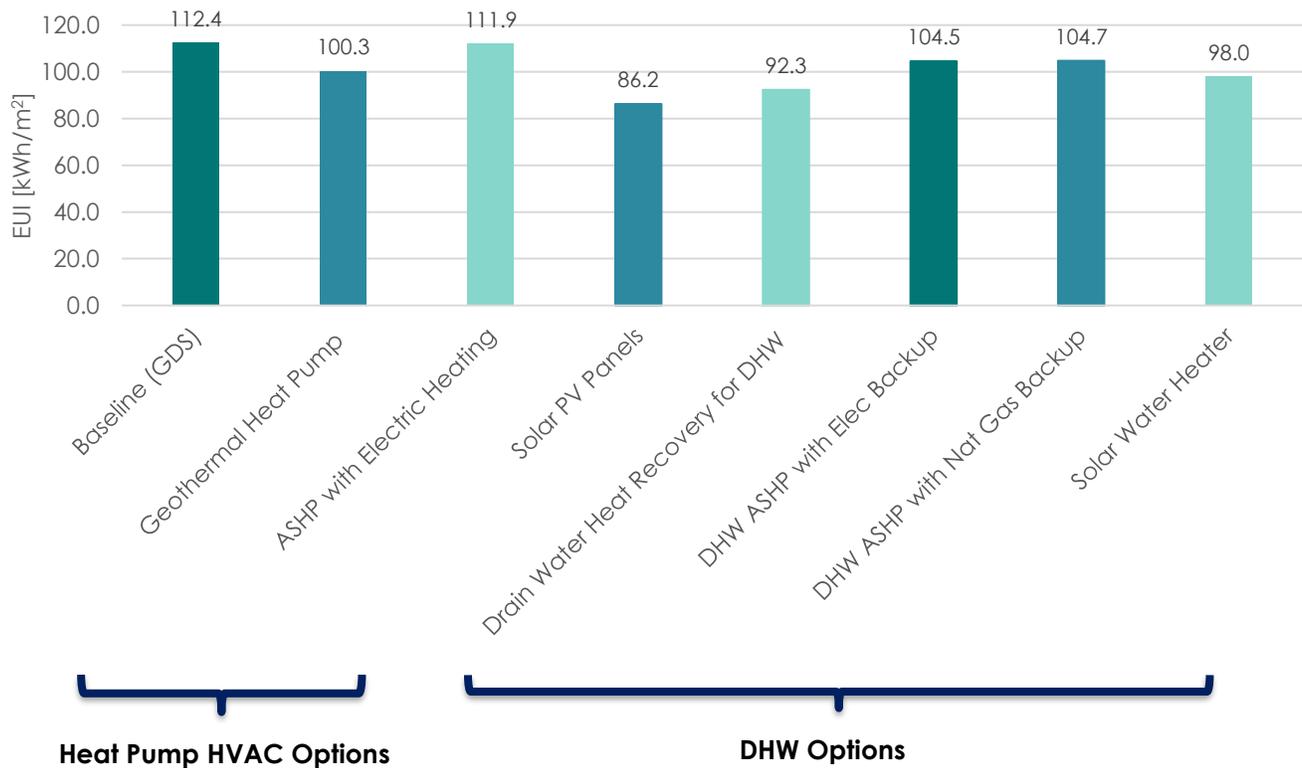


Figure 8 - Energy Use Intensity Results for Each HVAC System Assessed

4.1.2 Carbon

Figure 10 below illustrates the greenhouse gas intensities (GHGI) of the **Baseline Scenario** design and various other energy conservation and greenhouse gas reduction measures. Similar to the energy results, space heating and DHW are the primary contributors to greenhouse gas emissions of the proposed community development. Therefore, energy conservation measures targeting heating and DHW were applied to determine the most feasible strategies for reducing emissions and energy use.

The most impactful emission reduction measure assessed for the entire site is the use of air-source heat pumps for DHW with electric backup. Measures focused on DHW are particularly effective in reducing emissions because the baseline scenario relies entirely on natural gas for DHW, which accounts for approximately 62% of the GHG emissions in the **Baseline Scenario**. This reliance highlights significant potential for reducing GHG emissions through DHW measures.

In contrast, measures focused on space heating have a smaller impact on the GHG intensity compared to DHW measures. This is because space heating in the Baseline Scenario is already assumed to be electric, due to the GDS requirement for three-season air-source heat pumps in low-rise residential buildings. Consequently, there is less room for improvement in GHGI beyond the baseline through heating measures.

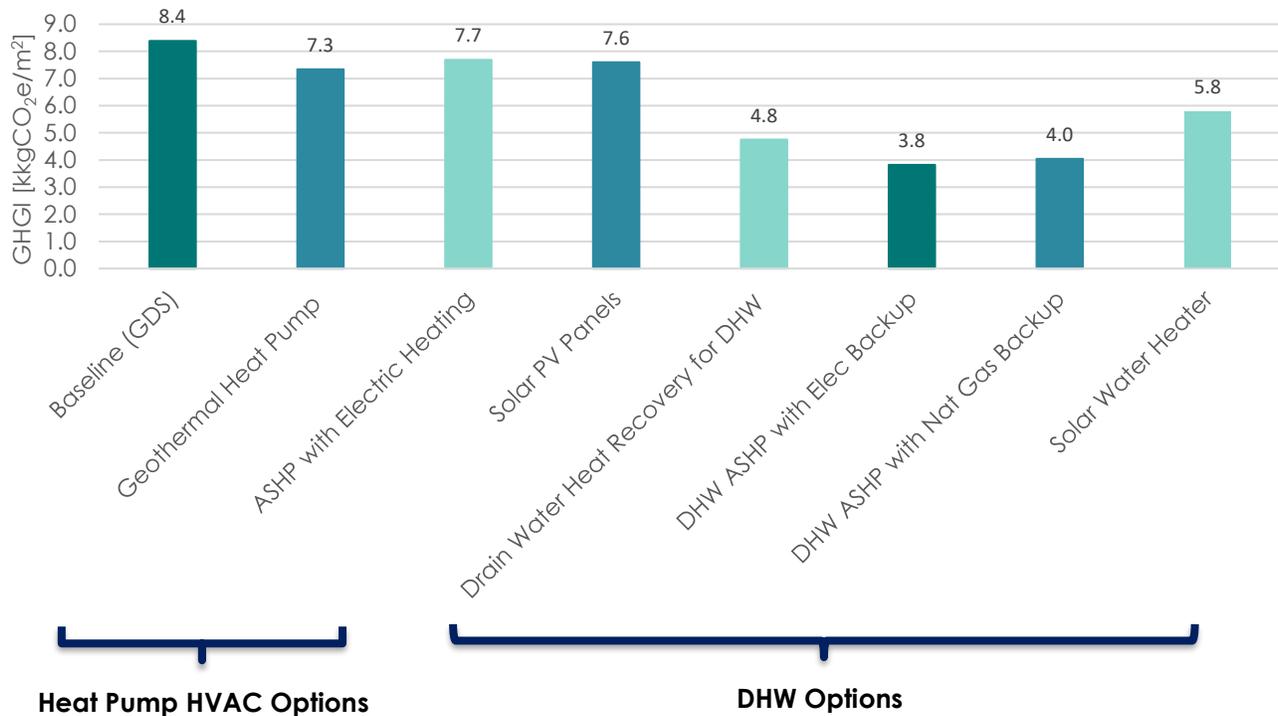


Figure 10 - Greenhouse Gas Use Intensity Results for Each HVAC System Assessed

4.2. Cost

Cost estimates (in net present value) over a 20-year period were evaluated for each of proposed HVAC options using

Equation 1, as outlined in **Figure 11** below. Total costs were used to evaluate relative costs between alternate system types over an extended period. Costs are broken down for each system as outlined in **Table 14** below.

Equation 1 - Total Cost

$$NPV \text{ Total Cost (20-year period)} = \text{Upfront Capital Cost} + \text{Energy Costs} + \text{Maintenance Costs} + \text{Replacement Costs} + \text{Carbon Costs}$$

Total costs consist of several components as highlighted below:

Total Cost (20-year period)	Total cost (in net present value) of implementing and operating the proposed system
Upfront Capital Cost	Initial capital cost of the proposed system
Annual Maintenance Cost	Cost to maintain the proposed system for a period of one year
Annual Energy Cost	Utility (gas/electricity) cost incurred over the period of one year
Replacement Cost	Cost to replace system components over the 20-year study period
Carbon Cost	Cost associated with operational carbon emissions

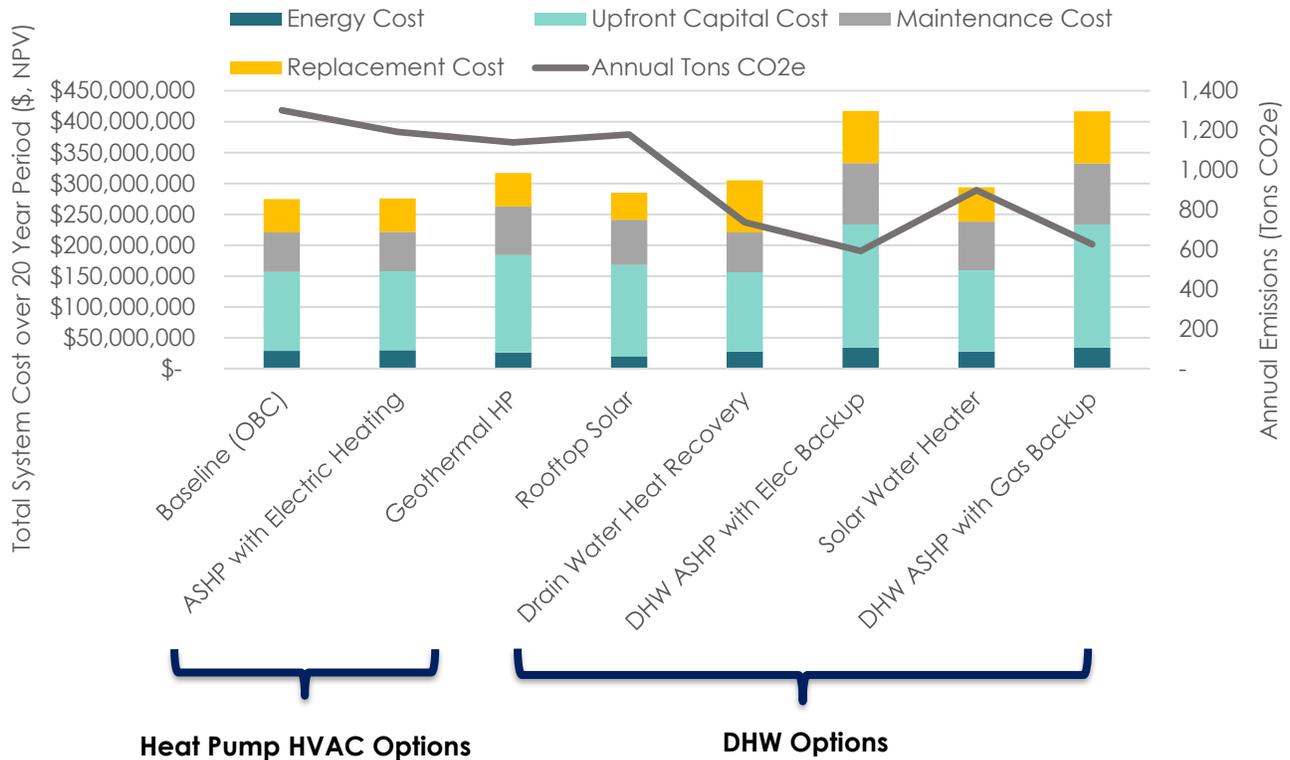


Figure 11: Total System Cost over 20 Year Period (NPV) of Each System Assessed Along with Annual CO₂e Associated with Each Measure

20-year costs are broken down by their respective cost components. Note that systems developed at the district scale were evaluated to be comparable (in terms of cost) to building level systems. Typically, DES providers aim to achieve a payback of 20 years, which is in line with the time frame adopted for the life cycle costing analysis conducted. The costs presented within the report are an estimated value and reflects a Class D estimate which has a variance of ±20% per the Public Services and Procurement Canada (Public Services and Procurement Canada, 2020).

The HVAC options and systems were assessed based on GHG impact as well as cost performance. Note that for the **Baseline Scenario**, no solar energy systems were assumed. Space heating and cooling were modeled using three-season air source heat pumps with natural gas backup as per GDS requirements, and domestic hot water would be provided with traditional natural gas sources. An overview of the cost analysis is outlined in **Table 14** (See **Appendix F** for details).



Table 14: HVAC System Class D Estimate Cost Analysis

HVAC Option	System Type	Cost Analysis	Est. 20-Year NPV Cost	Incremental Capital Cost over Baseline
Baseline HVAC	3 Season Air Source Heat Pump with Natural Gas Backup - Per GDS	Aligns with GDS requirements.	\$274,425,000	N/A
Air Source Heat Pump with Electric Heating	Air Source Heat Pump with Electric Heating	Notable impact on GHG emissions. Same upfront capital cost as Baseline with higher energy cost.	\$275,529,000	\$1,104,000
Geothermal Heat Pump	Heat Pump	Notable impact on GHG emissions. Barriers include higher upfront capital cost and impact on site kW demand. Complexity and uncertainty relating to willingness of individual buildings to opt into district energy system given the number of freehold and detached homes. Costs do not account for required infrastructure; however, these costs are usually paid by the user.	\$317,017,000	\$42,592,000

Renewables	System Type	Cost Analysis	Est. 20-Year NPV Cost	Incremental Capital Cost over Baseline
Rooftop Solar	Electricity Production	Negligible impact on GHG with significant additional cost.	\$285,017,000	\$10,592,000



DHW Option	System Type	Cost Analysis	Est. 20-Year NPV Cost	Incremental Capital Cost over Baseline
Drain Water Heat Recovery	DHW Heating	Notable impact on GHG emissions but may be complex to implement. Uncertainty relating to willingness of individual buildings to opt into district energy system given the amount of freehold and detached homes. Costs do not account for required infrastructure; however, these are usually paid by the user.	\$304,724,000	\$30,299,000
ASHP DHW Heater with Electrical Backup	DHW Heating	Notable impact on GHG emissions. The inclusion of electrical backup heating system achieves GHG savings as compared to option with natural gas backup.	\$417,109,000	\$142,684,000
Solar Water Heater	DHW Heating	Reduced GHG benefits as other DHW upgrades at costs relatively comparable to an ASHP Heater.	\$293,506,000	\$19,081,000
ASHP DHW Heater with Natural Gas Backup	DHW Heating	Notable impact on GHG emissions. The inclusion of natural gas backup heating systems mitigates on site kW impacts.	\$416,778,000	\$142,353,000

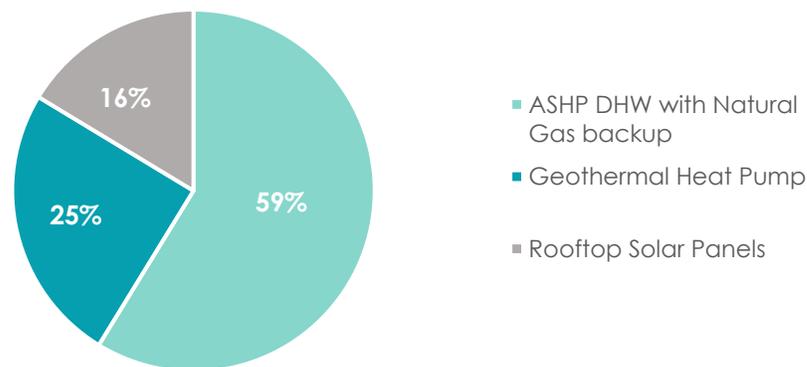


Figure 12: Total Incremental Upfront Capital Cost Distribution of Each Proposed Measure

The implementation of the ECMs in the **Net Zero Scenario** includes the installation of geothermal heat pump systems, rooftop solar PVs and domestic hot water served by air source heat pump with natural

gas backup across the site. This would lead to a substantial increase in capital costs as compared to the **Baseline Scenario**. **Figure 12** illustrates the incremental upfront capital cost distribution for each measure in the **Near Net Zero Scenario**. This shows that the geothermal heat pump system and Domestic hot water heat pump with natural gas backup contribute the most to the incremental upfront costs. The expected increase in the upfront capital cost for the **Near Net Zero Scenario** is approximately \$121.7M, or +95% (refer to **Figure 13**).

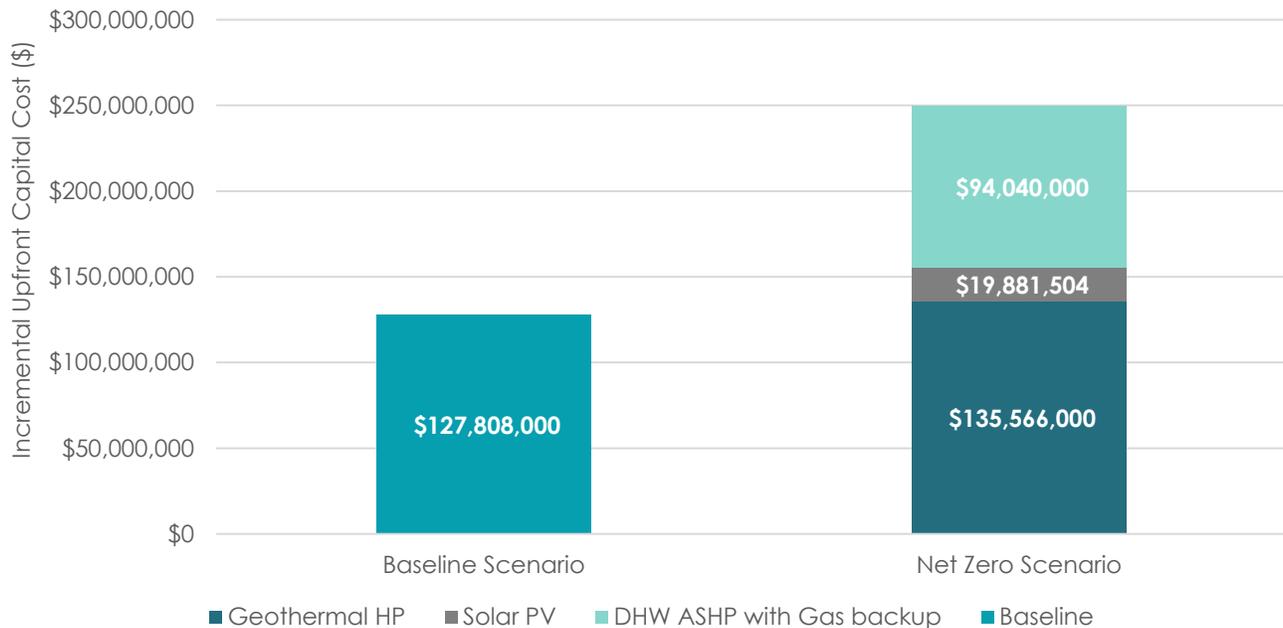


Figure 13: Total Incremental Upfront Capital Cost vs. Baseline Scenario

4.3. Traffic Vehicles & EV Charging

4.3.1 Estimated Electrical Demand

To estimate the electrical demand from EV chargers for the Healey Gore Secondary Plan Development, population and employment projections for each type of dwelling were used. EV charger electrical demand was estimated following the Town of Caledon GDS requirements. Level 2 chargers were applied to all residential parking spaces and are assumed to have an electrical demand of 6.6 kW per charging station. Level 3 chargers, or DC fast chargers designed for rapid charging in non-residential or public parking areas, were not considered as the site is entirely residential.

Transportation Case 1 and Case 2 represent scenarios in which 25% and 50% of residential dwellings install and utilize EV chargers. **Transportation Case 3** represents a conservative scenario in which the GDS's minimum required chargers are all installed and utilized. **Transportation Case 1** is used as a baseline in this analysis to compare other scenarios against.



The results of the analyses conducted demonstrate that EVs and their associated infrastructure requirements are expected to impose a significant electricity demand. The estimated overall energy demand associated with the scenarios modelled is summarized in **Table 15**.

Table 15: Estimated EV Charger Demand

Scenarios Assessed	Level 2 EV Chargers Residential*	Total EV Chargers Demand [kW]	Total Carbon Emissions [kgCO _{2e}]
Transportation Case 1	209	1,378	69
Transportation Case 2	418	2,756	138
Transportation Case 3	835	5,511	276

**No non-residential chargers are included, as the Secondary Plan development is entirely residential.*

Costing for the EV charging stations was based on average costs of \$2,000 per Level 2 charger for single family homes. These costs include charging station equipment, conduits, electrical cable runs and installation. These average costs were obtained from major suppliers in Canada (ChargePoint, Switch Energy, & Flo). Approximately 35% of these costs are associated with charging station equipment and installation for residential spaces, which the GDS indicates are to be borne by individual owners. The remainder of these costs are associated with the conduits, and electrical cable installation which are incurred by the developer.

This equates to \$1,300 for level 2 residential chargers. Based on the GDS requirements to make buildings EV-Charger ready, this results in a total of **\$1,085,500**. Major suppliers have suggested that there is a factor of economies of scale that exists when chargers are installed in larger quantities. This value varies between suppliers and would be determined at the time of procurement as it is based on market demand. Networking opportunities also exist in which chargers are connected to a central plant to reduce the energy required to operate the individual chargers.

Costs for electrical infrastructure upgrades (such as higher capacity transformers and sub-stations) were excluded from these calculations as further analysis will need to be conducted on anticipated usage of the EV chargers and transportation uses which is beyond the scope of this study.

It is not feasible to offset the expected electrical demand on-site through active or passive measures, and therefore electric vehicle charging demand was considered separately from the **Near Net Zero Scenario**.

In terms of emissions, **Transportation Case 3** would fully eliminate Scope 3 tailpipe emissions from the proposed community, however, it **3** also increases the energy demand and carbon emissions by 300% over **Transportation Case 1**.



4.3.2 Personal Vehicle GHG Reductions (Scope 3 Emissions)

In order to estimate the potential GHG reductions from transportation for the Secondary Plan Area, a **Business-As-Usual Scenario** was assumed in which personal vehicles are used by community members for all transportation needs for the entire Secondary Plan Area (i.e., at 100% use of fossil fuel-powered vehicles).

For the purpose of this analysis, an average trip distance of 1 km was assumed, representing the distance from the intersection of Healey Road and The Gore Road at the northwest corner of the site to the southeast edge of the site. It was also assumed that 1 gallon of gasoline provides a personal vehicle with approximately 25 miles, or 40.2 km of travel. Additionally, a tailpipe CO₂ emission factor of 8.887 kg / gallon of gasoline is used, where tailpipe emissions are the product of fuel combustion from a tailpipe of a vehicle (EPA, 2023). Transportation or tailpipe emissions are a Scope 3 GHG emission, which are emissions that result from the activities of the community during operation (National Grid, 2023).

Paradigm Transportation Solutions Limited provided a forecasted trip generation in February, 2026, as shown in **Table 16**. Based on forecasted trip values and the assumptions and GHG emission factor above, approximately 6,817 kg of daily CO₂e were estimated for the **Business-As-Usual Scenario**.

Table 16: Estimated Future GHG Emissions from Personal Vehicles for the Secondary Plan Area (Business-As-Usual Scenario) per Paradigm Transportation Solutions Ltd.

Residential Trips	AM Trips	kg of CO ₂ e
AM Trips	439	97
PM Trips	498	110
Total Trips	937	207

A study on active transportation conducted by the Victoria Transport Policy Institute in British Columbia suggests that active transportation can reduce automobile trips by 5% to 14% (Litman, 2023). This could provide a daily GHG reduction of between 10 kg to 29 kg of CO₂e.

The largest reduction in transportation GHG emissions can be achieved via the use of electric vehicles as they do not have any tailpipe CO₂ emissions (EPA, 2023). Transportation Case 3 outlines the GDS requirements if all residential dwellings install and use EV chargers. Should the proposed development move forward with full EV adoption, and assuming all community members make use of the chargers by owning EVs, 100% of tailpipe emissions would be reduced. As discussed in **Section 4.3.1**, the implementation of EV charging infrastructure and maintenance comes at a high cost and electrical demand should be considered when determining whether this strategy should be included within the Healey Gore Secondary Plan Area.

It should be noted that Scope 3 emissions are not within the scope of the study and were excluded from the total GHGI reduction for the Healey Gore Secondary Plan Area.

4.4. Roadmap to Near Net Zero Discussion

Table 17 and **Table 18** summarize the Near Net Zero Scenario, a potential lower carbon development pattern. This scenario incorporates strategies to achieve additional energy and carbon emission reductions beyond the **Baseline Scenario**. The percentage of individual reduction was calculated by using the individual measure reduction potential over the total reduction potential value.

Table 17: Estimated EUI Reduction Potential

Baseline Scenario EUI [kWh/m ²]	Reduction Strategies EUI [kWh/m ²]				Total Reduction Potential EUI [kWh/m ²]	Near Net Zero Scenario EUI [kWh/m ²]
	Geothermal Heat Pump	Solar Rooftop PV	Air Source DHW HP with Gas Backup	Passive Measures		
112.4	-12.1	-26.2	-7.7	-1.1	-46.9	65.5
% of individual reduction	11%	23%	7%	1%	42%	

Table 18: Estimated GHGI Reduction Potential

Baseline Scenario GHGI [kgCO ₂ e /m ²]	Reduction Strategies EUI [kgCO ₂ e/m ²]				Total Reduction Potential GHGI [kgCO ₂ e /m ²]	Near Net Zero Scenario GHGI [kgCO ₂ e /m ²]
	Geothermal Heat Pump	Solar Rooftop PV	Air Source DHW HP with Gas Backup	Passive Measures		
8.4	-1.0	-0.8	-4.5	0.0	-6.4	2.0
% of individual reduction	12%	9%	54%	0%	76%	

Table 19, **Figure 13**, and **Figure 14** summarize the results of the **Near Net Zero Scenario** compared to the **Baseline Scenario** and to a building built to the requirements of the Ontario Building Energy Code Requirements.

Table 19: Estimated GHGI Reduction Potential Comparison to OBC and Baseline Scenario

Metric	Ontario Building Energy Code	Baseline Scenario	Near Net Zero Scenario	Total Savings over OBC (%)	Total Savings over Baseline Scenario (%)
EUI [kWh/m²]	198.0	112.4	65.5	67%	42%
GHGI [kgCO₂e/m²]	26.2	8.4	2.0	93%	77%

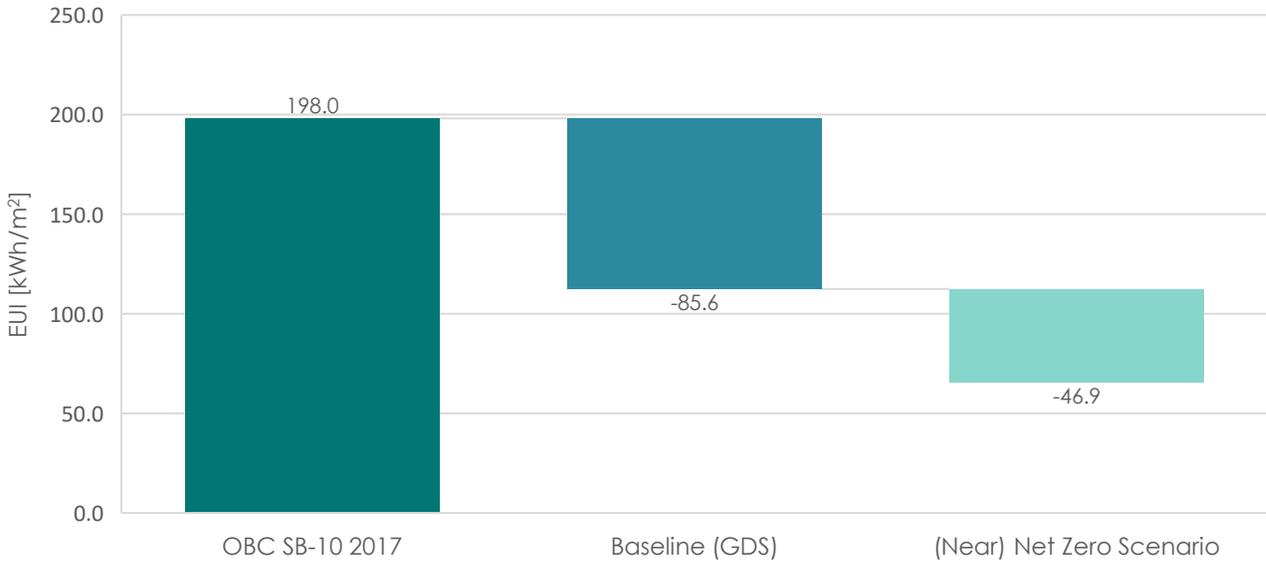


Figure 13: Estimated EUI Reduction Potential Comparison to OBC and Baseline Scenario

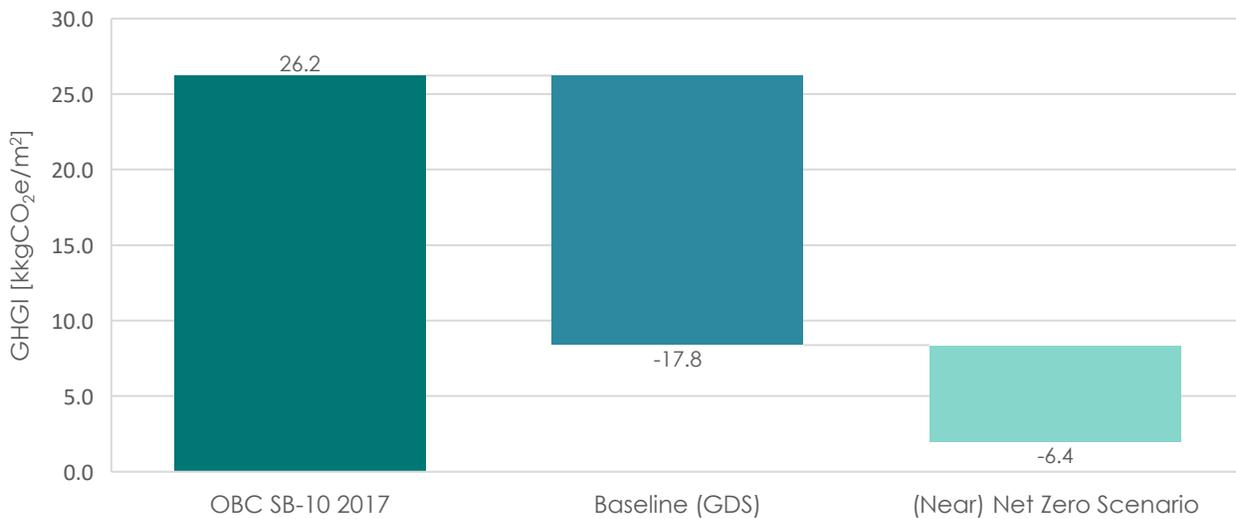


Figure 14: Estimated GHGI Reduction Potential Comparison to OBC and Baseline Scenario

The **Near Net Zero Scenario** demonstrates a potential pathway to near net zero carbon emissions for the Healey Gore Secondary Plan Area, which is visually presented in **Figure 15** and **Figure 16** showing how each considered viable strategy reduces the energy and carbon emission demand.

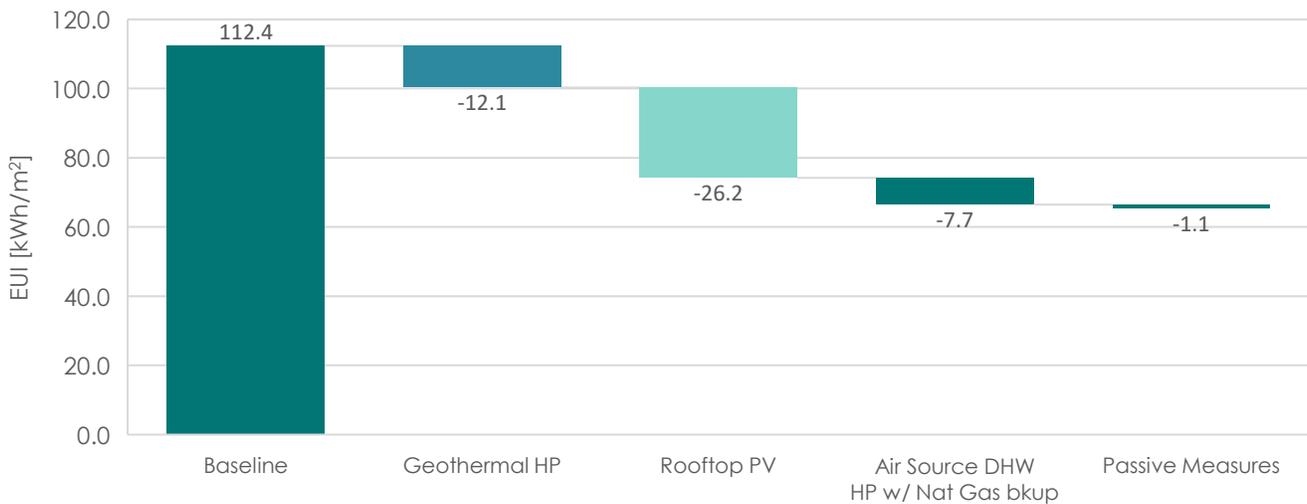


Figure 15: Energy Use Intensity Reduction Roadmap demonstrating EUI reduction potential

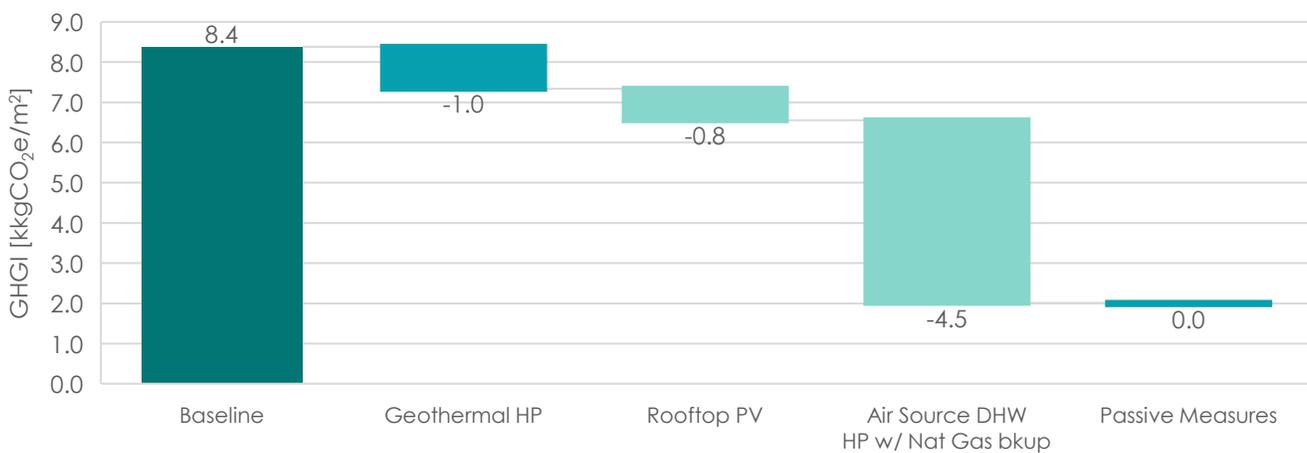


Figure 16: Greenhouse gas Intensity Reduction Roadmap demonstrating GHGI reduction potential

Therefore, the **Near Net Zero Scenario** as modeled achieves an EUI of 76.8 kWh/m² and a GHGI of 2.3 kg CO₂e/m². This represents 34% reduction in EUI and 76% reduction in GHGI over the baseline scenario.

The 20-year NPV total cost of implementing the strategies in this scenario is expected to be **\$1.0 billion**, based on the Class D cost estimate conducted, in **Section 4.1.3**. The incremental capital cost over the baseline for the Near Net Zero Scenario is approximately **\$195.5 million**. Passive measures are not reflected in this cost estimate as they are site dependent and will vary throughout the implementation process.

Table 20 provides a comparison of the NPV Total Cost and Incremental capital cost of the systems analyzed. As described, the geothermal heat pumps and air source DHW heat pumps drive the emissions reduction and perform well relative to energy performance, though there are significant costs associated with them.



Table 20: 20 Year NPV and Incremental Capital Cost of the Near Net Zero Scenario

System (Building-Scale)	20-Year NPV Total Cost (\$CAD)	Incremental Capital Cost over Baseline
Geothermal Heat Pump	\$317,017,000	\$42,592,000
Solar Rooftop PV	\$285,017,000	\$10,592,000
Air Source DHW Heat Pump with Gas Backup	\$416,778,000	\$142,353,000
Near Net Zero Scenario Total Cost	\$1,018,812,000	\$195,537,000

5. Implementation

Implementation of the proposed energy conservation and emissions reduction strategies within the Healey Gore Secondary Plan Area will require a range of actions at key milestones in the planning and development process. These are outlined in **Table 21**.

Table 21: Items For Implementation of the Near Net Zero Scenario

Actions	Reference Document	Timeline	Dependency
1: Policy			
The Landowner should engage with the Town of Caledon to confirm elements of the Town of Caledon Green Development Standard that the Landowner will agree to integrate into policy requirements for the Secondary Plan Area.	Secondary Plan	Official Plan Amendment	Town of Caledon
Introduce a policy statement that directs all developments within the Secondary Plan Area shall discourage the use of fossil fuels for building heating systems as an addition to 7.16.16.16.1.3 which encourages the use of low-carbon technologies including heat pumps.	Secondary Plan	Official Plan Amendment	None
2: District Energy System Feasibility			
If changes to the concept plan for the Secondary Plan Area are proposed that will increase the expected density, the Landowner should further analyze and define sub-areas that are best suited to district-level energy systems, which are expected to be based on density ratios of planned developments.	N/A	Draft Plan	None
3: Building-Scale Measures			
The Landowner shall demonstrate compliance with energy and emissions performance targets for all building typologies defined by the metrics in the Town of Caledon GDS agreed upon between the Town of Caledon and the Landowner.	Green Development Standard	Site Plan	Town of Caledon
The Landowner shall engage with renewable energy providers and utility companies to confirm design requirements for building-scale systems (e.g., heat pumps and solar photovoltaics).	N/A	Site Plan	None
4: Electric Vehicle Infrastructure			
The Landowner should consult the Town of Caledon to confirm electric vehicle charging capacity and infrastructure requirements (per building type).	Green Development Standard	Official Plan Amendment	Town of Caledon

Actions	Reference Document	Timeline	Dependency
The Landowner shall implement electric vehicle charging capacity and infrastructure requirements (by building type) based on agreed upon metrics with the Town of Caledon.	Green Development Standard Architectural / Urban Design Guidelines	Draft Plan	Town of Caledon Hydro One Networks Inc.
The Landowner shall liaise with utility providers to confirm the total electrical demand requirements for the Secondary Plan Area for electric vehicles based on the standards and requirements agreed upon with the Town of Caledon.	N/A	Official Plan Amendment	Town of Caledon Hydro One Networks Inc.

6. Conclusion

The development of the CEERP involved the exploration of various energy efficiency and emission reduction strategies and technologies for both buildings and transportation assets for the proposed Healey Gore Secondary Plan Area. This information was used to inform understanding of the likely energy performance within the development. The technical feasibility of several building-scale energy systems was then assessed based on the overall energy demand and the sizing of systems that would be required to meet this demand. Other factors including spatial, and financial considerations were considered to define a potential low-carbon community development design, termed the **Near Net Zero Scenario**. Of the potential building-scale energy systems considered, geothermal heat pumps, solar rooftop PV systems, domestic hot water systems with air-source heat pumps (and natural gas backup), and passive measures were considered as the most viable options for deployment of the Healey Gore Secondary Plan Area.

The results of the analyses conducted demonstrate EVs and their associated infrastructure requirements are expected to impose a significant electricity demand at their assumed usage. Average installation and material costs suggest that it would cost approximately \$1.1 million to install electrical wiring and infrastructure in buildings to make EV-charger ready, as per the GDS minimum requirements. A factor of economies of scale exists for this installation, however, this will be determined at the time of procurement. It is not feasible to offset the expected electrical demand on-site through active or passive measures, and therefore electric vehicle charging demand was considered separately from the **Near Net Zero Scenario**.

District energy systems (DES) were determined to be technically infeasible for several reasons. The site is predominantly low-density residential. Implementing DES for a low-rise built form would require extensive distribution infrastructure, resulting in additional capital costs. As a result, the overall development density within the Secondary Plan Area was evaluated to be insufficient to support a geothermal district energy system. Furthermore, a district-style solar photovoltaic system is impractical due to its limited contribution to meeting energy needs.

The **Near Net Zero Scenario** achieves an EUI of 65.5 kWh/m² and a GHGI of 2.0 kg CO₂e/m². This represents a 42% reduction in EUI and 77% reduction in GHGI over the baseline scenario.

The 20-year NPV total cost of implementing the strategies in this scenario is expected to be **\$1.0 billion**, based on the Class D cost estimate conducted. The incremental capital cost over the baseline for the Near Net Zero Scenario is approximately **\$195.5 million**.

Implementation of the strategies associated with the **Near Net Zero Scenario** would enable the Healey Gore Secondary Plan Area to achieve GHGI performance well beyond the Town of Caledon's interim emission reduction target of 36% by 2030. Individual strategies described under this scenario pursued in isolation would also have a meaningful impact on energy efficiency and emissions avoidance. Beyond the technical feasibility of these strategies described within this Community Energy and Emissions Reduction Plan, however, successful implementation of the systems identified will require effective consideration of ownership and management factors, and resulting operating costs would need to be evaluated at a more comprehensive level to define the business case.

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Appendix B. Site Plan and Statistics



- LEGEND**
- SUBJECT LAND BOUNDARY
 - PARK
 - STORM WATER MANAGEMENT
 - CHANNEL
 - NATURAL HERITAGE SYSTEM
 - EDGE OF PROTECTED COUNTRYSIDE
 - NATURAL HERITAGE AREA TO BE REMOVED

LOTING STATISTICS:

SYMBOL	TYPE	LOTS/BK	UNITS
▲	9.8m SINGLE DETACHED	128	128
●	6.85m SEMI-DETACHED	215	430
	7.62m STREET TOWNHOUSE	51	277
	TOTAL	394	835

Figure B-1: Preliminary Lotting Concept Plan for the Healey Gore Secondary Area

(KLM Planning, January 30, 2026)

Appendix C. Energy and Carbon Utility Cost Assumptions

The Secondary Plan Area is currently serviced by Hydro One for electricity, Enbridge for natural gas, and by the Region of Peel for domestic potable water. The prevailing Time-of-Use utility rates are summarized in **Figure C-1**. A blended electricity rate of 14.5 cents/kWh was used for all analyses conducted in the development of this report.

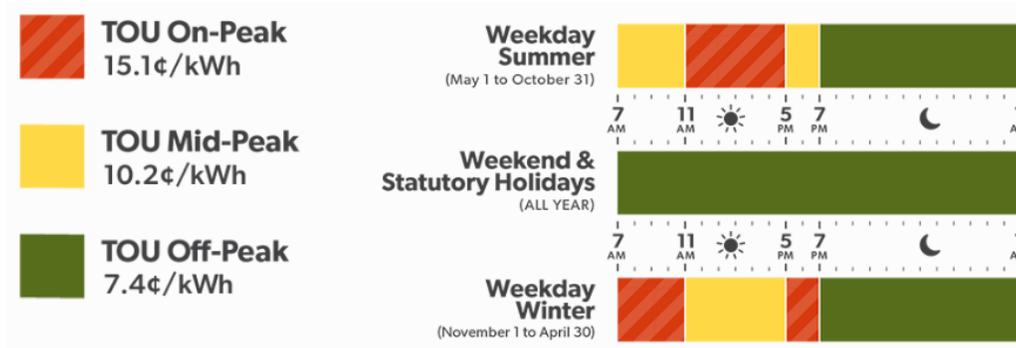


Figure C-1 – Hydro One Time-of-Use Rates Effective until October 31, 2023 (Hydro One, 2023)

Prevailing natural gas rates are summarized in **Table C-1**

Table C-1 - Enbridge Gas Rates (as of January 2025) (Enbridge, 2025)

Gas Consumption	Cost (cents/m ³)
First 30 m ³	65.8218
Next 55 m ³	65.0697
Next 85 m ³	64.4808
Next 170 m ³	64.0418

As part of the Government of Canada's national strategy for decarbonization, provinces and territories are directed to maintain or develop a carbon pollution pricing system. To ensure carbon pollution pricing applies throughout Canada, the federal backstop carbon pollution pricing system applies in whole or in part in any province or territory that requests it or that does not have a pricing system in place that aligns with the federal benchmark stringency requirements (ECCC, 2023a). The federal backstop is currently in place in Ontario.

As part of this program, a carbon charge is applied to fossil fuels sold in Ontario, including natural gas. On April 1, 2020, the federal carbon charge for natural gas was 5.87 cents per cubic meter (m³) (Enbridge, 2023). This charge is projected to increase annually each April. In April 2024, the charge increased to 15.25 cents per cubic meter (Enbridge, 2023). Expected pricing changes year after year is summarized in **Table C-2**.



Table C-2 - Federal Carbon Charge Rates for Marketable Natural Gas 2024 – 2030 (Enbridge, 2023)

Year	Carbon Charge (\$/tCO ₂ e)	Carbon Charge (cents/m ³)
2024	\$80	15.25
2025	\$95	18.11
2026	\$110	20.97
2027	\$125	23.83
2028	\$140	26.69
2029	\$155	29.54
2030	\$170	32.40

It is projected that the carbon charge rate will rise to \$170 per ton by 2030 (Enbridge, 2023). This will have a significant impact on the cost of using natural gas in buildings that will be constructed in development areas in the future. The current blended gas rate is approximately 50 cents/m³ with 9.79 cents of that charge being carbon tax. At \$170/ton, the carbon tax on a m³ of gas will increase to 33.3 cents. This will more than double the cost of natural gas by 2030. These costs have been accounted for in the cost feasibility analysis (Section 5.5).

Additionally, the GHG emissions factor of Ontario's electricity grid for 2023 is 30 grams of CO₂ equivalent (CO₂e) per kWh produced (ECCC, 2023b). By comparison, the GHG emissions factor of natural gas is 182 grams of CO₂e per kWh of energy produced by natural gas (ECCC, 2023b). Natural gas therefore has a GHG emission factor that is six times greater than that of electricity and therefore has a larger impact on GHG emissions.

Appendix D. Energy Modelling Considerations

Energy Modelling Considerations

To reduce variability in the analysis and directly evaluate the energy consumption and carbon emission results for each building archetype, the study focuses on studying active energy conservation measures such as alternate HVAC systems, and then subsequently studied on-site renewable energy opportunities. The analysis compared the various potential energy conservation measures while holding the assumption that enclosure performance and ventilation loads (passive measures) were comparable to that of a Town of Caledon GDS Tier 1 compliant building. As a result, GHG and energy reductions are compared directly against the mandated Town of Caledon GDS Tier 1 energy and carbon emission performance metrics (TEUI and GHGI). Passive measures were then considered as a final proposed measure in the roadmap to achieve near net zero emissions.

Passive measures (primarily building enclosure upgrades) offer wide ranging performance gains. Thermal bridging (linear and point thermal transmittance) through elements such as parapets, slab-by-passes, window perimeters, corners, and the slab at grade plays a crucial role in determining how effective heat moves through the enclosure. An exterior wall assembly with a nominally rated insulation layer of R-20 will achieve various levels of performance depending on how heat loss through the thermal bridging elements is managed. Due to the considerable level of ambiguity associated with passive measures, a modest thermal demand intensity reduction was applied in the improved design to demonstrate the impacts of a reasonable improvement in enclosure performance.

Energy Modelling Software

Energy usage was informed by simulations completed using the IES-Virtual Environment 2023 (IES-VE) building performance simulation software. IES-VE is a sophisticated building energy simulation software that enables simulation of complex building systems including solar shading, daylighting, natural ventilation, and highly customizable HVAC systems.

Building Strategies and Technologies Assessed

The Town of Caledon is located in a heating-dominated climate, and this will continue to be the case into the future based on climate modeling conducted for the local region (Amec Foster Wheeler, 2018). In a heating-dominated climate, the largest contributors to GHG emissions from buildings are heating demands experienced during winter months which are typically met by on-site combustion of fossil fuels. However, for the Healey Gore Secondary Plan Area, measures focused on space heating have a smaller impact on GHG intensity compared to domestic hot water (DHW) measures. This is because space heating in the Baseline Scenario is already assumed to be electric, due to the GDS requirement for three-season air-source heat pumps in low-rise residential buildings. With the entire site planned for low-rise residential development, the Thermal Energy Demand Index (TEDI) for space heating is lower than the overall DHW demand. As a result, measures aimed at improving the DHW system from natural gas to air-source heat pumps are more effective than those focused on space heating, since the Baseline Scenario relies entirely on natural gas for DHW. These strategies reduce GHG emissions by switching to less carbon-intensive fuel sources.

Appendix E. Evaluation of District Energy Systems

To evaluate the potential implementation of DES within the medium-density Urban Corridor areas of the Healey Gore Secondary Plan, the following analysis was conducted.

Geothermal Analysis

The medium-density peak heating and cooling load for Urban Corridors are estimated to be 333 kBTU/hr and 237 kBTU/hr, respectively, making the site dominated by heating loads.

The peak heating and cooling demand rate were obtained from the modelling analysis. A total of 199 boreholes were calculated, assuming one borehole per house unit within Urban Corridors. The boreholes were assumed to be 850 ft deep with 15 ft spacing for the purposes of calculating the total area required for the infrastructure. This results in a field with a total area of approximately 22,163 ft². This equates to approximately 20% of the medium-density development, indicating that there would be limited space based on the current development plans. The approximate NPV cost of implementing this system would be \$58,266,133.

Solar Photovoltaics Analysis

Solar PV is traditionally mounted on building roofs. Considering the size of the proposed development in the Secondary Plan Area, several opportunities to maximize PV deployment may exist.

PV is extremely flexible in the context of spatial feasibility. The ideal location for a District style PV array would be near electrical substations and on/near public property/buildings with adequate space to accommodate a sizable array. Using PV panels as potential shading devices would allow for additional panel area. Based on the site statistics provided by the planning consultant (refer to section 2.2.), 5% of the parks, comprising a land area of 8,300 square feet, have been allocated for photovoltaic (PV) installation. The estimated annual energy production of approximately 151,641 kWh is calculated based on the solar radiation for the city of Caledon for each month of the year.

A district style solar PV system installed in Public Parks would allow for approximately 8,300 square feet of panel area, which is equivalent to mounting panels on roughly 8% of all available roof area across medium-density development within the Urban Corridors. However, even with the additional space allocations towards Solar PV, the energy generation potential from the system only amounts to an EUI reduction of 2%. In addition, based on the location of the parks relative to the denser development, a solar PV system is not well suited for the Secondary Plan area. This style of system was therefore evaluated to be infeasible due to the large space demands and the small contribution to meeting energy needs.

It is our understanding that the Town of Caledon parkland property and Peel District School Board properties restrict PV arrays. This also makes it difficult to delineate a ROW for creating infrastructure and the proposed locations highlighted above were selected based on the assumption that the Town has the capability of enacting policy change that would permit some space from publicly owned lands to be used to house infrastructure.

The approximate NPV cost of implementing this system would be \$53,377,187.

Wastewater DES Analysis

Sewage waste could be collected for one or several building blocks to be stored in cisterns, where heat exchange can occur as outlined in **Figure E-1** below.

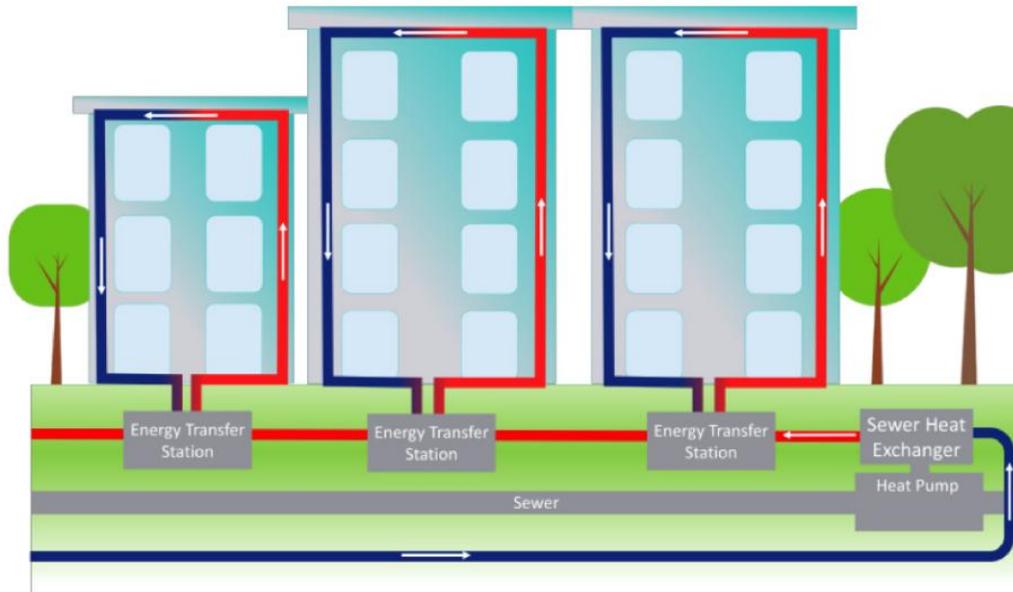


Figure E-1: DES Schematic of Wastewater Heat Recovery (City of Toronto, 2017)

Typically, this system has capacity solely to serve building DHW loads and would need to be used in conjunction with other energy-efficient mechanical systems.

To evaluate and demonstrate the feasibility of utilizing a wastewater heat recovery DES for the medium density development within the Urban Corridors, detailed calculations and post-processing of the modeling results were performed. This involved comparing the projected annual wastewater generation at the site with the minimum amount of wastewater required to meet the DHW load demand. This comparison was conducted to evaluate whether there would be sufficient wastewater produced to meet the energy needs of DHW.

Actual expected wastewater generation

To calculate the expected wastewater generation, LEED v4 WE indoor water use calculator worksheet was used. The summary of the assumptions used for this calculation is described below.

- Population – 2,923 (Calculated based on the total number of units)
- Annual days of operation – 365 days
- Washroom flush rate- 1.6 GPF*
- Urinal flush rate-1 GPF*
- Public lavatory flow rate- 0.5 GPM*
- Lavatory faucet flow rate- 2.2 GPM*
- Kitchen faucet flow rate-2.2 GPM*
- Showerhead flow rate-2.5 GPM*



*The flow rates have been assumed based on LEED requirements.

Required wastewater generation to meet DHW load demand

The required wastewater generation was estimated based on formulae of thermal energy

$$Thermal\ Energy\ (kWth) = Flow\ (m3/h) \times Specific\ Thermal\ Capacity\ (kWh/m3 \times ^\circ C) \times Temperature\ rise$$

- o Specific Thermal Capacity Wastewater = 1.16 (kWh/m³ x °C)
- o Temperature difference = 13°C -8°C = 5 °C (KEB Engineering & Project Management, 2021)

Thermal energy, which is essentially the heat extracted from the wastewater, is transferred to the evaporator side of the heat pump loop. Here, the heat is absorbed by the refrigerant. After the refrigerant is compressed, it transfers the absorbed energy to the condenser side of the system. This energy is then used to heat the domestic hot water.

From the energy modelling results the condenser energy (*Q_h*) of this cycle is obtained, and it is estimated to be around **1,041,455 kWh**. The COP of the water-to-water heat pumps is estimated at COP 2.5. Hence, based on the available information, the evaporator energy (*Q_c*) was computed using heat pump COP formula which is:

$$COP = Qh / (Qh - Qc)$$

The *Q_c* value was calculated to be around **624,873 kWh**. This value represents the thermal energy value to be used in the formula discussed above.

The required wastewater generation to meet the medium-density development's DHW load demand was estimated to be approximately **28.7 million gallons/ year**. The overall analysis summary is summarized in the **Table E-1** below.

Table E-1: Estimated wastewater generation vs estimated wastewater required for Neighbourhood Centre subarea

Wastewater Factor	Projected Flow Rates
Total wastewater generated	39,264,656 gallons/year
Total wastewater required	28,689,813 gallons/year

The wastewater that is expected to be generated in this subarea therefore is projected to exceed the volume required to meet the DHW demand. Cisterns would be needed to handle the flow and house heat exchangers, which would be required to capture the available waste heat from the water.

The approximate NPV cost of implementing this system in the neighborhood Centre would be \$56,006,742.

Wastewater recovery solutions are considered technically feasible. They would be, however, incompatible with geothermal solutions, and it should be noted that policy and ownership and management restrictions may still limit the viability of this approach.

DES Result Summary

Table E- 2 summarizes the evaluation of DES Results for the study.

Table E-2: DES Analysis Results

System	Infrastructure Required (Enbridge, 2025)	Considerations	Est. 20-Year NPV Cost
Geothermal Pumps System	835 boreholes and 22,163 ft ² land area for Urban Corridors	<ul style="list-style-type: none"> Typically sized to serve heating and cooling loads and optionally for DHW Space constraints must be studied (i.e., borehole field sizes/locations) Soil conditions Metering/financing considerations for owners/operators 	\$58,266,133
PV Array (District Level)	8,300 ft ² of Public Parks	<ul style="list-style-type: none"> Low energy generation potential Location of PV arrays and racks are limited to publicly owned property Metering/financing considerations for owners/operators 	\$53,377,187
Sewage Waste Heat Recovery	3,835,274 ft ³ cistern volume for Urban Corridors	<ul style="list-style-type: none"> Can only serve DHW loads Access to available sanitary waste matter streams Metering/financing considerations for owners/operators 	\$56,006,742

Appendix F. Costing Analysis

The total capital cost of the Rooftop Solar system is calculated based on the total estimated available PV area (50% of the total roof area), the total size of the PV system, and the cost of the panels, racks and DC to AC inverters. See **Table F-1** outlines rooftop solar capital cost calculations.

Table F-1: Rooftop Solar Capital Cost Calculation (RSMeans Data Online - Gordian, 2026)

	Metric	Cost
Panel	150 W	\$458
DC to AC inverter	5,500 W	\$3,208
Rack/panel	-	\$41
Roof area:	67,658 m ²	-
PV Area	33,829 m ²	-
PV W/ m²	150,300 W/m ²	-
Total Size of PV system	5,084,516 W	-
Number of Panels	33,896	-
Amount of inverter	925	-

The total capital cost of the geothermal system is calculated based on the total number of required boreholes for the site, with a unit cost of \$30,000 per borehole.

For all other systems, total capital costs are calculated based on the total residential GFA multiplied by the total HVAC cost per square foot for the site. Since the Baseline Scenario modelled as a three-season air source heat pump in accordance with GDS requirements, it carries the same upfront capital cost as the air source heat pump option.

Figure F-1 outlines the total upfront capital cost for each system. Cost assumptions were informed by market research and consultation with Quasar Consulting Group.

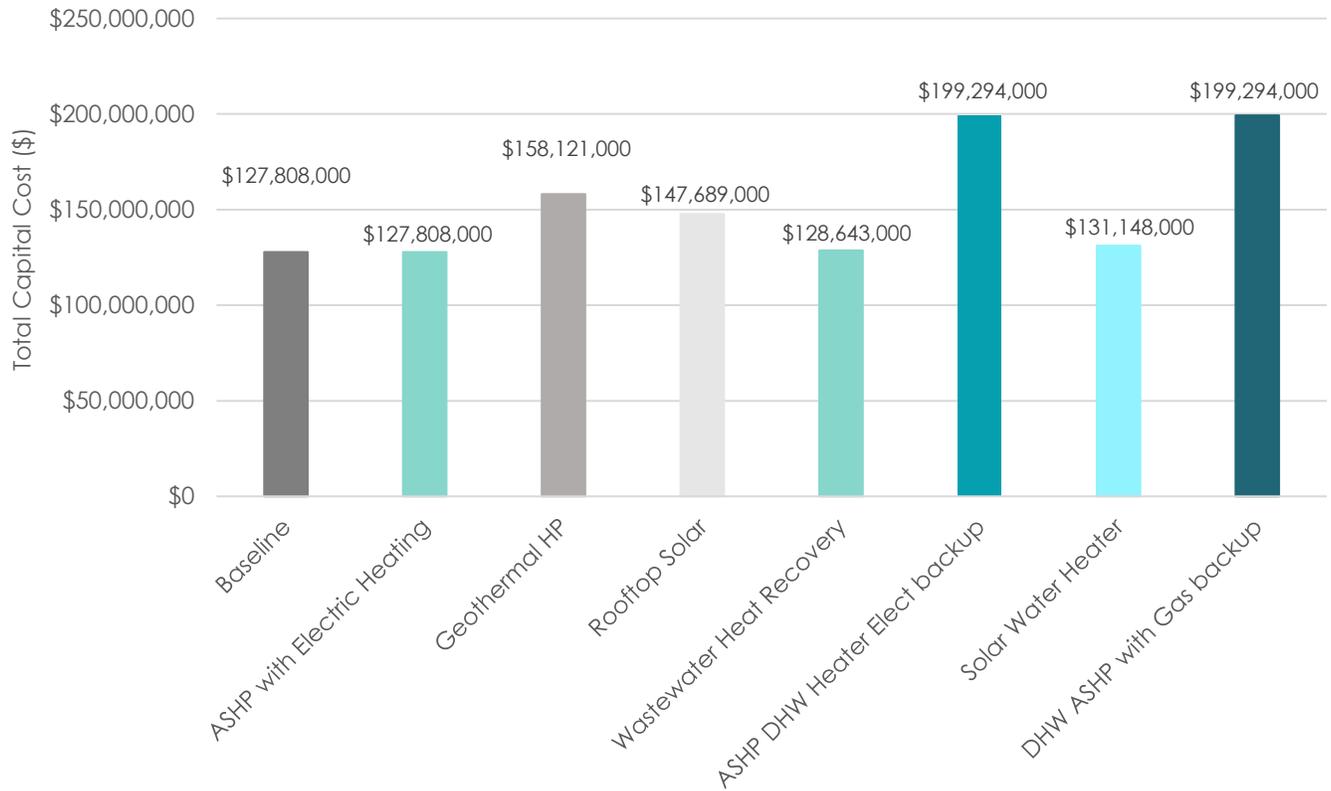


Figure F-1: Total Upfront Capital Cost For Each System

Appendix G. Resiliency

The Town of Caledon has identified resiliency as an area of focus as it strives to improve its response to the physical, social, and economic challenges of the future. Examples of external threats that could create vulnerabilities to the built environment may include:

- Overland flooding
- Extreme heat
- Blizzards or cold snaps
- Freeze-thaw events.
- Interruptions to energy supply
- Infrastructure failure
- Public health emergencies
- Cyberattacks

Events such as heat waves, ice storms, rain events and resulting power disruptions may force future residents of the community to rely on the passive and adaptive features of their residences for prolonged periods of time until service can be restored, or repairs can be made.

Resiliency as it relates to the proposed HVAC alternatives is primarily focused on flooding events and extreme weather conditions, and infrastructure failure.

Extreme Weather Conditions

Adapting to severe weather conditions is generally improved by having surplus heating or cooling capacity to service additional loads. This requires building in additional capacity at both the secondary/terminal level and/or plant level.

Per the Risk and Vulnerability Assessment prepared by ICLEI Canada (dated December 5, 2018) for the Town of Caledon, Caledon has previously experience extreme rain events, wind storms, ice storms during the winter months, and in more recent years, events of warmer temperatures during the winter months (February 2018) (ICLEI Canada, 2018).

Although numerous existing extreme weather conditions plans are in place to assist the Town of Caledon prepare for an emergency, the report identifies the gaps in these plans, such as the need for more robust condition assessment of infrastructure, and improvement and maintenance of stormwater management facilities (ICLEI Canada, 2018). The report also further emphasizes the need for municipality specific risk management plans in place to be prepared for such extreme weather conditions (ICLEI Canada, 2018).

Infrastructure Failure

Estimated baseline demand for the site is roughly 6 kW/unit. Fuel switching, via the introduction of air source heat pumps, can result in a 35% electricity demand increase, increasing the estimated peak demand for electricity to roughly 9 kW/unit. Switching again to geothermal reduces this demand back down to roughly 6 kW/unit as the geothermal system demands less peak electrical capacity at lower temperatures as compared to air source heat pumps.

Table G-1 outlines estimated kW demand for the heating and cooling systems under consideration.

Table G-1: Estimated Peak Demand of Alternate Heating/Cooling Systems

Heat Pump Options	Energy Demand (kW)
Baseline	5,010
Geothermal Heat Pump	5,010
Air Source Heat Pump	7,515

Futureproofing HVAC Systems

If air source heat pump systems with natural gas backup are currently the more viable HVAC option, installing connections for a future district-connected HVAC system presents an opportunity for a planned low-carbon retrofit in the future. Considerations for these systems are listed in the City of Toronto's Minimum Backup Power Guidelines for Multi-Unit Residential Buildings (City of Toronto, 2016b) and include:

- District Energy/Ground-Source Heating: In situations where a district energy system is being planned but will not be constructed in time to connect a building, the building can be future-proofed for connection (i.e. district energy-ready). This approach has the added benefit of also making the building ready for ground-source heating:
 - Install connections on reverse return piping - Arrange the reverse return piping from residential suites so that they have accessible points for future connections (ideally be a pair of riser isolation valves or a pair of Tee connections in communal areas). These connections would also prepare the building for a central heat pump.
 - Provide space for future vertical piping - Allocate vertical space from the parking through to the building level to the reverse return piping connections, in the form of sleeves over which flooring may be installed to avoid future costs. Service vestibules (elevator, garbage, corners of stair landings) may minimize the impact on space planning.
 - Provide space for the energy transfer station or central heat pump - Allocate parking spaces adjacent to the building core to create physical space for a future energy transfer station (ETS) or central heat pump. An ETS requires two (2) spaces, while a central heat pump would require approximately ten (10). MURBs using 4-pipe fan coil units in particular require additional power to be allocated for the future low carbon heating equipment. The estimated cost is \$105/kW.
 - Allocate power for the low-carbon heating source - A reasonable estimate is to double the power allocated to the cooling plant to account for the lower efficiency. When a similar technology is producing beneficial heat.

- Lower Heating Water Temperatures: Where a district energy connection is not likely, there are commercially available heat pumps with capacities and temperature ranges to provide low carbon heating and cooling on-site. Mechanical systems must be designed for lower heating water supply temperatures to increase the efficiency and cost effectiveness of heat pumps:

- Allocated roof space, structural support and power for an air-source heat pump to replace conventional cooling plant – allocate 50% additional peak electrical demand beyond conventional cooling plant for heat pumps.
- In a heat pump building, plan for water-to-water heat pumps in series with the air-source heat pump.
- In a fan-coil building, select building heating water distribution with ~50 °C supply water temperature – 50 °C supply water temp in line with commercially available heat pump supply water temp.



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