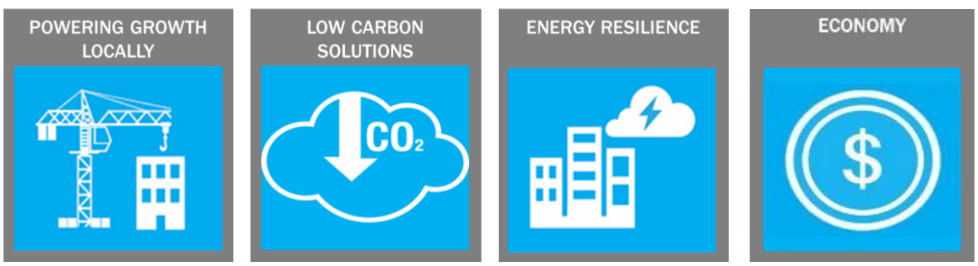
PE13.4
Attachment 1

DRAFT MOUNT DENNIS COMMUNITY ENERGY PLAN



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City of Toronto, Environment & Energy Division
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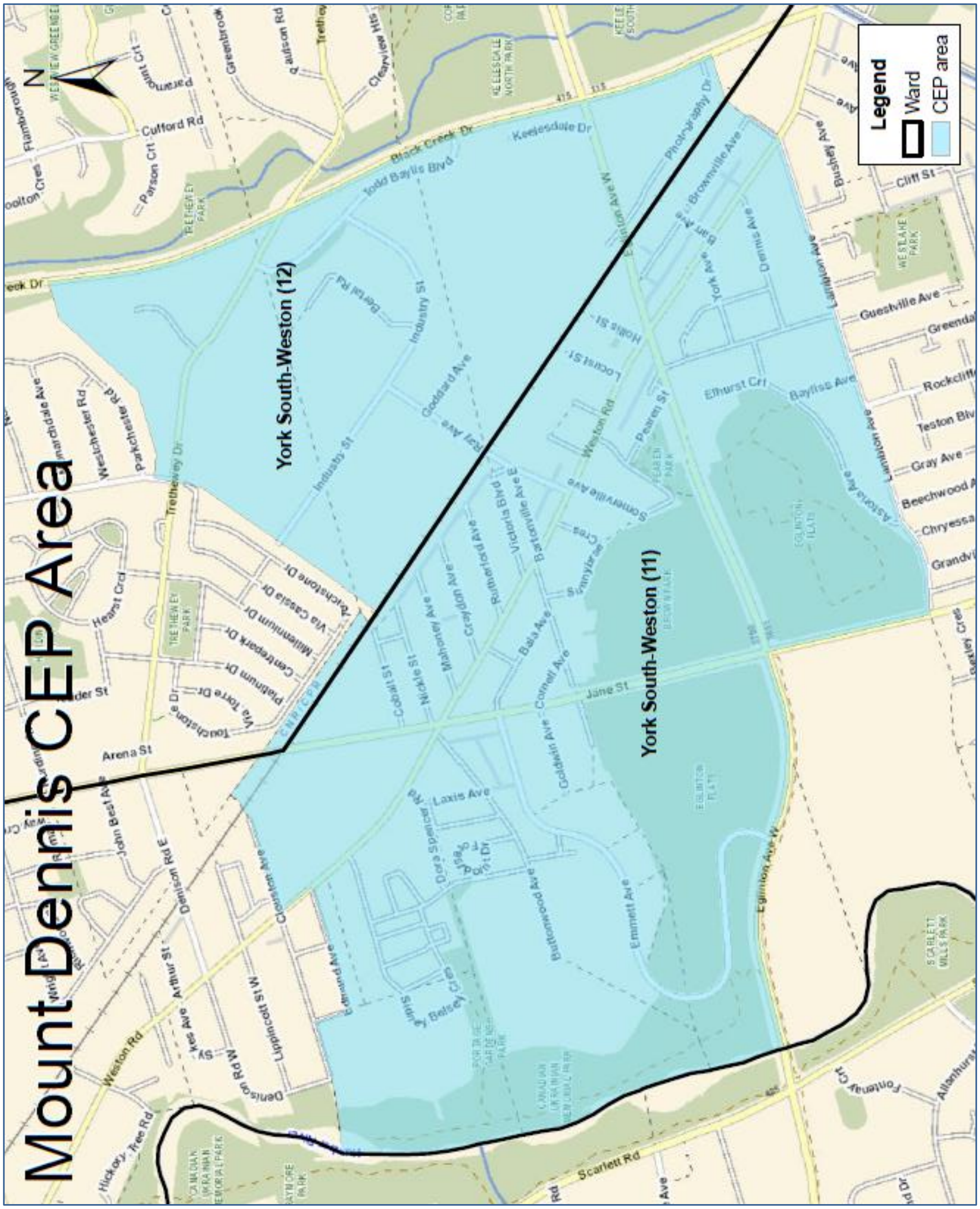

Figure 1. Mount Dennis Community Energy Plan Area

1. INTRODUCTION

The Mount Dennis CEP area (Figure 1 on the previous page) is the location of the western terminus of the under-construction Eglinton Crosstown LRT (Phase 1) and is being planned for a long-term transformation:

- Higher density, mixed-use development adjacent to the Mount Dennis Station, a designated Mobility Hub
- Maintenance and Storage Facility for the Light Rail Vehicles as well as a 15-bay Bus Terminal
- Infill residential and retail development along Weston Road
- Completion of the new, 6,500 m^2 York Community Centre
- Proposal for a new, 70,000 m^2 hospital building on the West Park Health Care Centre campus

Metrolinx/Crosslinx Transit Solutions is proposing to build an 18 MegaWatt (MW) natural gas-fired power plant to reduce electricity costs and provide backup power to the Crosstown. City Council, at its December 9, 2015 meeting, directed the EED to meet with Metrolinx, Crosslinx and Toronto Hydro, to report back on these meetings, and to prepare a Community Energy Plan to "*determine whether it would be feasible to integrate alternative energy sources and solutions that could potentially offset the back-up power facility's carbon footprint.*"[1]

EED staff met with these organizations in early 2016 to gather information and discuss opportunities for alternative energy solutions. Following these meetings, it was evident that low-carbon/renewable energy technologies, strictly as an alternative to the proposed backup power facility, are currently prohibitively expensive. Therefore, EED staff approached this Plan with consideration for energy solutions in the entire Mount Dennis area.

The CEP boundaries are defined by two large areas: the Mount Dennis Neighbourhood to the west of the rail corridor in Ward 11; and the Kodak Lands and industrial/warehousing properties east of the rail corridor in Ward 12. Although most new development will occur east of the rail corridor, the Mount Dennis Neighbourhood was also included to capture several existing large high-rise buildings as well as the West Park Health Care Centre.

Outside of potential intensification along Weston Road and Eglinton Avenue (both designated as *Avenues* in the Official Plan), much of the Mount Dennis is stable *Neighbourhoods* or *Employment Areas*, where development will be limited. The Plan therefore also considers opportunities for retrofits of existing buildings to reduce energy use and emissions.

This Plan is a draft document, intended to be presented to the local Councillor's as well as the Mount Dennis community for discussion and feedback. As such, there are no conclusions in this document, but rather a series of next steps that EED staff will undertake in the coming months.

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[1] http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2015.MM11.19

1.1. Community Energy Planning

The key mandate for CEP was established by City Council's adoption in 2009 of the Power to Live Green: Toronto's Sustainable Energy Strategy, which defines CEP as follows:

> *"CEP describes how energy is used in communities, and how its use affects the community including energy cost, energy security, and environmental impacts. Community Energy Plans show how designing for sustainable energy supports community objectives of greenhouse gas emissions reduction, local job creation and funds retained in community" (p. 19)*[2].

CEP considers energy early in the land use planning process for a specified area and, by estimating the energy performance over time, identifies opportunities to integrate efficient, resilient and low-carbon solutions at the building and block-scale. The key CEP objectives are as follows:

Climate Change

Meeting future GHG reduction targets will require efficient buildings and low-carbon energy solutions at the building- and neighbourhood-scale.

Growth

As Toronto continues to grow, energy conservation and accessing local sources of low-carbon energy can alleviate constraints in energy infrastructure and reduce GHG emissions.

Energy Resilience

Backup power solutions for multi-unit residential buildings and recreation centres can mitigate vulnerability to area-wide power outages associated with extreme weather.

Local Economic Benefit

Identify conservation and low-carbon energy opportunities in an area, with associated investment, and job creation potential.

1.2. Approach

Using building inventories and development estimates provided by City Planning, EED staff estimated energy use, demand and GHG emissions for existing buildings as well as different development estimates to understand the potential future energy demands of the area. Other unique opportunities, such as creating synergies with the Crosstown infrastructure, were identified. Specific technologies that were then evaluated to understand their potential application.

EED staff have met with Metrolinx, Crosslinx Transit Solutions (CTS), and Toronto Hydro to discuss the proposed backup power facility and opportunities for alternative energy solutions. Metrolinx, CTS, and Toronto Hydro are currently undertaking a feasibility study for alternative energy solutions, but the results have not yet been made available to EED staff.

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[2] http://www1.toronto.ca/city_of_toronto/environment_and_energy/key_priorities/files/pdf/2009-10_report.pdf

2. CALCULATIONS

Energy consumption, demand, and GHG emissions were estimated for existing buildings, the current development pipeline, and potential new development based on City Planning Property Assessment Data and development estimates prepared for the Mount Dennis Mobility Hub Study.

2.1. Inputs – Buildings

Existing Buildings

The Mount Dennis area (Figure 2) built form is predominantly low-rise, with large areas of single detached and row housing as well as light manufacturing/warehousing east of the rail corridor. Clusters of high-rise multi-unit residential buildings are found throughout the area, primarily at Black Creek & Trethewey and adjacent to the Eglinton Flats.

Weston Road is defined by small-format retail uses as well as walk-up apartments and new townhouses. There is also a significant institutional presence in the area with several elementary schools, churches and the West Park Health Care Centre.

Figure 2. Mount Dennis existing buildings. (Google Maps)

Figure 3 on the following page shows the breakdown of existing GFA as a percentage of the total for each building use (A), and the breakdown only for residential floor area (B).

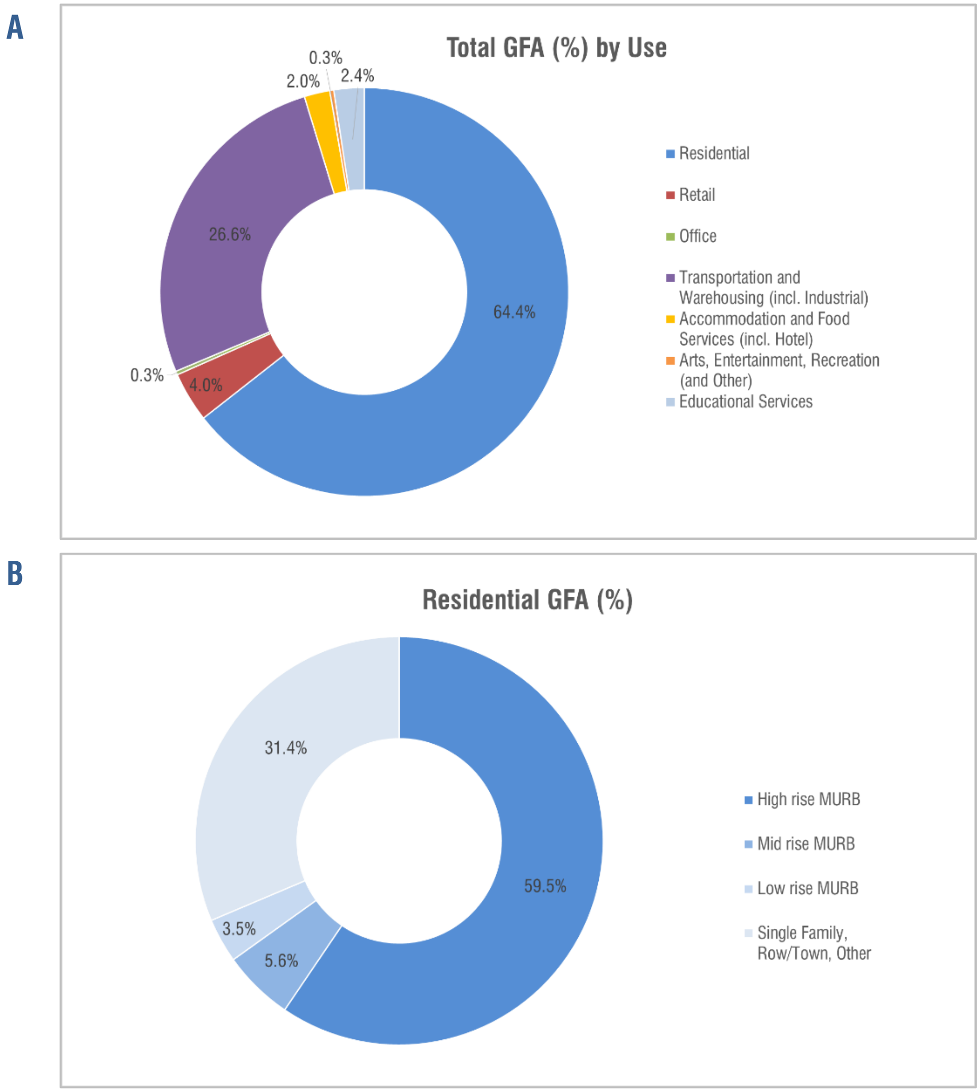


Figure 3. Existing Total and Residential GFA. (Source: City Planning Property Assessment Data).

Residential uses account for 65% of the total GFA and Transportation and Warehousing 26%. In the Residential category, High rise MURBs account for nearly 60% of floor space, with single family dwelling, row/town houses, and other dwellings (e.g. duplex) accounting for over 30%.

Development Pipeline

Applications currently under review total over 96,000 m^2 and include the Mount Dennis LRT Station and MSF, a 105-unit senior's apartment building, and the West Park Health Care Centre expansion (Figure 4 on the following page).

West Park is proposing a major redevelopment of the existing facilities, including construction of a new, potentially 70,000 m^2 hospital building[3]. The existing long-term care facility would be retained and several of the existing structures would be demolished, for a net expansion of 58,000 m^2.

[3] http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2016.EY15.10

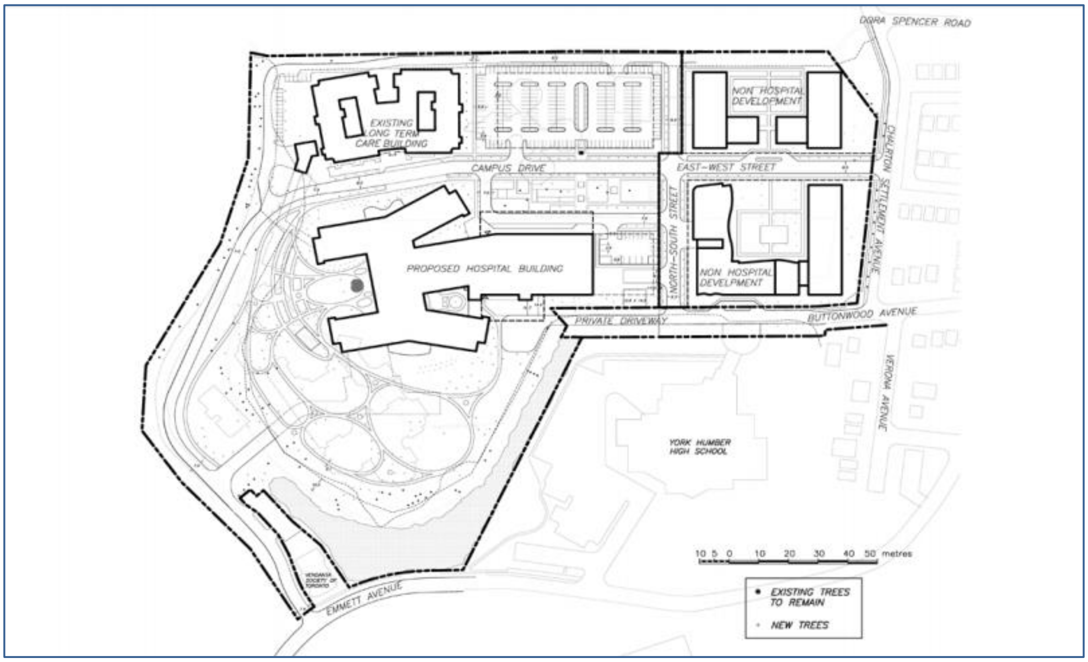


Figure 4. 82 Buttonwood Avenue (West Park Health Care Centre) proposed site plan. Only the proposed hospital building is part of this current application.

New Development

The Mount Dennis Mobility Hub Study identifies the potential for new development the following areas:

Kodak Lands – The mostly vacant site will contain the MSF, the bus bay, and proposed backup power facility. The vacant Kodak #9 building will be repurposed into a pedestrian entrance to the LRT station.

Weston Road – Numerous sites along Weston Road present opportunities for redevelopment into new low- and mid-rise residential use as well as small format retail.

Black Creek Triangle – Currently occupied by a grocery store and gas bar, this site presents the greatest potential for significant intensification. Various scenarios for the site include a mix of high- and mid-rise residential buildings and retail uses.

Weston & Eglinton – The main entrance to the LRT station will be built on the northeast corner of Weston & Eglinton. Over time, as individual lots are consolidated and the market develops, there could be potential for office development on this site.

Black Creek Business Area – There are large vacant sites at the intersection of Industry Street and Ray Avenue that can accommodate industrial, light manufacturing or warehousing uses.

Figure 5 on the following page illustrates what the area might look like as it develops over time.

Figure 5. Potential new development in Mount Dennis[4].

City Planning provided three new development scenarios for the Mount Dennis area:

- *Option A* – More residential, less retail
- *Option B* – More retail, less residential
- *Option C* – Significantly more residential, less retail

Overall Development Scenario

Over the next 25 years, there will be a significant amount of new development in the area. The Community Services and Facilities Strategy for the Eglinton Connects study indicates that Mount Dennis "could potentially accommodate approximately 1,000 new residential units with an estimated 2,300 to 3,300 new residents over the next 20 to 30 years"[5].

Much of the existing building stock will remain, though some sites will be redeveloped to accommodate population and employment growth. Figure 6 on the following page shows estimated GFA totals by use for the area.

[4] http://www.thecrosstown.ca/sites/default/files/pdf/reports/mountdennismobilityhubstudyfinal.pdf

[5] http://www1.toronto.ca/City%20Of%20Toronto/City%20Planning/Urban%20Design/Eglinton%20Connects/Apri14%20Update/Community%20Services%20Facilities%20Appendix%20G.pdf

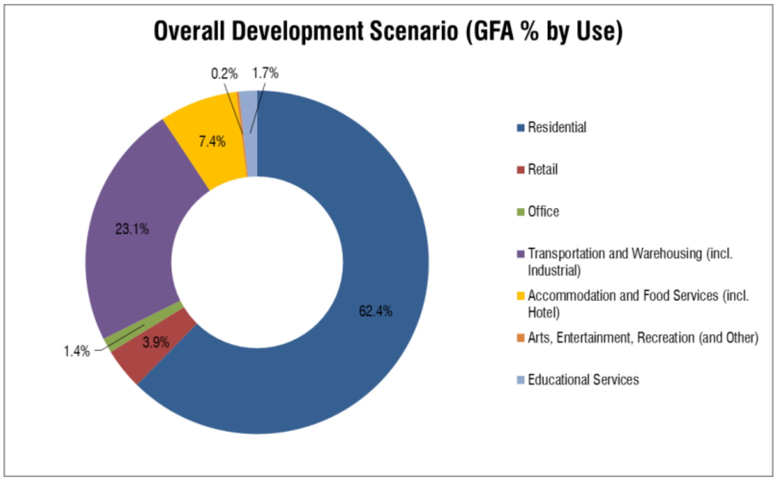


Figure 6. GFA (%) by use for the overall development scenario.

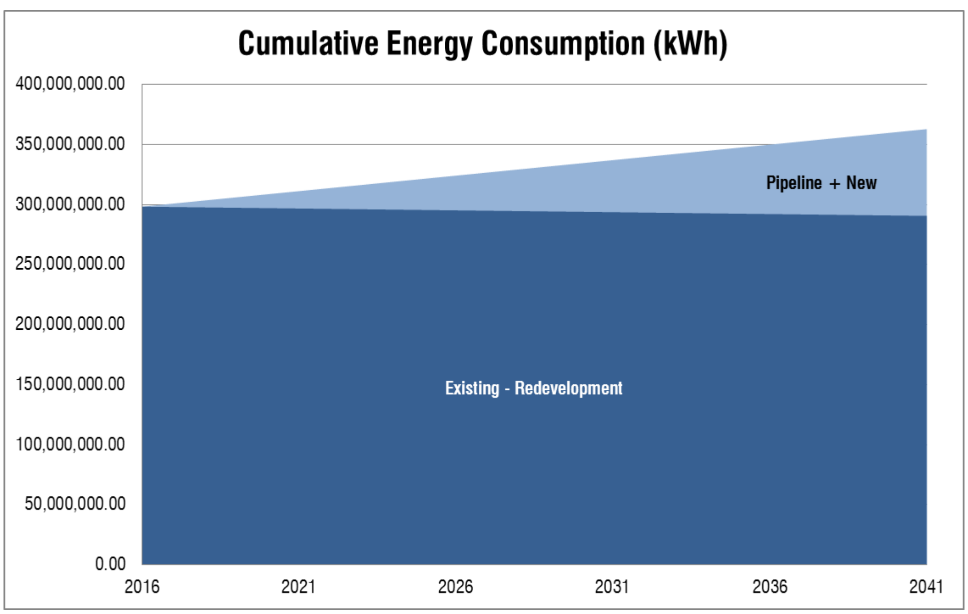
2.2. Methodology

Using the above inputs, we calculated the energy consumption, energy demand and GHG emissions for the area by applying energy coefficients (i.e. multipliers) for various building types to the estimated gross floor areas.

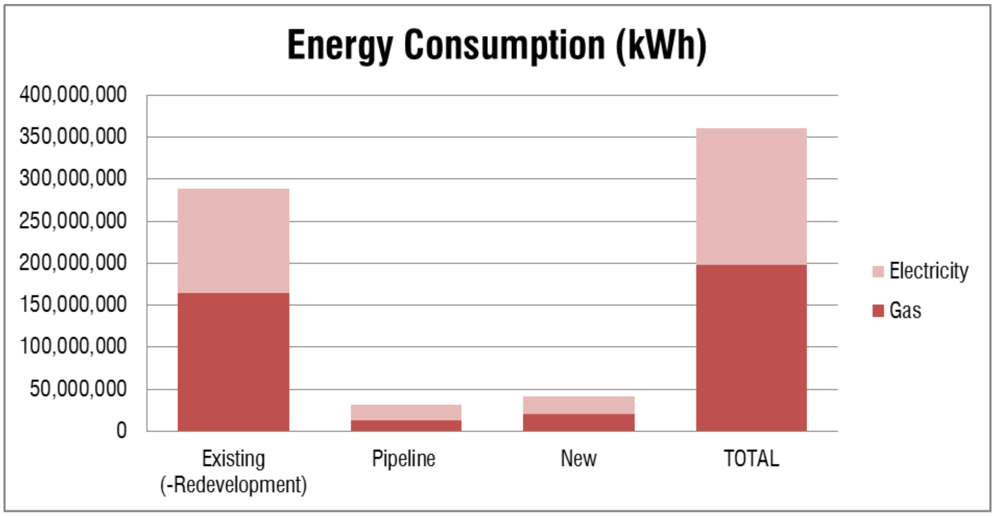
2.3. Outputs – Energy and Emissions

Figure 7 depicts energy calculations for the area, including existing buildings, development pipeline and new development (assuming Option C, designed to meet Tier 1 of the Toronto Green Standard). Specifically, it shows: A) Cumulative Energy Consumption; B) Energy Consumption; C) Energy Demand; and D) Emissions.

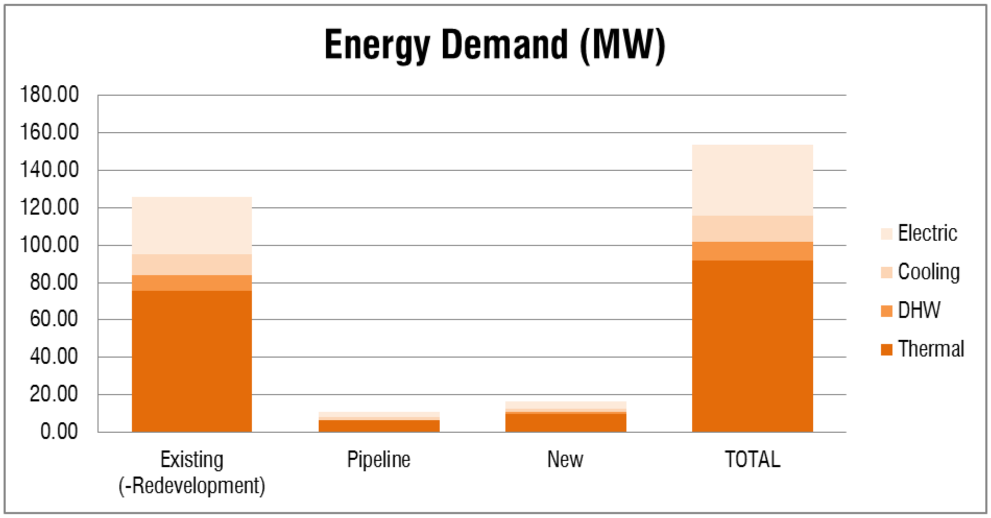
A



B



C



D

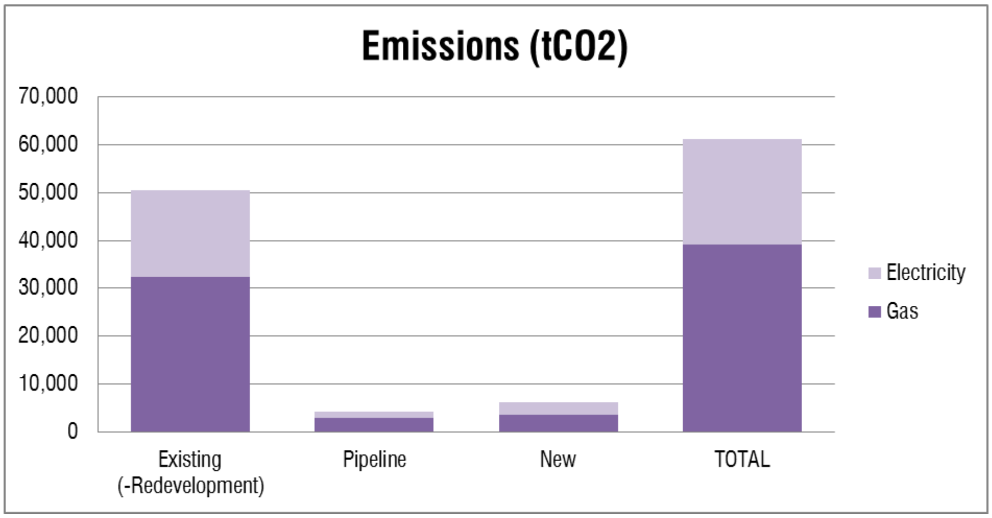


Figure 7. Baseline energy and emissions calculations.

3. PRELIMINARY ANALYSIS

In this section, the baseline calculations are used to estimate the impact that improved building performance or thermal networks, for example, could have as the area develops. Precedent examples of particular technologies are included where relevant.

3.1. Retrofitting Existing Buildings

Most of the energy use and emissions in the Mount Dennis area is attributed to existing buildings and this will continue to be the case as the area develops. Therefore, retrofitting existing buildings for improved energy performance, particularly reduced natural gas consumption in multi-unit residential buildings (MURBs), is critical to reducing total energy use and emissions in the area.

Multi-Unit Residential Buildings

MURBs account for 69% of residential energy use and 41% of the total, in Mount Dennis. Retrofitting these buildings for improved energy performance could achieve major reductions in natural gas use and emissions. Table 1 lists various Energy Conservation Measures (ECMs) for MURBs.

Table 1. MURB Energy Conservation Measures

Step	Simple Payback	Description	Energy savings (%)
Step 1	**<5 years**	Incandescent to compact fluorescent lamp conversion	0.8%
		Common area lighting reduction	0.1%
		Low flow shower heads	2.6%
		Tenant orientation and energy education programs	1.7%
		Variable frequency drive on domestic cold water pumps	0.2%
		MUA unit flow, heating and heat exchange retrofits	9.0%
		Eliminate garage heating for sprinkler freeze protection	3.4%
		Air sealing air conditioning units	0.4%
		Upgrade / optimize boiler digital control systems	2.9%
		CO-monitoring based control of garage exhaust	0.2%
		Total potential savings for Step 2	**21%**
Step 2	**5-10 years**	Low flow faucets	4.6%
		Apartment-level electric metering	1.3%
		Solarwall ventilation preheat system	2.6%
		Advanced suite controls upgrade	5.4%
		Total potential savings for Step 3	**35%**
Step 3	**>10 years**	Site lighting upgrades	0.2%
		Solar domestic hot water	3.1%
		Domestic hot water (DHW) boiler replacements	1.8%
		Kitchen and laundry appliance replacement	0.3%
		Heating boiler replacement	3.4%
		Window refurbishment	2.8%
		Advanced enclosure upgrade	4.3%
		Air sealing building core	2.8%
		Total potential savings for Step 4	**54%**

Retrofitting existing MURBs to ECM Step 1, 2, or 3, would lead to total energy savings of 9%, 14%, or 22%, respectively, as shown in Figure 8.

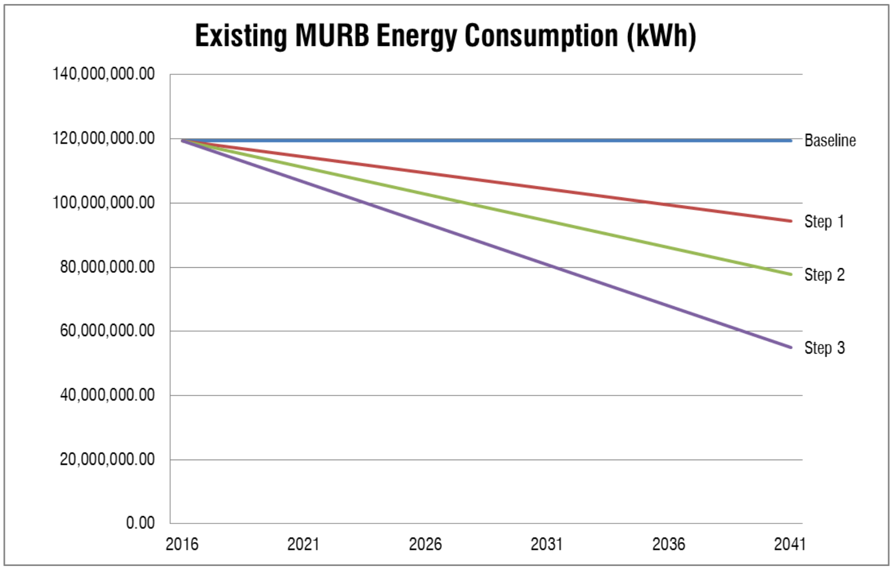


Figure 8. Energy savings over time by applying ECMs.

Hi-RISE Program – Of the 11 high-rise MURBs in Mount Dennis, 10 were built before 1985 and therefore fall within the scope of the City of Toronto's Tower & Neighbourhood Revitalization Unit, which works to improve the energy performance of these buildings, among other initiatives. This may allow eligible building owners to participate in the Hi-RISE program, through which the City provides financing to undertake energy and water efficiency improvements. The loan is then paid back through the property tax bill, with the energy savings helping to offset the costs of repayment[6].

Program results so far show that retrofits of these buildings reduce energy use by 28% and emission by 340 tonnes per building, on average.

Houses

Detached, semi-detached, row and town houses account for approximately 32% of residential energy use, 19% of the total for the Mount Dennis area. Retrofitting these houses for improved energy performance is therefore also an opportunity for significant reductions in gas consumption and emissions.

Home Energy Loan Program (HELP) – The City of Toronto's Home Energy Loan Program (HELP), administered by the EED, offers low-interest loans to eligible homeowners to undertake energy retrofits[7]. Similar to Hi-RISE, the loan is registered on title and paid back over time through the property tax bill. The program has been running for approximately two years and results show, on average:

- 25% less energy use overall

[6] http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=ab3147e94c5b3410VgnVCM10000071d60f89RCRD

[7] http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=7e00643063fe7410VgnVCM10000071d60f89RCRD

    - 30% less gas use
    - 5% less electricity use
- 2.5 tonnes less emissions per house
- $800 annual energy cost savings

The most common retrofits are increased insulation (attic and exterior walls), replacing windows and doors, and upgrading to a high efficiency furnace.

There are 1,276 detached and semi-detached houses in the Mount Dennis area, which represents 74% of non-MURB housing. Applying the average results would equate to a 4% reduction in total energy use and over 6% total emissions reductions in Mount Dennis. Considering the above most common retrofits focus on the building envelope and heating system, gas savings are significant and therefore lead to substantial emissions reductions.

Other Buildings

Industrial uses such as manufacturing and warehousing are the other major energy users in Mount Dennis, accounting for 30% of the total. There are conservation opportunities in these buildings as well, but the measures applied and ultimate impact will vary based on the particular operations/process in each building.

3.2. High Performance New Building Design

The energy performance requirements of Tiers 1 and 2 of the *Toronto Green Standard* (explained below) were applied to the development estimates (Option C) to calculate the potential reduction in electricity demand, energy consumption, and GHG emissions associated with Tier 2 compared to Tier 1.

The TGS is a development standard that specifies environmental performance measures for new buildings related to sustainable building and site design[8]. Performance measures are grouped into categories such as Air Quality and GHG Emissions/Energy Efficiency (see Table 2 below), to name a few. Each category has mandatory, Tier 1 elements and optional, Tier 2 elements. Tier 2 earns developers a 20% refund on development charges.

Table 2. GHG Emissions/Energy Efficiency performance measures of the Toronto Green Standard.

Tier 1	Tier 2
Must achieve a 15% improvement in energy efficiency compared to the Ontario Building Code	Must achieve a 25% improvement in energy efficiency compared to the Ontario Building Code
City facilities over 600 m^2 must generate 5% of total energy load from on-site renewables	1% of total energy load from solar or wind resources OR 20% from geo-exchange

Designing to Tier 2 Energy Performance

Table 3 on the following page shows the calculated electricity demand, energy consumption and emissions of new buildings, including pipeline development, designed to TGS Tier 1 compared to Tier 2.

[8] http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=f85552cc66061410VgnVCM10000071d60f89RCRD

Table 3. Resulting Energy Use, Demand and Emissions – Tier 1 vs Tier 2

	Tier 1	Tier 2	% Reduction (Tier 2 vs Tier 1)
Total Energy (eMWh)	72,251	58,706	**19**
Gas Use (eMWh)	32,886	24,852	24
Electricity Use (MWh)	39,364	33,854	14
Electricity Demand (MW)	6.96	5.85	**16**
Total GHGs (tons eCO_2)	10,700	8,233	**23**

Designing new buildings to Tier 2 performance standards would reduce energy consumption by 19%, electricity demand by 16%, and GHG emissions by 23%, as shown in Figure 9.

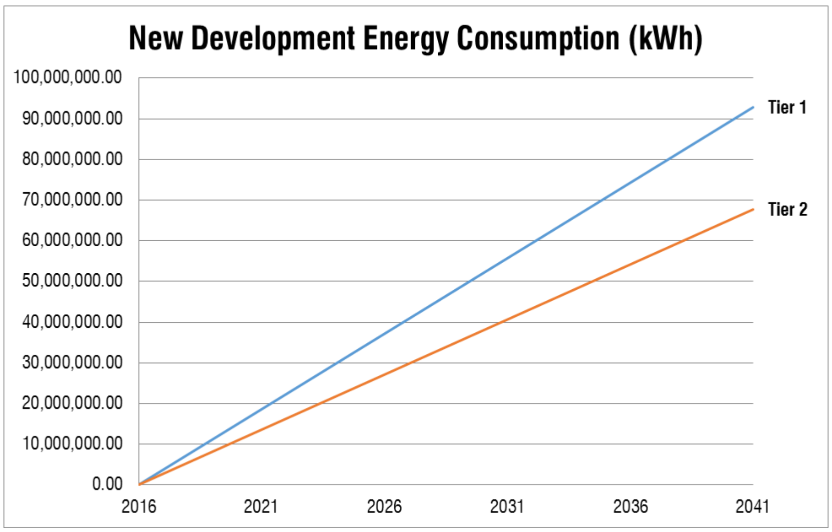


Figure 9. Energy consumption of new development - TGS Tier 1 vs Tier 2

The Featured Solution on the following page identifies some of the ways in which Tier 2 can be achieved.

FEATURED SOLUTION – Achieving Tier 2 of the Toronto Green Standard

Design Consideration	High Efficiency 50% better than MNECB (equivalent to TGS Tier 2)
Common Area Lighting	40% below MNECB Occupancy sensors throughout
Parking Lighting	1.6 W/m^2 Occupancy sensors
Roof performance*	R-30
Wall performance*	R-20
Window-to-wall ratio (WWR)	40%
Window Performance*	U-value < 0.3 SHGC < 0.35
HVAC Distribution	4-pipe fan coils
Boiler Efficiency	Condensing @ 92+%
Chiller Efficiency	COP 6+
Fan and Pump motor efficiencies	Variable Speed Drives Premium motor efficiency
Makeup Air Units combustion efficiency	92+%
Domestic Hot Water (DHW) efficiency	95% with low flow fixtures
Ventilation Heat/Energy Recovery	70+% overall effectiveness
Appliances	EnergyStar

* Roof, wall and window performance is considered overall assembly and includes the impact of framing

Total Potential Energy Conservation

If, over time, all existing MURBs are retrofitted to Step 3 ECMs, all detached and semi-detached houses participate in the Home Energy Loan Program, and all pipeline and new development meets Tier 2 of the TGS, overall energy consumption would be approximately the same as it is currently (Figure 10).

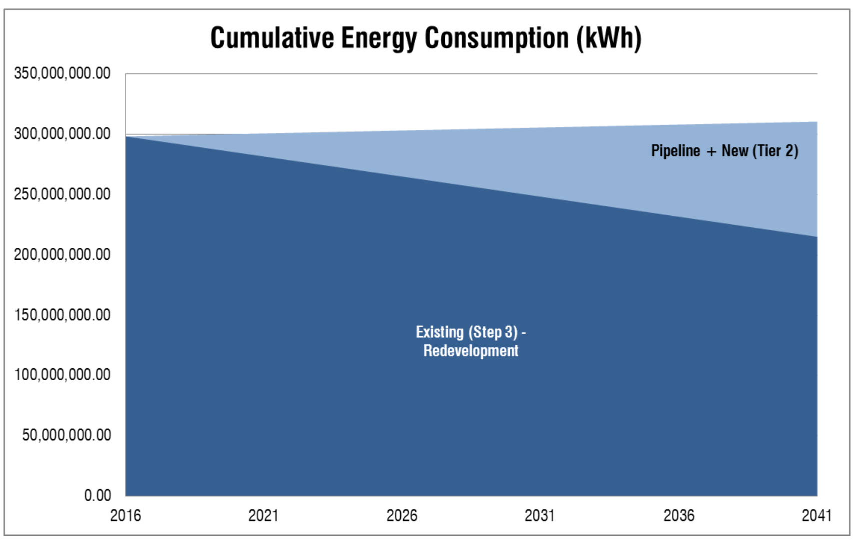


Figure 10. Cumulative energy consumption with existing building retrofits and high performance new building design.

Since most retrofit measures and high performance new designs are skewed towards gas savings, building emissions would likely decrease overall in this same scenario despite growth in the area.

3.3. Building-scale Renewables

At the scale of individual buildings, there are several viable low-carbon energy supply options that can be integrated into buildings, including:

- Solar photovoltaics (PV)
- Geo-exchange (i.e. ground source)
- Biomass boilers/combined heat and power (CHP)

Solar Photovoltaics

Industrial/warehouse rooftops offer an opportunity to install large solar PV systems. Mount Dennis has a significant number of industries and warehouses east of the rail corridor that can possibly be used. In fact, the North York Women's Centre and the building at 25 Bertal Road already have operating systems.

Analysis of the proposed LRT Maintenance and Storage Facility indicates the potential to support 1 MW of solar PV on its nearly 12,000 m^2 roof without precluding the installation of a green roof. A saw tooth panel arrangement would allow light to reach the roof and shade-loving plants can be arranged under the panels. This approach would maintain the stormwater management capability of the roof and the plants would also help keep the solar panels cool, thus improving their operation (Figure 11).

Figure 11. Solar PV installation on a green rooftop installation in Munich, Germany[9].

Total existing industrial/warehouse roof space in the Mount Dennis area is approximately 194,000 m^2. The presence of rooftop heating/cooling units and other obstructions, as well as potential structural limitations, would limit space available for solar PV arrays. If 10% of this space can be used, an additional 3 MW of solar PV can potentially be installed. Although the installation of solar PV systems would have a marginal impact on emissions, it would create room for new development by reducing demand on electricity infrastructure.

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[9] http://www.zinco-greenroof.com/EN/references/green_roofs_solar_energy.php

High-rise residential and office buildings are generally less optimal for solar PV given the small roof area relative to the building volume. However, advances in building-integrated PV (where the solar panels form part of the building envelope) and on-site electricity storage could increase the potential for electricity generation over time from high-rise buildings.

Geo-exchange

Geo-exchange systems have the potential to contribute large amounts of renewable thermal energy, which would displace gas and reduce emissions substantially. However, using electric heat pumps will result in an increase in electrical demand. Therefore, reducing electricity demand through conservation and solar PV installations is even more important as this would help make room in the electricity grid without the need for new infrastructure.

New development provides the ideal opportunity to implement geo-exchange systems. Although geo-exchange systems are viable at different sizes, large systems supplying multiple buildings through a thermal network create economies of scale, reducing the costs per tonne of avoided emissions. The large green spaces adjacent to the Kodak Lands and Black Creek Triangle may present an opportunity to implement large well-fields close to new development. Further investigation, beginning with geotechnical studies, is necessary.

Biomass

Replacing natural gas with locally-sourced biomass, such as urban waste wood, could be a viable low-carbon opportunity. Invasive species such as the Emerald Ash Borer, extreme weather events such as the December 2013 ice storm, and construction activities create large amounts of waste wood.

The economic feasibility of any biomass solution depends on a sustainable fuel supply. EED staff are investigating the potential use of waste wood as a viable fuel source in Toronto. To identify specific opportunities in the Mount Dennis area more detailed analysis will be needed, including transportation considerations.

La Cite Verte, an 800-unit, residential development in Quebec City, uses biomass wood pellet boilers and a thermal network to heat all buildings, including 6,700 m^2 of non-residential space. Boilers are located in the basement and the wood pellets storage silo is integrated seamlessly with the buildings (Figure 12).

New development in the Black Creek Triangle could amount to over 800 residential units, comparable to La Cite Verte.

Figure 12. Wood pellet storage silo integrated with residential buildings in La Cite Verte, Quebec City.[10]

[10] www.biomassthermal.org/resource/CaseStudies/Cite-Verte-Reference.pdf

3.4. Block- and District-Scale Low-Carbon Solutions

Sharing energy at the block- or district-scale has the potential to make a much more substantial contribution to low-carbon energy supply because it provides the platform necessary to cost-effectively incorporate large low-carbon/renewable energy sources. A thermal network that connects multiple buildings can take advantage of:

- Waste heat recovery from sewers, industrial processes, and combined heat and power (CHP) plants
- Large geo-exchange fields coupled with solar thermal arrays

New development in proximity to these potential energy sources provides an opportunity to co-locate energy solutions with infrastructure such as sewers and transit lines, or with other municipal assets such as parks.

Sewer Heat Recovery

Heat can be recovered from wastewater flowing through sewers. The Vancouver 2010 Olympic Village uses sewer heat as part of a neighbourhood energy strategy with a thermal network that connects buildings (Figure 13)[11].

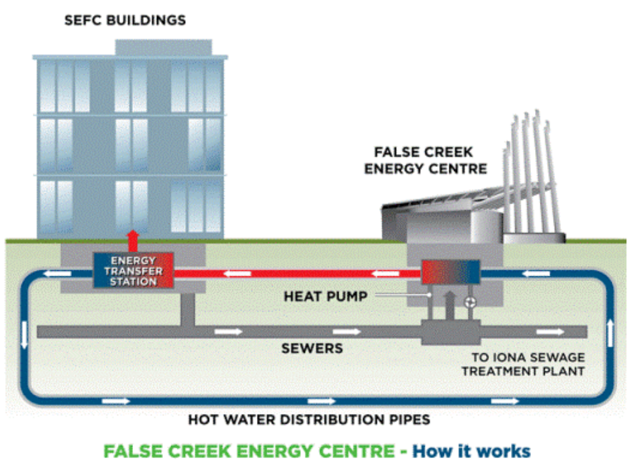

Figure 13. Sewer heat recovery at the False Creek Energy Centre, Vancouver, BC.

The False Creek Energy Centre uses heat pumps to extract heat from sewage before treatment. This provides 70% of the needed heat for connected buildings, with the remaining 30% from natural gas boilers. The system reduces GHG emissions by 60%.

As a city-wide initiative, Toronto Water has retained an external consultant to prepare an Energy Optimization Plan. EED staff are working with Toronto Water and their consultant on mapping and identifying the potential for using sewer heat to heat buildings.

Toronto Water is also currently underway with the Black Creek Sanitary Trunk Sewer (STS) Drainage Area Servicing Improvements Study, which includes an assessment of capacity needs to service future growth. The Black Creek STS (Figure 14) on the following page flows through Mount Dennis, which may present opportunities to use sewage as a heat source[12].

[11] http://vancouver.ca/home-property-development/false-creek-neighbourhood-energy-utility.aspx
[12] http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=7bf15184350ff410VgnVCM10000071d60f89RCRD

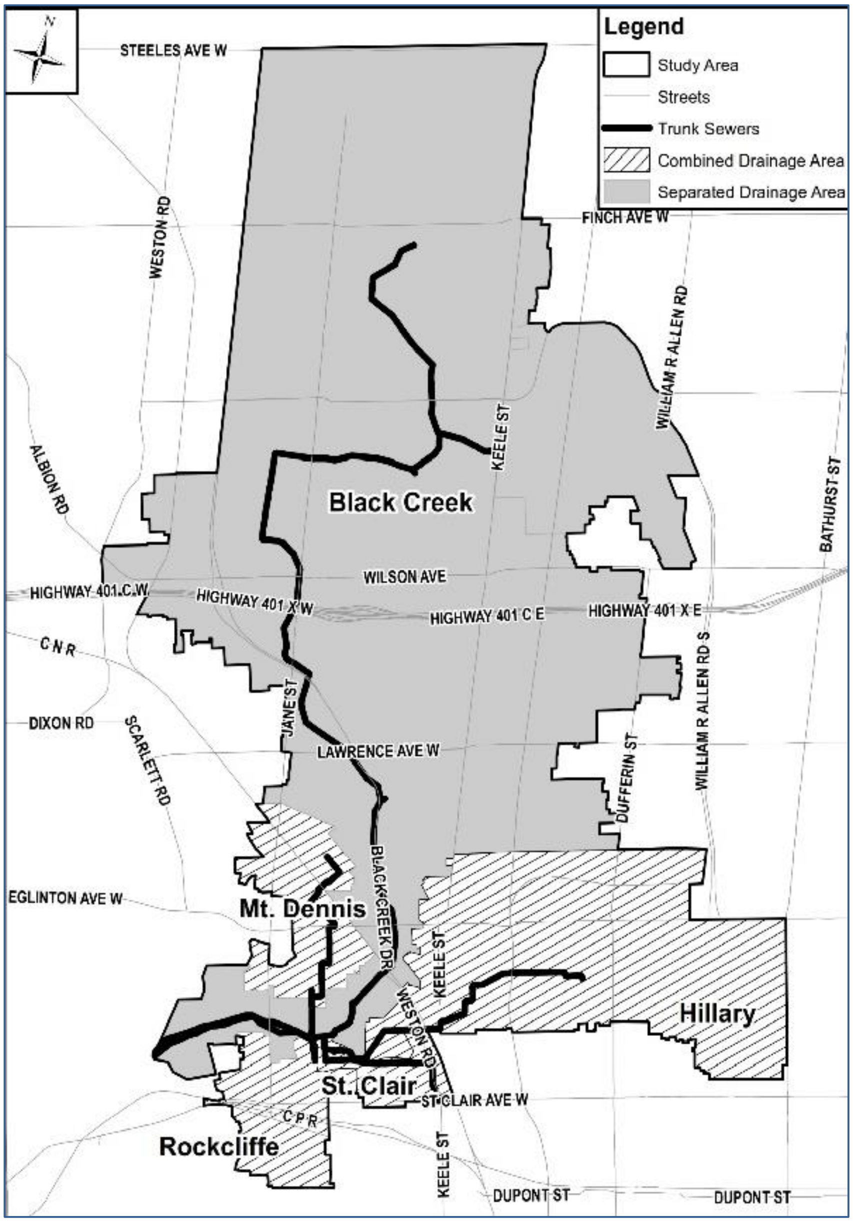

Figure 16. Black Creek Sanitary Trunk Sewers and Drainage Area. Note the trunk sewers flowing directly through the Mount Dennis area[13].

High Efficiency Combined Heat and Power (CHP)

CHP is electricity generation and simultaneous recovery of waste heat, which can be used to fully or partially satisfy space heating or domestic hot water demands. CHP can achieve efficiencies of 80-90% compared to 35-50% for a modern power plant (Figure 15 on the following page). High efficiency CHP has double the efficiency and half the GHG emissions compared to the gas power plants used only to generate electricity. The

[13] http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=7bf15184350ff410VgnVCM10000071d60f89RCRD

implementation of small, load-displacing CHP has proven successful in several instances in Toronto, generating internal rates of return greater than 10%.

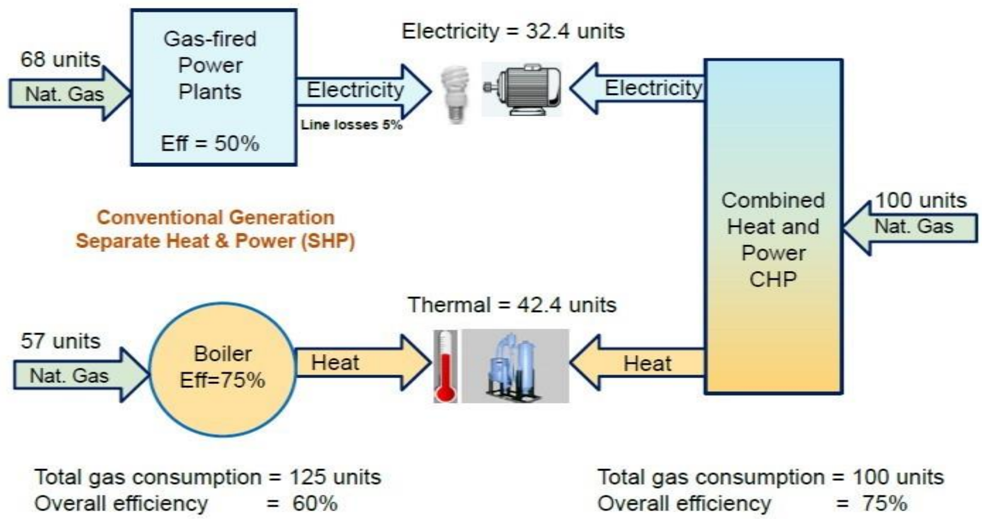

Figure 19. CHP versus conventional, separate heat and power. CHP uses less fuel to produce the same amount of heat and power compared to separate power plants and boilers. Its efficiency means it is less carbon intensive as well (Source: Short & Zaidi, 2015).

Hospitals often present good business cases for CHP because they have consistent and large demands for both electricity and thermal energy. As West Park redevelops, there may be an opportunity to implement CHP in the existing on-site physical plant. In terms of potential capacity, Sudbury Regional Hospital (Health Sciences North) has 454 beds and utilizes a 6.7 MW CHP plant[14]. The proposed new West Park hospital building, at 460 beds, could potentially support a similar size plant. Excess heat could potentially be exported to nearby MURBs through a thermal network to reduce gas consumption in these buildings.

The proposed backup power facility in Mount Dennis could be configured to operate as a CHP plant and in fact, Crosslinx has proposed using a limited amount of the waste heat from the facility to heat the MSF[15]. As the Kodak Lands and Black Triangle develop over time, there may be enough thermal demand from the buildings to be able to cost-effectively utilize more of the waste heat through a larger thermal network.

The alternative to a single large plant would be numerous small (< 5 MW) CHP plants at strategic locations along the length of the Crosstown. By co-locating a thermal network along the Crosstown route, CHP plants can be deployed in areas of higher growth (e.g. Yonge Street, Don Mills Road, etc.) where thermal demand is more concentrated. The electricity can be used to power the transit line and the waste heat can be used to heat buildings connected to the thermal network.

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[14] http://www.powerauthority.on.ca/sc-cc/sudbury-district-energy-hospital-cogeneration-67-mw-sudbury
[15] http://www.toronto.ca/legdocs/mmis/2016/ex/bgrd/backgroundfile-92958.pdf

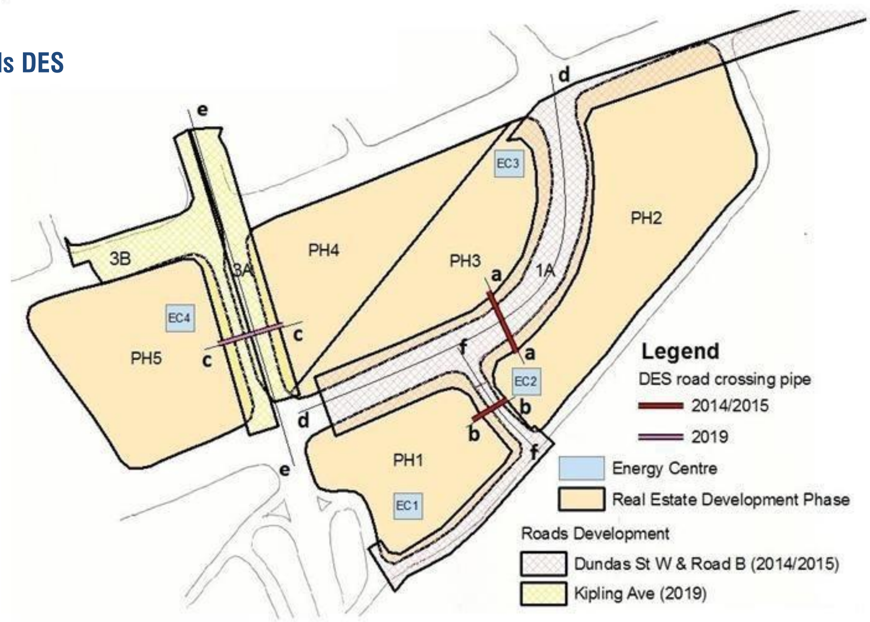
District Energy

A district energy system (DES) is not a technology; it is a thermal energy distribution strategy for multiple buildings. Modern systems often have distributed energy centres in buildings and pipes crossing streets to connect development parcels/buildings.

Critical to their success is attracting energy developers for private investment, just-in-time capital outlays, flexibility to grow the network over time, and buildings designed for connection. This is the approach in the Westwood Theatre Lands (Figure 16), a brownfield being master-developed by Build Toronto. Pipes are being installed in road crossings to connect future parking garages and, working with Build Toronto, developers will be asked to design mechanical rooms for easy connection.

Figure 26. Westwood Theatre Lands DES Concept.

- Phased development
- Just-on-time capital investment
- 4 Energy Centres (heating, cooling, CHP potential) thermally connected (heating only)
- Road crossing DES pipes to be placed in advance



The broader opportunity is to co-locate distribution pipes along the length of the Crosstown to heat new development along Eglinton Avenue. This would allow strategic deployment of CHP plants, but also the ability to access nearby low-carbon energy sources. In Bergen, Norway, land-use policies encourage co-locating thermal networks with new transit[16].

Where development is expected to precede the construction of a district energy system, buildings must be designed to enable a future connection. This is referred to as 'district energy (DE) ready' design and it requires:

- Adequate space in a building's mechanical room for a future energy transfer station;
- An easement, free of physical obstructions, between the mechanical room and the property line to allow for thermal piping;

[16] http://www.unep.org/energy/portals/50177/DES_District_Energy_Report_full_02_d.pdf

- Two-way pipes placed in the building to carry the thermal energy (hot water, steam or chilled water) from the district energy network to the section in the building where the future energy transfer station will be located;
- A hydronic heating system that allows for a large ΔT in order to reduce the pipe sizes and associated valves, fittings, etc.; and
- Appropriate thermal energy metering.

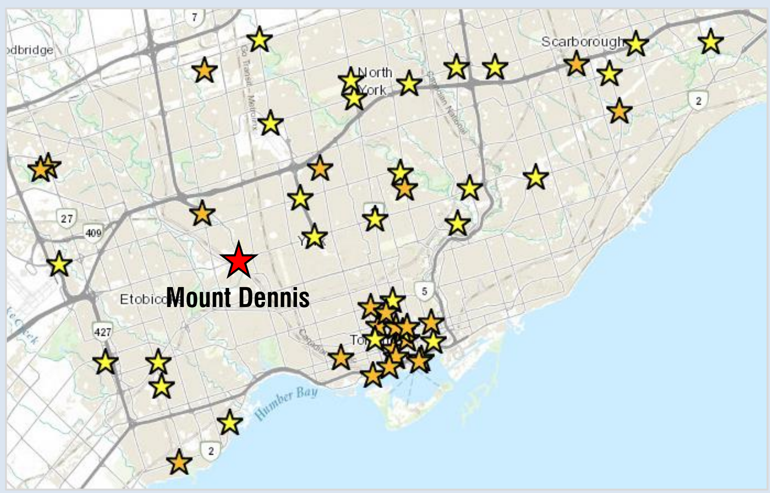
It will be important to establish a framework that can be referenced to guide future network development as new buildings are developed. This would include designing all new buildings in the area to be DE ready, setting aside space for small energy centres, and specifying rights of way or easements for linear infrastructure.

FEATURED SOLUTION – District Energy

The Mount Dennis area, particularly the areas around the Black Creek Triangle and West Park Health Care Centre, have the key ingredients for district energy. The area surrounding the Black Creek Drive & Eglinton Avenue intersection is one of 27 potential locations identified for new district energy systems in Toronto based on a 2011 Study by the EED.

Opportunity for New DES in Toronto.

DES is not new in Toronto. It has a 100 year history in the downtown core and it has potential for City wide application. A DES opportunity scan based on current and projected geographic energy use intensity identified 27 potential new district energy systems in the City of Toronto[17].



Prospects for implementing district energy systems in the Mount Dennis area are attractive because of planned higher-density development and the presence of a large health care facility. In this situation, investment in a DES could easily generate an internal rate of return of 10% and although capital intensive, long-term operational cost savings can be substantial.

3.5. Energy Resilience

Resilience is a key aspect of energy planning that is independent of energy efficiency. Extreme weather events, which are expected to occur more frequently and be more intense in Toronto, have the potential to cause sustained, area-wide power outages as witnessed during the December 2013 ice storm. Therefore, no matter how efficient a building, it should have backup power systems designed to provide safety and a degree of comfort to occupants so they can remain in their building when grid power supply is disrupted.

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[17] http://bbptoronto.ca/wp-content/uploads/2012/06/FINAL-GENIVAR-Report-City-of-Toronto-District-Energy-September-4-12.pdf

Backup Power Guidelines for MURBs

Minimum codes for standby power systems in multi-unit residential buildings (MURBs) have not changed significantly in the last 30 years, so they are not typically designed to deal with area-wide (i.e. non-emergency) power outages. The EED worked with Hidi Rae Consulting Engineers to prepare business cases to improve MURB standby power systems, including retrofit opportunities for existing buildings and design guidelines for new buildings. The report found that resilience can be improved in many MURBs at a low incremental cost. For example:

- Powering domestic water booster pumps and hot water boilers to provide hot and cold water to units can be done is most new MURBs with little added cost.
- Additional elevators can be powered to allow residents to move freely throughout the building.
- In both existing and new buildings, where it is cost-prohibitive to backup all systems, common areas such as lobbies or amenity spaces can be converted to refuge areas, which have heating, cooling and convenience electricity.

The report also recommended that natural gas generators, though approximately 10-15% more expensive than diesel systems, are the preferred solutions for backup power because they offer indefinite run time (i.e. no refuelling) and are less prone to failure.

FEATURED SOLUTION – Natural gas-fired Backup Generators

Natural gas-fired generators provides two major advantages compared to diesel generators. First, fuel supply is much less likely to be interrupted because the generator does no rely on a stored fuel source – it is directly connected to the natural gas grid.

Second, the cost premium associated with a natural gas generator can be offset by revenue earned through enrollment in the provincial Demand Response (DR) 3 program. Demand response describes the shedding of electrical loads during times of peak demand and one of the ways this can be accomplished is by generating electricity onsite to offset what is required from the electricity grid.

Packaged, 400 kW natural gas-fired generator.

Natural gas-fired generators, such as the unit pictured above, are a proven technology that is commercially available. Though more expensive that typical diesel generators, they are more reliable and resilient, and there is a business case when revenue earned through the provincial demand response program is considered.

Solar PV, combined with energy storage systems, can also be used to provide zero-emission backup power to buildings. Over time, with the price of solar PV-generated electricity expected to reach grid parity by 2020 and the cost of battery storage systems also declining, such systems could be implemented to help strengthen resilience.

Community Reception Centres

City of Toronto Community Centres, as well as facilities run by other community organizations (e.g. YMCA), can greatly improve the resilience of a particular area by doubling as a Reception Centre for people displaced from their homes by power outages, especially during extreme weather events when shelter is essential.

Previously, during a major power outage, Community Centres were opened as needed and operated by the Red Cross. This will continue, but four Community Centres (one in each district of the city) have now been permanently designated as Reception Centres and efforts are currently underway to upgrade/augment standby power systems to allow for longer operation in the event that they are needed to receive displace individuals.

4. EMERGING DIRECTIONS

The transformation of the Mount Dennis area provides an opportunity to consider energy early in the planning process for new development, and also to identify opportunities to reduce energy use and emissions in existing buildings. High levels of energy conservation, improved resilience, and low-carbon energy solutions are central to this transformation.

Managing the energy challenges that could arise from this transformation, including increased energy demand, greater vulnerability during area-wide power outages, and increased GHG emissions, will require certain key up-front decisions as well as an ongoing commitment to implementation. Based on the preliminary analysis, the emerging directions for Mount Dennis are:

Existing Building Retrofits

Energy conservation in multi-unit residential buildings, perhaps through the Hi-RISE program, and in houses through the Home Energy Loan Program, could energy use by 26% compared to current levels while also saving money and improving indoor comfort.

High Performance New Buildings

New construction that achieves Tier 2 of the Toronto Green Standard (TGS) would reduce energy use, electricity demand and emissions by 19%, 16%, and 23%, respectively compared to the mandatory Tier 1.

Local Energy Solutions

Solar PV installation industrial building and warehouse rooftops in the area could potentially total 3 MW. An installation on the roof of the Maintenance and Storage Facility could potentially total 1 MW.

Geo-exchange systems and biomass solutions could potentially contribute a large amount of renewable heat and/or power.

Low-Carbon Thermal Networks

Thermal networks can provide a platform for large-scale renewable energy sources (e.g. sewer heat recovery or biomass CHP) and can potentially provide most of the required low-carbon energy of new development in the area. Areas of higher density development such as the Black Creek Triangle, or major energy use such as the proposed new West Park Health Care Centre hospital building, merit further consideration.

Energy Resilience

Strategic backup power capability (i.e. essential systems such as common areas, elevators, water pumping to upper floors) for existing and new MURBs can be implemented at little or no additional cost compared to minimum building code requirements and would allow residents to withstand area-wide power outages.

5. NEXT STEPS

Community Consultation

In coordination with the local Councillors' offices, EED staff will host a consultation with the community to present the preliminary analysis in this document and receive feedback on the emerging directions.

Collecting Additional Information

For example

- Surveys of energy use in existing multi-unit residential buildings in the Mount Dennis area in order to better understand specific opportunities to conserve energy and reduce emissions.
- Meetings with representatives of West Park Health Care Centre to identify and discuss opportunities for on-site combined heat and power and potential export of heat to nearby buildings.
- Engagement with owners of existing industrial buildings and warehouses to discuss opportunities for energy conservation and local energy solutions, including solar rooftop PV installations.

Evaluation of Local Economic Benefits

Based on feedback received, EED staff will evaluate opportunities to leverage potential energy solutions to deliver local economic benefits for the Mount Dennis area.

6. REFERENCES

Toronto Official Plan, 2006
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Backup power module for updated Community Energy Plans
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How CHP Systems Save Fuel and Reduce CO2 Emissions
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