DRAFT

THE POCKET CHANGE PLUS: SCOPE, OPPORTUNITIES & QUICK STARTS

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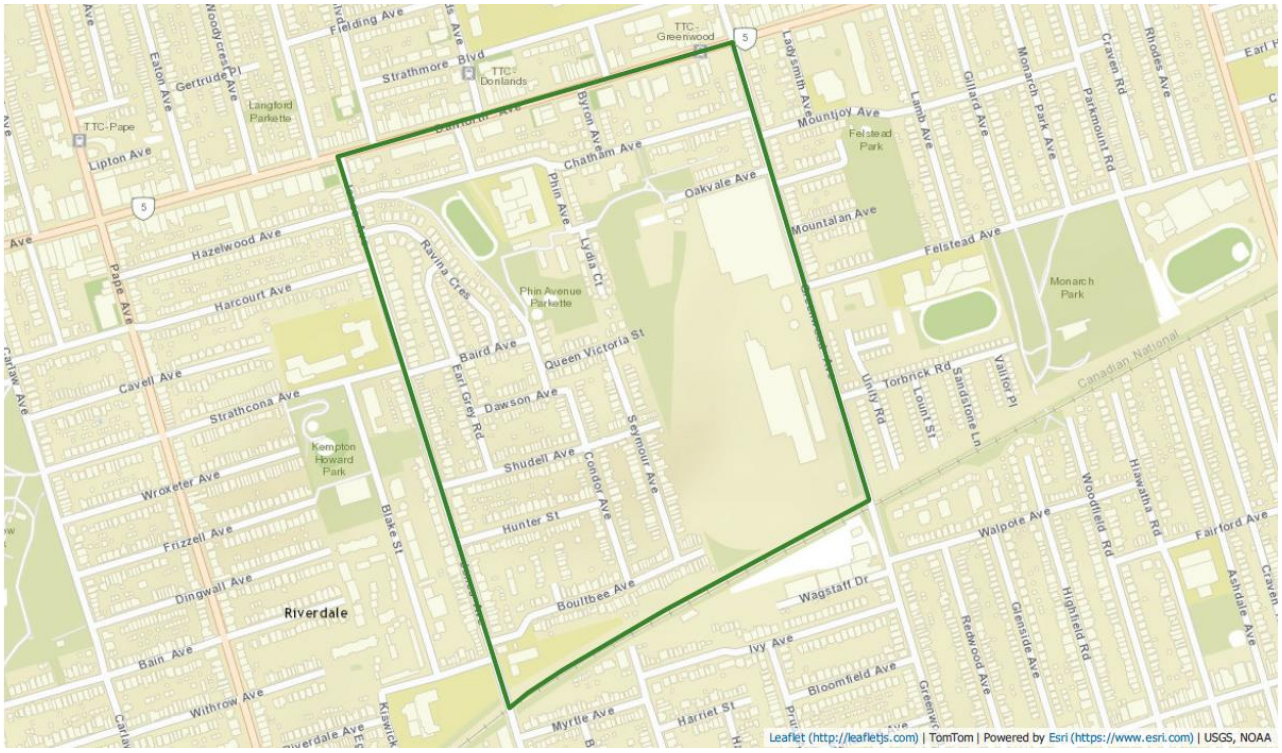


Figure 1 The Pocket Neighborhood Community Boundaries

1. INTRODUCTION

The "Pocket" is an east-end neighbourhood (east of the Don River), south of the Danforth, bounded by Jones Ave, Greenwood Avenue and CN train tracks. It's a small neighbourhood of just under 1,400 residential households and a population of approximately 3,500 people.

In April 2021, the "Pocket Change Plus" initiative was born out of a Council adopted member motion by Councillor Paula Fletcher, for the institutional organizations present in the Pocket to explore opportunities for TransformTO climate action accelerations. This is a long-term transformation initiative focused on reducing the environmental footprint of the community through a suite of environmental actions for both residential and institutional stakeholders living and operating in the Pocket Neighborhood.

The community is made up of mostly single family residential homes and low-rise apartment buildings, but it also has considerable institutional/public organizations presence (publicly-owned infrastructure and buildings), including:

- Greenwood TTC Subway yards
- Toronto Community Housing Phin Community
- Phin Park
- Toronto District School Board's First Nations Junior and Senior School (formerly Eastern Commerce Collegiate Institute)
- Fire Station
- An Early Learning and Child Care Centre
- École Élémentaire Catholique du Bon-Berger (French School)

The Pocket Community Association (PCA) - an active group of residents with a mission to promote a strong, vibrant, walkable, livable and safe community - engaged the Toronto Region Conservation Authority (TRCA) to undertake the development of a Sustainable Neighbourhood Action Plan (SNAP) for the neighbourhood.

Pocket Change Plus will support the next phase of the PCA's Pocket Change project and City-led efforts to leverage institutional assets and expertise to 'green' the neighbourhood and maximize opportunities for environmental transformation.

The suite of community-wide energy solutions being explored include, but are not limited to:

- Conservation Measures
    - Net-Zero path for TCH buildings & other City buildings
    - Neighbourhood-based home retrofit
- Transit
    - Greening TTC Fleet, as a model for sustainability and innovation. Opportunity to pilot and replicate as part of TTC's Innovation & Sustainability Program
    - EV Charging Infrastructure opportunities on institutional property including TTC employee charging stations
- Renewable Energy Generation and Storage
    - 2MW roof top PV (largest in Ontario) + green roof for TTC Yard and potential energy flaring storage opportunities
    - Geothermal Systems in City and private lands
    - Solar PV + Storage
        - Fire station resilience opportunities
    - Wastewater Recovery
- Design competition
    - Synthesize the architectural, communal and environmental components of sustainable neighborhoods

2. APPROACH

Pocket Change Plus advances two separate but complementary efforts: the Pocket Change Home Retrofit Project (PCHRP) and the Pocket Plus Institutional Greening Project (PPIGP).

The PCHRP initiative, coordinated by TRCA in collaboration with the Environment and Energy Division (EED) and the PCA, is focused on the development of a single-family residential retrofit program design and identify partnerships and resources to advance these efforts.

The PPIGP initiative brought together the following stakeholders:

- Corporate Real Estate Management (CREM);
- Toronto Fire Services;
- Toronto Children's Services;
- Parks, Forestry and Recreation (PF&R);
- Toronto Community Housing Corporation (TCHC);
- Toronto Transit Commission (TTC);
- Toronto District School Board (TDSB)/Toronto Lands Corporation;
- Toronto Hydro; and
- Toronto & Region Conversation Authority - Sustainable Neighborhood Action Program (TRCA - SNAP).

Through the PPIGP, the City and partners aim to identify and advance opportunities to lead by example and further advance the objectives of TransformTO and realize the co-benefits of climate action while integrating sustainability and climate resiliency.

City Divisions and Agencies have allocated resources to bring forward building inventories and energy use, demand and GHG emissions estimates for existing buildings as well as any development estimates to understand the potential future energy demands of the area. Other unique opportunities, such as creating synergies with Toronto Hydro infrastructure, are being identified, primarily at the TTC Greenwood Yard.

3. EXISTING BUILDINDS: FINDINGS & OPPORTUNITIES

The Pocket Neighborhood area (Figure 2) built form is predominantly low-rise, single detached houses and semi-detached houses as well as some mid-rise buildings and a TTC railyard to the east. In addition, there is a small park, two schools (a French and an Indigenous school), a fire station and early learning centre.

Residential uses account for about 80% of the total GFA, Transportation & Warehousing 15% and Education & Community Services total 5%. In the Residential category, low-rise single family-dwelling, row/town houses, and other dwellings (e.g. duplex) account for nearly 75% of floor space, while mid-rise affordable housing accounts for about 5%.

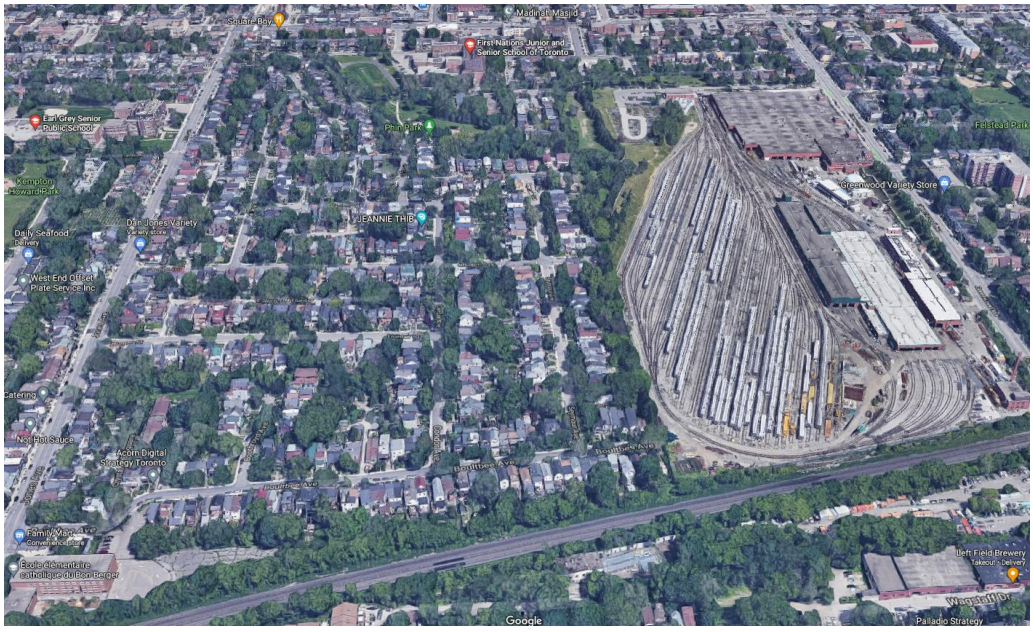


Figure 2 Existing Buildings in the Pocket Neighborhood (Google Maps)

There are 1,381 detached and semi-detached houses in the Pocket Neighborhood, which represents 80% of non-institutional housing. Applying the average results would equate to a 40% reduction in total energy use and over 80% total emissions reductions in the Pocket. 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.

Detached, semi-detached, duplex and town houses account for the majority of households, although there are some low-rise multi-unit residential buildings (MURBS) in the Pocket neighborhood. Retrofitting these buildings represents a significant opportunity to improve energy performance and, in turn, decrease overall energy use and emissions in the neighbourhood.

Based on the data available for the area, homes in the area see average emissions reductions of around 33% after completing a home energy retrofit. Emission reductions of this nature would likely have resulted from a 'Like for Similar' replacements of windows, and heating, ventilation and air conditioning systems of a similar type, but higher efficiency.

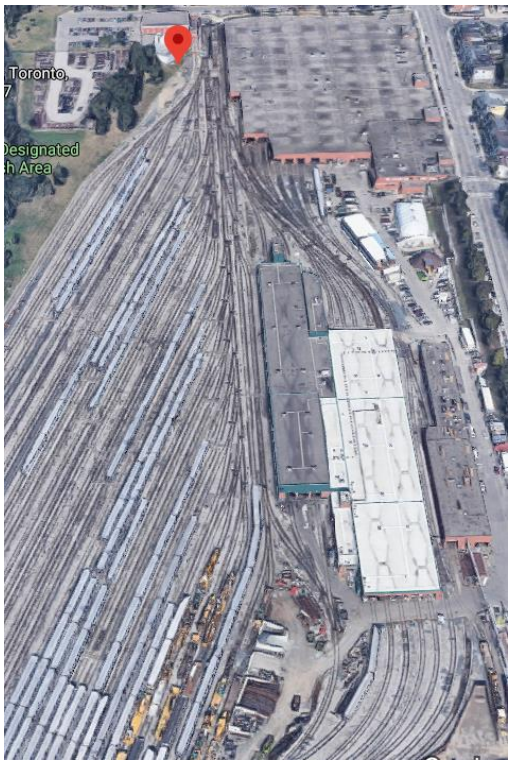
To drive deeper reductions would require more substantial upgrades, including substantial improvements in insulation and air sealing. To drive down emissions will require retrofits to the building enclosure (e.g. air sealing, improved insulation) and fuel switching. Substantial reductions will come from replacing natural gas furnaces and water heaters with heat pumps.

For a number of years, staff have been engaged with the Pocket Community Association (PCA) in supporting local energy efficiency and decarbonisation efforts.

The City has been successful in an application to the Federation of Canadian Municipalities through the Home Energy Loan Program (HELP). Financing and support made available through the FCM funded enhancements to HELP is intended better support homeowners and communities across the City, including the Pocket in driving decarbonisation.

In addition, the community undertook a successful tree planting project for the ROWs and have successfully worked on Vision Zero initiatives. Recently Pocket Change was selected by SNAP (Sustainable Neighbourhood Action Plan) as a project deserving of their assistance. SNAP already assists Black Creek and Weston neighbourhoods in the ongoing development and implementation of their neighbourhood environmental plan. Outside of residential homes, the Pocket also hosts considerable City and public infrastructure – Greenwood TTC Subway yards, the Toronto Community Housing Phin Community and the City's Phin Park. As well, the Toronto District School Board's First Nations Junior and Senior School, formerly Eastern Commerce Collegiate Institute, is sited here. Environmental sustainability and transformation of City related properties can complement the existing Pocket Change project.

Toronto Transit Commission (TTC) – Greenwood Yard



The TTC is in the early stages of launching an agency-wide Innovation and Sustainability Program with a mandate to advance planning, integration, delivery & reporting of innovation initiatives focused on climate and resiliency. The program elements aim to green both the fleet and facilities infrastructure by undertaking actions to valuate energy and emissions, decarbonisation strategies and resiliency measures.

Greenwood Yards will serve as the first active project for the TTC to establish the Green Facility Program and set a Net-Zero Path for the fleet and facilities portfolio at large.

Currently, the TTC has 75 state-of-good-repair and facility modification projects planned for the Greenwood Complex over the next 5 years. The introduction of the Innovation & Sustainability Program along with the Pocket Change initiative provides an opportunity to incorporate renewable energy and climate resiliency measures into the 5-year capital plan at the site.

Work has already commenced with a Greenwood Shop Roofing Rehabilitation roof assessment completed in March, 2021 to assess the existing construction and condition of the Greenwood Yard roof and plan for new green roof installations. TTC has also retained an independent energy consultant to perform energy and engineering audits for the Greenwood Complex to identify the facilities current condition, including but not limited to energy demand consumption, emissions and more, and aim to propose sustainability solutions.

The TTC, with the support of the EED, will continue to advance the following activities:

- Facility Energy Audits to identify opportunities, such as:
    - Automated, quick Roll-up doors as part of the Door Replacement Program
- Decarbonisation & Resiliency Studies at Greenwood complex
- Beautification of the Public realm
    - Greening adjacent parts of land (land between Greenwood facility & streetscape)
- The Portal (Oakvale Ave)
    - A rail observation deck viewing platform overlooking the tunnel entrance for the TTC Train.
- Maximize Solar PV and Renewable Energy Generation
    - Engage with OPG/PowerON to initiate studies, building on the green roof assessment.
- EV charging at institutional sites for employer with potential public access
- Innovative Energy Storage Solutions to address energy flaring
- Design competition (with architects, landscape architect, the arts, and energy professionals to design a unique vision for integrated energy and landscape features).

Toronto Community Housing Corporation (TCHC)

The TCHC performed energy audits on the 4 site located in the Pocket Neighborhood. The summary of results of the analysis and potential solutions can be found below. Alongside energy and environmental improvements, tenants' will experience improvements in quality of life and living conditions through more comfortable buildings that limit drafts, improved air quality, lower chance of mold growth, reduced noise pollution and more.

Summary

Baseline of TCHC properties

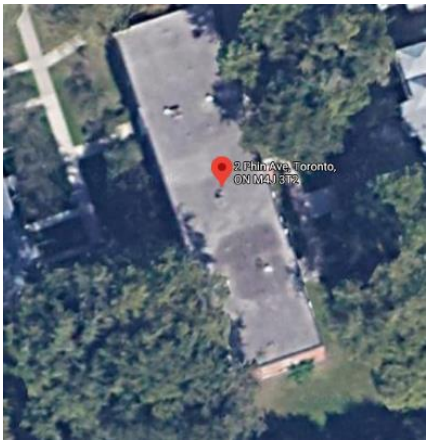
Location	Natural Gas (m3)	Electricity (kWh)	Water (m3)	GHG (tCO2e)	Cost
2 Phin	52,500	129,500	3,010	104	$44,300
40 Queen Victoria	N/A	99,400	950	3.1	$15,800
Chatham Ave	5,000	96,300	2,000	12.4	$21,400
Riverdale Mews	N/A	161,300	4,400	5.0	$41,600
Total	57,500	486,500	10,360	125	$123,100

Potential Environmental Improvements after retrofit

Location	Natural Gas Savings (m3)	Electricity Savings (kWh)	Water Savings (m3)	GHG Reduction (tCO2e)	Opinion of Probable Cost
2 Phin	52,500 (100%)	-80,100 1 (-62%)	380 (13%)	97 (93%)	$1,711,000
40 Queen Victoria	N/A	99,400 (100%)	200 (21%)	3.1 (100%)	$515,000
Chatham Ave	5,000 (100%)	79,400 (82%)	530 (26%)	12 (95%)	$630,000
Riverdale Mews	N/A	161,300 (100%)	1,460 (33 %)	5.0 (100%)	$1,350,000
Total	57,500 (100%)	260,000 (53%)	2,570 (24 %)	117 (94%)	$4,206,000

1 negative value indicates increase in electricity

2 Phin Avenue



The apartment building at 2 Phin Avenue has three floors above grade, 24 one-bedroom suites and an estimated average occupancy of 2 tenants per suite. The building has a gross floor area of 15,150 square feet and dates from 1959. The building envelope consists of mostly uninsulated concrete blocks with a clay brick veneer, flat roof covered with gravel over a layer of insulation, and double-glazed windows with aluminum frames. Space heating is provided by natural gas-fired boilers and delivered to each suite through hydronic radiators. Domestic hot water (DHW) is heated by atmospheric tank-type hot water heaters.

The following table summarizes existing utility consumption, cost and greenhouse gas emissions.

Natural Gas (m3)	**Electricity (kWh)**	**Water (m3)**	**GHG Emissions (tCO2e)**	**Cost**
52,500	129,500	3,010	104	$44,300

Based on non-intrusive building condition assessments, it is estimated that a budget of approximately $1.1M is required to maintain state of good repair over the next 10 years. TCHC does not guarantee to make these investments.

Possible future development plans involve a Deep Energy Retrofit (DER) including the following measures:

- Installing an electric air-source heat pump (ASHP) system to replace gas-fired space heating boilers and DHW heaters (removal of all natural gas equipment)
- Adding insulation (over-cladding) to the exterior walls and roof to reduce heat losses
    - TCHC, with EED support, will also try to address air sealing and thermal breaks
- Replacing windows with new double-glazed, low emissivity equivalents
    - TCHC with support of EED to investigate triple glazed with thermally broken window frames
- Installing Heat Recovery Ventilators (HRV) in all units to improve indoor air quality and humidity levels while saving energy through heat retention and lowering utility costs.
- Retrofitting lighting to LED equivalents
- Water recommissioning and installing low-flow showerheads
- Where applicable, with the support of the SolarTO program, TCHC and EED will investigate the potential for Solar PV installations.

Based on a Level 2 ASHRAE energy audit, the following table summarizes the potential Environmental Improvements and estimated implementation cost of the DER.

Natural Gas Savings (m3)	Electricity Savings (kWh)	Water Savings (m3)	GHG Reduction (tCO2e)	Opinion of Probable Cost
52,500	-80,100 2	380	97	$1,640,000

2 negative value indicates increase in electricity, does not account for potential solar

40 Queen Victoria

The apartment buildings at 40 Queen Victoria consist of two adjacent 3-storey buildings constructed in 1983. The total floor area of the site is approximately 8,600 square feet and houses approximately 23 tenants in nine 2-bedroom suites. The building envelope consists of clay face-brick and metal siding wood framing walls, a sloped roof with wood deck covered with asphalt multi-tab shingles, and aluminum framed double-glazed windows. All building systems are electric including space heating and DHW (no on-site natural gas consumption).

The following table summarizes existing utility consumption, cost and greenhouse gas emissions.

Natural Gas (m3)	**Electricity (kWh)**	**Water (m3)**	**GHG Emissions (tCO2e)**	**Cost**
N/A	99,400	950	2.6	$15,800

Based on non-intrusive building condition assessments, it is estimated that a budget of approximately $2.4M is required to maintain state of good repair over the next 10 years. TCHC does not guarantee to make these investments.

Possible future development plans involve a Net Zero Energy retrofit including the following measures:

- Installing an electric air-source heat pump (ASHP) system to replace electric baseboard heaters and DHW tank heaters
- Replacing windows with new double-glazed, low emissivity equivalents
- Upgrading building envelope and roof insulation
- Installing Heat Recovery Ventilators (HRV) in all units to improve indoor air quality
- Installing roof-mounted solar photovoltaic (PV) system
- Water recommissioning and installing low-flow water closets and showerheads

Based on a Level 2 ASHRAE energy audit, the following table summarizes the Environmental Improvements and estimated implementation cost of the deep energy retrofit.

Natural Gas Savings (m3)	Electricity Savings (kWh)	Water Savings (m3)	GHG Reduction (tCO2e)	Opinion of Probable Cost
N/A	99,400	200	3.1	$515,000

195-203 Chatham Ave.

The apartment building at Chatham Ave. consists of a 3-storey building constructed in 1982. The total floor area of the site is approximately 11,000 square feet and houses approximately 26 tenants in 12 suites. The building envelope consists of clay face-brick and metal siding wood framing walls, typical inverted roof assembly covered by a crushed stone layer, and aluminum framed double-glazed windows. Heating is provided by wall-mounted natural gas furnaces through forced air system and supplemental electric baseboard heaters. DHW is generated by natural gas-fired water heater tanks.

The following table summarizes existing utility consumption, cost and greenhouse gas emissions.

Natural Gas (m3)	**Electricity (kWh)**	**Water (m3)**	**GHG Emissions (tCO2e)**	**Cost**
5,000	96,300	2,000	12.4	$13,200

Based on non-intrusive building condition assessments, it is estimated that a budget of approximately $500k is required to maintain state of good repair over the next 10 years. TCHC does not guarantee to make these investments.

Possible future development plans involve a Deep Energy Retrofit including the following measures:

- Installing an electric air-source heat pump (ASHP) system to replace furnaces, electric baseboard heaters and DHW tank heaters (removal of all natural gas equipment)
- Replacing windows with new double-glazed, low emissivity equivalents
- Upgrading building envelope and roof insulation
- Installing Heat Recovery Ventilators (HRV) in all units to improve indoor air quality
- Retrofitting lighting to LED equivalents
- Installing roof-mounted solar photovoltaic (PV) system
- Water recommissioning and installing low-flow water closets and showerheads

Based on a Level 2 ASHRAE energy audit, the following table summarizes the Environmental Improvements and estimated implementation cost of the deep energy retrofit.

Natural Gas Savings (m3)	Electricity Savings (kWh)	Water Savings (m3)	GHG Reduction (tCO2e)	Opinion of Probable Cost
5,000	79,400	530	11.9	$630,000

Riverdale Mews (436 Leslie St.)

The apartment building at Riverdale Mews consists of a 2-storey building constructed in 1983. The total floor area of the site is approximately 21,450 square feet and houses approximately 77 tenants in 22 3-bedroom suites. The building envelope consists of clay face-brick wall for the ground floor and asphalt shingle covered mansards on top floor, a pitched roof and mansards covered with asphalt shingles, and aluminum framed double-glazed windows. All building systems are electric including space heating and DHW (no on-site natural gas consumption).

The following table summarizes existing utility consumption, cost and greenhouse gas emissions.

Natural Gas (m3)	Electricity (kWh)	Water (m3)	GHG Emissions (tCO2e)	Cost
N/A	161,300	4,400	5.0	$41,600

Based on non-intrusive building condition assessments, it is estimated that a budget of approximately $2.1M is required to maintain state of good repair over the next 10 years. TCHC does not guarantee to make these investments.

Possible future development plans involve a Net Zero Energy retrofit including the following measures:

- Installing an electric air-source heat pump (ASHP) system to replace electric baseboard heaters and DHW tank heaters
- Replacing windows with new double-glazed, low emissivity equivalents
- Upgrading building envelope and roof insulation
- Installing Heat Recovery Ventilators (HRV) in all units to improve indoor air quality
- Retrofitting lighting to LED equivalents
- Installing roof-mounted solar photovoltaic (PV) system
- Water recommissioning and installing low-flow water closets and showerheads

Based on a Level 2 ASHRAE energy audit, the following table summarizes the Environmental Improvements and estimated implementation cost of the deep energy retrofit.

Natural Gas Savings (m3)	Electricity Savings (kWh)	Water Savings (m3)	GHG Reduction (tCO2e)	Opinion of Probable Cost
N/A	161,300	1,460	5.0	$1,350,000

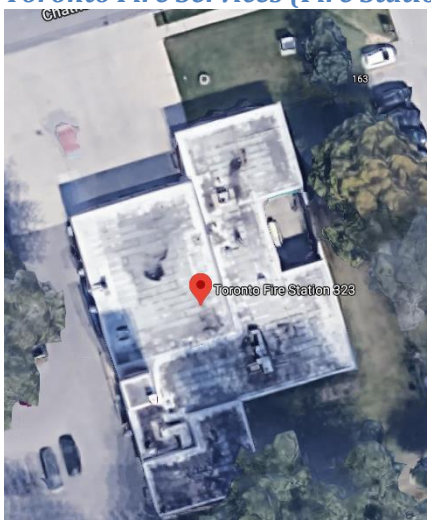
Parks, Forest and Recreation (Phin Park)

Phin Park is a neighbourhood park South East of Jones and Danforth Avenues and the TTC's Greenwood Yard to the east featuring a children's playground, outdoor table tennis, a basketball court and a wading pool. The park is surrounded by trees providing many shady spots in the summer.

Currently, there are no major public works planned for the park. The park was identified as a potential site for a community-wide geothermal thermal energy network. Initial analysis from surrounding property owners and industry experts indicates there would need to be a significant increase in population, density and energy demand in order to support a community-wide thermal energy network within the community. Such a solution would require sufficient energy demands and mandates for customers to connect.

Public realm beautification, such as inclusive lighting designs, and environmental/resiliency measures such as storm-water management could also be explored.

Toronto Fire Services (Fire Station 323)



Fire Station 323 at 150 Chatham Avenue is a joint operational Fire hall and Fire Prevention office that serves the community. It is 58 years old and was built in 1963 in the former City of Toronto. The facility sits on a lot size of 40,000 sq ft with a 10,252 sq ft building on the site.

There are currently no major environmental projects over the next 10 years. However, an energy lighting retrofit program that was initiated in 2019 will begin replacing the existing lighting with LED at 86 locations over the next 3 years. The savings in energy costs will offset the capital outlay.

Moving forward Facilities Operations and Capital group will promote environmental sustainability, energy efficiency and conservation in developing our existing infrastructure and SOGR.

Additionally, Fire Stations across the City fall under Corporate Real Estate Management Division (CREM) and will be subject to CREM's Net Zero Strategy for existing buildings which will require Fire Station 323 to develop plans and budgets over next few years to realize the path toward net zero.

Toronto District School Board (TDSB)/Toronto Lands Corporation (Wandering Spirit School)

Existing infrastructure and usage

The existing infrastructure located at 16 Phin Avenue, Toronto is being used as an Indigenous school and for several other programs namely: Creative Pre-school, EarlyON, Deaf/Hard of Hearing, Education and Community Partnership Program (ECPP- formerly Section 23 safe schools) and Archives for TDSB. The building is also shared with Subway Academy 1.

Energy Consumption, Demand and GHG Emissions

In October 2015, Potentia installed 84kW Photo Voltaic (PV) solar on the school roof. Below is the energy consumption and Green House Gas (GHG) emission report for the School.

Energy Consumption

Gas Consumption (m3)					
	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Sep	1,102	890	2,096	3,017	950
Oct	10,180	9,996	19,372	13,524	12,640
Nov	25,455	33,335	41,500	32,557	27,747
Dec	44,863	53,862	44,728	41,867	45,131
Jan	45,339	52,551	63,618	42,873	50,160
Feb	39,605	38,098	53,054	41,963	53,413
Mar	43,928	37,645	43,910	26,586	39,357
Apr	16,585	22,112	20,468	9,836	23,239
May	7,061	1,893	8,974	3,486	7,938
Jun	321	508	2,807	843	496
Jul	93	240	218	74	516
Aug	174	76	634	594	512
Total	234,706	251,206	301,379	217,220	261,927

Electricity Consumption (kWh)					
	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Sep	44,614	41,890	48,081	39,092	43,488
Oct	42,797	51,038	57,884	36,176	50,668
Nov	41,816	52,028	58,349	34,521	49,383
Dec	41,385	47,470	50,359	45,415	47,021
Jan	49,790	53,987	57,138	51,090	44,143
Feb	44,252	46,118	49,794	45,701	48,306
Mar	49,191	44,206	53,056	48,115	54,024
Apr	43,773	49,187	44,991	41,310	39,060
May	45,963	47,537	42,856	33,938	38,176
Jun	40,801	37,943	38,582	30,393	38,810
Jul	32,571	24,610	35,576	35,284	38,829
Aug	30,148	39,187	30,385	33,852	41,466
Total	507,101	535,201	567,051	474,887	533,374

GHG Emissions (kgCO2e)					
Year	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
GHG Emissions	464,582	496,941	593,192	430,193	517,163
GHG KgCO2/ft2	2.35	2.52	3.01	2.18	2.62

4. RENEWABLE ENERGY EXAMPLES *(BUILDING & NEIGHBOURHOOD SCALES)*

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)
- Air-source Heat Pumps
- Wastewater Heat Recovery
- Geo-exchange (i.e. ground source)

Solar Photovoltaics + Green Roofs

Industrial/warehouse rooftops, namely the TTC Greenwood yard, offers an opportunity to install large solar PV systems. Analysis of the Greenwood Yards Maintenance and Storage Facility indicates the potential to support 2 MW of solar PV 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). Additional analysis is required to assessment the structural viability of the roof.

Figure 3. Solar PV installation on a green rooftop installation[1].

Geo-exchange

Geo-exchange systems have the potential to contribute large amounts of renewable thermal energy, which would displace gas and reduce emissions. However, using electric heat pumps will result in an increase in electrical consumption. 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.

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

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.

A pilot project is currently underway in the City of Markham aim to connect approximately 300 new homes, serviced by a community-scale distributed geothermal energy system for heating, cooling, and domestic hot water[2].

Phin Park has a relatively small footprint, but may present an opportunity to implement well-fields close to residential customers, provided customers. Next steps for the Pockect would be to establish demand/willingness for home owners to connect to a shared geothermal system, property rights, feasibility studies and business case development.

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)[3]. Toronto's first sewer energy transfer project is being designed for construction at the UHN Western Hospital at Bathurst and Dundas.

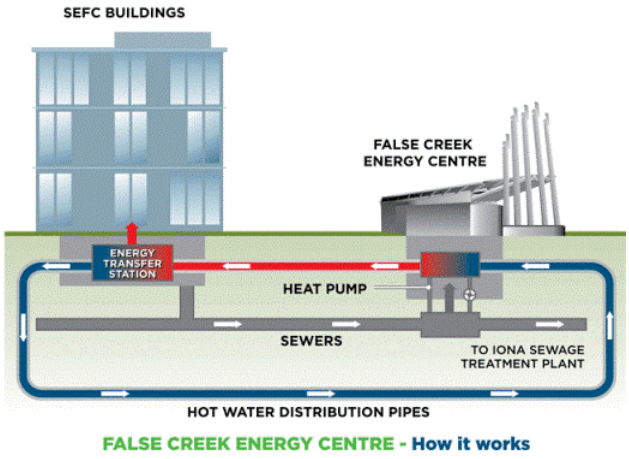


Figure 3. Sewer heat recovery at the False Creek Energy Centre, Vancouver, BC.

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%.

District Energy

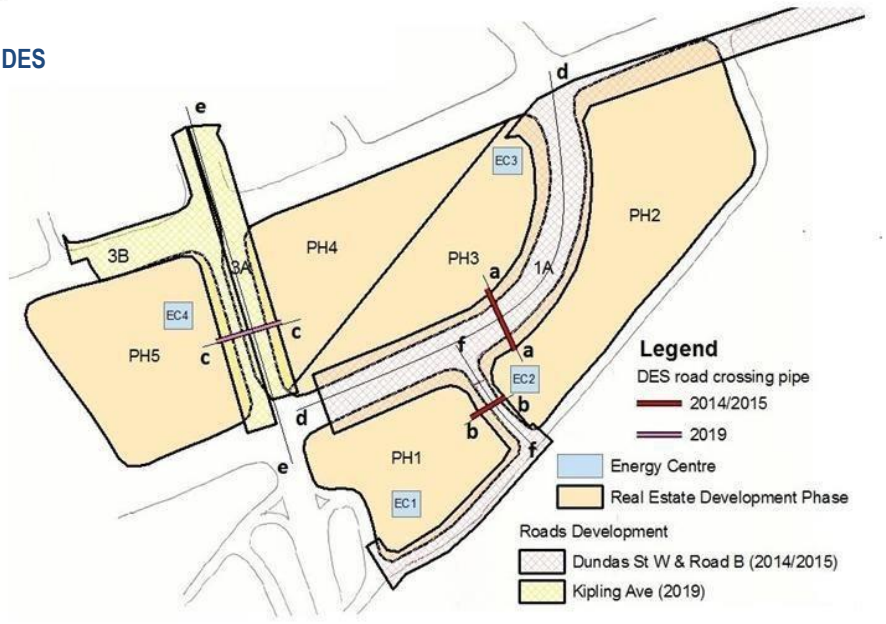
A district energy system (DES) is not a technology; it is a thermal energy distribution strategy for multiple buildings. Modern systems often have distributed energy centres in buildings and pipes crossing streets to connect development parcels/buildings.

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 5), a brownfield master-development.

[2] https://www.enwave.com/resources/smartenergy-efficienthomesofthefuturecomingtomarkham/
[3] http://vancouver.ca/home-property-development/false-creek-neighbourhood-energy-utility.aspx

Figure 5. 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



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;
- 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 delta temperature 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.

As discussed previously, the concept of district energy combined with a geo-exchange system is currently being researched, designed and tested in Ontario for a new neighborhood development, but has not proven to be commercially viable at that scale and for existing neighborhoods.

5. EMERGING DIRECTIONS

The transformation initiate at the Pocket Neighborhood provides an opportunity to consider energy retrofits in an established community, and identify opportunities to reduce energy use and emissions in existing residential buildings. High levels of energy conservation, improved resilience, and low-carbon energy solutions are central to this transformation. It also presents a unique opportunity to integrate private homes and institutional community energy planning.

Based on the preliminary analysis, the emerging directions for the Pocket are:

Existing Building Retrofits

Energy conservation and fuel switching in single and multi-unit residential buildings, partially assisted through the Home Energy Loan Program, could reduce energy use by 40% compared to current levels while also saving money and improving indoor comfort.

Local Renewable Energy Solutions

Significant solar energy generation potential in homes and institutional buildings. Residents are encourages to visit the City's SolarTO self-serve free of charge solar assessment map/tool.

https://www.toronto.ca/services-payments/water-environment/environmental-grants-incentives/solar-to/solarto-map/#location=

An installation on the roof of the TTC Greenwood Yards Facility could potentially total 2 MW, making it one of the largest roof-top solar systems in Ontario.

Geothermal and Low-Carbon Thermal Networks

Thermal networks that can provide a platform for large-scale renewable energy sources (e.g. sewer heat recovery or geo-exchange) merit further consideration. Geo-thermal systems could also potentially contribute a large amount of renewable heat and/or power, but face considerable challenges.

6. NEXT STEPS

Residential Surveys led by the Pocket Community Association (PCA)

The Pocket Residents Association had agreed to conduct residents' surveys (delayed due to COVID) about current heating and cooling equipment and the willingness/readiness to adopt sustainable solutions, such as: renovations, heat pumps, electric vehicles, solar, geothermal and more. As part of the survey, residents are asked to provide consent to the City in order to access gas and electricity consumption data for existing homes and multi-unit residential buildings directly from Toronto Hydro and Enbridge, due to privacy considerations.

Community Consultation

In coordination with the local Councillors' office, TRCA, EED and the Resident's Association will host community/stakeholder consultation to present the preliminary analysis in this document and receive feedback on the emerging directions.

Stakeholder Engagement and Collaboration

Continue to meet regularly with representatives of the TTC and energy consultants to identify and discuss opportunities for on-site quick starts and long-term solutions.

Engagement with owners of non-residential buildings to discuss opportunities for energy conservation and local energy solutions, including solar rooftop PV installations, and create capital plans to fund interventions.

Evaluate Energy Opportunities & Local Economic Benefits

Based on feedback received, EED staff will evaluate opportunities to leverage potential energy solutions at both the individual scale (displace fossil fuel use in individual homes) as well as community/sharing scale opportunities (shared geothermal systems, group procurements) to deliver climate and local economic benefits for the Pocket Neighborhood.

Finalize Report

The EED will compile consented energy consumption, emissions and behavioral change data inputs from PCA's residential surveys along with inputs from institutional stakeholders. Data inputs will be consolidated into a comprehensive database, synthesised to establish a community-wide baseline, analysed bases on the implementation of potential solutions and evaluated for energy conversations and GHG emission reductions. The final report will set a pathway towards a Net-Zero community for the residents and business operators living and operating in the Pocket Neighborhood.

7. REFERENCES

Members Motion MM28.20: Pocket Change Plus by Councillor Paula Fletcher, seconded by Councillor Mike Layton: Agenda Item History - 2021.MM28.20 (toronto.ca)

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https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/official-plan/

The Pocket Community Association (PCA)
https://www.thepocket.ca/pocket-projects/pocket-change-project/

Toronto Green Standard
https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/

Toronto Net-Zero Existing Buildings Strategy
https://www.toronto.ca/legdocs/mmis/2021/ie/bgrd/backgroundfile-168402.pdf
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