

TOcore Planning Downtown

Energy Working Group Report

Phase 1 – Existing Conditions & Emerging Priorities

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EXECUTIVE SUMMARY

EXISTING CONDITIONS

Energy, including the infrastructure that delivers it, is critical to Toronto's prosperity. While energy challenges are city-wide issues, the Downtown is dealing with the acute version:

- Electricity demand is increasing twice as fast as the rest of the city. With limited opportunities for new supply, and existing infrastructure that cannot be easily upgraded, the Downtown is facing an "electricity crunch."
- With the tallest buildings and largest population densities, vulnerability to power outages is heightened. Area-wide outages would affect many people and would require significant public resources to address.
- Major interventions are unlikely given spatial limitations. Reducing demand and addressing vulnerability, will require integrated energy solutions for new and existing buildings. Furthermore, in the context of Toronto's GHG emissions reduction objectives, these solutions must be low-carbon.

Expected growth will only exacerbate these challenges, therefore an energy strategy is essential to the continued success of Toronto's Downtown.

EMERGING PRIORITIES

The TOcore study provides an opportunity to address these challenges through an energy strategy that focuses on the following priorities:

- **Reducing electricity demand** – Explore more aggressive energy standards for new buildings and deep retrofits to existing buildings, in order to help reduce electricity demand.
- **Improving resilience to energy disruptions** – Consult with multi-unit residential building (MURB) developers, owners and property managers, on guidelines for backup power.
- **Facilitating thermal networks** – Develop an implementation framework for thermal networks to attract investment in local, low-carbon energy solutions.

NEXT STEPS

- 1) Explore opportunities to reduce electricity demand in existing and new buildings through aligned initiatives, including, but not limited to:
 - a. The Energy Strategy required as part of a complete development application
 - b. Enhanced requirements in the next version of Toronto Green Standard
 - c. Potential changes to the City of Toronto Act review process
- 2) Prepare backup power guidelines for existing and new multi-unit residential buildings in collaboration with City Divisions, including, but not limited to:
 - i. Toronto Building
 - ii. Fire Services
 - iii. Toronto Paramedic Services
 - iv. Toronto Public Health
 - v. Social Development, Finance & Administration
 - vi. Office of Emergency Management

- 3) Explore opportunities to establish backup power guidelines as minimum requirements through aligned initiatives, including, but not limited to:
 - i. The Energy Strategy
 - ii. City of Toronto Act review process
 - iii. Ontario Building Code review

- 4) Create a framework for real estate and energy developers regarding thermal network development, including, but not limited to:
 - a. Role and responsibilities of the City of Toronto
 - b. Preferred business model
 - c. Technical guidelines for connection

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INTRODUCTION

Most of the basic services that allow people to live, work, learn, play and shop, rely on energy – it keeps us warm or cool, gets water to our taps, provides for lighting and the use of electronic devices, and allows us to move around the city whether by car or public transit. For the most part it has been taken for granted as planning for energy infrastructure has historically been the domain of the provincial government and local utilities, not municipalities directly. However, recent emerging challenges are changing this dynamic.

Energy challenges are city-wide issues, but the Downtown is dealing with the acute version:

- Sustained residential and commercial development over the past decade has put tremendous pressure on energy infrastructure, particularly the electricity distribution system.
- During the same time, aging electrical equipment and extreme weather events have caused several major power outages.
- With limited opportunities for large-scale interventions, local, integrated energy solutions for new and existing buildings are needed.

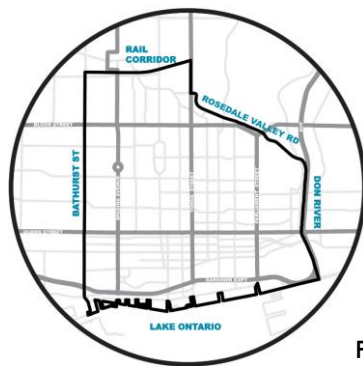


Figure 1. Downtown energy consumption (relative to the entire city).

PURPOSE

The objective of the TOcore Energy Working Group is to inform a strategy for addressing the future energy requirements of a growing Downtown while maximizing the City's ongoing efforts towards conservation and resilience within the core. The Working Group identified three key themes to be addressed:



GROWTH

Buildings are becoming more energy efficient, but electricity demand is increasing with development intensification in a constrained electricity scenario



CLIMATE CHANGE

Meeting future GHG reduction targets will require deep retrofits to existing buildings, high performance new building design, and implementing local, low-carbon energy solutions



RESILIENCE

Extreme weather and aging infrastructure leave residents, particularly those living in dense, vertical neighbourhoods, vulnerable to power outages

This Phase 1 'Taking Stock' report addresses existing conditions and emerging energy priorities for the Downtown. Phase 2 will consider potential future conditions given projected Downtown growth. This report recommends next steps for addressing these priorities, including leveraging aligned initiatives.

EXISTING CONDITIONS SUMMARY

ELECTRICITY DEMAND

Toronto's electricity infrastructure is under significant pressure as a result of increasing demand in a constrained supply scenario. The Downtown is experiencing the acute version of this problem given the amount of growth occurring and the spatial challenges associated with upgrading infrastructure. High temperatures during the summer and the corresponding use of electric air conditioners only exacerbate the issue.

Major investments in infrastructure, conservation and demand management programs, and local distributed generation have provided relief, but more can be done to address this pressing issue. Enwave's Deep Lake Water Cooling system, which uses cold, Lake Ontario water to cool Downtown office buildings, is a made-in-Toronto success story that helps reduce demand.

Intensification

Growth challenges electricity infrastructure in two ways: not only are buildings getting larger, thus demanding more electricity, but they are replacing shuttered industries on brownfields and sprouting out of once empty parking lots. Such large, infill developments (particularly multi-residential and commercial buildings with "peaky" loads) are especially challenging because infrastructure cannot be easily upgraded to service them and the result is that existing Downtown electricity capacity is increasingly constrained.

New multi-residential and commercial development is one of the main drivers of electricity demand in Toronto. Although new buildings are generally less electricity intensive due to improved efficiency, demand is increasing due to housing and employment growth. (Figure 2)

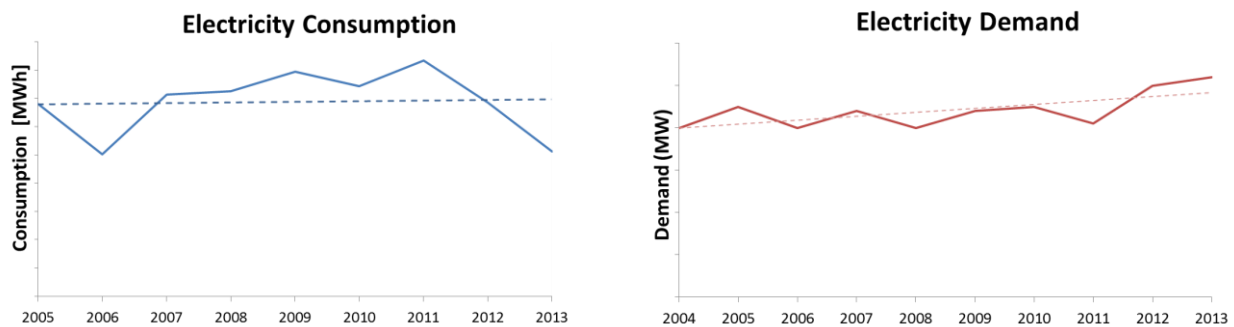


Figure 2. City-wide electricity consumption and demand. Improvements in energy efficiency through initiatives like the High Performance New Construction Program and the Toronto Green Standard have kept electricity consumption relatively flat despite the growth occurring. However, demand over the last decade has been increasingly steadily.

The same pattern holds for the Downtown, where electricity consumption has been relatively flat for the last 10 years, but demand has continued to increase rapidly – approximately twice as fast compared to the rest of the city.

Figure 3 on the following page shows the increasing demand at five Downtown transformer stations, which are critical components of the distribution system. From 2007-2014 these stations averaged growth rates of approximately 2% per year. Many of these stations were built in the 1950s and 60s, including the Windsor TS on John Street, which serves critical areas like the Financial District. Recent growth, particularly in the King-Spadina area, the Railway Lands and the Waterfront, has put significant pressure on the Windsor TS and it is now over 90% loaded.

By 2019, these stations will be approaching their maximum rated capacity (Figure 4). In order to help address this demand growth, Toronto Hydro is building the Copeland Transformer Station (TS), the first Downtown station to be built in 50 years. The first phase of construction of the Copeland TS will relieve the Windsor TS and free up substantial electrical capacity – enough for approximately new 70 condominiums.

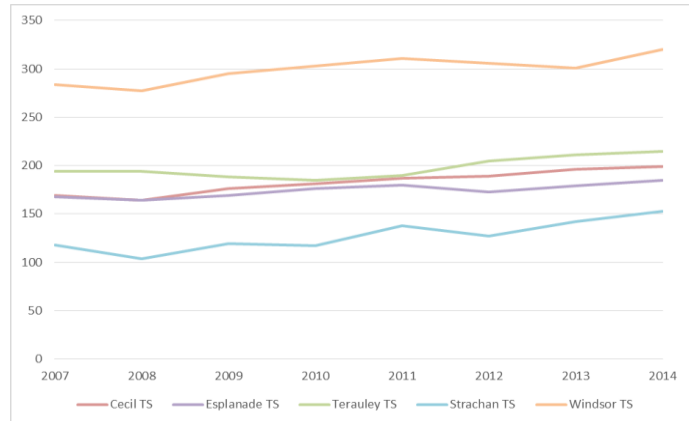


Figure 3. Downtown transformer station demand growth from 2007-2014.

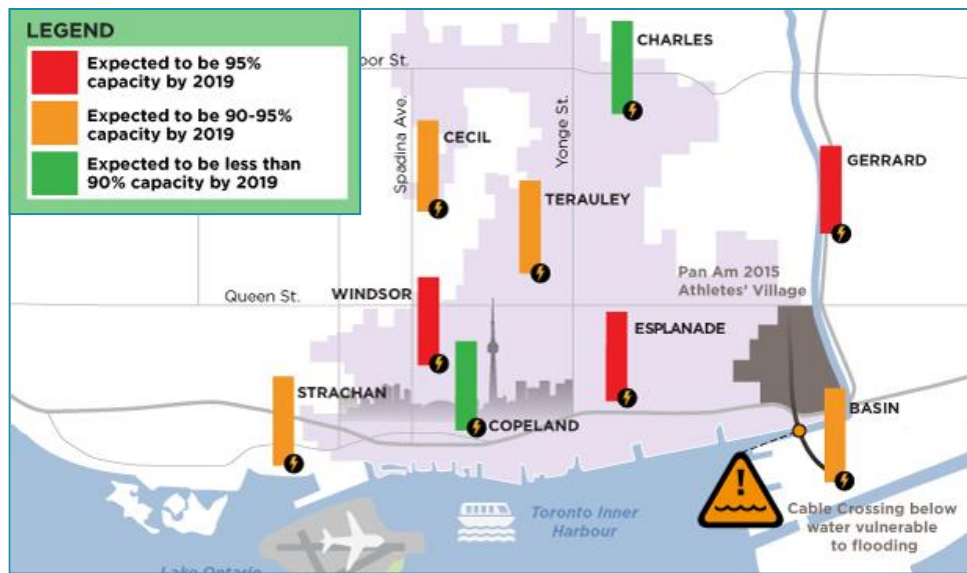


Figure 4. Existing Downtown stations as well as the under-construction Copeland Transformer Station. The orange and red bars represent stations that will be at 90 and 95% of rate capacity by 2019, respectively. (Adapted from Toronto Hydro).

Consumption vs. Demand

The distinction between energy consumption and demand is subtle, but very important as the challenges associated with increases in each, and the opportunities to address them, can be quite different.

Consumption is the amount used, while demand is the rate at which it was used – peak demand is therefore the highest rate. Demand is what establishes the size, and thus, the cost of infrastructure. While reducing consumption can help reduce GHG emissions, reducing demand relieves stress on the electricity system, helps defer/avoid major investments in infrastructure, and makes room for additional development.

Supply Constraints

The Central Toronto Area, which includes Downtown, is supplied with electricity at only three points as shown in Figure 5. The Manby and Leaside Transformer Stations bring in high voltage electricity from the west and east, respectively, while the Portlands Energy Centre (PEC) combusts natural gas to generate electricity. (The total load of the area is about 2,000 MW – 40% of the total Toronto peak load of approximately 5,000 MW). Due to spatial challenges, there are limited opportunities for additional major supply.

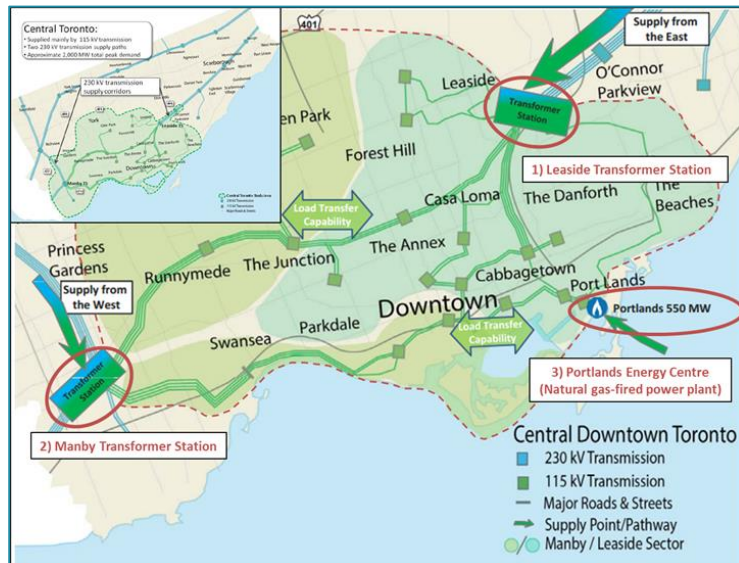


Figure 5. Central Toronto area electricity supply. The three circled points establish the "electricity budget" for the Central Toronto area. The Downtown, at approximately 700 MW, represents almost half of the total. (Adapted from the Central Toronto IRRP, 2015).

With respect to electricity generation, the 550 MW PEC, commissioned in 2008, is the most recent major supply investment in Toronto. Originally conceived as a peaking plant, meant to provide electricity during the few hundred hours of the summer when demand is greatest, it currently follows a fairly regular operating schedule due to the Downtown's increasing electricity demand and needed capacity when other supply resources are offline.

Regarding electricity transmission, provincial planning documents identify needed upgrades and enhancements to the existing system, but there are no plans for new lines into Toronto due to the disruption and costs that would be incurred in such a scenario. While Toronto Hydro is working to make capacity available through distribution system improvements, for all intents and purposes Toronto's electricity supply is fixed.

Deep Lake Water Cooling

Electricity demand is seasonal and Toronto's demand peaks in the summer when temperatures are highest and electric chillers (i.e. air conditioners) are being used extensively to cool buildings (Figure 6). Recognizing this opportunity, Enwave began pumping cold, Lake Ontario water through Downtown office buildings in 1994, effectively replacing all the electric chillers being used previously and substantially reducing electricity demand. (Table 1 provides a summary of the DLWC system).

Enwave's Deep Lake Water Cooling (DLWC) system is the largest lake-source cooling system in the world and this made-in-Toronto solution quickly became an international example of district cooling best practice. (See Figure 7 for a description of how it works).

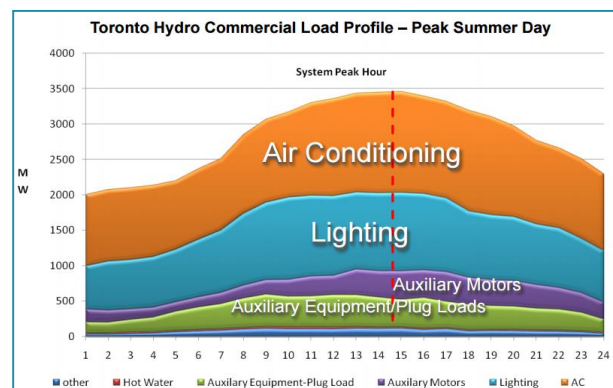


Figure 6. Electricity demand of commercial buildings on a summer peak day. At 3 pm, air conditioning accounts for approximately 40% of the total demand.

Table 1. Enwave DLWC System

General Distribution Stats for Cooling	
Total Number of Buildings Served	62
Square Footage Served	34 million
Cooling System Length	12 km
Total Number of Plants	2 (1 cooling plant, 1 pumping station)

The benefits of using cold water for air conditioning are astounding: in connected buildings a 90% reduction in electricity consumption, and system-wide a 79,000 tonne reduction in GHG emissions and a 61 MW reduction in electricity demand (Table 2). 61 MW represents over 8% of the TOcore area demand, roughly equivalent to the Windsor TS. After selling out initial DLWC capacity, Enwave is currently pursuing a 41% expansion of this system.

Table 2. Enwave DLWC System Benefits

DLWC benefits	
Electricity Consumption Reduction	90% or 85 million kWh/yr (equiv. to 6,800 homes)
Electricity Demand Reduction	61 MW
Overall Energy Use Reduction	75%
GHG Reduction	79,000 tons (equiv. to 15,800 cars)
Water Consumption Reduction	714 ML/yr

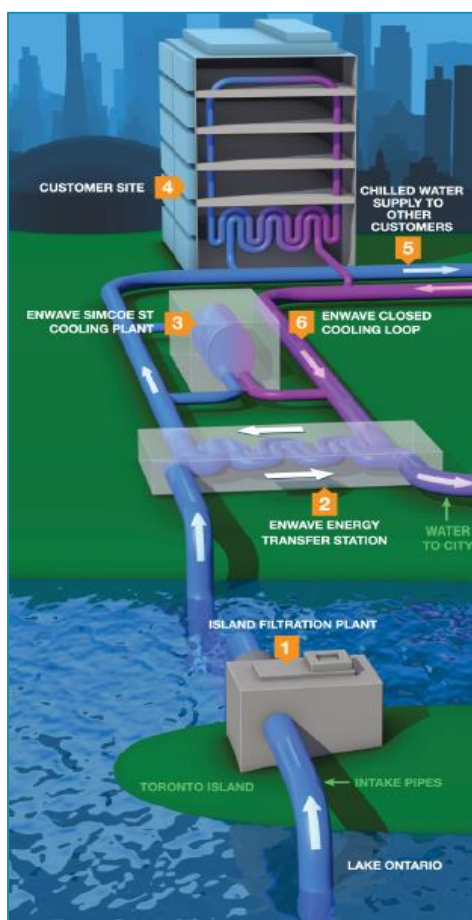


Figure 7. How DLWC works:

- 1 Three intake pipes draw 4°C water from Lake Ontario at a depth of 83 metres. Water is then filtered and treated for the City's potable water supply.
- 2 At the Energy Transfer Station, the icy cold water is used to cool Enwave's closed chilled water supply loop through 36 heat exchangers.
- 3 During the colder months, chilled water bypasses Enwave's cooling plant and continues onto the customer's building.
- 4 At the customer's site, the water is used to provide comfort cooling for building occupants.
- 5 Enwave chilled water loop extends to other buildings.
- 6 Chilled water is returned to the Enwave Transfer Station to repeat the cycle.

ENERGY RESILIENCE

Area-wide power outages are a major stressor for cities and their inhabitants because they can affect large populations for extended periods of time. As cities rely on electricity, power outages can disrupt essential urban services such as public transit and communication, as well as basic necessities within buildings such as lighting and water. The assumption of the resilient approach is that we cannot predict what will occur, but we can prepare for it. While major power outages remain infrequent and Toronto Hydro continues to strengthen electricity infrastructure to prevent them, future plans for the Downtown must include preparation for power outages.

Extreme Weather

Although power outages can be caused by various events, extreme weather is often responsible for the most significant disruptions. Two extreme weather events caused major power outages across Toronto in 2013. In July, a severe rain storm flooded critical infrastructure, including the control room of the Manby Transformer Station, which is one of the three electricity supply points to the Downtown. Approximately one million people lost power, some for several days. In December, an ice storm blanketed parts of the city and disrupted power to approximately one million people for 24-72 hours on average, but some for over a week (Figure 8).



Figure 8. Impacts of power outages caused by the December 2013 ice storm. Interviews with Toronto residents after the ice storm revealed that many multi-unit residential buildings lack basic services during power outages, including heat and water, leading some to abandon their units after 2-3 days and seek temporary shelter. Many small businesses lost merchandise and were forced to close.

Extreme Weather

Extreme weather events are expected to occur more frequently and with greater intensity. In a 2012 report prepared for the City of Toronto, SENES Consultants found that from 2040-2049, Toronto will experience:

- Five times more heat waves (at least 3 consecutive days about 32 °C);
- Six times more air conditioner use;
- Double the maximum amount of rain; and
- More intense summer storms.

Vulnerability

Since we rely on electricity for the provision of most basic services, power outages can be very problematic, particularly for vulnerable populations. The City of Toronto Social Development, Finance and Administration (SDFA) Division borrows from Cutter & Finch, 2008, to define vulnerability as "sensitive populations that may be less likely to respond to, cope with, and recover from a natural disaster." SDFA identifies sensitive populations as seniors, children, youth, persons in low income, and newcomers (i.e. immigrants).

With respect to power outages, especially area-wide disruptions, vulnerable populations could be anyone living in tall buildings as they rely on electricity for essential services like the provision of domestic water and elevator service. Interestingly, SDFA notes that "highrises often act as a proxy and clustering focus for these sub-populations." Tall buildings can be found throughout Toronto, but the tallest buildings at the greatest concentrations are found Downtown. Although improving energy resilience is a city-wide objective, improvements Downtown would have the most substantial impact given the population that is considered vulnerable to power outages.

Sustained power outages, especially during periods of extreme heat or cold, can eventually displace people from their homes and force business to close if living or working conditions become unsafe. In these situations, individuals require temporary shelter and provisions until power can be restored.

Reception Centres: The Public Response

The City of Toronto and other organizations can mitigate this vulnerability by providing temporary shelter for citizens displaced by power outages. Currently City of Toronto facilities such as Recreation Centres and Civic Centres are used for this purpose during a major power outage as long as they have power. To ensure that these facilities continue to provide this critical function efforts are being made to strengthen their resilience.

The Office of Emergency Management and Parks, Forestry & Recreation have designated four Recreation Centres (Agincourt, Wellesley, Edithvale and Thistletown) as Emergency Reception Centres during major outages. Backup generators are on standby should they be needed and two of the Centres are being planned for permanent natural gas combined heat and power (CHP) plants that provide heat and some power to the facility during normal operation, but also, in the event of a power outage, are a reliable source of backup power.

The City of Toronto is also partnering with community and religious organizations to create additional resilience hubs throughout the city (Figure 9). Through low-interest loans, the YMCA is planning to install a CHP plant at one of its new facilities and several religious organizations are exploring opportunities to install backup generators.

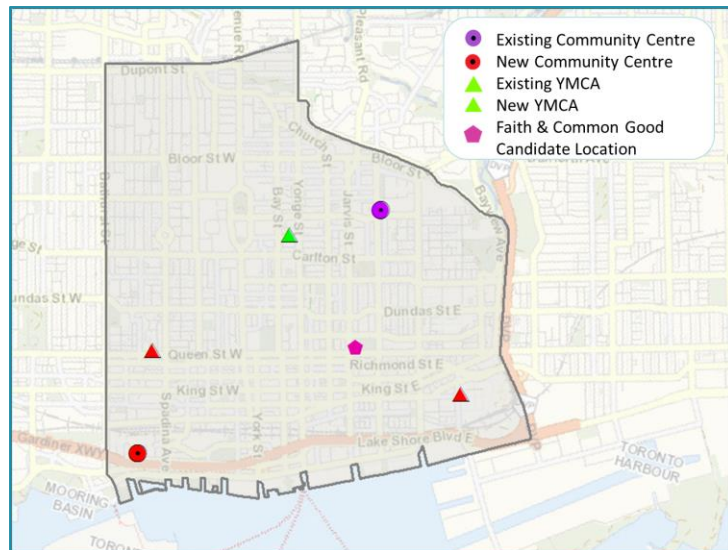


Figure 9. Potential Downtown resilience hubs. Organizations such as the YMCA and various faith-based associations are exploring opportunities to act as temporary shelters for those displaced by power outages.

Backup Power: The Private Response

Although the majority of multi-unit residential buildings (MURBs) will have a generator that automatically provides power to the building if the grid fails, most of these systems were designed to meet minimum codes and standards, which specify "emergency" power requirements that are predicated upon ensuring life safety above all else. Many of these life safety requirements originated in the 1980s as an outcome of a judicial inquiry into a series of high-rise fires in Ontario. Therefore, they function primarily to facilitate resident evacuation and firefighter response.

However, during a power outage like those of 2013, where there may not be an emergency in a particular building, these systems fall short because they are not designed to provide the continuous "backup" power necessary for residents to remain in the building. Improving MURB backup power systems helps building residents directly, but also other citizens and the City of Toronto indirectly as it minimizes the need and competition for public resources.

Hidi Rae Consulting Engineers prepared a report for the City of Toronto in which they identified several cost-effective opportunities to improve resilience in both new and existing MURBs (Figure 10):

Minimum Resilience – The following loads beyond minimum code, but considered essential for resilience, can be added to most new MURBs at a low incremental cost:

- Booster pumps and gas-fired boilers for cold and hot water supply to the units, respectively
- Sump pumps to protect underground spaces from flooding
- Passenger elevators

For older, existing MURBs the electrical costs associated with such improvements may be significant so consideration should be given to opportunities to coordinate with other capital works or scheduled end-of-life replacements.

Refuge Area – Common spaces such as lobbies or amenity rooms can be made to act as refuge areas for residents during power outages, especially if services to individual units are limited. Heating and cooling, lighting, ventilation and some convenience electricity in common spaces can be cost-effectively added to a generator in existing, but particularly new buildings where provision of such services to individual units is likely cost-prohibitive. However, given that common spaces are not usually suited for substantial occupancy, property management will need to coordinate access through an operational plan.

Heating – Individual units in existing MURBs with radiator heating systems can be heated at a low incremental cost because it only requires powering of boilers and pumps. In new MURBs, where HVAC systems are compartmentalized, heating individual units would be cost-prohibitive and the better option is to create a refuge area instead.

Natural gas generator – Although natural gas generators tend to cost about 10-15% more than diesel generators, they do not require refueling and are thus the preferred option, especially for sustained, area-wide disruptions. Furthermore, diesel fuel handling system components can be expensive and subject to strict regulations, which can increase costs such that natural gas and diesel are almost at par, especially in large buildings.

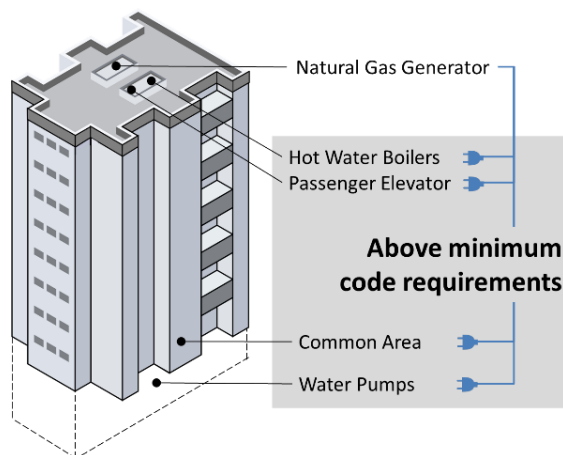


Figure 10. Backup power in MURBs. Powering the equipment identified here (location indicated is typical for a MURB) would improve the energy resilience of the building and allow for residents to remain in the building for a much longer period of time compared to a system designed to meet emergency power requirements only.

Natural Gas Capacity

When discussing increased reliance on natural gas-fired CHP plants or backup generators, the question of adequate natural gas capacity often arises. Natural gas is the most common fuel for space and water heating in Toronto, and similar to electricity, consumption and demand trends have changed in the last 20 years.

Across Toronto, declining industrial activity and an increase in heat-sensitive loads associated with new residential and commercial development, have led to a drop in average natural gas use, but an increase in demand. In other words, the few large consumers are disappearing, being replaced by many smaller consumers with an overlapping, seasonal consumption profiles.

This trend is likely more pronounced in the Downtown, although the supporting data is limited. Not unlike electricity trends, natural gas consumption is probably increasing slowly due to new development (being offset by improving efficiency), but demand is increasing quickly due to the changing user profiles.

Enbridge, the natural gas utility serving Toronto, is currently undertaking the GTA Project, a reinforcement of the distribution system between Brampton and Markham. Over the past 20 years, major investments have been customer-specific, such as supplying the Portlands Energy Centre. However, demand growth over this same time period from new GTA development, particularly Downtown Toronto, has created a need for upgrades to the system in order to support future growth, eliminate constraints, diversify supply and improve reliability. This project will ensure adequate GTA capacity through 2025.

What about capacity specifically during a power outage? Discussions with Enbridge indicate that natural gas supply is actually abundant during a major power outage because the natural gas-consuming equipment in buildings (e.g. water heaters and furnaces) requires electricity to operate. Further reinforcement will eventually be required, but currently and for the foreseeable future, there is adequate capacity.

LOCAL ENERGY SOLUTIONS

Toronto has a long history of local innovation with respect to addressing energy challenges. In particular, the City of Toronto has developed several energy conservation and demand management programs, as well as a renewable energy policy that has led to numerous projects on City facilities.

Beyond the building scale, Toronto has a century of experience with thermal networks and, in addition to the DLWC system, there are three large networks operating in the Downtown. Local energy solutions not only help reduce electricity demand and improve resilience, but they are key to meeting long-term carbon reduction objectives as well.

Energy Conservation and Demand Management

Various policies and programs are in place to help reduce energy use and demand, thus reducing the size and cost of new infrastructure and making room for growth. In addition to conservation programs administered by Toronto Hydro and Enbridge, the City of Toronto has had tremendous success in this area.

- **The Toronto Green Standard**

The TGS is a two-tier set of performance measures that requires new buildings to go beyond minimum code in areas such as air quality, emissions, energy efficiency, water quality and efficiency, solid waste and ecology. Table 3 shows the impact the standard had from 2010 to 2014.

Table 3. TGS Results from 2009 to 2014

Toronto Green Standard: 2010 – 2014	
Total number of projects	770
Number of Tier 2 projects (completed and pending)	75
Annual energy cost savings (\$/year)	30 million
Annual CO ₂ emissions reductions (tonnes/year)	250,000

- **The Green Roof By-law**

Toronto is the first city in North America to have a green roof by-law. With certain exceptions, it requires new buildings to install a green roof, the size of which depends on the available roof space. Green roofs have multiple energy benefits: indirectly, they help reduce energy use by reducing stormwater runoff and mitigating the urban heat island effect; directly, they reduce the need for air conditioning through evaporative cooling and may provide some insulation. There are 147 green roofs in Toronto, including the one on the podium of City Hall (Figure 11).



Figure 11. Toronto City Hall green roof

- **The Better Building Partnership**

The BBP manages several programs that reduce energy use and demand in existing and new buildings: High Performance New Construction (HPNC) offers financial incentives for improved energy performance in new buildings; the Municipal, Academic, Social and Health Care (MASH) program helps City facilities and the broader public sector reduce energy use and realize cost savings; and the Demand Response (DR) program works other Divisions, Corporations and Agencies to reduce electricity demand through load curtailment or on-site generation.

- **Home Energy Loan Program (HELP)**

HELP is a new initiative whereby the City of Toronto offers low-interest loans to qualifying homeowners in order for them to undertake energy efficiency improvements, the savings from which cover the costs of repayment. Through the Tower and Neighbourhood Revitalization Unit, this program is also being rolled out to older high-rise buildings.

Building-Scale Solutions

The City of Toronto has had success with building-scale renewable energy policies and projects, particularly solar photovoltaic systems and geothermal systems.

- **TGS Renewable Energy policy for new City facilities**

Under the Toronto Green Standard new City of Toronto facilities over 600 m² are required to obtain 5% of annual energy consumption from renewable sources.

- **Toronto Hydro solar PV partnership**

The first phase of this partnership led to 10 installations that produce 1,357 MWh of electricity per year, equivalent to the annual consumption of 113 households.

- **MicroFIT solar PV program for City facilities**

As of 2014, this program has established six systems totaling 52 MWh of electricity production.

Although solar PV opportunities are limited Downtown, the City of Toronto is also currently engaged in several geothermal feasibility studies, including Downtown sites.

District-scale solutions: thermal networks

Thermal networks (district energy systems) are well-established in Toronto and particularly the Downtown, where the large densities and extensive mix of uses are able to support these systems.

- **University of Toronto (St. George Campus)**

U of T has been providing heating and cooling to St. George campus buildings for over 100 years and, since the late 1990s, has also powered these buildings using a 6 MW natural gas-fired combined heat and power (CHP) plant. The system heats 98 buildings (~12.5 million sq. ft.) and cools 23 (~5.3 million sq. ft.) through a 9 km network.

- **Regent Park**

As part of the ongoing revitalization of Regent Park (Figure 12), Toronto Community Housing rebuilt the original district energy system. The boilers, chillers and future CHP plant are located in the parking level of the first high-rise constructed at 252 Sackville. This plant provides hot and cold water to all Regent Park buildings and will later provide electricity as well through a CHP plant.



Figure 12. Regent Park revitalization

- **Enwave District Heating**

In addition to the DLWC system, Enwave also operates a steam system in the Downtown. It began as the result of connecting several plants at hospitals along University Avenue in the 1960s, and later expanded from this central spine to a 28 km network that heats 156 buildings today (Tables 4).

Table 4. Enwave district heating system

General Distribution Stats for Heating	
Total Number of Customers	110
Total Number of Buildings Served	156
Square Footage Served	55.8 million
Heating System Length	28 km
Total Number of Plants	3
Total Number of Boilers	16

SWOT ANALYSIS

<p>Strengths</p> <ul style="list-style-type: none"> • Conservation and energy efficiency • Decreasing emissions overall • Numerous energy conservation programs/policies for new buildings • Several large district energy systems • Public response to power outages 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Increasing electricity demand • Few block-scale energy solutions to date • Challenges for renewables related to density • Aging electricity infrastructure • Limited private response to power outages
<p>Opportunities</p> <ul style="list-style-type: none"> • New development – opportunities for embedded energy solutions • Deep Lake Water Cooling expansion • Energy Benchmarking and Reporting Bylaw • Energy Strategy • IRRP/Toronto Hydro's Copeland TS load relief • Enbridge's GTA Project – Increased gas capacity 	<p>Threats</p> <ul style="list-style-type: none"> • Electrical capacity for new development, particularly along the waterfront • New codes/standards for new buildings not stringent enough/slow to change • Limited participation in existing building retrofit programs • Increasing reliance on gas-fired electricity generation • Increasing temperatures, more heat waves, and more frequent extreme weather

EMERGING PRIORITIES

REDUCING ELECTRICITY DEMAND

A constrained electricity supply, in the face of infrastructure that is not easily upgraded, is a threat to Toronto's prosperity and the Downtown is experiencing the acute version of this problem. Toronto Hydro is making the necessary efforts to mitigate the issue through projects like the new Copeland Transformer Station, as is the City of Toronto through requirements under the Toronto Green Standard and programs like High Performance New Construction and Demand Response.

However, the TOcore study represents an opportunity to explore more aggressive energy standards for new buildings, deep retrofits to existing buildings and local energy solutions, all specifically within the Downtown where such efforts would have the greatest impact.

IMPROVING ENERGY RESILIENCE

Major power outages are another challenge for Toronto. An area-wide outage in the Downtown, where large populations in tall buildings could be displaced, would be especially difficult to address. With the potential for future disruptions, in particular due to more frequent and intense extreme weather events, it is critical to prepare for power outages.

The City of Toronto has already designated four Recreation Centres as Emergency Reception Centres, including one Downtown. Furthermore, it continues to work with community partners such as the YMCA and various faith-based organizations to create resilience hubs that can act as temporary shelters for those displaced by power outages.

However, a corresponding private response from developers, owners and property managers of tall multi-unit residential buildings is also needed to mitigate the demand for public resources during such events. A critical first step in making the Downtown more resilient is providing backup power such that residents can remain – safely and with a degree of comfort – in the building.

FACILITATING THERMAL NETWORKS

Substantial GHG emissions reductions will depend, in part, on large-scale adoption of low-carbon energy solutions for buildings. Modern thermal networks, which distribute thermal energy from small, distributed central plants to groups of buildings, can leverage low-carbon and renewable energy sources. The technical and economic performance of thermal networks are improved in dense, mixed-use areas, so the growing Downtown provides the ideal setting to expand existing networks and develop new systems as well.

Most of Toronto's existing thermal networks (e.g. Enwave, U of T) developed as institutional systems that expanded over time to serve other buildings. Without a framework that outlines the roles and responsibilities of the various stakeholders, it will be difficult to replicate these systems on privately-held lands, especially where buildings already exist. Although keen real estate developers are seizing opportunities to develop their own networks, most would expect a clear framework from the City of Toronto that outlines the roles and responsibilities of those involved.

CONCLUSION

This account of existing conditions indicates that the Downtown faces significant energy challenges for which there are limited policies and programs to address them. While new development will exacerbate these challenges (i.e. increasing electricity demand, heightened vulnerability and increasing GHG emissions), it also presents opportunities to address these issues early on through improved design and alternative infrastructure.

However, new buildings are a small fraction of the approximate 8,300 existing buildings in the Downtown. A complete energy plan for the Downtown thus requires a plan for all buildings, new and existing. Furthermore, in the context of Toronto's GHG emissions reduction goals, opportunities to reduce demand, improve resilience and facilitate thermal networks should take advantage of low-carbon solutions where possible.

NEXT STEPS

- 1) Explore opportunities to reduce electricity demand in existing and new buildings through aligned initiatives, including, but not limited to:
 - a. The Energy Strategy required as part of a complete development application
 - b. Enhanced requirements in the next version of Toronto Green Standard
 - c. Potential changes to the City of Toronto Act review process

- 2) Prepare backup power guidelines for existing and new multi-unit residential buildings in collaboration with City Divisions, including, but not limited to:
 - i. Toronto Building
 - ii. Fire Services
 - iii. Toronto Paramedic Services
 - iv. Toronto Public Health
 - v. Social Development, Finance & Administration
 - vi. Office of Emergency Management
 - b. Explore opportunities to establish backup power guidelines as minimum requirements through aligned initiatives, including, but not limited to:
 - i. The Energy Strategy
 - ii. City of Toronto Act review process
 - iii. Ontario Building Code review

- 3) Create a framework for real estate and energy developers regarding thermal network development, including, but not limited to:
 - a. Role and responsibilities of the City of Toronto
 - b. Preferred business model
 - c. Technical guidelines for connection

ALIGNED INITIATIVES

- **Official Plan Review**

Revisions to the environmental policies of the Official Plan were adopted by Council in November, 2015. Language was added to address issues of peak demand, resilience and local energy solutions, and to require an Energy Strategy be completed for large development applications <http://tinyurl.com/mecet74>

- **Energy Strategy**

A proposed addition to Schedule 3 of the revised Official Plan, it would require developers of large sites to study the potential for improvements to building energy performance, resilience, and local solutions. This includes opportunities to reduce electricity demand, improve backup power systems, and implement thermal networks, for both new and existing buildings (if there are existing buildings on the site where the new building is being constructed).

- **Toronto Green Standard**

Scheduled to be reviewed in 2017, there may be an opportunity to encourage electricity demand reductions and improvements to backup power systems in the new version. The current TGS already encourages connection to district energy systems (i.e. thermal networks). The TGS only applies to new buildings. <http://tinyurl.com/ngotpbu>

- **The City of Toronto Act (COTA)**

COTA is currently being reviewed by the Ministry of Municipal Affairs and Housing. City Council has recommended that the City be allowed to pass bylaws respecting climate change mitigation and adaptation, such as improving energy efficiency and greater resiliency of infrastructure and buildings. If this permission is approved, it could allow the City to specify mandatory Energy Use Intensities (EUIs) and backup power minimum requirements. <http://tinyurl.com/olr6n93>

- **Central Toronto Area Integrated Regional Resource Plan (IRRP)**

The IESO, with Toronto Hydro and Hydro One, undertook this IRRP to assess electricity needs for the Central Toronto Area (which includes Downtown) given increasing demand growth. One of the plan's recommendations is to establish a Local Advisory Committee to inform the long-term electricity vision for the area, which could include opportunities for demand reduction and distributed generation. During 2016, the City of Toronto will be supporting the IRRP process through the provision of updated population projections to 2041. <http://tinyurl.com/ophcp73>

- **TransformTO**

A city-wide strategy for achieving an 80% reduction in GHG emissions (from 1990 levels) by 2050, while enhancing our local economy, reducing social inequalities, and shifting our consumption patterns. Premised on the notion that meeting this goal requires transformational change, the strategy will consider issues including resilience and climate change adaptation, and energy systems and buildings. <http://tinyurl.com/ooftqtu>

- **Energy Reporting and Benchmarking**

The City of Toronto is considering a by-law that would require large commercial and multi-unit residential buildings owners to report on annual energy and water consumption as well as GHG emissions. Benchmarking against past performance and against other buildings may facilitate improvements to energy and water efficiency. If the Ontario Ministry of Energy enacts province-wide legislation, the City of Toronto will not proceed with a by-law. <http://tinyurl.com/ogpucnf>

- **Towards a Resilient City**

The Resilient City Working Group has a broad mandate to make Toronto more resilient to climate change and other disruptions, including power outages. <http://tinyurl.com/qjg2zb2>

- **Toronto Public Health**

In the last several years, Toronto Public Health has issued numerous reports addressing the health impacts of extreme heat and cold, and climate change on people, including vulnerable populations. Many of these reports specifically address the need for backup power in dealing with such issues. <http://tinyurl.com/prnocke>

- **DLWC expansion**

Enwave is planning a 41% expansion of its existing Deep Lake Water Cooling system, which would further reduce Downtown electricity demand and GHG emissions. <http://tinyurl.com/plqelzk>

- **Copeland TS**

Toronto Hydro is building the new Copeland Transformer Station, the first to be built Downtown in over 50 years. This will provide needed relief to the Windsor TS and facilitate new development. <http://tinyurl.com/p3nkcp5>