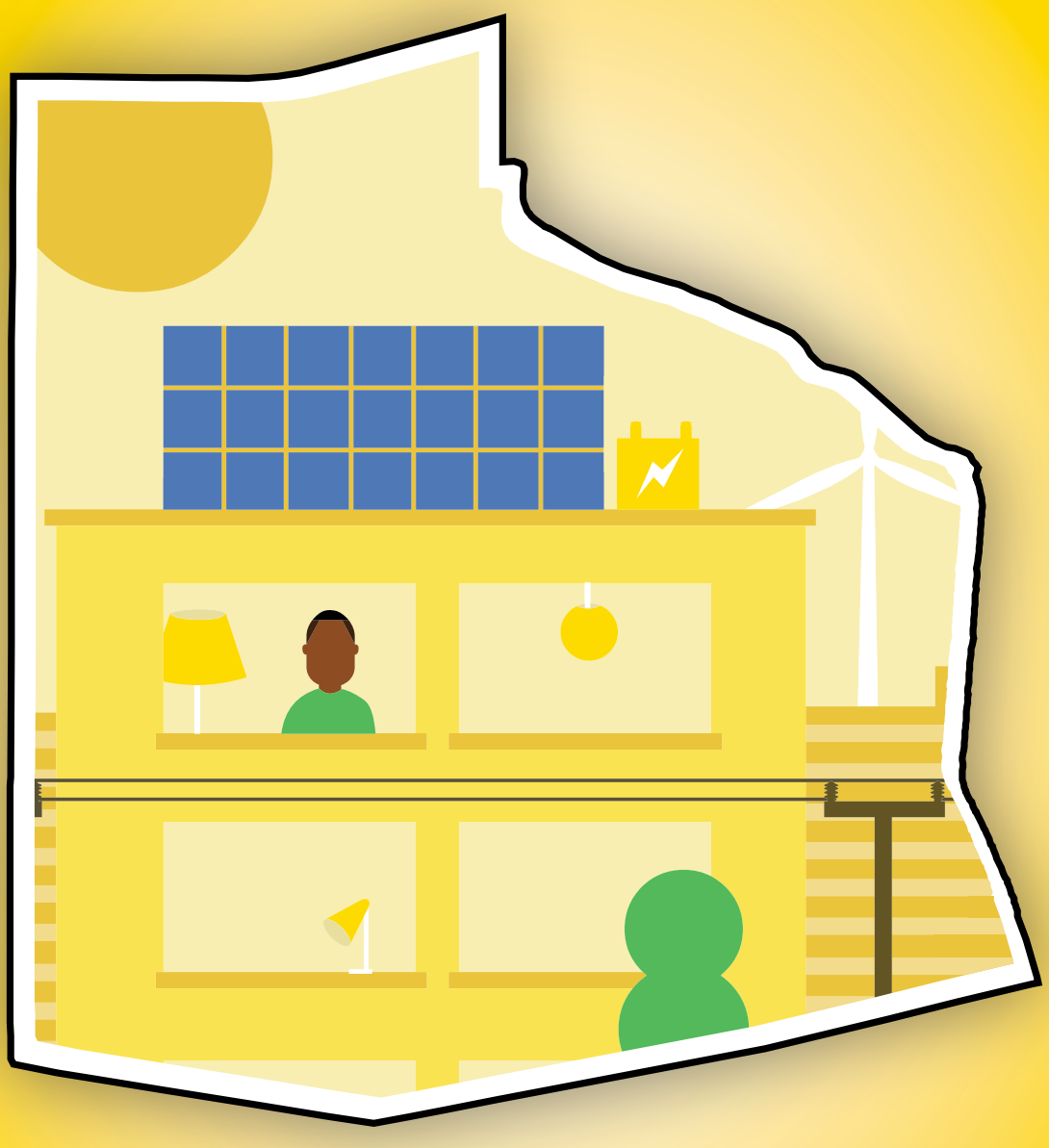
Attachment 1

DOWNTOWN ENERGY STRATEGY

TOcore



APRIL 2018

TORONTO

Acknowledgments

We acknowledge that the City of Toronto is located on the traditional territory of the Huron-Wendat Confederacy, the Haudenasaunee Confederacy, the Mississaugas of New Credit First Nation, and the Métis people, and is home to many diverse Indigenous peoples.

The Downtown Energy Strategy was developed as part of "TOcore: Planning Downtown." TOcore is a comprehensive and integrated look at Toronto's Downtown, its relationship to the City and region around it, and the planning framework governing growth, development and the provision of infrastructure. Informed by public and stakeholder consultation, this Strategy is the collaborative work of the following Divisions and Agencies:

City Planning
Environment and Energy Division
Toronto Hydro

DOWNTOWN ENERGY STRATEGY

APRIL 2018

PREAMBLE

The Downtown Plan is a 25-year vision that sets the direction for the city centre as the cultural, civic, retail and economic heart of Toronto, and as a great place to live.

The Plan is a response to rapid growth in the core that is placing pressure on physical and social infrastructure. The Plan provides a renewed planning framework for 17 square kilometres—the whole of Downtown.

The Downtown Plan is supported by five infrastructure strategies:

- Downtown Parks and Public Realm Plan
- Downtown Community Services and Facilities Strategy
- Downtown Mobility Strategy
- Downtown Water Strategy
- Downtown Energy Strategy

These strategies set priorities for infrastructure investment, and guide implementation of the Downtown Plan, which encompasses the area from Bathurst Street to the Don River and from the waterfront to about the CP rail corridor/ Rosedale Valley Road. Each strategy outlines a series of transformative ideas and actions intended to align infrastructure planning with long-term growth.

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EXECUTIVE SUMMARY

The Downtown Energy Strategy is one of five strategies designed to ensure that development Downtown is accompanied by investment in necessary energy infrastructure. It guides implementation of the Downtown Plan through a suite of transformative actions intended to align infrastructure planning with long-term growth.

The Downtown Energy Strategy confronts the challenges of rising greenhouse gas emissions, growing electricity demand in the face of constrained supply, and more frequent extreme weather events. It identifies immediate and long-term actions to improve Downtown's energy performance. It also aligns the Downtown Plan with TransformTO, the City's climate action plan.

The Downtown Energy Strategy addresses Downtown's vulnerability to area-wide power outages due to its vertical built form and the age

of its infrastructure. It also seizes opportunities that come with growth and intensification to leverage investments in district energy and other low-carbon energy solutions.

The Downtown Energy Strategy outlines the following actions:

1. Work with thermal energy network owners and operators to reduce greenhouse gas (GHG) emissions from existing thermal energy networks, such as through improved efficiency or fuel switching.

2. Work with energy developers in development of new low-carbon thermal energy networks. Actions could include provision of information, analysis, and access to City assets, including rights-of-way and facilities to assist energy developers in establishing new low-carbon thermal energy networks.

3. Work with energy developers to identify and develop local renewable energy solutions (solar photovoltaics, biogas, sewer heat recovery, and energy storage).

4. Promote residential buildings retrofits, focusing conservation and efficiency initiatives on existing multi-unit residential buildings Downtown.

5. Encourage development applicants to achieve near-zero emissions buildings and the highest tier of the Toronto Green Standard, through the Energy Strategy Report.

6. Prepare design guidelines for low-carbon thermal energy-ready buildings and make the guidelines available to development applicants in the Energy Strategy Report Terms of Reference.

7. Encourage multi-unit residential development applicants to follow the “Minimum Backup Power Guidelines” for multi-unit high-rise residential buildings, provided to applicants seeking higher levels of the Toronto Green Standard and through the Energy Strategy Report.

8. Encourage development applicants to salvage and reuse materials through the higher levels of the Toronto Green Standard and through the Energy Strategy Report. Update the Energy Strategy Report Terms of Reference to require accounting of embodied energy and to identify opportunities to limit its loss, including through the salvage and reuse of materials, when proposing demolition of existing buildings.

Moving Forward

Successfully implementing the transformative actions set out in the Downtown Energy Strategy will be a coordinated effort, led by Environment and Energy in collaboration with City Planning and other Divisions, Agencies, and Corporations, as well as building developers and owners, and energy developers/asset owners. Continuing and building upon Aligned Initiatives identified in this document will drive implementation.

1. INTRODUCTION

The purpose of the Downtown Energy Strategy is to set out a series of actions that will achieve reductions in overall greenhouse gas (GHG) emissions, address constraints within the electricity distribution grid, and enhance resilience to area-wide power outages.

This will contribute to achieving the City's long-term goals to reduce GHG emissions and will result in the following environmental, social and economic benefits:

ENVIRONMENTAL BENEFITS

- Improved air quality and water conservation due to local, low-carbon solutions.

- Land preserved for other uses due to integrated energy solutions.

SOCIAL BENEFITS

- Increased resilience to extreme weather by enabling residents to remain in their buildings during power outages and by ensuring that the City and its partners have the available resources to respond appropriately.

- Improvements to the existing building stock. Existing buildings will continue to be the major contributor to Downtown energy use and GHG emissions.

ECONOMIC BENEFITS

- Increased attraction for private investment in energy solutions.

- Local energy generation means local revenue, and will have a positive impact on the Downtown economy.

- Reduced constraints on local utilities, deferring or avoiding the need for investments in new large-scale energy supply infrastructure funded through the rate-base.

- Potential new City revenue stream by leveraging municipal assets for low-carbon energy solutions.

In 2007, Toronto set a greenhouse gas emission reduction target of 80% of 1990 levels by 2050, and in July 2017 City Council adopted TransformTO, which sets out the bold actions required to transform the City's urban systems—buildings, energy, transportation and waste—to meet the 2050 target. Toronto's climate is also changing with predicted hotter, drier summers, more heat waves, and more intense rainfall events. These changes will affect how buildings, landscapes, infrastructure and the public realm need to be designed to be resilient to new weather patterns.

While these challenges are city-wide issues, Downtown is particularly vulnerable due to its vertical built form and density, the age of its infrastructure and its constrained electricity

supply. To address these challenges, the Energy Strategy identifies the key objectives and actions needed to align the Downtown Plan with TransformTO, both in the short and long term.

Figure 1 depicts the relevant planning timelines. While TransformTO looks out to 2050, and the Downtown Plan to 2041, the Energy Strategy is focused on addressing the development pipeline, which has an estimated build-out range of 2026–2031.

The policy framework for the Downtown Energy Strategy—Community Energy Planning (CEP)—is an area-based approach that considers energy early in the land use and infrastructure planning process, and identifies opportunities to integrate resilient, low-carbon energy solutions at the building and neighbourhood scale.

The mandate for Community Energy Planning was established by City Council's 2009 adoption of the Power to Live Green: Toronto's Sustainable Energy Strategy. Community Energy Planning is defined in the sidebar on the opposite page:

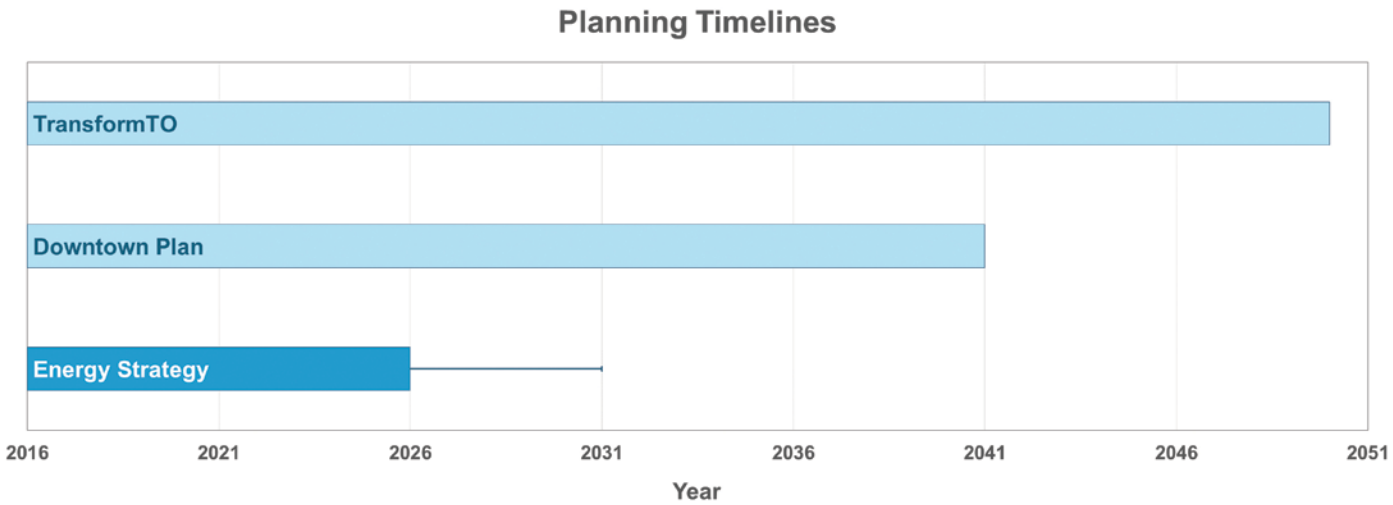


Figure 1: Planning timelines for TransformTO, Downtown Plan, and the Downtown Energy Strategy.

"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)[1].

Opportunities lie in four categories: growth, climate change, resilience and economy:

GROWTH

New buildings are designed to use less energy, have less demand on energy infrastructure, and catalyze improvements to existing buildings.

CLIMATE CHANGE

Low-carbon solutions at the building and block/district scale, as well as low-carbon transportation choices, help drive deep GHG reductions.

RESILIENCE

Backup power solutions for multiple-unit residential buildings and recreation centres can reduce vulnerability to area-wide power outages.

ECONOMY

Energy conservation and low-carbon energy solutions keep more energy dollars in the community and create local jobs

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

2. CHALLENGES

The development pipeline—development projects proposed to the City that are either approved (under construction or yet to be built) or under review—provides the most reasonable estimate of short-term growth, but it also aligns with long-term population and employment projections. Therefore, actions to reduce the energy and emissions associated with the development pipeline will have the appropriate magnitude in the short-term, while providing a foundation for long-term success.

The 2012–2016 development pipeline could increase Downtown gross floor area by 36% overall, including a 63% increase in apartment gross floor area (GFA) and a 30% increase in office GFA (Table 1).

This level of growth would drive significant increases in energy consumption, electricity demand and GHG emissions (Table 2). If the City is to meet its long-term emissions targets and become more resilient, new development will have to address these challenges.

Table 1. Downtown Gross Floor Area (million m^2)—Existing and Estimated

Building Type	Existing	Estimated (Pipeline)	Change
Apartments	13.4	8.5	63%
Office	6.4	1.9	30%
Retail	4.3	1.2	28%
Institutional	3.5	-	-
Industrial	1.5	-	-
Res-singles	1.2	-	-
Res-town homes	0.75	-	-
Recreation	0.5	-	-
TOTAL	32	11.6	36%

The existing building inventory was prepared using property and structural characteristics from the IBMS/LUISII database. The current development pipeline comprises all projects at various stages of development review between January 2012 and December 2016. (Source: City of Toronto, City Planning Division, current Land Use Information System II)

Table 2. Estimated Change in Energy Consumption, Electricity Demand, and Emissions Downtown

Category	Existing	Pipeline	Change
Electricity Demand (MW)	1,100	250	+22%
Electricity Consumption (MWh)	4.8 million	1.2 million	+25%
Natural Gas Consumption (m3)	550 million	100 million	+18%
Emissions (tonnes CO2)	1.7 million	379,000	+22%

Calculations based on coefficients for different building types.

2.1 Increasing greenhouse gas emissions

Build-out of the 2012–2016 development pipeline is estimated to increase electricity and natural gas consumption by 25% and 18%, respectively, leading to an increase in emissions of 22% (approximately 380,000 tonnes CO2). While the Ontario electricity grid is largely carbon-free, increasing natural gas consumption for space and water heating will directly increase emissions from buildings.

Although the increase will be partially offset by rising temperatures, conservation efforts and a greater use of renewables, as well as reductions in other sectors (e.g., transportation, solid waste, etc.), additional actions are necessary to limit the overall increase.

Toronto Council has approved city-wide targets to reduce GHG emissions 80% by 2050 (1990 base year). Although there is no target specifically for Downtown, it is possible to assign an estimated value based on the proportion of emissions Downtown (~20%) compared to the entire city (Table 3).

This means that by 2050, Downtown building emissions will need to be reduced by nearly 1.3-million tonnes from current amounts. Furthermore, this will have to be done while growing, meaning that estimated emissions from the development pipeline (i.e., 379,000 tonnes) will have to be entirely avoided. This would bring the total reduction required to over 1.6-million tonnes.

To put this in perspective, it took approximately 27 years to reduce CO2 emissions by 900,000 tonnes, and there are now 33 years left to avoid or reduce another 1.6 million tonnes. The previous reduction in GHG emissions was largely due to the phasing out of coal to generate electricity, so meeting the next target will be more challenging.

The continued and growing demand to provide the electricity needed for growth, transit and widespread electrification means that electricity generation will need to be from low-carbon sources.

Table 3. City-wide vs. Downtown emissions (Baseline, current estimate, and 2050 target)

Year	City-wide (tonnes CO^2)	Downtown (tonnes CO^2)
1990	14.3 million	2.7 million
2017	9.9 million	1.8 million
2050	2.9 million	540,000

2.2 Increasing electricity demand

Buildings: With electricity distribution infrastructure already constrained in the areas anticipating the most growth, the estimated 22% increase in electricity demand due to development pipeline build-out will be a major challenge (Figure 2). Furthermore, cooling demand will increase with rising temperatures, which means that the 22% estimate is conservative.

Electric transit: Electricity demand will also increase due to electrification of the GO rail network and the UP Express along with planned construction of the Relief Line and the Waterfront East LRT. Downtown's transit-based electricity demand is already large compared to Downtown's size, and is set to more than double within 15 years based on current plans (Figure 3).

Broader electrification: Electrification of personal transportation (i.e., electric vehicles), as well as space and water heating, will further increase electricity demand. Though the uptake will take place over time, TransformTO envisions that by 2050, transportation is 100% low-carbon, and heat pumps are widely used for residential and non-residential heating. Given that natural gas provides approximately 2/3 of heating energy, and liquid fuels (i.e., gasoline and diesel) nearly all transportation energy, it is absolutely critical that we reduce electricity demand while also increasing local electricity supply

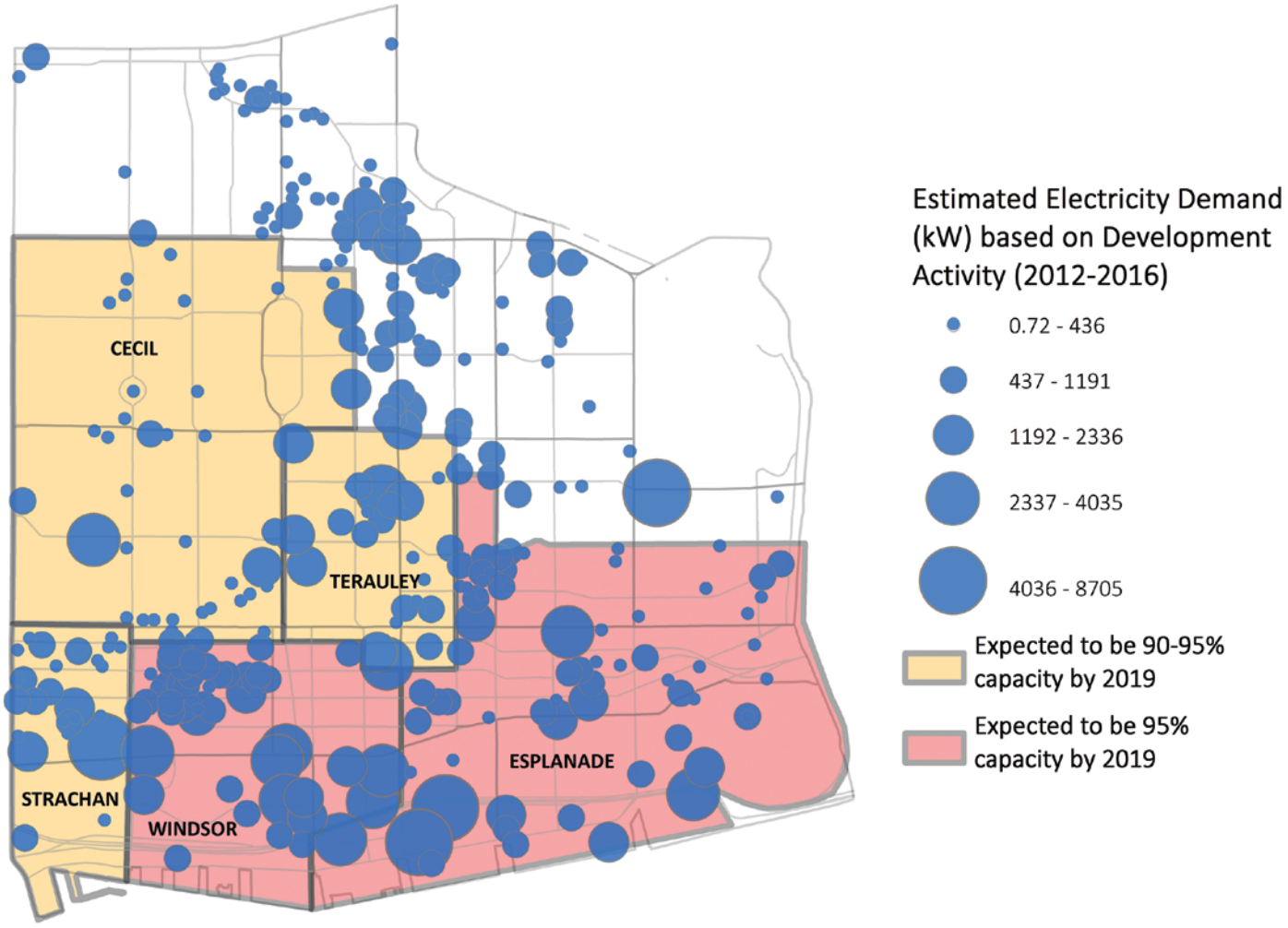


Figure 2: Downtown transformer stations are expected to be over 90% loaded by 2019 and demand will continue to increase as the development pipeline is built-out. Once complete, the Copeland transformer station (currently under construction, not shown) will provide relief to the Windsor transformer station, but growth will continue to put pressure on Downtown electricity infrastructure. (Estimates based on coefficients; transformer station service areas and loading based on Toronto Hydro data.)

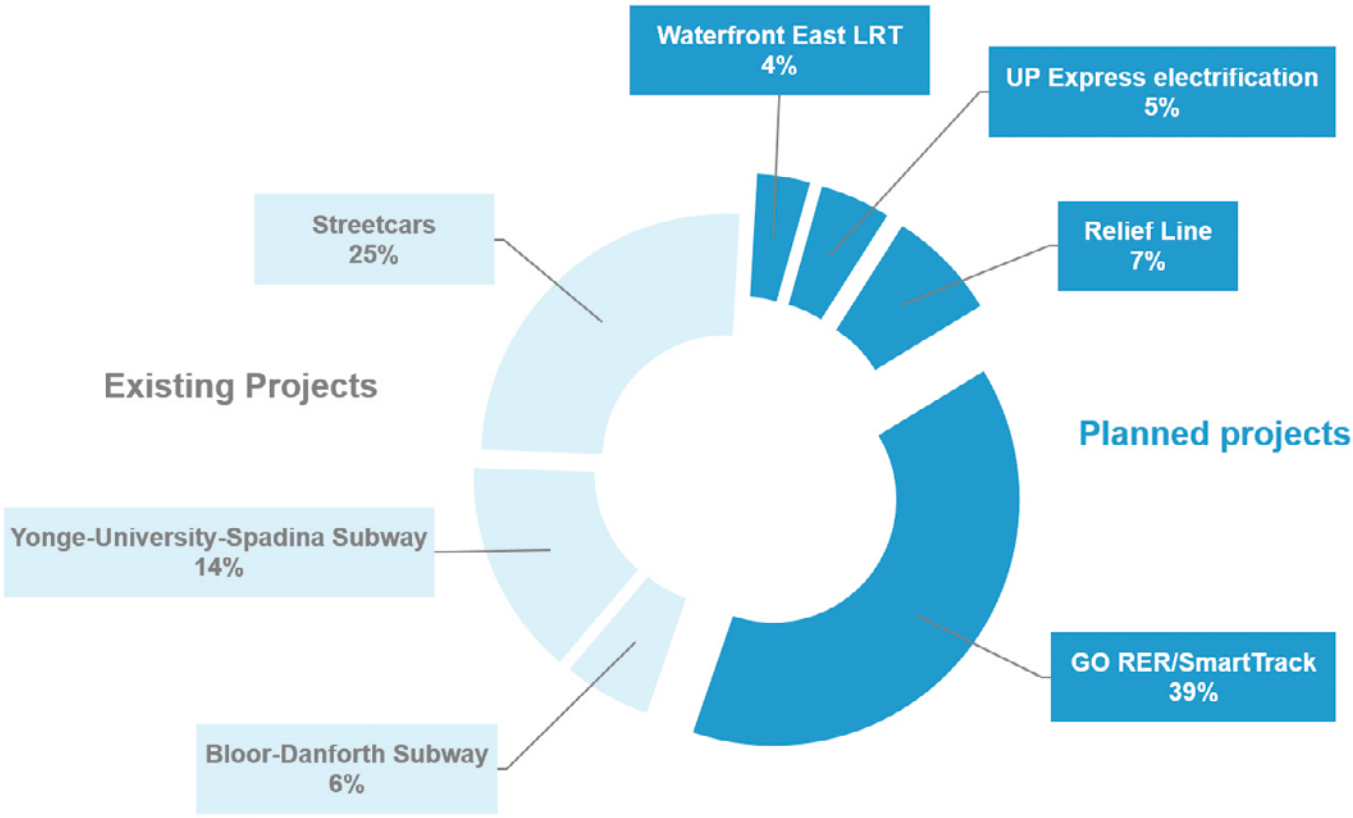


Figure 3: Estimated electricity demand of existing and planned transit projects. Transit electricity demand estimates are based on the 18 Downtown subway stations, the traction power used to run subways through Downtown, and the sections of the streetcar routes within Downtown. Implementation of the transit network plan would lead to new subway stations (Relief Line) and LRT stations (Waterfront LRT), SmartTrack (including new stations), and GO/RER electrification. This could add 41 MW of electricity demand Downtown by 2031, more than doubling the current 35 megawatts.

2.3 Constrained electricity supply

The concern with the anticipated load growth, not unlike the situation in the mid-2000s when Toronto was facing potential brownouts, is that the default solution could be a second natural gas-fired power plant next to the existing Portlands Energy Centre. The Portlands Energy Centre is currently Toronto's single largest source of GHG emissions (emitting 371,000 tonnes of CO2 annually). Adding a second plant would make meeting long-term GHG emissions reduction targets virtually impossible.

2.4 Extreme weather

The 2012 "Toronto's Future Weather and Climate Driver Study" predicted that extreme weather events will increase in frequency and severity (Figure 4). These events can cause area-wide power outages. Residents of multi-unit residential buildings are especially vulnerable given their reliance on electricity for essential services such as water supply, elevators and security.

Analysis of the development pipeline indicates that fewer than 100 of the 116,000 residential units in the development pipeline will be located in buildings less than six storeys tall. This means that almost all new Downtown residents will rely on electricity for essential services.

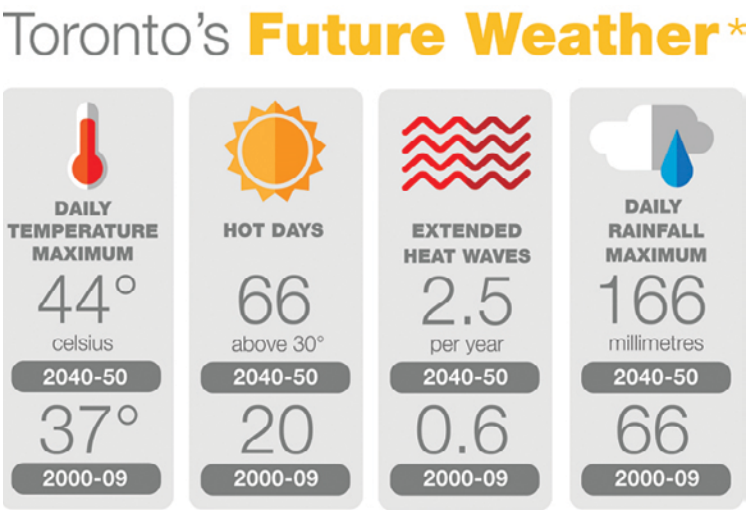


Figure 4: Toronto's Future Weather and Climate Driver Study estimates.

3. TRANSFORMATIVE ACTIONS

The Energy Strategy identifies the immediate actions necessary to help avoid the expected increase in energy use, electricity demand and emissions, and decrease in resilience associated with the build-out periods of the development pipeline and transit network.

Also important is quickly implementing the necessary future-proofing measures to ensure that the Downtown is prepared for continued growth, electrification and extreme weather while meeting city-wide GHG emissions reduction targets.

Although there will be many solutions and many actors with a role to play in achieving a low-carbon, resilient Downtown, the focus of this strategy is on actions that can be scaled-up or initiated quickly, that the City has a key role in implementing, and that have the appropriate magnitude.

TransformTO targets:

- 75% of community-wide energy use is derived from renewable or low-carbon sources by 2050.
- 30% of total floor space community-wide—residential and commercial—will be connected to low-carbon thermal energy by 2050.
- 100% of existing buildings are retrofitted to the highest emission reduction technically feasible, on average achieving a 40% energy performance improvement over 2017 levels, while limiting affordability impacts to residents, by 2050.
- 100% of new buildings are designed and built to be near-zero greenhouse gas emissions by 2030.

3.1 Support efforts to reduce GHG emissions from existing thermal energy networks

Priority actions:

- Work with thermal energy network owners and operators to reduce GHG emissions from their existing assets, such as through improved efficiency or fuel switching.

Downtown has three operating thermal networks—Enwave (Deep Lake Water Cooling and District Heating), University of Toronto St. George campus, and Toronto Community Housing's Regent Park—and several new systems in progress. Improving their efficiency and more so, fuel switching, have the potential to deliver substantial GHG emission reductions.

3.1.1 Enwave Deep Lake Water Cooling and District Heating

Enwave Energy Corporation operates the Deep Lake Water Cooling (DLWC) system and a district steam system Downtown, both of which are being expanded and made more efficient.

DLWC uses lake water to cool approximately 2.5-million m2 of primarily office space and is already Toronto's largest renewable thermal energy network (Figure 5). By reducing the use of electric chillers for space cooling, DLWC reduces electricity demand by 61 MW (~5% of the Downtown load). Enwave is currently pursuing a 40% expansion, which would reduce an additional 30 MW of electricity demand. Toronto Hydro supports the expansion of the Deep Lake Water Cooling system through promotion on its website, including offering incentives to building owners.[2]

Enwave also recently installed a 4MW Combined Heat & Power system at its Pearl Street Steam plant and is using recovered heat to expand its district heating presence in the form of hot water, which is generally more efficient

2 http://www.torontohydro.com/sites/electricsystem/electricityconservation/businessconservation/Pages/DeepWaterCooling.aspx

and less GHG emissions-intensive compared to steam.[3]

The City plays an important role in facilitating thermal network expansion, and also benefits financially from it. For example, the City enables Enwave's access to rights-of-way for pipe installation, and provides space for the DLWC heat-exchangers at the John Street Pumping Station, which earns revenue for the City. Toronto Water also continues to negotiate with Enwave on its proposal to amend the existing Deep Lake Water Cooling Energy Transfer Agreement to provide the capacity for DLWC expansion.[4]

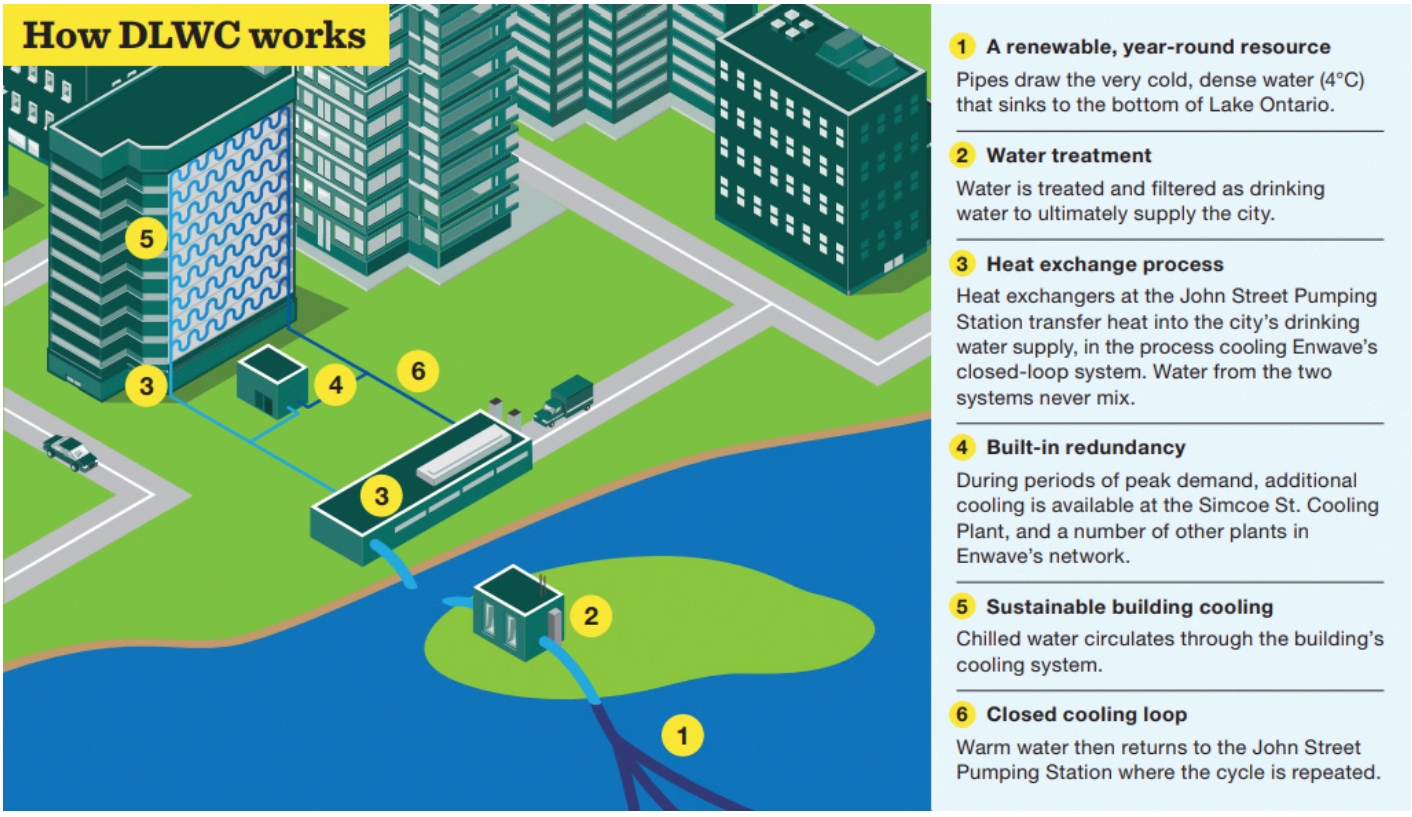


Figure 5. How Deep Lake Water Cooling works (Source: Toronto Hydro)

3 http://reinboldengineering.com/projects/multi-residential/19-duncan-street.html

4 http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2013.PW23.5

3.1.2 Other thermal networks

The University of Toronto's St. George Campus and Toronto Community Housing's Regent Park, both make use of extensive thermal networks.

- U of T is pursuing expansion of its Combined Heat & Power (CHP) system capacity at its central plant, and is also exploring expansion of the thermal network as part of the Huron-Sussex Neighbourhood Plan, which identifies the potential for a new "community energy system" to serve the neighbourhood.[5]

- Toronto Community Housing continues to expand the footprint of its Regent Park thermal network as new buildings connect to the system, and it is also in the midst of integrating a Combined Heat & Power system into its central plant to provide power to Toronto Community Housing buildings through a microgrid.

A key advantage of thermal networks compared to individually heated and cooled buildings is that large-scale efficiency improvements and fuel switching efforts are more cost-effective with networks. The City will therefore support system owners and operators to facilitate expansion as well as efforts to reduce GHG emissions from these systems.

5 http://app.toronto.ca/DevelopmentApplications/associatedApplicationsList.do?action=init&folderRsn=4027340&isCofASearch=false&isTlabSearch=false

3.2 Support development of new Low-Carbon Thermal Energy Networks

Low-Carbon Thermal Energy Networks (LCTEN) are the most-effective way to reduce emissions in dense, growing areas like Downtown, and they will be critical components to achieving GHG emissions reduction targets. The City has an important role to play in LCTEN development as it controls access to rights-of-way and often low-carbon energy sources.

Priority actions:

- Work with energy developers in the development of new low-carbon thermal energy networks, which may include provision of information, analysis, and access to City assets, including rights-of-way, and facilities.

Low-Carbon Thermal Energy Networks

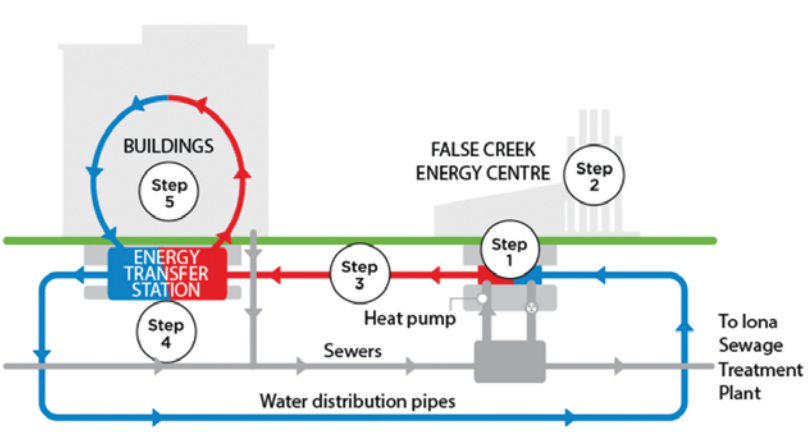
- Low-carbon thermal energy networks—also known as district energy systems—distribute hot and cold water from one or more energy centers to multiple buildings.
- They are fundamental to reducing greenhouse gas (GHG) emissions from buildings because they create the economies of scale to access large, low-carbon energy sources at a lower cost compared to individual buildings.
- Downtown has both the density necessary to support shared energy infrastructure and available low-carbon energy sources.

3.2.1 New lake-source cooling

Planned development on the eastern side of the central waterfront presents a strategic opportunity to establish a new lake-source cooling system. Sherbourne Common, a waterfront park that doubles as a stormwater management/treatment facility, could provide the location for such a system.

3.2.2 Sewer heat recovery

Major investments in sanitary servicing are planned for the eastern part of the central waterfront due to capacity constraints. Potential short-term projects include new trunk sewers and sewage pumping stations. These present opportunities to recover renewable heat, which would be confirmed on a case-by-case basis based on feasibility studies. An example of this is the False Creek neighbourhood in Vancouver, which is served by a thermal network that recovers sewer heat (Figure 6).



Step 1: A heat pump captures heat from the sewer line flowing to the treatment plant.

Step 2: Additional heat is provided by boilers, if needed.

Step 3: Hot water is sent to the neighbourhood through underground pipes.

Step 4: Heat is exchanged with the building to provide space heating and hot water to residents.

Step 5: Water is returned to the energy centre to be re-heated.

Figure 6: 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 buildings, with the remaining 30% coming from gas boilers. The system reduces GHG emissions by 60%. Adapted from http://vancouver.ca/home-property-development/how-the-utility-works.aspx

3.2.3 Ground-source heating and cooling under new parks

New parks planned for the central waterfront, such as the Lower Yonge Park present an opportunity to access renewable thermal energy from the earth without encumbering the park surface.

3.2.4 Co-locating linear infrastructure

Low-carbon thermal energy network development can also take advantage of opportunities to co-locate with linear infrastructure. For example, Environment and Energy Division staff are coordinating with City Planning to plan for a low-carbon thermal energy network for the Port Lands, which includes the possibility of pipes in/crossing roadways, bridges, and other rights-of-way.

Rail Deck Park, which is proposed to cover the rail corridor between Bathurst Street and Blue Jays Way, presents a similar opportunity: installing pipes within or underneath the decking would create a physical connection with existing/ in-progress low-carbon thermal energy networks at The Well development (former Globe and Mail site) in the King-Spadina neighbourhood and a new network in the CityPlace neighbourhood.

CityPlace is a maturing neighbourhood and the buildings' mechanical systems will require major reinvestment at some point in the future. If a thermal network were to be available, the buildings could be retrofitted for connection to the network, which would enable the integration of low-carbon energy sources.

3.3 Support development of local renewable energy solutions

Priority actions:

- Work with energy developers to identify and develop local renewable energy solutions, such as solar photovoltaics, biogas, sewer heat recover, and energy storage.

Local renewable energy solutions will be important to reducing GHG emissions and electricity demand, and improving resilience. As electricity demand increases due to development of buildings and transit lines, local electricity generation and storage will be needed to manage this growth and ensure resilience to power outages. For example:

- Solar photovoltaics plus battery storage in new buildings; and
- Local electricity generation located at new transit stations and/or traction power substations.

As discussed in section 3.2, development of large-scale renewable thermal energy sources will be key to reducing GHG emissions from buildings. For example:

- Expansion of lake-source water cooling to substantially reduce electricity demand;
- Heat recovery from sewage infrastructure, including heat from trunk sewers/sewage pumping stations, as well as biogas utilization; and
- Large-scale ground-source heating and cooling (geo-exchange).

3.4 Promote residential building retrofits

Priority actions:

- Focus conservation and efficiency initiatives on existing multi-unit residential buildings Downtown.

Reducing energy use, and then using needed energy as efficiently as possible, are essential steps towards cost-effective emission reductions in existing buildings. Reducing natural gas consumption, and to a lesser extent electricity consumption, will directly reduce emissions. Reducing electricity demand will also reduce emissions by making room in the electricity grid for electric (i.e., low-carbon) solutions.

Analysis of the existing building stock indicates that apartment (i.e., multi-unit residential), and commercial buildings account for the majority of GFA, emissions and electricity demand (Table 4).

Given the distributed nature of retail ownership, the early focus should be on apartment and office buildings. It will be important to further identify the owners and property managers of the larger building portfolios for the most focused conservation efforts.

An additional but important consideration is that office building owners of large portfolios are likely to have already undertaken conservation efforts, especially Downtown where competition for tenants is strong. Therefore efforts to reduce natural gas consumption and electricity demand should tailor programs to multi-unit residential buildings.

Table 4. Percentage GFA, Emissions, and Electricity Demand by Sector

Sector	GFA	Emissions	Electricity Demand
Apartment	42%	35%	36%
Office	20%	22%	32%
Retail	13%	15%	16%
Total	75%	72%	84%

3.4.1 Programs

The City already has experience with this sector having now offered the High-rise Retrofit Improvement Support (Hi-RIS) Program for several years. Through Hi-RIS, owners of 3+ storey purpose-built rental apartments are eligible for low-cost financing from the City to undertake energy retrofits, and more recently renewable energy installations. The loan is then paid back through the property tax bill, with the energy savings, as well as various utility incentives, helping to offset the costs of repayment.

Although there are no Downtown projects yet, Hi-RIS has been instrumental in retrofitting about six buildings (~1,000 units) in other areas of the city, reducing natural gas use by 27%, emissions by 1,400 tonnes, and annual operating costs by $46,000 per building, on average.

At its meeting of December 13, 2016, City Council adopted the TransformTO Short-term Strategies, including the strategy to “Enhance the Better Buildings Partnership.” By supplementing the existing partnership structure with new resources to focus on natural gas conservation, the enhanced partnership could achieve substantial city-wide emissions reductions[6].

6 https://www.toronto.ca/wp-content/uploads/2017/10/8ec4-TransformTO-Climate-Action-for-a-Healthy-Equitable-and-Prosperous-Toronto-Report-1-November-2016.pdf

3.5 Encourage developers to achieve near-zero emissions buildings

Priority actions:

- Encourage development applicants to achieve near-zero emissions buildings by pursuing the highest tier of the Toronto Green Standard through the Energy Strategy Report.

The Toronto Green Standard (TGS) is a set of sustainable performance measures required for new development. Since the TGS became mandatory in 2010, as of 2017 1,500 projects have been subject to the mandatory Tier 1 requirements, and 20 projects have voluntarily certified as Tier 2, which collectively has avoided about 115,000 annual tonnes of CO2. The Toronto Green Standard has also played a role in market transformation, pushing the development industry to design more efficient buildings, and influencing *Ontario Building Code* changes.

Toronto Green Standard Version 3, in effect May 2018, establishes a four-tiered framework for near-zero emissions buildings by 2030. It specifies absolute energy and emission targets for each Tier for various building types. These include Energy Use Intensity (total amount of energy used in a building, including plug loads), Thermal Energy Demand (envelop and building orientation) and Greenhouse gas inventory (target for reducing GHG emissions by energy source). The intent is to encourage passive design coupled with high efficiency active systems, such as heat recovery and improved air tightness. Tier 4 targets represent a near-zero level of emissions performance, at which point fuel switching is promoted to foster a shift away from natural gas towards electricity and renewable energy sources.

As shown in Figure 7, meeting these targets generally requires building design and development teams to follow a hierarchy:

- Prioritize passive design solutions (e.g., solar orientation, building envelope efficiencies).
- Use high-efficiency mechanical systems (e.g., heat/energy recovery ventilation).
- Integrate low-carbon energy sources last.

The minimum absolute energy performance targets requirements are proposed to be raised every four years such that by 2022 Tier 2 becomes Tier 1, in 2016 Tier 3 becomes Tier 1, and in 2030 the Tier 4 of Version 3 becomes Tier 1 of Version 6, which would mean all new buildings are designed to near-zero emissions levels starting in 2030. This will avoid over 30 megatonnes of CO2, equal to removing 250,000 cars off the road.

To avoid growth in new emissions, it is important that new buildings are designed to near-zero emissions levels today, which would reduce energy use by 56% and emissions by 75% compared to the current minimum in the *Ontario Building Code*, 2017.

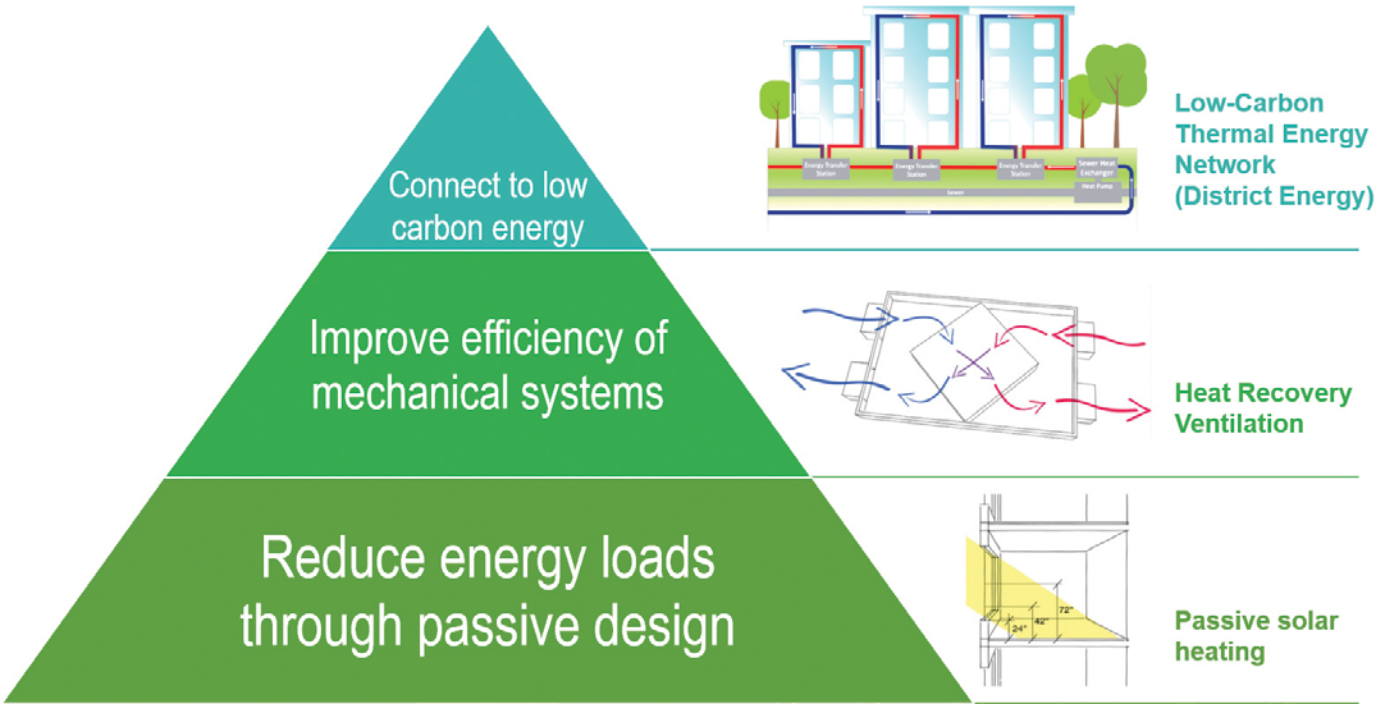


Figure 7: Low-carbon building design hierarchy. (Adapted from https://web.toronto.ca/wp-content/uploads/2017/11/9875-Zero-Emissions-Buildings-Framework-Report.pdf)

Energy Strategy Report and Toronto Green Standard

- The City of Toronto has a development review process that considers energy and emissions at all levels.
- Development applicants seeking an Official Plan Amendment, Zoning By-law Amendment, and/or Plan of Subdivision Approval are required to submit the Toronto Green Standards checklist which includes energy performance and, for a proposal with at least 20,000 m2 of gross floor area or any proposal within a Community Energy Plan area, to prepare an Energy Strategy Report.
- The Energy Strategy Report allows City staff to engage with development applicants early in the development review process to discuss opportunities for energy conservation, resilience, and low-carbon solutions.
- At the Site Plan approval stage, all development is required to submit an Energy Modelling Report to identify how they will meet the Toronto Green Standard energy performance requirements. The Energy Modelling Report will reflect any of the opportunities identified through the Energy Strategy Report that the applicant chooses to implement.

3.6 Provide guidance for low-carbon thermal energy-ready building design

Priority action:

- Prepare design guidelines for low-carbon thermal energy-ready buildings and make the guidelines available to development applicants in the Energy Strategy Report Terms of Reference.

Perhaps most important for ensuring that Downtown buildings are low-carbon is designing mechanical systems to be ready for future integration of low-carbon thermal energy sources, whether through thermal networks or in-building solutions. In cases where a thermal network is not yet built, or on-site renewables are not currently economically viable, buildings should still be designed as if these opportunities were available given that retrofits later will likely be more complex and costly.

In practice, this means that mechanical systems (i.e., HVAC) are designed to utilize low-temperature thermal energy sources (e.g., ground-source heat). Low-temperature thermal energy-ready design has two key requirements:

1. Hydronic distribution equipment (e.g., valves, risers, fan coils, etc.) is sized to allow for a large temperature differential (Delta T or ΔT).

2. Heating/cooling equipment (i.e., boilers and chillers) are located at- or below-grade to reduce costs.

3.7 Encourage backup power for multi-unit high-rise residential buildings

Priority action:

- Encourage multi-unit residential development applicants to follow the "Minimum Backup Power Guidelines" for multi-unit high-rise residential buildings through the Energy Strategy Report.

Planning for resilience recognizes that despite efforts to mitigate climate change, disruption will occur and the prudent approach is to prepare. Extreme weather, compounded by already-stressed electricity infrastructure, demands that we prepare for power outages. Given the extent to which multi-unit high-rise residential building residents rely on electricity for essential services such as elevators, water supply, and security, it is critical that these buildings have backup power.

Emergency versus Backup Power

- Emergency power is provided to meet minimum life safety requirements, which specify 2 hours of power supply to facilitate occupant evacuation and firefighter access.
- During sustained area-wide power outages, emergency power is not designed to keep residents in their buildings with any degree of comfort, even if there is no particular problem with the building.
- Backup power is provided to meet non-life safety requirements that are considered essential for occupant well-being (e.g. water supply, heating, elevators), such that occupants can remain in their building safely and with a degree of comfort for at least 72 hours.

To address the vulnerability of high-rise residents to area-power outages, the City prepared the "Minimum Backup Power Guidelines for MURBs"[7] based on business cases for several existing and new multi-unit high-rise residential building archetypes. Recommendations include:

- Powering essential loads beyond life safety requirements, such as additional elevators, domestic water pumps, and common areas.

- Ensuring backup power provision for at least 72 hours.

- Using natural gas generators.

The guideline is being provided to developers as part of the Energy Strategy Report Terms of Reference for voluntary implementation. It is also an optional performance measure for owners seeking the Tier 2 or higher level of performance for their buildings and is included in the TGS Resiliency Checklist.

7 https://www.toronto.ca/wp-content/uploads/2017/11/91ca-Minimum-Backup-Power-Guideline-for-MURBs-October-2016.pdf

3.8 Encourage development applicants to salvage and reuse materials

Priority action:

- Update the Energy Strategy Report Terms of Reference to require accounting of embodied energy and identifying opportunities to limit its loss, including through the salvage and reuse of materials, when proposing demolition of existing buildings.

Much of the development in the Downtown involves demolishing an existing building to build a new one. This can result in the loss of the embodied energy—energy that was consumed to build the existing building. Salvaging or reusing the materials will reduce the loss of embodied energy and will assist the City to achieve its GHG reduction targets. This action is included as a performance measure for higher performance buildings (Tier 2 or higher) in the TGS.

4. ALIGNED INITIATIVES

4.1 Development of Low-Carbon Thermal Energy Networks

Development of low-carbon thermal energy networks is a TransformTO strategy, which is fundamental to meeting climate change targets adopted by City Council, while attracting significant investments to the benefit of the local economy, generating revenue, ensuring energy does not become a limiting factor for growth, and improving energy resilience. In order to accelerate and scale-up development, City Divisions, Agencies and Corporations will assist energy developers with establishing new low-carbon thermal energy networks. Assistance may include information, analysis, and access to City assets, including rights of way, and facilities.

4.2 Energy Strategy Report required as part of development review

An Energy Strategy Report is required for large developments (i.e., at least 20,000m2 GFA) as part of a complete application under the Official Plan. The purpose of the Energy Strategy report is to have developers engage in considering options to reduce GHG emissions and improve energy efficiency. It is anticipated that applicants will hire a qualified consultant to prepare the report according to the City's Terms of Reference, which includes the identification of opportunities for conservation, renewables, thermal networks and resilience.

This requirement provides a key opportunity to engage with developers proposing to build Downtown on the issues discussed in this Energy Strategy and how they might address them through their development proposals.

Of the 94 projects that have triggered the requirement since it came into effect in June 2016, 33 are Downtown. Of these applicants, 15 submitted Energy Strategy Reports that fulfill the complete application requirement. The City is working with these applicants on implementation.

4.3 Toronto Green Standard Version 3

The Toronto Green Standard is a set of sustainable performance measures required for new development. Toronto Green Standard Version 3, approved by Council in December 2017, sets out a four-tiered framework to progressively reduce energy use and GHG emissions such that by 2030, all new buildings are designed to near-zero emissions levels.

Key changes to Version 3, which comes into effect on May 1, 2018, include:

- New requirements for Tier 1 buildings include an option to use absolute performance targets for energy.
- New core measures for Tier 2 include using absolute performance targets for energy, solar readiness, connection to district energy, stormwater retention and a resilience checklist.
- New Tier 3 performance measures.
- New Tier 4 absolute performance targets for energy.
- A separate standard for residential developments owned by the City or its agencies.

Given the importance of avoiding new GHG emissions, City staff is exploring financial and other incentives to offset the Tier 3 and 4 construction cost premiums, which can range from 3.6–4.9% for residential and commercial office space, and be as high as 16.9% for retail. (Currently, achieving Tier 2 or higher is incented through a rebate on development charges for certified high performance building projects.)

4.4 Coordinated energy planning at the local & regional levels

The City, with funding support from the Ontario Ministry of Energy, is developing a Municipal Energy Plan that will identify opportunities to coordinate with regional energy planning efforts, in particular with respect to the forthcoming update to the Integrated Regional Resource Plan led by Hydro One, the Independent Electricity System Operator and Toronto Hydro.

Hydro One recently identified the urgent need to coordinate investments in electricity infrastructure with municipal plans/needs in certain areas, including Downtown, given potential new development, transit, and municipal infrastructure.

Toronto Hydro, a member of the TOcore Energy Working Group, has already committed to continued participation in planning and delivering solutions to meet the needs of Downtown. (See Appendix A for Toronto Hydro letter of support.)

The City and the Independent Electricity System Operator have also agreed to coordinate more closely on energy planning efforts, with a particular focus on the Downtown.

4.5 Emergency management

A key aspect of Toronto's resilience is ensuring that the City can provide critical services during and after an emergency, including area-wide power outages. Four City-owned recreation facilities, one in each district, are designated for use as pre-planned emergency 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 displaced individuals. The City is also working with community organizations, such as the YMCA, to provide backup power for the same purpose.

4.6 Downtown Mobility & Water Strategies

Both the Downtown Mobility Strategy and Downtown Water Strategy support the Downtown Energy Strategy. The Mobility Strategy recognizes that the transportation sector has a significant impact on the environment, including the production of greenhouse gases and/or criteria air pollutants, and the environmental and health impacts of transportation choices. It identifies priority actions to help achieve TransformTO's long-term goals that 75% of trips under five kilometres be active trips, and that all vehicles be low or zero-emissions by 2050.

The Water Strategy supports the implementation of the Energy Strategy by coordinating efforts related to lake-source cooling and heat recovery from sewers.

4.7 Renewable Energy Strategy

As part of TransformTO, Environment and Energy Division staff will be leading the creation of a city-wide renewable energy strategy. The objective of a renewable energy strategy is to advance emerging clean technologies such as solar photovoltaics, wind, biogas, geo exchange and energy storage through a comprehensive long-term strategy developed with industry and community stakeholders.

Moving Forward

Successfully implementing the transformative actions set out in the Downtown Energy Strategy will be a coordinated effort, led by Environment and Energy in collaboration with City Planning and other Divisions, Agencies, and Corporations, as well as building developers and owners, and energy developers/asset owners. Continuing and building upon Aligned Initiatives identified here will drive implementation.

APPENDIX: TORONTO HYDRO LETTER OF SUPPORT

Toronto Hydro-Electric System Limited
14 Carlton Street
Toronto, Ontario M5B 1K5

Telephone:
Facsimile:
torontohydro.com

July 14, 2017

Gregg Lintern
Director, Community Planning, Toronto and East York District
City Planning Division

Jim Baxter
Director, Environment and Energy Division

City of Toronto
Metro Hall, 55 John Street
Toronto, ON. M5V 3C6

Dear Sirs,

Thank you for engaging Toronto Hydro in the TOcore Plan. The TOcore Plan provides a useful reference for Toronto's Downtown infrastructure needs in the near- and long-term. Toronto Hydro can confirm that we have taken TOcore into account as part of our short- and long-term asset management strategy – including the renewal and enhancement of electrical infrastructure to meet the growth and transformational needs of Toronto's Downtown. Our letter describes the process we are following, the steps we have taken already and those we will take in the future to meet the electrical infrastructure needs of the Downtown Core.

Toronto Hydro's infrastructure planning process is comprehensive and takes into account multiple inputs, including but not limited to, planned short- and long-term development activities, electricity load forecasting, natural growth, resiliency, conservation and demand management and climate change, to name a few. The TOcore Plan has provided valuable input into these considerations and will form part of our planning process to determine the best options and value for our customers, as well as minimize costs, address shareholder objectives and satisfy the long-term needs of the City.

Options we consider include both traditional "wires" solutions (i.e., building traditional electrical utility infrastructure) but also, where applicable, "non-wires" alternatives such as conservation, demand management, energy storage and distributed generation. More innovative solutions are also being explored and piloted to manage growth across the city. As these new technologies mature and the regulatory framework evolves, we will integrate them into our asset management plans.

In the short term, Toronto Hydro will continue to incorporate the city's growth needs in our load forecast and asset planning, while we make significant investments in the replacement of aging infrastructure to help improve reliability and to build in resiliency to safeguard our plant from the effects of climate change.

In fact, we are finalizing construction of a new transformer station (TS) Copeland TS. When it enters into service in 2018, it will provide increased capacity and resiliency benefits for present and future customer needs in the Downtown Core.

We are also developing the next five-year asset management plan and will seek approval from our regulator, the Ontario Energy Board, for investments needed as part of our 2020-2024 distribution rates application — expected to be filed in Q2 of 2018. Our infrastructure investments are contingent upon Ontario Energy Board approval.

For longer-term planning, we are continuing to work together with the Independent Electricity System Operator (IESO) and Hydro One under the provincially-driven Integrated Regional Resource Plan (IRRP) framework to plan for future local and regional resource needs. The IRRP is focused on mid- and long-term infrastructure needs with a 25 year horizon.

Through this framework, and with the input of the City of Toronto and others, we published in 2015 the IRRP for Toronto as well as a Regional Infrastructure Plan in 2016. Toronto Hydro is currently working with the IESO and Hydro One to undertake a new forecast of electrical needs in the Downtown using TOcore Plan and refresh the IRRP.

We want to assure you of our continued participation in initiatives such as TOcore as well as our continued efforts in planning and delivering solutions to meet the growth and transformation needs of the Toronto Downtown. Close coordination is crucial for Toronto Hydro to meet electricity infrastructure needs today and into the future.

Sincerely,

Dino Priore

EVP and Chief Engineering and Construction Officer

Chris Tyrrell

EVP and Chief Customer Care and Conservation Officer

CC: Anthony Haines, President and CEO, Toronto Hydro
David McFadden, Chair, Toronto Hydro Corporation
Ben La Pianta, EVP and Chief Electrical Operations and Procurement Officer
Conrad Sheppard, Director, Legal Services and Corporate Secretary

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