Transforming Toronto with Solar

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ONTARIO CLEAN AIR ALLIANCE

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Overview

Solar power is exploding on the world stage, accounting for 30% of the world's projected electricity capacity by 2030.[1] It is time for Toronto to get onboard the clean energy revolution. This report outlines how solar systems on buildings and large parking lots within Toronto could generate the equivalent of more than half of its total electricity needs.

In June of 2024, Toronto City Council adopted a motion requesting the Independent Electricity System Operator (IESO) and Toronto Hydro to develop an Integrated Regional Resource Plan (IRRP) for the City's electricity system that is aligned with its target of net zero greenhouse gas emissions by 2040.[2] The motion includes a call to phase-out virtually all gas-fired electricity generation at the Portlands Energy Centre on Toronto's waterfront by 2035 and increase local renewable energy generation to meet the city's low-carbon electricity needs both today and in future. In this process, it is vital that all stakeholders recognize the huge potential for solar generation within the city and address outdated barriers that continue to hinder progress.

By moving aggressively on solar, Toronto has an opportunity to become a national leader in solar energy, reducing its emissions, displacing dirty power, and building resilience, all while meeting its growing electricity needs.

Toronto's solar energy potential is equivalent to

50–80%

of Toronto's electricity needs

Toronto Has Huge Potential for Solar Generation

If many buildings and large parking lots in the city were to install solar systems, Toronto could generate up to 12 terawatt-hours (TWh) per year of clean energy (see **Table 1**). This is a staggering figure: equivalent to more than 50% of Toronto's total electricity consumption in 2023 (23.7 TWh)[3]. This clean, renewable electricity could offset polluting sources and help to meet the growing need for electricity as we increasingly electrify transportation, heating for buildings and industrial processes.

Table 1 | Solar Generation Potential of Toronto's Buildings and Large Parking Lots

Building type	Percent of roof footprint covered*	Capacity (Megawatts)	Generation (Terawatt hours/yr)	Avoided emissions (tonnes CO2e/yr)
Residential	25%	3,100	3.49	493,000
Residential apartment	30%	227	0.28	36,000
Commercial and commercial mixed use	30%	697	0.86	111,000
Institutional	30%	55	0.07	9,000
Industrial	30%	1,176	1.46	187,000
Parking lots (>1,500 m^2)	50%	4,776	5.83	759,000
Total		10,031	11.98	1,594,000

*See methodology for rationale.

The greatest potential for solar is from large open air parking lots where the City of Toronto can follow France's lead and require the installation of solar systems over half of the area of larger parking lots (>1,500 m^2).[4]

Solar systems on residential rooftops are another huge opportunity. A study by Dunsky highlighted that solar on homes and businesses are essential to cost-effectively achieving our country's net zero goals by 2050. In their analysis, aggressive policies to promote residential solar would see systems on 1 in 3 homes.[5]

Toronto's total solar potential in this analysis is nearly 6 times greater than the total output of the Portlands gas plant in 2023 (2.1 TWh).[6] Portlands is the city's largest single source of greenhouse gas emissions and a contributor to air pollution. Ontario is most reliant on generation from gas plants such as Portlands during peak and mid-peak hours, especially in summertime, which coincides with peak generation from solar systems: a third of Toronto's solar generation potential occurs during summer peak time-of-use hours and a further third occurs during mid-peak hours year-round.

Toronto's solar energy potential is
6–9 times
greater than the output of the Portlands gas plant

The analysis above is based on conservative estimates of the areas over parking lots and building roofs that could be covered by solar systems in Toronto. The technical potential for solar generation is likely significantly higher. With more ambitious assumptions (50% of all building footprint areas and 70% of areas of large parking lots), 19.6 TWh per year could be generated from solar systems within the city, which is more than 80% of Toronto's power needs in 2023, and more than 9 times the total output of the Portlands gas plant last year.

When paired with batteries, solar systems have the potential to provide resilience during power outages which may increase in frequency as extreme weather events become more common and intense.

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Changes are Needed to Unlock Solar Potential in Toronto

With growing demand for clean energy and falling equipment costs, there has never been a better time to install solar systems in Toronto. But out-of-date regulations, compensation structures and connection processes are hindering progress. The IESO, Toronto Hydro and the City of Toronto must work together to eliminate barriers and unlock solar potential.

1 The IESO and Toronto Hydro must establish a fair standard offer price for all solar power exports.

Most building or parking lot owners who install solar systems are compensated using net metering where credits for electricity added to the grid are used to offset the cost of electricity purchased from the grid. This system is unfair to owners because they are not paid for any net annual exports of clean electricity. The result is that some solar projects are downsized to avoid overproducing and some projects may be abandoned altogether if economies of scale cannot be achieved without generating electricity that is provided to the grid for free.

A better alternative is to offer a fair standard offer price for all solar electricity delivered to the grid. This fair price would ensure owners enjoy a financial benefit from investing in solar over the system's lifetime at a cost to the utility that is less than investments in large-scale centralized forms of new generation. This is possible today. According to the IESO, electricity from new distributed solar installations such as those on rooftops or over parking lots costs less to produce than electricity from new gas-fired power plants (on a Levelized Cost of Energy basis).[7]

Toronto Hydro and the IESO would also benefit from prioritizing new generation from rooftop and parking lot solar because it can avoid the need to invest in new transmission and distribution infrastructure, and because solar projects are better at meeting demand as it arises: solar projects can be implemented in months instead of the years that it takes to plan and build large power stations.

2 The Province of Ontario should eliminate or reduce its 15-metre property setback requirement for solar installations.

Ontario O. Reg 350/12 requires all ground-mounted, non-residential solar installations to be set back 15 metres from all property lines.[8] This is an unnecessary barrier to the realization of parking lot solar projects. The purpose of the regulation is to reduce the visual impacts for neighbouring properties,[9] but in urban settings solar canopies have the potential to improve the aesthetics of parking lots and improve a business's green image[10] rather than obscuring pristine sightlines.

The IESO, Toronto Hydro and the City of Toronto must

work together

3 The City of Toronto must remove bylaws that restrict energy projects in the front and side yards of commercial properties.

City of Toronto zoning by-law 569-2013, section 30.5.75 prohibits renewable energy installations in the front or side yards of commercial properties when those yards abut a street.[11] This prevents most commercial parking lots from installing solar canopies. Those solar systems can provide shading and protection from the elements for customers, clean energy for building operations, and low carbon exports for Toronto Hydro's grid.

4 Toronto Hydro must streamline solar applications and reduce connection fees.

Installing solar systems and getting them connected to the grid requires multiple steps, including preliminary consultations with the local utility, installation, inspections, and arranging grid connections. The fees from Toronto Hydro are among the highest in the province.[12] Delays can also occur at any stage and building owners are often required to manage the entire process.

In addition, Toronto Hydro requires projects over 10 kW of output (equivalent to systems on a typical home) to be subject to connection impact assessments to determine the impact of solar arrays on the local utility's distribution grid. These assessments can add thousands of dollars to the overall cost of the project and are often more comprehensive than necessary.

Toronto Hydro must follow through on its commitment to streamline the solar connection process.[13] For example, it should raise the 10 kW threshold for connection impact assessments to at least 25 kW to be aligned with North American best practices.[14] Instead of a full connection impact assessment, these smaller projects could undergo a simplified and low-cost connection screening. This would not require approval from the Ontario Energy Board and could be implemented immediately.[15] This could reduce costs that can be used to cut Toronto Hydro's fees.

5 Toronto Hydro must modernize its distribution network to support electrification and distributed energy generation.

Some solar projects do not get approved because grid conditions, such as capacity constraints, mean that the local distribution infrastructure cannot support the addition of new generation. Grid constraints can also be a barrier to the adoption of heat pumps and EV chargers. Given the urgent need to adopt low carbon technologies, Toronto Hydro should modernize and upgrade its grid to ensure all customers can install solar systems and low carbon technologies.

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The City of Toronto Can Lead the Way

Toronto has already installed over 100 solar arrays totalling 9 megawatts (MW) on its city-owned buildings and has a goal of increasing that to 37 MW by 2030.[16] Deployment of solar power systems is also a key recommendation of the TransformTO Net Zero Strategy for achieving the City of Toronto's goal of net zero emissions by 2040.[17]

Solar parking lots represent a major opportunity for the City of Toronto. The Toronto Parking Authority is North America's largest municipal parking operator, with profits from parking fees funding municipal programs and services.[18] Adding solar systems over its large open-air parking lots is an opportunity to showcase the potential for solar and generate new revenues to support important community services such as affordable housing.

The time to move is now because the IESO and Toronto Hydro have been asked by the City of Toronto to develop an Integrated Regional Resource Plan that will include strategies for the near-complete phase-out of the Portlands gas plant by 2035, and a rapid increase in local renewable electricity generation. This plan must recognize and champion the huge potential for solar in Toronto and provide a roadmap to eliminate the barriers that stand in the way.

Let's make Toronto the Solar Capital of Canada!

The time to move is now because the IESO and Toronto Hydro have been asked by the City of Toronto to develop an Integrated Regional Resource Plan

Methodology

The spreadsheets used to perform this analysis can be found on the Ontario Clean Air Alliance website.

Q Geographic Information System (QGIS) and City of Toronto zoning maps were used to get a count and total footprint area of all buildings plus open-air parking lots with areas greater than 1,500 square meters.

Solar panels were assumed to have 186 W/m^2.[19]

PVWatts[20] was used to estimate the kWh/kW for different solar system configurations in Toronto using default parameters and no production in January (due to snow coverage). For large buildings and parking lots, a 35° tilt and 180° azimuth were used. For residential buildings, a 4/12 roof pitch was used with the average for azimuths of 90°, 135°, 180°, 225° and 270° to account for the fact that roof may be facing east, south, west, and anything in between.

Annual generation during time of use blocks was calculated from Engineering Climate Datasets for Toronto.[21]

The 2024 and 2030 marginal emissions factor for each TOU period was calculated by taking the average emissions from an Ontario gas power plant (390 g CO2e/kWh)[22] multiplied by the percentage of time gas is on the margin for the TOU period.[23] The annual greenhouse gas emissions avoided with the solar array was calculated using this marginal emission factor, the percentage of annual solar generation that occurs during each TOU period and the annual kWh of electricity generated by the array.

The percentage of roof area covered is based on the assumption that:

- half of residential buildings are suitable for solar due to shading and orientation and they cover half of their footprint areas in solar;
- on average all residential apartment, commercial, institutional and industrial buildings cover 30% of roof areas with solar panels;
- on average all large parking lots cover half of their surface area with solar panels, based on requirements in France.[24]

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