Feedback Form

Regional Electricity Planning in Toronto – December 5, 2024

Feedback Provided by:

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Date: December 13, 2024

To promote transparency, feedback submitted will be posted on this engagement webpage unless otherwise requested by the sender.

Following the Toronto regional planning webinar held on December 5, 2024, the Independent Electricity System Operator (IESO) is seeking feedback on the draft regional electricity needs and the Local Achievable Potential Study. A copy of the presentations as well as recordings of the sessions can be accessed from the engagement web page.

Please submit feedback to engagement@ieso.ca by January 3, 2025.

Please note that most of my comments are in the last two pages of this submission.

Regional Planning - Draft Electricity Needs

Topic	Feedback
What feedback do you have regarding the draft electricity needs identified?	Please see the next two pages
What feedback do you have regarding how to meet the electricity needs to inform upcoming milestones?	Please see the next two pages
What additional information should be considered as we screen high-level potential options?	Please see the next two pages
What additional information should be provided in future engagements to help understand perspectives and insights?	Full information about the modelling used together with the assumptions employed for the modelling – for all scenarios.

Local Achievable Potential Study (LAPS)

Topic	Feedback
What feedback do you have on the scope that the IESO should consider?	Give more attention to heating requirements on very cold days.
What feedback do you have on the methodology that the IESO should consider?	Please see the above and the next two pages
What feedback do you have on the potential uses for the LAPS that the IESO should consider?	Please see the above and the next two pages
What additional sources or regional policies and trends should be considered?	Please see the above and the next two pages

General Comments/Feedback

It was hard to explain the unreal nature of the webinar in the spaces above – unreal because of the implausibly low estimate of peak electricity in 2044 following 100% electrification of space heating. This explanation is provided in the next two pages.

Introduction

Slide 16 presented at the webinar suggested that over the next 20 years electricity demand in the City of Toronto could grow from 4.8 to 8.4 GW (Winter High Electrification Forecast). The answer to a question at the webinar indicated that this forecast assumed 100% electrification of space heating.

The analysis below suggests that this forecast is implausibly low enough to raise doubts about the planning exercise that was the subject of the webinar. It mostly considers only what might be the electrical demand for space heating in the City of Toronto in 2044 during the coldest part of a winter day following hours of unusually low temperatures.[1] The analysis concludes with a pointer to how Toronto's peak electricity demand in 2044 could be reduced to below the level indicated in Slide 16.

Peak electricity demand: space heating in existing buildings

Regarding Toronto's existing buildings:

- Floor space in 2021 for Commercial-Institutional (CI), Multi-unit Residential (MR), and Single-family Residential (SR) buildings was 69, 52, and 69 million square metres (link).
- An SR building is served on average by a heat pump drawing 12 kW (link, link). There are some 450,000 SR dwellings in Toronto (link). Perhaps 15% of them will be served by ground-source heat pumps (GSHPs)[2] having an average heating coefficient of performance (COP)of 4.0, with the remainder using air-source heat pumps (ASHPs) with an average COP at -10°C of 1.2.[3] This points to a total SR demand of 4.8 GW. If a diversity factor of 1.2 is assumed,[4] the peak SR demand to be provided for would be 4.0 GW.
- In Toronto in 2021 there was roughly three-quarters as much apartment floor space as that in SR dwellings (link). On average, each square metre of MR floor space used a third less energy for space heating (link). If peak demand is proportional to total energy use, the electricity demand for space heating in MR buildings would be about 2.0 GW.
- The source at link suggest the energy intensity of space heating in Ontario's CI buildings is 2.7 times that of its SR buildings. However, the effective COP at -10°C could be three times higher because of the much lower use of ASHPs, and the diversity factor could be higher – perhaps 1.5 – because of lower use outside business hours. Putting this all together suggests a 2021 peak demand estimate for CI buildings of 2.9 GW.

Thus, the total peak demand for buildings existing in 2021 would be about 8.9 GW. Measures applied at buildings until 2044 could perhaps reduce this demand by 20%, to 7.1 GW (e.g., link, link, link).

Peak electricity demand: space heating new buildings

Newer buildings generally use less energy for space heating. The source at link suggests that the energy intensity of residential buildings constructed since 2016 was about half the average of all such

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[1] The source at link indicates that during the six winters from 2017 to 2023, there were 41 occasions when temperatures in Toronto remained below -10°C for 10-24 hours, and seven and five occasions when they were below -10°C for 24-48 hours and for more than 48 hours. It's hard to know whether variations in climate will change this distribution and, if they do, whether there will be more or fewer cold periods that may be longer or shorter.

[2] The penetration of GSHPs in Toronto will be constrained by their high cost and requirements for land.

[3] Limited use of cold-weather ASHPs is assumed on account of their high cost. Manitoba Hydro recommends that regular ASHPs not be used below -10°C (link). Most electric heating at these low temperatures is assumed to be resistive, with a COP of 1.0.

[4] The diversity factor takes into account that not every heat pump will be operating at the same time, and the consideration that the factor is generally lower when supply availability decreases (link).

buildings. Assuming a further reduction by 50% across the period until 2044 – i.e., new buildings would have energy intensities averaging about a quarter of that of existing buildings – and noting expected population growth in the City of Toronto of about 32% until 2044 (link) with commensurate construction, the expected addition to peak demand from new buildings would be about 0.7 GW.

Total peak electricity demand in 2044: all in-building uses

Thus, a conservative estimate of the peak demand to be served for fully electrified space heating in all buildings in the City of Toronto in 2044 could be 7.8 GW — i.e., almost the total demand of 8.4 GW suggested for *all* uses in the webinar's Slide 16.

Also to be served by Toronto's electricity supply at the peak will be provision of domestic hot water (perhaps 10% of the peak heating demand), EV charging, which could be about a quarter of Toronto's peak demand for space heating, and demand for cooking, lighting, industry, data centres, etc. – presently unknown, but perhaps also a quarter of the peak electricity demand for space heating. Together these other uses could total about 60% of the peak space heating demand, bringing the total demand to be served to about 12.5 GW.

This total is alarmingly more than the estimate presented at the webinar, suggesting that on very cold days, with 100% electrified heating, Toronto residents could be freezing in the dark for many hours – a life-threatening condition when the outside temperature is below -10°C.

Reconciliation of peak electricity demand estimates

It's not possible to figure out from the supporting document – the Technical Approach Memo at link – how the estimate of 8.4 GW in the webinar's Slide 16 can be reconciled with the above estimate of 12.5 GW. Clarification would be much appreciated.

Widespread deployment of district heating could reduce Toronto's peak electricity demand for space heating in 2044 by 50% or more,[5] bringing the peak demand estimated above for all uses to near the estimate in Slide 16 or even below it. In August 2024, Toronto Hydro issued a request for proposals "to conduct a research project … to understand the drivers behind the expansion of [Thermal Energy Networks] in the Toronto area" (see Toronto Hydro's RFP No. 24P-1663). This could well be a first step towards the widespread deployment of district heating that may be required to avoid freezing in the dark during the 2040s.

[5] This could be achieved by serving almost all Toronto buildings with thermal networks supplying hot water from a variety of sources. The simplest way to appreciate the extent of possible reduction in peak electricity demand is to consider that all the hot water is fed to the networks from large-scale heat pumps. They would be powered by electricity and extract heat from, for example, wastewater, lake water, borehole storage, etc. (but not from air), with an average COP of 4.0 on the coldest days. Such arrangements are being installed in Europe using heat pumps rated at 30 MW and higher (link, link). Deployment in Toronto for buildings without GSHPs could reduce these buildings' peak electricity demand for space heating by about 65%, or by about 50% for all buildings. Use of thermal networks with heat sources relying less on electricity – e.g., on seasonally stored hot water from solar thermal panels – could provide larger reductions in peak demand.