Feedback Form

Regional Electricity Planning in the Toronto Region – July 10, 2025

Feedback Provided by:

Name: John Stephenson

Title: Member

Organization: Boltzmann Institute

Email: [redacted]

Date: July 24, 2025

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

Following the Toronto regional planning webinar held on July 10, 2025, the Independent Electricity System Operator (IESO) is seeking feedback on the results of the options screening. A copy of the presentation as well as recording of the session can be accessed from the engagement web page.

Please submit feedback to engagement@ieso.ca by July 25, 2025.

Topic	Feedback
What feedback do you have regarding the results of the wire and non-wire options screening?	It is good that Ontario plans to pay more attention to energy efficiency. However, some caveats should be recognized. First there is the often observed "rebound effect" (also known as the Jevons Paradox). Increased efficiency in resource use (like energy) can paradoxically lead to a higher overall consumption of that resource. Essentially, if less is used in one way, more may be used another way, negating the expected energy savings. We can think of numerous examples of such increased use of electricity in households over the years. By way of contrast, replacement of natural gas or electricity by thermal energy is likely to be permanent. Once connected to thermal energy, customers tend to never go back to using natural gas or electricity for heating or cooling. And there is a limit to how warm we want our living spaces. In any case, that would not increase electricity demand. Hence district energy is a demand side management strategy with predictable, permanent results on an industrial scale, each project saving energy for multiple customers. And the capital cost per kilowatt saved is very competitive with the costs of energy savings programs to date and planned for the future. When electricity is substituted for natural gas using air source heat pumps there may appear to be energy saving, but it will not be a saving in costs to ratepayers as a whole. Most of the cost of electricity is driven by capacity. Air source heat pumps have a low operating capacity factor, as little as 8%, which results in the need for system capacity that generates lower than average offsetting revenue. This jacks up retail electricity prices for all ratepayers who effectively subsidize those who have installed the heat pumps. This could be avoided by replacing natural gas not so much with electricity as with local waste heat via thermal networks.

Topic	Feedback
What feedback do you have on the preliminary transmission wire options?	It would make more sense not to replace the PEC with a third transmission line. The economic comparison is between about 1 GW of new transmission into Toronto PLUS 1 GW of incremental generation somewhere outside Toronto versus the non-wires alternative of 1 GW of new generation at the PEC site. The wires (third line) option would be more expensive than new generation at the PEC site by approximately the cost of the third line, which is likely to be considerable. There are foreseeable challenges with all three options for the third line (public fear of EMF from more overhead high voltage lines, unknown costs for tunnelling, approvals for submarine cables in waters popular for recreation). Any, or a combination of four non-fossil fuels could be used to re-power the PEC without greenhouse gas emissions: 1) Contract for an equal volume of Renewable Natural Gas (RNG) – this could be implemented immediately with RNG delivered anywhere in Canada, not necessarily coincident but over time equal to the methane burned at PEC. 2) Replicate the 4 Darlington SMR's (or some other type of SMR) at the PEC site, in-service in the 2030's, but configured for Combined Heat and Power (CHP), i.e. controlled extraction/condensing turbines, not conventional power only condensing turbines. A) cogenerate hot water for new district heating systems in Ookwemin Minising (the new neighbourhood in the Port Lands), facilitated by large scale thermal energy storage (TES) to enhance dispatchability (for either or both heat and electric power), while also supplying steam to Enwave's existing 500 MW thermal downtown steam system. Storage of large amounts of energy in the form of hot water at modern district heating low supply temperatures is a lot more common

Topic	Feedback
	than storing hot water at pressures and temperatures from which district steam could be produced, but AI came up with a list of 15 commercial examples world-wide, so it is evidently not impossible and would be worth investigating, given the potential benefits of making the CHP dispatchable. (For example, it might involve a lined rock cavern at a suitable depth, that could be later re-purposed for hot water supply). B) convert Enwave's steam system to modern, low temperature hot water – this would facilitate TES, improving dispatchability of the CHP. Naturally this would be a cooperative venture with Enwave (owned by Ontario Teachers), possibly with finance from the Canada infrastructure Bank. 3) in parallel with option 2, and likely complementary, investigate the feasibility of a new thermal power plant at the PEC site fueled by local biomass and/or municipal solid waste (MSW), configured as CHP with TES per options 2A and 2B. These fuels could be delivered by lake barge via the ship channel and unloaded using covered material handling equipment to obviate dust, odours or noise, with no outside storage. Ash would be disposed of also by barge. The CHP facility could be designed to be architecturally attractive, or interesting, like the Copenhill in Copenhagen, which incorporates a scenic lookout/bar on a high roof, ski slopes and a climbing wall. A further development of this idea would use gasification, not combustion, thereby avoiding a possibly controversial new tall stack, such that the existing short stubby PEC stacks could be re-purposed (as might much of the PEC because it would still be essentially a gas turbine combined cycle – the only difference being the source of gas would be non-fossil, local, produced on-site).

Topic	Feedback
	Whatever the fuel used, large scale TES, now well proven in Europe and China, allows hourly heat and power outputs to be controlled to ensure reliability of both electric and thermal energy supply, whatever the season. For example, if there were too much local power generation at noon in summer due to a proliferation of distribution connected solar PV, the CHP operation could be modulated to produce less power and more useful heat, which could be stored. It would thereby continue at full power output, producing valuable energy products, yet avoiding curtailment of other clean generators. Conversely in winter, in hours when more power was needed, heat production could be reduced or curtailed yet customer supply maintained from TES. Thus, enabled by large-scale TES, which is a game-changer, yet very economic (less than 1/100th the cost of battery electric storage), CHP could potentially produce approximately twice the retail value of energy products (annually about the same amount of heat as electricity) for a very similar investment, thereby helping to mitigate electricity rates. These opportunities to keep energy costs down for households and businesses, while still reducing emissions, ought to be carefully considered at the strategic planning level (as they have been in China, see later comments), whether in IRRP's or on a provincial level perhaps by the Ontario Energy Board (OEB), whose remit is protect the public interest.
What feedback do you have regarding how screened-in options could inform the options analysis and draft recommendations?	It is good that the IESO is engaging with energy service providers and the City of Toronto to understand the potential for district energy systems within the city. These studies should not be limited to new development. AI informs that based on current projections and industry research, it is estimated that about 50% to 70% of the buildings standing in Toronto in 2025 will still be in use by 2050. Hence, the goal of

Topic	Feedback
	zero emissions from buildings can be reached only if heating of existing buildings is also decarbonized. To ensure reaching zero emissions from buildings requires a thorough, detailed, data-driven thermal energy plan, led by each municipality, such as is mandated by the Energy Efficiency Directive of the European Union (more on this in later comments). This would be ancillary to, but feed into, IRRP's.
Additional information that should be provided in future engagements to help understand perspectives and insights.	The Province should push the municipalities, and support them, into engaging in thermal energy planning, which would provide more accurate fact-based data for IRRP's.

General Comments/Feedback

My comments are informed by 40 years professional (both operating and consulting) experience in the electricity and thermal energy businesses and participation in a two-year research project recently completed by the Boltzmann Institute (BI), partially funded by Environment and Climate Change Canada. The 189-page Two Pathways report, its six annexes, a documentary video and an Executive Summary are available via BI's website www.bi-ib.ca.

These links have been forwarded to the OEB and the IESO, with yet no response. But it is highly recommended that both take note of the results of this rigorous, data-driven research to inform future planning strategies that ought to be undertaken in parallel with thermal energy planning led by municipalities but supported by both senior levels of government.

Thermal energy planning requires factual understanding of peak winter heat loads at a granular scale, for example Forward Sortation Areas (FSA), the first 3 characters of a postal code. This is difficult but not impossible using local gas consumption data in concert with hourly temperatures from local weather stations. It appears that such necessary rigour was not employed to inform the Winter High Electrification forecast.

In the high electrification scenario—where EV policies, new developments, and data centres are accommodated and all buildings are electrified by 2040—TIRRP projects the annual peak to grow from around 4,800 MW in 2024 to roughly 8,200 MW in 2040, an increase of 3,400 MW. BI's estimate of the magnitude of incremental winter peak power demand from space heating electrification alone (not counting domestic hot water, EV's, data centres, etc.) would be approximately four times that - 15,000 MW.

This is based on analysis for six past years, 2019 through 2023, hypothesizing overnight 100% electrification and estimating the heating demand hourly profile in each of those years. It assumed

93% air source heat pumps and 7% ground source heat pumps, which is reasonable, based on the population density in Toronto.

Some possible reasons for the vast discrepancy between TIRRP's high electrification forecast and BI may be:

(i) failure (by the TIRRP) to estimate the aggregate hourly heat load in Toronto at the winter heating peak (this is not a parameter commonly measured, but can be estimated with various levels of accuracy depending on data availability for defined areas from gas consumption and local hourly outdoor temperature data),

(ii) failure to recognize that the effective Coefficient of Performance of air source heat pumps including supplementary electric resistance falls to essentially 1 at the coldest outside air temperatures experienced in Toronto, and,

(iii) overly optimistic hopes about the potential for decreasing peak energy demand through building improvements. For example, the TransformTO Net Zero Existing Buildings Strategy (2021) assumed a 75% decrease in thermal demand, a feat never achieved anywhere for significant numbers of buildings. Which is not to say that something that has never been done cannot be done in future, there is always a first for everything, but usually there is a reason. In this case, there is no reason to expect owners of almost half a million buildings to undertake expensive improvements, having no economic pay back, nor to acquiesce in any moves to make that mandatory.

Having said all that, there is a scant chance the TIRRP demand forecast will prove to be drastically underestimated because the actual uptake of heat pumps is unlikely to be significant. The IESO's APO assumption of 7% by 2050 is likely to be close to the mark.

This means that achievement of zero emissions from buildings must look to another pathway and those concerned with achieving that goal would be advised to look at the potential and then support planning and development of thermal energy networks using upgraded local residual and environmental heat. The Two Pathways project determined that compared with the electrification pathway, thermal networks would be about half the cost to ratepayers/taxpayers.

The following are further notes re possibility of a MSW CHP at the PEC site. On a personal level, besides Copenhill, I am also familiar with both the Energy from Waste CHP facility in my alma mater City of Leeds that supplies hot water to the City's district heating system and which has no smells, no dust, you could eat off the floor and is beautiful architecturally with a huge green wall on one side, and also, in sad contrast, with the City of Toronto's Green Lane Landfill, which is ugly and nearing capacity. Must additional farmland be despoiled for yet another ugly landfill in somebody else's backyard? As an environmentalist, I am ashamed that Toronto fails to clean up its own mess, trucking it 200 kilometres, consuming, estimated by AI, about 20,200 litres of diesel per day with all the associated pollutants, not to mention toxic leachate and fugitive methane at the landfill. Landfills are largely banned in Europe, for good reasons.

The City of Toronto will exhaust its present landfill arrangement (Green Lane Landfill, in Southwold) in about a decade, about the time that all of Ontario's present landfill space is exhausted. It takes a decade or more to approve a new landfill. Getting the kind of capacity required for Toronto is considered nearly impossible. Michigan beckons again, but the nearest site is 350 kilometres distant. And there could be tariffs on waste!

A May 2023 City report suggested it could take up to 18 years to approve an Energy from Waste facility, but that depends almost entirely on the Province, which may be motivated to expedite to keep energy costs down, and more good farmland from being defiled.

Despite a vocal anti-crowd, a good majority of the overall population has supported Energy from Waste in the past and may now be more inclined to do so, especially if it took inspiration from Copenhill with a high scenic waterfront lookout, and a superb recreation centre (perhaps a water park connected with a long chute to the outer harbour in summer and ski hill in winter, avoiding more greenhouse gas emissions from those who would drive to Collingwood and beyond).

Nuclear CHP was previously confined to Eastern Europe, (with a couple of exceptions, in Sweden and Switzerland). But now China is leading the way. Five nuclear CHP district heating case studies were presented at this year's AGM of the Canadian Nuclear Society, forwarded to BI from Professor Jianjun Xia from the School of Architecture, Tsinghua University, Beijing, China, who unfortunately could not secure a visa in time, but asked BI to present on his behalf. These included a plan to pipe hot water from a nuclear CHP up to 125 kilometres.

It is long past time Ontario woke up and smelled the coffee related to such opportunities and to that end BI is in the early stages of planning a study tour of several Chinese nuclear CHP facilities supplying district heating, tentatively scheduled for 2026 or 2027. The IESO and OEB ought to send representatives.