RESEARCH NOTE — SUBMISSION TO PUBLIC CONSULTATION

ALTO High-Speed Rail: Electricity Demand and Grid Integration Risk

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Prepared by	ALTO HSR Citizens Research Initiative
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Summary

ALTO has publicly disclosed almost no information about the electricity its high-speed rail network will consume, the substations it will require, or how those demands intersect with Ontario's already-stressed transmission grid. What limited information does exist, drawn from an access-to-information request obtained by The Canadian Press and a February 2026 interview with CEO Martin Imbleau, reveals demands that conflict directly with active grid planning studies in Eastern Ontario. This brief documents the disclosure gap, quantifies the known demand figures, identifies the specific planning processes from which ALTO's load appears to be absent, and assesses the physical land requirements for traction substation infrastructure that have not been publicly discussed.

1. What ALTO Has Said Publicly

ALTO's public communications on electricity are remarkably thin. The entirety of the project's public disclosure on this topic consists of a single FAQ entry on altotrain.ca:

> *ALTO FAQ — altotrain.ca (accessed March 2026)*
>
> *"ALTO will be 100% electric and powered from low-carbon sources like hydro and nuclear. That will make ALTO one of the lowest-emission transport solutions in the country. ALTO will work closely with federal and provincial governments and power utilities to ensure the electricity needs of the project are evaluated by the highest authorities in Quebec and Ontario."*

This statement contains no figures. It names no utilities, commits to no timeline for grid integration studies, and uses the notably weak formulation that electricity needs will be "evaluated" — not assessed, disclosed, quantified, or planned for. No document on ALTO's public website discloses:

- Estimated total annual electricity consumption (TWh or GWh)
- Peak instantaneous demand (MW)
- Number, location, or capacity of planned traction substations
- Confirmation that IESO or Hydro One have been formally notified of project load
- Reference to Ontario's Eastern Ontario Bulk Planning engagement or Supply to Belleville study

2. What CEO Martin Imbleau Has Said — February 2026

In a February 8, 2026 interview with The Canadian Press, Imbleau provided the most substantive public disclosure to date on ALTO's electricity needs:

> *Martin Imbleau — Canadian Press, February 8, 2026*
>
> *"I haven't done the calculations on a yearly basis, but at any one point in time we need 50 megawatts of power to supply a train running at 300 kilometres safely."*
>
> *On total demand: "It's a significant block. But we're already in discussion with Hydro-Québec to make sure the capacity is there, and there's no issue either in Ontario."*

The same article reported that Imbleau expects to build up to a dozen traction substations along the corridor. University of Ottawa professor Ryan Katz-Rosene was quoted: "Each of those little substations is like powering a small town. So then the question becomes, can the existing grid handle it?" He estimated the full network would drain between one and three per cent of Ontario and Quebec's current electrical capacity.

3. What an Access-to-Information Request Revealed

The Canadian Press obtained documents through an Access to Information Act request referencing a 2023 study by ALTO's predecessor organization (VIA HFR). That study showed the following estimated power supply split:

Supply Source	Estimated Share of ALTO Load
Hydro-Québec	Approximately one-third (33%)
Hydro One (Ontario)	Approximately two-thirds (67%)

This split has significant implications: Ontario's grid is expected to carry the majority of ALTO's traction power load. Yet Imbleau's assurance of "no issue in Ontario" was offered without reference to any equivalent engagement with IESO, Hydro One, or Ontario's grid planning processes.

Critical note: These figures were produced under the original high-frequency rail (HFR) design. The February 2025 announcement that ALTO would be built as true high-speed rail (300 km/h) on fully dedicated track substantially increases power requirements. No updated electricity demand figures have been made public.

4. What 50 Megawatts Per Train Actually Means

Imbleau's figure of 50 MW per train is consistent with international HSR benchmarks. During peak hours, with multiple trains operating simultaneously across a 1,000 km corridor, simultaneous substation demand could reach several hundred megawatts. The demand profile is not 50 MW once, but 50 MW per active train across all operating substations simultaneously.

Parameter	Figure / Derived Estimate
Power per train at speed	50 MW (Imbleau, Feb 2026)
Planned substations (full corridor)	Up to 12 (Imbleau, Feb 2026)
Trains per day (planned)	72
Ontario share of network load	~67% (2023 ATI documents)
Ontario peak traction load (estimated)	200–400 MW simultaneously at full service
Ontario grid demand growth forecast	75% increase by 2050 (IESO)

The "up to a dozen substations" figure warrants scrutiny. The California High-Speed Rail Authority's design standard (Technical Memorandum TM 3.1.1.3, Traction Power Facilities — General Standardization Requirements, Parsons Brinckerhoff for California HSR Authority, June 2010) specifies that full traction power substations "should be spaced approximately every 30 miles" — approximately 48 km. Applied to a 1,000 km corridor, that standard implies approximately 20 full traction substations, not 12. There is an important technical distinction, however: modern HSR uses a 2×25 kV autotransformer feed system in which the full traction substations (TSS) — the expensive installations requiring a 115–230 kV bulk grid connection — are complemented by intermediate autotransformer or paralleling stations (AT/PS) spaced every 8–13 km that have no direct bulk grid connection. If Imbleau's "up to a dozen" refers only to full TSS in a 2×25 kV configuration, spacing of 83 km between full substations sits at the outer edge of but is not necessarily outside all published design precedents for this system type. However, ALTO has not explained which counting convention applies, and has not disclosed how many intermediate AT/PS facilities would be required across the Ontario corridor, each of which represents additional land acquisition and grid interface infrastructure. A full traction power system for a 1,000 km corridor at 300 km/h would include dozens of AT/PS installations in addition to any full TSS — a land and infrastructure requirement that has received no public disclosure. These figures may also reflect an early-stage estimate or refer only to the Ottawa–Montréal first segment.

5. International Comparators: What Established HSR Systems Tell Us

Because ALTO has not disclosed annual energy consumption figures, international HSR benchmarks can establish an independent baseline against which any future disclosure can be assessed. The table below summarises published consumption data from comparable 300 km/h wheel-on-rail systems:

System	Speed	Energy per train-km	Notes
Japanese Shinkansen N700 (8-car)	285–300 km/h	~21.5 kWh/km	One of the most energy-efficient at this speed class
Chinese CR400 (350 km/h)	350 km/h	~21.4 kWh/km	At higher speed; comparable figure reflects efficient rolling stock
French TGV Duplex (300 km/h)	300 km/h	~42–52 Wh/seat-km	Higher per-seat consumption than Shinkansen due to vehicle weight
German ICE 3 (300 km/h)	300 km/h	~40–59 Wh/seat-km	Range reflects varying route profiles and regenerative braking

Applying the Shinkansen benchmark to ALTO's disclosed operating parameters (72 trains/day, 1,000 km corridor): a conservative estimate yields annual energy consumption of approximately 560–750 GWh per year for the Ontario portion of the network alone — equivalent to the annual consumption of 50,000–60,000 Ontario households. These figures are independent estimates only; ALTO has not disclosed its own projections.

The emission-intensity assumption in ALTO's FAQ, that the system will be powered from "low-carbon sources like hydro and nuclear", also warrants scrutiny. Ontario's grid carbon intensity is already rising as data centres, EV charging, and building electrification compete for clean supply. By the time ALTO reaches full service, the marginal unit of electricity required to supply peak traction load may not be hydro or nuclear. ALTO has provided no analysis of grid carbon intensity under its anticipated operating conditions.

6. Substation Physical Footprint and Land Expropriation

Traction substations for a 300 km/h HSR system are large, permanent industrial installations that require dedicated land, high-voltage transmission connections, access roads, and security perimeters. This dimension of ALTO's infrastructure has received no public attention — yet it represents a distinct category of land expropriation beyond the rail corridor itself.

6.1 What a Traction Substation Requires

A standard 25kV AC traction power substation for HSR (the voltage class used by all modern 300 km/h systems) consists of: one or more main power transformers converting incoming 115–230 kV bulk supply to 25 kV traction voltage; high-voltage switchgear and protection systems; power factor correction equipment; a security perimeter fence; and vehicle access for maintenance. The California High-Speed Rail Authority's published technical standards, the most detailed publicly available benchmark for a North American HSR system, specify that traction substations must be located within approximately 30 metres of the track alignment where possible. Where a substation is sited away from the track, an additional 12-metre wide strip of land is required for underground duct banks connecting the substation to the overhead contact system.

Based on published specifications for comparable 25kV HSR systems, a full traction power substation compound (equipment, switchgear, access road, and security fencing) typically occupies 0.5 to 2 hectares of land. The lower end of this range applies to compact, standardised sites on flat terrain with direct bulk grid access; the upper end applies to sites requiring additional civil works, retaining structures, or custom layouts due to terrain constraints.

6.2 Applying This to ALTO: Land Requirement Estimates

If ALTO deploys the technically appropriate number of substations for a 1,000 km corridor operating at 300 km/h (20–33 sites, as discussed in Section 4), total land acquisition for substation compounds alone would be approximately:

Substation Count Scenario	Site Area per Substation	Total Substation Land
12 substations (Imbleau figure)	0.5–2 ha each	6–24 hectares
20 substations (lower technical estimate)	0.5–2 ha each	10–40 hectares
33 substations (upper technical estimate)	0.5–2 ha each	17–66 hectares

These figures do not include the new bulk transmission infrastructure required to supply each substation. A 25–60 MW traction substation requires a 115 kV or 230 kV connection to the existing bulk grid. In rural Eastern Ontario, where the southern ALTO corridor runs through areas with limited existing high-voltage infrastructure, each substation may require a new transmission line spur of several kilometres, with its own right-of-way (typically 30–45 metres wide for 115 kV).

6.3 Southern Corridor Constraints

The southern corridor through the Frontenac Arch and Napanee Limestone Plain presents specific siting constraints that would complicate substation land acquisition beyond what comparable flat-terrain projects have encountered:

- Karst dissolution features: Siting a heavy electrical installation (transformers, switchgear, oil-filled equipment) on dissolution-prone limestone requires detailed subsurface investigation and potentially deep foundation engineering. Sinkhole risk and groundwater sensitivity may exclude otherwise suitable sites.
- Wetland density: The corridor traverses extensive wetland complexes. Substation sites must avoid regulated wetlands; each excluded site expands the search radius and may require expropriation of land further from the alignment.
- Existing transmission gaps: The Eastern Ontario bulk grid in the corridor between Kingston and Ottawa is not uniformly well-served by 115–230 kV infrastructure. New transmission line rights-of-way for traction substation supply would represent additional expropriation entirely separate from the rail corridor. By contrast, the northern corridor along Highway 7 benefits from a major planned transmission upgrade: Hydro One's Durham Kawartha Power Line project will construct a new double-circuit 230 kV line from Clarington TS to Dobbin TS near Peterborough, adding over 400 MW to eastern Ontario with IESO-recommended in-service by 2029. No equivalent planned bulk transmission reinforcement exists along the southern corridor alignment.
- Agricultural land: Much of the rural Eastern Ontario corridor is Class 1–3 agricultural land. Permanent substation sites convert productive farmland to industrial use with no prospect of restoration.

None of these constraints have been publicly assessed by ALTO. No substation site selection process has been disclosed. Landowners and municipalities in the affected corridor have received no information about potential substation locations or associated expropriation requirements.

7. Total Land Footprint: Putting the Numbers Together

ALTO's corridor, substations, stations, and maintenance infrastructure together represent one of the largest single land acquisition programmes in Canadian history. The table below draws together estimates from international HSR benchmarks and applies them to ALTO's disclosed parameters.

Land Component	Low Estimate	High Estimate
Rail corridor (60 m × 1,000 km)	14,826 acres	14,826 acres
Traction substations (20–33 sites)	25 acres	163 acres
Bulk transmission spurs to substations	297 acres	1,834 acres
Stations — 7 stops (urban + greenfield)	116 acres	274 acres
Maintenance depots + stabling yards	136 acres	494 acres
Total	~15,400 acres	~17,600 acres

7.1 What 15,000–18,000 Acres Means in Practice

Numbers at this scale are difficult to comprehend in the abstract. Some comparisons that help:

- The total footprint is roughly equivalent to the entire urban area of Kingston, Ontario, every street, house, park, and business, taken as a continuous strip across Eastern Ontario.
- It is approximately three times the total area of the Town of Perth, Ontario.
- It is equivalent to 18–21 Central Parks laid end to end.
- It is comparable to all the farmland in a typical Eastern Ontario township.

The corridor alone, at 60 metres wide and 1,000 km long, runs the equivalent of a drive from Kingston to North Bay. Every farm, woodlot, wetland, and rural road in that strip is either acquired outright or severed.

The critical distinction from a highway: a highway can be crossed at grade. Every kilometre of HSR corridor is fully fenced and impermeable, no level crossings anywhere. A farmer whose land sits on both sides of the alignment does not lose 60 metres of productive land. They lose the ability to operate both halves as a single farm. This severance effect multiplies the practical impact of the corridor far beyond its physical footprint.

7.2 Greenfield Stations: An Underappreciated Land Category

Of ALTO's seven planned stops, at least two, Peterborough (Coldsprings) and Laval, are greenfield suburban sites with no existing rail infrastructure. California HSR's comparable greenfield stations are consuming 20–50 acres for the station compound alone, with surface parking for 2,800–3,400 cars adding another 10–15 acres per site. Peterborough City Council has approved $1 million in planning funds for the Coldsprings area. No land acquisition figures for that site have been publicly released by ALTO.

7.3 Maintenance Facilities: Undisclosed

A 1,000 km HSR line requires 2–3 heavy maintenance depots of 20–50 hectares each, plus several overnight stabling yards. ALTO has not publicly identified any maintenance facility sites, discussed their land requirements, or indicated whether they fall within or outside the 60-metre corridor study area. These facilities represent an additional 136–494 acres of land acquisition that has received no public attention.

8. Ontario Grid Planning: What Is Already Underway

Ontario's grid planners are conducting active studies in the affected corridor right now — without any evidence that ALTO's load has been factored in.

7.1 IESO Eastern Ontario Bulk Planning Engagement

The Independent Electricity System Operator (IESO) has launched an Eastern Ontario Bulk Planning engagement to assess transmission adequacy over the next 20 years. Its stated objectives include supply adequacy for key focus areas including Ottawa and Belleville, intertie expansion with Québec and New York, and transmission capability improvements for new resources in Eastern Ontario. The "Supply to Belleville" sub-study is a focused assessment of bulk transmission serving the Belleville area in response to regional demand growth. The southern ALTO corridor runs directly through this zone.

7.2 Hydro One 2025 Regional Planning Status Report

Hydro One's October 2025 Regional Planning Status Report (filed with the Ontario Energy Board) documents accelerated needs assessments in precisely the regions ALTO would traverse:

- Greater Ottawa: Needs Assessment completed December 2022; Regional Infrastructure Plan due February 2026
- Peterborough to Kingston: Needs Assessment completed December 2024; Scoping Assessment completed April 2025; IRRP underway, completion estimated November 2026. Note: Hydro One's Durham Kawartha Power Line project — a new double-circuit 230 kV line from Clarington Transformer Station to Dobbin Transformer Station near Peterborough — will add over 400 MW of capacity to this region. IESO has recommended in-service no later than 2029; the Environmental Study Report was finalised and submitted to MECP in late 2025. This upgrade is aligned with the northern ALTO corridor and would represent existing planned bulk transmission infrastructure relevant to traction substation supply on that alignment. (Sources: Hydro One Durham Kawartha Power Line project page, hydroone.com; Peterborough to Kingston Needs Assessment, December 2024.)
- St. Lawrence: Needs Assessment to be initiated Q1 2026

7.3 The Disclosure Gap

There is no public evidence that ALTO has submitted its electricity demand projections to IESO, participated in the Eastern Ontario Bulk Planning engagement, or provided load information to Hydro One for incorporation into regional planning assessments. If ALTO's load has not been disclosed to these processes, the studies currently being conducted are planning for a grid that will be materially inadequate the day ALTO opens — with the gap falling disproportionately on the Eastern Ontario transmission system serving communities along the southern corridor.

9. The Data Centre Precedent: A Process ALTO Has Not Followed

The disclosure gap is not a technical inevitability — it is a choice. Ontario's electricity system has a well-established regulatory process for large new loads. It requires any organization seeking to connect a new facility to the IESO-controlled grid to complete a formal System Impact Assessment (SIA), which identifies the adverse effects the project will have on grid reliability and the system upgrades required to mitigate them. Conditional approval typically requires approximately one year; for projects requiring significant new transmission reinforcements, total lead times to energization can extend several additional years.

Data centre developers — whose loads at large facilities are comparable in scale to individual ALTO substations — have been required to follow this process in full. Ontario's government introduced Bill 40 in June 2025 to create specific connection rules for large data centres precisely because the volume and scale of load requests was placing pressure on the IESO's connection assessment process. The regulatory precedent is unambiguous: a new load of 20–60 MW at each of 20–33 substation locations — totalling 200–400 MW on the Ontario grid — requires formal engagement with IESO and Hydro One before construction, not after route selection.

There is no public record of ALTO having filed a System Impact Assessment application with IESO, nor any public acknowledgment that such a filing is planned or underway. Imbleau's February 2026 assurance of "no issue in Ontario" does not constitute a system impact assessment, nor does it substitute for one.

10. The Timeline Mismatch

A critical sequencing problem has received no public attention. Hydro One's Peterborough-to-Kingston Integrated Regional Resource Plan (IRRP) — the most directly relevant grid study to the southern ALTO corridor — is not expected to conclude until November 2026. ALTO's route selection decision is expected to precede that date.

This means: the most important regional grid study for the southern corridor will be completed after the route decision has been made. If ALTO's load has not been submitted to that process before its conclusions are drawn, the IRRP will not model the corridor that is actually being planned. The grid infrastructure recommendations that emerge from it will be inadequate — by design — the moment ALTO comes online. Correcting that inadequacy will require reopening completed assessments, commissioning new studies, and constructing infrastructure that was not included in the original plan. All of that delay and additional cost is downstream of a disclosure failure that could be remedied now.

11. Who Pays for New Transmission Infrastructure?

The brief has established that new 115–230 kV transmission lines will likely be required in rural Eastern Ontario to supply ALTO's traction substations. The question of who bears that cost has not been addressed publicly.

Under Ontario's regulatory framework, large load connections that require transmission reinforcements are generally subject to cost responsibility rules that can require the connecting party to fund or contribute to required system upgrades. For data centres and other large industrial loads, the IESO's System Impact Assessment process identifies required upgrades and assigns cost responsibility. For infrastructure of provincial or federal significance, the Ontario Energy Board may determine that costs should be socialized across the ratepayer base.

Neither outcome is obviously preferable from a public interest standpoint. If ALTO bears the full cost of required transmission upgrades, those costs — unquantified and absent from any published fiscal model — increase the project's true capital requirement. If costs are socialized across Ontario ratepayers, electricity consumers across the province bear the infrastructure cost of a project that serves a specific corridor. The McGill TRAM report's self-sustainability model has not been assessed against either scenario.

12. Questions ALTO Has Not Answered

- Has ALTO submitted electricity demand projections to IESO? If so, when, and have those figures been incorporated into the Eastern Ontario Bulk Planning engagement and the Supply to Belleville sub-study?
- What are the updated electricity demand figures for full HSR? The 2023 ATI documents predate the February 2025 pivot to 300 km/h HSR. Peak power requirements at 300 km/h are substantially higher. What are current estimates?
- Why does the "up to a dozen substations" figure appear low? Standard HSR substation spacing for a 1,000 km line implies 20–33 substations. Is the 12-substation figure a preliminary estimate, corridor-specific, or based on a different technical architecture?
- Where will traction substations be sited? What is the expropriation footprint for each site, including access roads and associated bulk transmission line corridors? Have landowners in the corridor been notified of potential substation locations?
- What new bulk transmission infrastructure will be required, and who will pay for it? Traction substations of 20–60 MW each require 115 kV or 230 kV supply from the bulk grid. What new lines are needed in rural Eastern Ontario and how will costs be allocated?
- Has ALTO filed a System Impact Assessment with IESO? If not, when will it do so, and how will the results be incorporated into route selection?
- What engagement has occurred with Hydro One and IESO specifically regarding the Ontario corridor? Imbleau named only Hydro-Québec as an active discussion partner. Ontario carries an estimated two-thirds of the load.
- How do electricity costs factor into ALTO's fiscal projections? The McGill TRAM self-sustainability model has not been assessed against realistic electricity costs for a 300 km/h system at full service frequency, nor against the cost of required transmission upgrades.
- Does the southern corridor's karst and wetland terrain create additional substation siting constraints? Foundation engineering on dissolution-prone limestone and proximity to sensitive karst aquifers may impose significant additional cost and environmental review requirements not present on the northern corridor.
- What is the grid carbon intensity assumption underlying ALTO's low-emission claim? By the time ALTO operates, the marginal electricity required to supply peak traction load may not come from hydro or nuclear. What emissions modelling has been done under realistic grid-mix scenarios for the 2035–2050 operating period?

13. Recommendations

- ALTO should publicly release its current electricity demand projections, including annual GWh consumption, peak MW demand, and the number, location, and estimated land footprint of planned traction substations, as a precondition to final route selection.
- ALTO should file a System Impact Assessment application with IESO immediately. The current absence of any public record of such a filing is inconsistent with the scale of the load and the proximity of route selection decisions.
- IESO should confirm whether ALTO's load has been incorporated into the Eastern Ontario Bulk Planning engagement and the Supply to Belleville sub-study. If not, those studies should be supplemented before conclusions are drawn.
- Hydro One's Peterborough-to-Kingston IRRP (due November 2026) should be conditioned on receiving ALTO's traction load projections before finalising its conclusions. A grid study that does not include ALTO's load will be inadequate from the day it is published.
- The Parliamentary Budget Officer should verify whether ALTO's fiscal self-sustainability projections include realistic electricity cost assumptions for full 300 km/h service, and whether required transmission upgrade costs have been included in the capital programme.
- The federal Impact Assessment for ALTO should include a mandatory Grid Integration Assessment addressing bulk transmission capacity, new infrastructure requirements, substation land expropriation, and corridor-specific siting constraints.
- Access to Information requests should be filed with VIA Rail/ALTO and Transport Canada for the 2023 electricity demand study and any subsequent updates, and with Hydro One and IESO for any records of formal engagement with ALTO regarding HSR traction power load in Ontario.

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