NO LITTLE PLAN:

Electrifying GO Transit

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TRANSIT FOR A HEALTHY CITY

Transport Action Ontario

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BY

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PART 2 of 4: CHAPTERS 2 and 3

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"As diesel locomotive operators, we are the prisoners of a single fuel; a fuel that is fast becoming a pawn on the chessboard of international politics. One does not need sophisticated techniques for predicting the future to form the view that, whatever else happens, its price is bound to rise."

Keith Campbell
Vice-President, Administration
Canadian Pacific Railway
1972

The benefits and the means of electrifying GO have been studied on numerous occasions in the past by GO, the Government of Ontario and qualified outside parties. Each of the previous studies contains data still relevant to the issue today. Indeed, many of the answers have been sitting on government bookshelves for decades and, from the start, it has struck many informed observers that the recent Metrolinx exploration of the issue is merely an expensive re-ploughing of old ground.

Electric commuter rail service was no mystery to GO Transit staff when they launched the service in 1967. Some were former CN staffers with experience on that railway's Montreal electric line, which had run from downtown through Mount Royal to the northern suburbs since 1918. Others had worked on electrified rail and transit operations elsewhere before joining GO. But the early days of GO were no time for electrification dreams. With slim budgets and a growing call for expansion of the Lakeshore service to other lines, GO had to stretch its provincial funding thin. The OPEC oil embargo encouraged management to keep a watch on electric rail developments, but little else.

That situation changed for a reason unrelated to electrification. On November 10, 1979, an eastbound CP freight train with several tank cars of dangerous commodities derailed near Mavis Road in Mississauga. The fear of a chlorine cloud from a ruptured tank car resulted in the evacuation of 200,000 residents. The public and the media were whipped into a frenzy. The provincial government of Premier Bill Davis announced the formation of the Ontario Task Force on Provincial Rail Policy to investigate the state of the railways, explore their potential and "safeguard the public interest." The group was led by MPP Margaret Scrivener and backed by a panel of planners, academics and senior Ontario bureaucrats.

Although rail matters had always been largely federal responsibilities, the Province had several reasons for wading into the fray. First, the public and the media wanted to know what the Province was going to do about the perceived deterioration of the railways, even though they weren't under Ontario's legislative control.

As well, GO was enmeshed in tough negotiations with CN over its operating agreement, which had expired in 1977. CN wanted a substantial fee increase. It also insisted GO-related improvements be totally funded by Ontario and all upgraded infrastructure was to be the railway's property. The Province was eager to resolve this issue.

Finally, the government had created the Urban Transportation Development Corporation (UTDC) in 1975 in the backwash of praise it received for halting Toronto's controversial Spadina Expressway and committing itself to transit alternatives. UTDC intended to revolutionize the global transit market with Ontario-grown innovations.

Some critics noted that established manufacturers already had designs to meet the industry's current and future needs. Rejecting this rationale, the Province lavished funds on UTDC and co-opted various transit projects to showcase its wares. The rail policy review would be yet another opportunity to trumpet UTDC's capabilities.

If nothing else, the Scrivener Task Force accomplished one worthy goal by kick-starting serious consideration of electrification.

2.1 The 1980 Electrack Study

This altered political landscape started a wave of serious and credible studies of the benefits, technical requirements and costs of electrifying GO's Lakeshore Line from Pickering to Hamilton, as well as considering its application to other lines in the growing commuter system. The first of these studies was delivered in June, 1980, by the specialized U.S. consulting firm, Electrack, Incorporated.

Swedish-designed AEM-7 electric locomotives became the mainstay of Amtrak's popular and fast Northeast Corridor intercity passenger services beginning in 1979. The AEM-7 and it successor ALP-44 also found homes on the commuter rail systems of NJ Transit, Philadelphia's SEPTA and Baltimore's MARC. Photo by Joseph Barillari.

The report spelled out the technical details and benefits of GO electrification, many of which remain valid 30 years later. It clearly established:

> *"[The] technical feasibility of electrifying the GO Transit Rail Services, provisionally at a voltage of 25 kV, 60 Hz. The initiation of the Phase I electrification proposal would be a natural first step, making use of the existing bi-level passengers cars, for introduction of electrified service on the Oakville-Pickering Lakeshore route.*
>
> *"Subsequent introduction of electrified service to other branches and to Hamilton would be appropriate if service were expanded to an all-day regular interval operational format, contingent upon purchase of additional passenger cars and locomotives."*

First and foremost, Electrack declared an electrified GO would please commuters with its "quiet, clean and more reliable service. The public benefit would be further enhanced in the event that the extent and frequency of service was increased above existing levels." The report noted electrification's "sparks effect" in attracting new riders who weren't using the existing, infrequent GO diesel services.

The expanded operation would use GO's new Hawker-Siddeley (now Bombardier) bi-level rolling stock and state-of-the-art motive power, such as the GE E60C or the Swedish-designed, GM-built AEM7. Rated at 6,000 and 7,000 horsepower, respectively, both were in daily service on Amtrak's former PRR Northeast Corridor.

Phase I would electrify the Pickering-Oakville Lakeshore Line and Phase II would extend it to Hamilton, as well as convert the Georgetown, Richmond Hill and Milton services. The estimated costs, including motive power and rolling stock, were:

Phase I	$ 80.8 million
Phase II	$168.1 million
Total	$248.9 million

Phase I required five years from negotiation of agreements through to training and testing. Proceeding directly to Phase II added only two more years, resulting in a completely electrified GO rail system in seven years. The study noted:

> *"After recovery of initial design and tooling-up costs, the capital cost per mile for subsequent railway electrification projects will progressively reduce in real terms, to the extent that Phase II unit cost rates could prove to be less than those for Phase I."*

The financial findings were based on the demonstrated savings realized by other electric commuter operations around the world.

Looking forward, the report pointed out the capital value depreciation of electric installations and locomotives would occur over at least a 35-year period, as compared with the 18 to 25 years for diesel. As well, a move to longer GO trains would require two of the current diesel locomotives per train, while the electric option required only one, which would have a longer service life. The cost ratio of an electric locomotive was estimated at only 40 per cent of a diesel due to its extended life and reduced maintenance.

Electrification would reduce GO's energy costs significantly due to several factors, including the elimination of energy consumption during locomotive coasting and idling and the lower cost of electrical energy. The costs involved with refuelling operations would be totally eliminated. Furthermore, maintenance costs would be reduced by approximately 30 per cent by virtue of the relative simplicity of electrics.

In answer to the government's stated policy to make Ontario less dependent on imported oil, the report emphasized that electrification would achieve a saving in oil imports by reducing GO's energy consumption and cutting automobile and GO bus mileage. The increased service frequencies possible with electrification would boost ridership further.

The projected Ontario employment and industrial benefits were large:

> *"The initiation and carrying through of a railway electrification project resulting in a more economic and reliable transportation service will make an effective contribution to the economy of the Province of Ontario.*
>
> *"Such a project creates a number of temporary and permanent industrial and economic impacts on both local and national spheres of activity as well as on the railroad organization involved. It also creates a number of business and employment opportunities, some of which are new technology areas which are likely to be in increasing demand in future years.*
>
> *"When a manufacturing capability has been established, Ontario firms will be able to compete more effectively for electrification business in other provinces and even outside Canada.*
>
> *"Many standard components and assembly designs are available to Canadian suppliers from European manufacturers on a royalty or licensing basis. This type of arrangement avoids unnecessary repetition of research and development work already accomplished in other countries, and it also provides opportunities for two-way improvement of designs and manufacturing techniques."*

Still, the Province would not take the 1980 Electrack report at face value and more studies began under the Scrivener Task Force. One was undertaken by Queen's University's Canadian Institute of Guided Ground Transport (CIGGT) and another by the Ministry of Transportation and Communication (MTC).

2.2 Alternate Ontario Rail Policy Task Force Studies

The CIGGT study looked at the entire Ontario rail network – commuter, intercity passenger and freight – and provided an academic endorsement of electrifying GO's Lakeshore Line only, as well as a crazy quilt of other CP and CN freight and passenger lines.

The MTC study looked at rail electrification, TTC trolley bus network expansion, new trolley bus systems for Hamilton, Ottawa and conversion of GO's bus services to electric. It was moderately supportive of GO rail electrification and negative on all of the electric bus proposals.

Updating the Electrack data, the MTC report pegged the cost of GO Phase I (Pickering-Oakville) at $91.9 million. Electrification would be achievable within five years, would require 40-42 kWh of electricity (0.4% of Ontario's total) and eliminate 12.8-13.6 million litres of diesel fuel (0.8% of Ontario's transportation consumption). The project would create 1,225 man years of employment, of which Ontario's share would be 1,022.

Phase I's estimated net saving in annual operating costs was $683,000 to $834,000, paying back the capital investment within 15 years of the service launch.

MTC estimated the cost of Phase II (Hamilton Extension, Georgetown, Milton and Richmond Hill lines) at $114.4 million, but did not calculate the operating and energy cost savings. Phase II would result in 1,597 man years of employment, of which Ontario's share would be 1,378.

In light of recent statements by Metrolinx regarding the time required to electrify any of the GO lines, one section of the MTC report stands out:

> *"The technology is well proved, although substantial lead times are required for construction.... It is, however, quite feasible, given speedy attention and cooperation by the parties involved, to have Phase I electrification in operation five years after authorization to proceed is given.*
>
> *"Some reduction of the time-span would be feasible if negotiation of project agreements could be accomplished in less time or concurrent with engineering work; if engineering and construction were undertaken consecutively by a single contractor; or if longer track-possession time could be provided by the owning railroad.*
>
> *"Typical catenary construction rates achievable in medium-level commuter and freight-rail territory are between 80 and 240 track kilometres per year, dependent primarily upon the amount of installation equipment mechanization, and the ratio of off-track and on-track accessibility to the tracks to be electrified."*

In its 1980 interim report, the Scrivener Task Force called rail electrification "a course well worth exploring." Its final report of August, 1981, recommended:

> *"The Province should prepare for future change by completing current planning studies and carrying out detailed design and financial implementation studies needed to validate and implement electrification of the Lakeshore portion of the GO Transit commuter rail network."*

2.3 Electrification Derailed

The GO board was sufficiently encouraged to approve a study management plan leading to an electrification implementation plan. Delivered in May, 1982, it was the work of engineering consultants DeLeuw Cather International, its Canadian subsidiary, DelCan, and Electrack, which had by then established a Toronto office in anticipation of approval of the GO project. A major contributor on motive power and rolling stock issues was Philadelphia-based Louis T. Klauder & Associates (LTK).

The plan proposed a rolling investment program that would begin with the launch of the Lakeshore Line in 1990 and full GO system electrification by 2020. This would have spread the capital requirements to a palatable annual level for the Province.

LTK analyzed three types of service-proven equipment: GE E60C locomotives, GM-ASEA AEM7 locomotives and the latest generation of Silverliner EMUs then being operated by Philadelphia's Southeast Pennsylvania Transportation Authority commuter rail system. The latter was included as an alternative to a frequently-advanced argument by the Province that the Ontario-built, diesel-hauled GO bi-level cars could and should be converted to EMUs. The report said:

> *"At present, the consultant teams understand that they are to investigate the feasibility of converting the existing bi-level cars now in service on the Lakeshore Line to EMU operation. The consultant feels that there is a strong case to be made for eliminating this alterative and we are prepared to submit a summary report and recommendations on this matter.... EMU operation can still be considered with new vehicles while the existing bi-levels remain in use for their service life."*

It appeared that GO electrification was finally on track. But it was not to be.

A Silverliner EMU train of the Southeastern Pennsylvania Transportation Authority approaching Philadelphia's Temple University station. Photo by Adam E. Moreira.

The explanation is buried in the Throne Speech of April 21, 1981, which noted "design work for electrification of the GO commuter rail system from Oakville to Pickering is under way." But it also sketched out the future of Crown-owned UTDC:

> *"My government has every confidence that the development of an intermediate capacity transit system by the Urban Transportation Development Corporation is but the beginning of an auspicious future for the industry. Additional investments in UTDC will allow for production facilities in Ontario. A feasibility study for an Intermediate Capacity Transit system for the City of Hamilton is expected to be ready by this fall, and negotiations will begin with Metropolitan Toronto for an ICTS line in this area."*

The unproven ICTS helped undo the GO electrification plan. UTDC predicted it would revolutionize transit worldwide and produce a stream of orders, but it needed a showcase for such sales. Because of its large contributions to transit capital and operating costs since the early 1970s, the Province convinced the TTC to substitute ICTS for the conventional light rail technology slated for its new Scarborough RT line.

Eager to promote its wares, UTDC then proposed a modified version of ICTS known as GO-Advanced Light Rail Transit (GO-ALRT) using enlarged versions of the rolling stock for the Scarborough RT, which opened in 1985. GO-ALRT would dispense with the ICTS's linear induction motors and DC third rail power supply system, evolving into a more conventional, 25,000 volt AC catenary rail system.

GO-ALRT was selected for the proposed Lakeshore Line extensions from Pickering to Oshawa and Oakville to Hamilton, as well as a new northern Pickering-Oakville line serving the Scarborough Town Centre, North York City Centre, Pearson International Airport and Mississauga City Centre. A north-south route would connect the Port Credit and Brampton GO stations via Hurontario Street.

In addition to showcasing GO-ALRT for sale outside Ontario, this plan was motivated by the high cost of the renegotiated CN-GO operating agreement. GO-ALRT was also viewed as a system that could parallel and replace the existing Lakeshore and other rail services operated on CN lines, producing a system entirely owned and operated by the Province.

Another wrinkle was added by the Province's interest in hydrogen as an Ontario-developed power source for rail and transit operations, which the Scrivener report highlighted and endorsed. Nearly 30 years later, a practical design has still not been produced.

GO's electrification plan was halted. All attention focused on meeting commuter demand with slightly increased GO rail service and more parallel diesel bus services. Engineering and land acquisition began for GO-ALRT's Pickering-Oshawa line.

Three years later, GO-ALRT was shelved when the costs escalated and CN – facing new, passenger-friendly federal legislation – lowered its charges for GO. There was no need to proceed. But the electrification momentum had vanished and the time lost to the aborted GO-ALRT project resulted in yet more unserved demand for GO's services. This had to be met with expanded diesel operation and more diesel buses.

2.4 The 1992 CPCS Study

Wisely, GO established a practice of periodically reviewing plans that had not been funded. In 1992, Canadian Pacific Consulting Services (CPCS) updated and expanded the earlier electrification work with input from Hatch Associates.

> *"Although electric railways have been in existence for over 100 years, significant technological advances have been made in recent decades and will continue to be made in the future. These technological advances have resulted in reduced fixed equipment cost, reduced maintenance costs and increased energy efficiency. The accelerating development of technologies makes it appropriate to review the economics of electrification on a regular basis."*

Additional impetus came from the accelerated rail and transit electrification program under study in Los Angeles, including its new Metrolink commuter system. GO had assisted Metrolink with the design of this copycat system, which used Ontario-built bi-level rolling stock. The push for electrification resulted from the stringent air quality management regulations being imposed throughout Southern California.

The 1992 CPCS study was a tour de force that took into account recent developments in motive power and rolling stock, as well as changes in capital, operating and maintenance costs. The team included some who had conducted CP's extensive electrification testing in the 1970s. These experienced railroaders spelled out the virtues of electric traction.

DIESEL BENEFITS	DIESEL DRAWBACKS
Unlimited route and assignment choice	Limited hotel (lighting/air conditioning/heating) and standby power
Compatibility with other equipment in all corridors	Cost and time lost servicing and overhauling diesel engines
Mechanical breakdowns confined to one train	Health concerns from noise, fumes, oil and fuel dispersion
Low first cost	Limited per-unit horsepower
	Slow acceleration
	Shorter economic life
	Limited categories of usable fuels
	Non-revenue moves to refuelling points
	Powerful cleaning agents required to remove of oily residue
	Contributes to CO2 emissions
	Fuel not available from Ontario sources
	Susceptible to fuel cost and supply fluctuations

ELECTRIC BENEFITS	ELECTRIC DRAWBACKS
Reduced maintenance cost and time	Equipment confined to electrified lines
Choice of primary energy source	Reduced available clearance envelope
Fumes and oil dispersion eliminated	Signal system modernization required
Reduced main line operation noise	Cost of catenary maintenance
Reduced noise at yard and layover sites	Train immobilization by catenary damage or power failure
Greater per-unit horsepower	Supplementary operating/safety rules
Greater acceleration	Reduced mobility for work equipment
Shorter headways	Visual intrusion of catenary
Higher traffic capacity	High first cost
Greater energy efficiency	
Partial recovery of braking energy	
Over-track air rights development	
Ample hotel and standby power	
Wayside power requirements eliminated	
Lower energy costs	
Less prone to energy price fluctuations	
Not dependent on energy sources outside Ontario	
Large economic and job creation benefits	

Based on GO's long-range plans, the CPCS study assumed the Oshawa-Hamilton Lakeshore trains would operate every 10 minutes during peak hours and every 30 minutes off-peak. The other lines would operate every 20 minutes during peak periods and 60 minutes off-peak. These operations were compared under four 10-car equipment scenarios:

(1) Diesel locomotives with bi-levels system-wide;
(2) Electric locomotives with bi-levels on the Lakeshore and diesels on the Milton, Georgetown, Bradford, Richmond Hill and Stouffville lines;
(3) Electric locomotives with bi-levels system-wide; and
(4) Electric locomotives on the Lakeshore and 10-car EMUs elsewhere.

The equipment types used for the economic analysis were the GE E60C locomotive used in previous studies and the Asea Brown Boveri (ABB) ALP44, a more advanced, commuter-specific version of the previously-studied AEM7. As well, the X10 single-level EMUs that ABB had recently built for the Swedish State Railway's regional passenger services and Stockholm Transport's commuter rail operations were examined. The study compared the benefits and drawbacks of EMU operation.

EMU BENEFITS	EMU DRAWBACKS
Trains easily sized to suit passenger load variations	More motor equipment to inspect and maintain
Frequent off-peak service maintained while most rolling stock is receiving servicing	Inspection time increased, requiring more inspection trackage in yards or more manpower
Frequent off-peak service at lower energy cost	
Very high power-to-weight ratios	
Higher acceleration due to power being distributed throughout the train	
More rapid deceleration due to greater braking power distributed throughout train	
Less stress on track structure due to even distribution of weight and traction motors	

The suitability of EMUs vis-à-vis locomotive-hauled electric trains received serious study. While the performance of the recent European EMUs went into the comparisons, the suggestion was not made that they could simply be operated as-is on GO's lines. There are substantial differences in the standards for railway equipment in North America and Europe, the principal one being the mandatory end-strength or buff-load requirements. The higher North American standards, as set by the U.S. Federal Railroad Administration (FRA), reflect the greater equipment weights and lower level of crash-preventive train control systems. Because of the inter-connected nature of the North American rail system, the FRA standards apply in Canada and Mexico, too.

What was investigated as part of the 1992 study was the possibility of converting the non-powered GO bi-level coaches and cab cars to self-propelled EMU operation. It had long been assumed that the squeezed ends of these distinctive cars had been designed to accept the pantographs to collect power from the catenary if GO electrified and converted them to EMUs. However, the study team reported:

> *"The most significant design feature [of the bi-levels] is the drop floor (or well) construction between the trucks. This permits an upper floor level to be added over the well.... The well-style of the bi-level coach leaves no underfloor space for traction equipment. In addition, the GO cars leave very little space for traction motors. The Consultant considers that the car design is efficient and harmonious for its current purpose, but conversely is not suited to 'conversion' to an EMU traction power car....*
>
> *"The only 'conversion' scenario suggested here, and in later economic comparisons, is the purchase of new driving motorized cars to be paired up one-plus-one with existing bi-levels. The new motor-cars would be built to harmonize with the existing cars but sacrifice some seating to structural differences over the trucks and in the lower body sides. Assume a 40 seat loss. All four axles of the motor-car are assumed to be motorized up to modern motor design horsepower for EMUs."*

The report introduced another new concept in GO electrification. The study team affirmed the earlier selection of a 25,000 volt (25 kV) AC traction power system, but they took this a step further with the recent, service-proven autotransformer system using a voltage of +/- 25 kV (now known as 2 x 25 kV). In simple terms, it reduces the substation requirements and provides the same benefits of more powerful 50,000 volt (50 kV) AC without the costs and problems it would entail, such as increasing the height of bridges and station roofs.

A Swedish State Railways X10 EMU in Stockholm commuter service. This rolling stock was examined in detail by the authors of GO's 1992 electrification study and was rated highly for consideration, in modified form,as part of any plan to electrify all or portions of the GO system.

On the selection of the traction power system, the authors reported:

> *"The +/- 25 kV system has, therefore, a transmission capability close to that of a 50 kV supply, but without the problems of increased clearances appropriate to 50 kV. It also offers the benefits of reduced electro-magnetic interference in parallel communications circuits.... From this viewpoint, the system performance is similar to a simple 25 kV system with booster transformers."*

The study team reported the all-in capital costs of four equipment options, including the new bi-level EMU design, as:

(1)	Diesel locomotives system-wide	$ 708.5 million
(2)	Electric locomotives on Lakeshore and diesel elsewhere	$ 809.2 million
(3)	Electric locomotives system-wide	$1,109.8 million
(4)	Electric locomotives on Lakeshore and EMUs elsewhere	$1,171.3 million

In summary, the 1992 study team concluded:

> *"As would be expected due to the high capital cost of electrification infrastructure, Scenarios 3 and 4 – the two full electrification scenarios – have a significantly higher economic cost than Scenario 1 – full dieselization – and Scenario 2 – dieselization of the branchlines and electrification of the Lakeshore Line only. The differences between the present values of Scenarios 2, 3 and 4 from the base [diesel] case are: +9.7%, +28.8% and +32.3%....*

"For practical purposes, however, the increase in the economic cost of Scenarios 2, 3 and 4 [electric] over that of Scenario 1 – continued full diesel operation – could be viewed as the cost of environmental benefits and service improvements and evaluated in that context."

Exhaustive though it was, nothing came of the 1992 study, even though the government of Premier Bob Rae was philosophically supportive. The global economy had melted down and there were no provincial funds available to move forward. In fact, several GO route extensions and off-peak service additions were discontinued.

2.5 Opportunity Lost: The 2001 Lakeshore Line Study

The GO electrification issue slumbered until 2001, when a golden opportunity appeared. The state-owned National Railways of Mexico had begun to realign, rebuild and electrify its main Mexico City-Guadalajara trunk route in the early 1980s; 39 GE E60C-2 electric locomotives built in Erie, Pennsylvania, were delivered in 1983-1984. But then the Mexican government decided to privatize and split up its state railway. The new owner didn't want the electrification, partially because the catenary wires prevented the use of extra-high double-stack container cars, which came into service after the electrified plant had been built. The bulk of the Mexican electrification system was for sale – cheap.

A 2001 study by Hatch Mott Macdonald, in association with CPCS Technologies, examined the feasibility of electrifying the Oshawa-Hamilton Lakeshore Line with the surplus Mexican equipment. All analysis was done on the basis of GO's service expansion plans for the period from 2004 through 2025 and the acquisition of 20 of the GE locomotives, 11 of which had never entered revenue service in Mexico. These would be updated with more efficient AC traction systems to haul 10- and 12-car Bombardier bi-level consists. As well, much of the Mexican electric traction power system would be included without charge and additional materials would be obtained inexpensively from a recently decommissioned electric freight line in northern British Columbia.

National of Mexico GE E60C-2 electric power in freight service in 1996. In 2001, these locomotives were available to GO at a fraction of their new or replacement cost, as well as the electrical infrastructure from the 218-kilometre double-track line. Photo by Raymundo Collada

A comparison of the electric and diesel options revealed that capital costs over the 21-year planning horizon would be $454 million for electric and $208 million for diesel. Because of their higher acceleration, higher average speeds and greater availability, electric locomotives would have enabled GO to avoid the purchase of 24 additional bi-level cars required under the diesel scenario, saving $62.4 million.

The combined capital, operating and maintenance costs over the 21-year study period yielded a net present value for the electric option of -$445 million vs. -$348 million for diesel – a difference of $97 million. Although described as "significant," the study team was unable to quantify the health and environmental benefits of electrification or the expected "sparks effect" on ridership and revenue.

GO electrification had never been more affordable. But these were the last days of Premier Mike Harris' government, which had eliminated virtually all provincial support for urban transit. GO's funding was in disarray and it was impossible to embark on even a cut-rate electrification project that would have reduced the commuter railway's operating and capital expansion costs dramatically.

Rail electrification in Toronto remained a dormant issue until the provincial government changed in 2003 and new players came on the scene.

3.0 Enter Metrolinx

"Studies cause delay and enable government officials to in turn delay making decisions; in this, they are sometimes welcomed by those government officials...."

Minister of Transport's Rail Passenger Action Force, 1985

GO electrification might have remained just a wistful "what if" scenario if not for the actions of two Liberal governments – one federal and the other provincial – and the response of a group of affected Torontonians. More than anything else, it was this citizen reaction that put electrification back on the table.

When the Liberal government of Premier Dalton McGuinty swept to power in October, 2003, it carried with it many campaign promises to rein in urban sprawl, protect undeveloped land around Ontario's cities and promote transit options to lure commuters from their cars. Among the various legislative initiatives was the creation of the Greater Toronto Transportation Authority in April, 2006. Renamed Metrolinx later that year, it was charged with planning and coordinating transportation within the Greater Toronto and Hamilton Area (GTHA). A takeover of provincially-owned GO Transit was later added to its mandate, much to GO management's chagrin.

Staffed largely with former politicians and provincial bureaucrats without real-world transportation experience, Metrolinx was eager to impress the public and its political masters with a series of "early wins." As a result, the agency floated numerous visions for GTHA transportation improvements. One was electrification of GO's Lakeshore, Georgetown, Milton and Richmond Hill lines under labels such as SuperGO and Express Rail. Metrolinx early on announced this would be studied as part of its Regional Transportation Plan (RTP), due for delivery in late 2008.

3.1 MoveOntario 2020

Before the delivery of the RTP, the Premier released his MoveOntario 2020 plan on June 15, 2007, four months prior to the provincial election. Bypassing his new agency, McGuinty made an $11.5 billion commitment to 52 priority projects for the GTHA. At the top of the list were 17 GO projects, including Lakeshore, Georgetown and Milton service expansion and line extensions. Number five was "increasing speed and reducing emissions by electrifying the GO Lakeshore line and expanding capacity on all GO lines."

In the press release issued by the Premier's Office, McGuinty said:

> *"The time to make this sort of ambitious but realistic investment is now. Our economy demands it," McGuinty said. "What's more, our families deserve it, because gridlock not only saps strength out of our economy, it steals time from our families."*
>
> *To cite one example, with electrification of the GO Lakeshore line, a commuter will get from Toronto to Hamilton 15 minutes faster.*
>
> *"That's an extra half-hour a day. And that can make the difference between missing your daughter's first goal at soccer – or seeing it," McGuinty said.*

Under priority subway and other rapid transit projects, the Premier also identified a Pearson Air-Rail link to Union Station.

The release from the Premier's Office qualified these recommendations so as to not appear to totally pre-empt his new agency, adding in fine print, "Projects subject to the review of the Greater Toronto Transportation Authority." Many critics asked publicly if there could be a clearer sign that Metrolinx was just going to be a rubber stamp for any politically-motivated decisions from the Premier's Office.

3.2 The Big Move

But the government's endorsement of electrification didn't stop here. It escalated with the September, 2008, release of the draft of the Metrolinx RTP, which it labelled *The Big Move* when it was accepted and endorsed by the board in November. Among the transit technologies woven into this grand plan were:

> ***Express Rail**: High-speed trains, typically electric, serving primarily longer-distance regional trips with two-way all-day service. Regional Express service could have a capacity of 25,000 to 40,000 passengers per hour in the peak direction with trains operating in completely separated rights-of-way, with as little as 5 minutes between trains. Average speed: 50 to 80 km/h with stations two to five km apart. Example: Paris Region Réseau Express Regional (RER).*
>
> ***Regional Rail**: Diesel-electric or electric trains serving primarily longer-distance regional trips; approximate capacity at 10-minute headways of 5,000 to 20,000 passengers per hour peak direction; service can be enhanced by electrification, enabling better train performance (acceleration) and therefore higher average speeds even with relatively close station spacing. Average speed: 30 km/h with two km station spacing; 50 km/h with wider station spacing or electrified trains. Example: GO Transit rail system.*

The Big Move set out a series of investments spread out over a 25-year timeframe and with options for afterward, which would be subject to a comprehensive review at that time. Among the top transit priorities within the first 15 years were Express Rail on the Lakeshore Line from Hamilton to Oshawa and a Union Station-Pearson International Airport rail link:

> *"The GTHA's first Express Rail service will provide significantly faster and higher capacity service to commuters travelling along the GO Lakeshore Line, connecting several of the Growth Plan urban growth centres: the downtowns of Hamilton, Burlington, Oakville, Toronto, Pickering and Oshawa. Collectively, these six centres are forecast to accommodate significant growth over the next 25 years, and new Express Rail service will make transit an attractive alternative.*
>
> *"Express Rail will also be extended to Downtown Brampton, along with more frequent, two-way all-day Regional Rail service to the urban growth centres of Downtown Milton, Richmond Hill/Langstaff Gateway, Markham Centre and Etobicoke Centre."*

In years 16-25 of *The Big Move*, additional GO investments would "consolidate and strengthen the 15-year network described above." These would include:

- Express Rail service to Cooksville on the Milton Line and to the Richmond Hill/Langstaff Gateway on the Richmond Hill Line; and.
- Improvements to existing GO Rail services and extension to Bowmanville.

The GO expansion program was expected to continue beyond the 25-year timeframe of *The Big Move* with priority projects including:

- A direct Express Rail link between Mississauga City Centre and Union Station via Cooksville;
- Additional capacity on the Yonge subway or the Richmond Hill Express Rail corridor to relieve the Yonge subway;
- East-west Express Rail connecting Oakville, Mississauga, Vaughan, Richmond Hill, Markham and Pickering; and
- Extension of all-day two-way regional rail service to additional communities.

The inspiration for this rolling program of GO investments, according to one Metrolinx senior staff member, was provided by the electrified, high-frequency urban rail systems of Western Europe, such as the Parisian Réseau Express Regional (RER) and the S-Bahn networks of several German, Swiss and Austrian urban regions (see Appendix A).

Bi-level EMU equipment of the Réseau Express Regional, the electrified urban rail system of Paris, which initially inspired some Metrolinx staff and led them include mention of a Toronto version in their 2008 regional master plan, *The Big Move*.

Further encouragement came from the longstanding Caltrain plan to transform its San Francisco commuter service with electrification and service-proven European bi-level equipment designs and operating concepts (see Appendix B).

The Caltrain plan had only recently become known to Metrolinx staff and it obviously impressed some of them. In the April 19, 2008, edition of *The Toronto Star,* Metrolinx general manager of strategic investments and initiatives, John Howe, said of GO electrification, "It's not just about stringing wires over the tracks. It opens up all sorts of opportunities, just like that Caltrain project. We are re-examining the whole GO Lakeshore service in terms of equipment and frequency to make it a cornerstone of our regional transportation plan. We want it to be transformational."

3.3 Restudying Studies

As part of its initial interest in electrification, Metrolinx commissioned Hatch Mott Macdonald (HMM) to revise the 2001 Lakeshore Line study to reflect:

- The used locomotives and other electrification materials from Mexico and B.C. were no longer available, having been sold to other operators or scrapped;
- Performance data was available on Bombardier's new ALP-46A electric locomotives, which were in service on New Jersey Transit;
- GO had begun planning for 12-car bi-level trains on the Lakeshore; and
- Capacity expansion programs had increased the amount of track that would have to be electrified.

HMM's April, 2008, electrification study reported:

> *"The 2001 study update had concluded that diesel operation demonstrated a clear economic advantage over the introduction of electrification on the Lakeshore corridor....*

"The results of this study are less conclusive in demonstrating a clear advantage for continued diesel operation. For the base case scenario over the 2008-2033 study period, using current energy costs and considering an annual escalation of 3% and discount rate of 6%, the net present value is -$765 million for the electric option and -$578 million for the diesel option (all net present values are negative on account only cost streams have been considered).

"The case for electrification is compelling when only operating costs are considered. For all sensitivity analyses, the electric operation advantages range from a low of $150 million to a high of $453 million over the study period, depending on which sensitivity cases are being compared.

"Although the environmental implications of electrification are reviewed in this study, an economic analysis of the environmental benefits of electrification has not been quantified. Clearly, if outside economic justification can be brought to bear to offset the high capital cost of electrification (such as capacity improvements when done in concert with other plant improvements) then the economic benefits accrued to GO Transit will continue in perpetuity."

Just prior to the release of *The Big Move* plan in September, 2008, Metrolinx hired HMM again to expand on this work. Among the additional issues explored was the time saving possible through the use of bi-level EMUs similar to Alstom's Coradia Duplex equipment, as used in Sweden. No analysis of the costs involved in substituting bi-level EMUs for electric locomotive-hauled trains occurred. Another new item in this so-called addendum to the April, 2008, study was the provision of background information on positive train control (PTC) and other automatic train stop systems.

The most useful element in the two HMM studies was the cost updating. The all-in Lakeshore Line electrification capital cost was now pegged at $2.619 billion without contingency, to be spread over the 2016-2031 period, or $4.086 billion with an extremely large contingency.

Alstom's Coradia Duplex bi-level EMU received superficial analysis as part of the 2008 Metrolinx updating of the 2001 GO Lakeshore Line study. The high-capacity electric rolling stock has been purchased by several European operators. Coradia trainsets of the national railways of France (left) and Luxembourg (right) are shown here at rest at Luxembourg Central Station.

At this stage, Metrolinx seemed to chill on the electrification of any portion of the GO system. Observers have suggested that in its eagerness to please the public and its political masters, Metrolinx had endorsed the idea without knowing what it entailed. As well, Metrolinx had promoted other big-budget projects and the tally was obviously higher than the Province was prepared to fund in a first round of transportation improvement projects.

3.4 GO 2020

Before negative comments on electrification began emanating from Metrolinx, GO waded into the situation. With its shotgun marriage to Metrolinx looming, GO management released its own strategic vision plan, GO 2020, on December 12, 2008. In common with the Premier's Move Ontario2020 program and *The Big Move*, this plan also raised the probability of electrification as part of a slew of rail improvements to be undertaken by 2020. The plan noted that "introducing electric trains on the Lakeshore corridor, and the Georgetown corridor if appropriate, will offer travel time savings and environmental benefits."

Now, three plans and two studies from the Government of Ontario and its agencies had placed electrification on the table in the space of 18 months. But what set the issue on fire was another project that, like electrification, had been smoldering away.

3.5 The Airport Rail Link Factor

For decades, there had been talk about a rail link to serve Pearson International Airport. These public and political calls for action grew as many European cities began working with their nationalized railways, airport authorities and airlines to seamlessly connect and integrate their air and rail passenger systems with rail links to their major international airports.

In May, 2003, the talk finally produced a plan, but a controversial one. The federal government invited f our pre-qualified private consortia to submit business cases for the project, following a request for expressions of interest issued in April 2001. On November 13, 2003, it was announced that Union Pearson AirLink Group (UPAG) had been selected as the successful respondent. UPAG was owned by SNC-Lavalin Engineers & Constructors Inc., a member of the SNC-Lavalin Group of Companies.

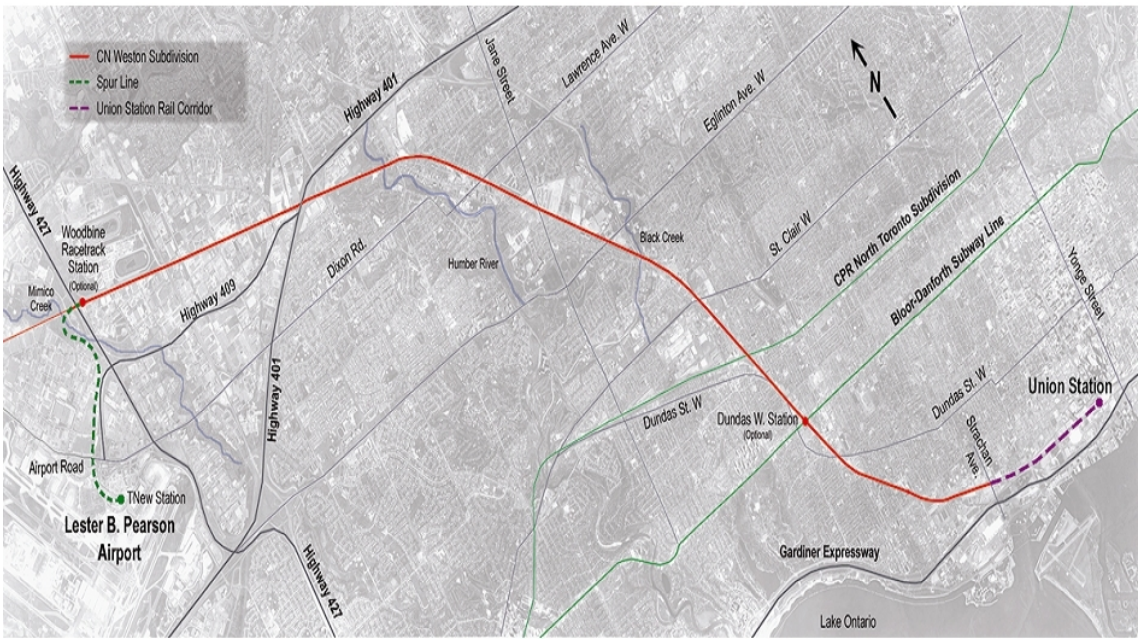
The project was a pet of then Don Valley East MP and Minister of Transport David Collenette. At the time of the announcement, he said there wouldn't be a nickel of public money spent on the project. That has proven untrue.

To be known as Blue 22, the project would use CN's Weston Subdivision from Union Station to a 3-km spur to be built into the new terminal slated for construction at Lester B. Pearson International Airport. Service would be provided by a fleet of retired VIA Budd rail diesel cars (RDC), remanufactured by Industrial Rail Services, Inc., of Moncton, N.B. The name was derived from the running time of 22 minutes between the end terminals with one intermediate stop at Bloor Street West. The one-way fare would be $20.00.

The announcement of Blue 22 started many residents of Weston pondering the implications for their community. Bisected by the busy CN Weston and CPR MacTier Subdivisions that share a wide corridor slightly east of and parallel to Weston Road, the community had endured decades of disruption by the trains that passed over the grade crossings on four east-west residential streets.

Largely under the guidance of resident Mike Sullivan (now MP for York South-Weston), residents began asking questions of Transport Canada, GO Transit (which used the Weston Subdivision for its Georgetown service) and CN. The answers they received were not encouraging. Blue 22 would require the closure of some of the grade crossings, cutting access to TTC services and shopping on Weston Road. The air rail link proponents next suggested building full-scale road-rail grade separations, which would have required the demolition of more than 100 homes.

Union-Pearson Air Rail Link



As well, with a service frequency of 15 minutes in each direction for 19 hours daily, questions were asked about the resulting noise and diesel-generated pollution, especially in light of the long-discussed expansion of service on GO's Georgetown Line and the VIA Toronto-London service that share the route.

The lack of satisfactory answers from the Blue 22 proponents and GO led to the formation of the Weston Community Coalition as "a grassroots, non-partisan organization comprised of a voluntary group of residents, business owners, and representatives from community associations, schools and faith groups. The group was formed in early 2005 to protect the Weston community from the threat of a privately run Air Rail Link, but is also actively involved in seeking the betterment of the greater Weston area through other initiatives."

The Weston residents and others further south along the entire line to Union Station were galvanized into action by the multiple GO expansion plans flung out by Premier McGuinty, Metrolinx and GO. Simple math told the residents they could be dealing with more than 400 Blue 22, GO, VIA, CP and CN diesel-powered trains on a portion of the corridor. The result was the creation of the Clean Train Coalition in early 2009 to represent the interests of all the citizens along the line.

After much confrontation in so-called "inclusive consultation" sessions, a proposal came forward on the grade crossing issue and an agreement to place the expanded rail corridor in a trench below street level. Later, SNC Lavalin switched its equipment choice from the remanufactured Budd RDCs of the original Blue 22 proposal to new, diesel-powered self-propelled cars under the renamed Airport Rail Link (ARL). SNC Lavalin said these unspecified new cars would allegedly meet the Tier 4 emissions standards that would come into effect in 2015 and would be "convertible" from diesel to electric traction at a later date.

Stoked by the discussions of electrification that had been initiated by the Premier, Metrolinx and GO, the WCC and CTC both advocated the adoption of this form of traction. They quite correctly pointed out that Tier 4 diesels did not exist and the manufacturers admitted it was going to be difficult to produce them by the 2015 deadline set by the U.S. Environmental Protection Agency, which has also been accepted by the equivalent regulatory authorities in Canada.

Furthermore, the two citizens groups pointed out they were not saying "not in my back yard," but "yes, in my back yard – if done properly." The residents all welcomed improved transit service to their communities, which are transit deficient. The fact that the ARL would be a premium-priced service with only one intermediate station stop did not endear it to the online residents. The SNC consortium finally bowed to protest and added a Weston station stop to its plan.

In fact, the ARL had run into trouble. With the change of government in Ottawa in 2006, the ARL lost its federal champion. Responsibility slowly migrated to the Province and it announced on December 15, 2008, that it would become the main proponent of the project. Sources at Queen's Park revealed Premier McGuinty chose it as one of his legacy projects and had it attached to Toronto's bid for the Pan American Games, to be held between July 10 and 26, 2015, and billed as the world's "greenest" sporting event ever. Word was the Premier had ordered the ARL completed in time for the games without fail.

Adding to the frustration of the residents was the way Metrolinx and GO seemed to change their facts and arguments constantly regarding the number of trains, the number of tracks and the performance of the trains in terms of noise and emissions. Their distrust of the provincial consultation process only grew when the *Globe & Mail* published excerpts from a Metrolinx internal strategy paper in February, 2009. The document advised staff:

> *"Our consultation period needs to be tightly structured and telescoped. The last thing we need is for this to be hijacked by nimbies or local politicians on the make. These should be mainly informational briefings. We should salt the sessions with supporters. An orgy of consultation will mire this in controversy and delay."*

The strategy paper also advised staff to "de-emphasize maps, which require precision we cannot yet offer and make us vulnerable to discrediting when an error or inconsistency is identified."

3.6 The Study to End All Studies

Finally, under pressure from the WCC and CTC, and with support from numerous local politicians, NDP MPPs and even members of its own caucus, the Liberal provincial government announced on May 26, 2009, that it would embark on a $4 million "comprehensive review" of GO electrification, although the ARL was not initially included in the terms of reference.

Like all the other consultations on the rail expansion that would affect the corridor northwest of Union Station to Malton and beyond, the GO Electrification Study got off to a shaky start. Participants complained that the deck already seemed to be stacked against electrification. For example, graphics chosen for presentation and publication invariably showed the heaviest, ugliest examples of catenary, not the light and unobtrusive systems that many foreign railways use today.

Metrolinx staff has called it "ugly," but modern catenary can be designed and built unobtrusively, as demonstrated in this recent shot of an Austrian States Railways Vienna-Budapest Railjet zooming through Biatorbágy, Hungary. Photo by Ligeti Gábor.

Worse were comments made by the staff members, many of whom admitted they had never even ridden on an electric train, let alone had any experience building, managing or operating electric railway systems. Typical were those by the team leader Karen Pitre and Metrolinx executive vice-president and GO managing director Gary McNeil, as quoted in the June 5, 2010, edition of the *National Post*:

> *"In order electrify a system, it's hundreds of millions, or in the case of our whole system it would be in the billions of dollars to electrify and that doesn't really get any more capacity," said Mr. McNeil...*
>
> *[Ms. Pitre] said a lot of people call the catenary system, in which a web of overhead wires power trains, a mixed blessing. For one thing, "it's ugly," she said, and for another, it's not especially conducive to windy or snowy conditions.*
>
> *And while electric trains do not spew out pollutants, there are other environmental costs, said Ms. Pitre, like using more power.*

In answer to these specious claims, this author replied in a July 21, 2010, article in *The Toronto Star*:

> *Metrolinx executive vice-president Gary McNeil has argued that electrification doesn't add any capacity to rail lines. Wrong. That was one of the principal reasons commuter railways in New York, Philadelphia and Chicago electrified nearly a century ago. Electric trains accelerate faster than diesels and allow for more runs without track expansion. When traffic soars, as it has on many GO routes, electrification creates carrying capacity.*
>
> *Metrolinx study team leader Karen Pitre has said that electric trains use more power than diesels. Also wrong. In fact, when they apply their brakes, they send electricity back into the overhead wires to help power other trains. Pitre has also questioned the ability of overhead wires to withstand our winter weather. This will, no doubt, shock the railway managers of Scandinavia and Russia. The latter's 9,288-kilometre Trans-Siberian route is fully electrified, traversing some of the world's coldest and snowiest terrain.*

An EMU trainset on Basel's five-line S-Bahn, unaffected by the snow and low temperatures that seem to concern Metrolinx staff.

After two fractious stakeholder workshops, the mood improved marginally as some useful materials arrived from one of the study team's nine consultants, LTK Engineering Services, one of the few North American firms with any electrification experience. LTK managed to eliminate ridiculous options such as unproven hydrogen-powered conventional rail equipment – which had previously been promoted by Premier McGuinty – and overpriced and inappropriate magnetic levitation technology. LTK also recommended the use of the proven 2 x 25 kV AC traction power system, as had already been established in the 1992 GO electrification study.

The study team's documents are all available on the GO Transit website, so repetition of their myriad details is unnecessary. They have contributed little except to update the previous cost figures. The validity of this massive research project is also questionable given the fact that members of the study team revealed their role was not to make recommendations; the ultimate decision would be made at the highest political levels, principally by Minister of Transportation Kathleen Wynne and Premier McGuinty.

So, the advocates of GO electrification awaited the delivery of a report they expected would yield little. Their expectations were not dashed.