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December 6, 2012

via RESS e-filing – signed original to follow by courier

Ms. Kirsten Walli
Board Secretary
Ontario Energy Board
PO Box 2319
2300 Yonge Street, 27th floor
Toronto, ON M4P 1E4

Dear Ms. Walli:

Re: Toronto Hydro-Electric System Limited ("Toronto Hydro")
OEB File No. EB-2012-0064 (the "Application")
Evidence introduced during technical conference

THESL writes in respect of the above-noted proceeding.

Ontario Energy Board ("OEB") Staff presented the attached document to THESL's witness during the Technical Conference held in this proceeding on November 21, 2012. The document, a study entitled "Adequacy of Transmission Facilities and Transmission Supply Plan for the Central Toronto Area 2006-2021" and previously filed in OEB Case No. EB-2006-0501, was not on the record of evidence for this proceeding. Discussion of the document can be found on pages 122-123 of the transcript from the first day of the Technical Conference.

As this document was the subject of evidence at the Technical Conference, THESL respectfully requests that it be entered on the record of evidence in this proceeding and be assigned an exhibit number.

If you have any questions in this regard, please do not hesitate to contact me.

Yours truly,

[original signed by]

Amanda Klein
Director, Regulatory Affairs
Toronto Hydro-Electric System Limited
regulatoryaffairs@torontohydro.com

:AK/RB

cc: Fred D. Cass, Aird & Berlis LLP, Counsel for THESL, by electronic mail only
Intervenors of Record for EB-2012-0064, by electronic mail only

City of Toronto Electric Supply Study

Adequacy of Transmission Facilities

and

Transmission Supply Plan for the Central Toronto Area

2006-2021

Privileged and Confidential

(Internal Hydro One Networks and Toronto Hydro-Electric System Limited use only)

August 10, 2006

City of Toronto Electric Supply Study - Adequacy of Transmission Facilities And Transmission Supply Plan 2006-2021

August 10, 2006 R3

Foreword

This report is the result of a joint study by Toronto Hydro-Electric System Limited and Hydro One Networks. The study team members were:

Angelo Boschetti, THESL

Chun Hung Ngai, THESL

Paul Cook, Hydro One Networks

Stan Dafoe, Hydro One Networks

Ibrahim El Nahas, Hydro One Networks

Lyla Garzouzi, Hydro One Networks

Farooq Qureshy, Hydro One Networks

This report is for the internal use of Toronto Hydro-Electric System Limited and Hydro One Networks.

The preferred plan has been selected based on technical considerations. The issue of cost allocation between utilities was not addressed.

The study team would like to express its thanks to Cathy Neal, Ian Fielding, Hugh Crockett and Norm Girard of Hydro One Networks for their help and input to the study.

Farooq Qureshy

Farooq A. Qureshy

Signatures

We have reviewed this report and concur with its recommendations.

Utility	Signature	Title
Toronto Hydro-Electric System Limited		Ben LaPianta Manager, Investment Planning
Hydro One Networks		Naren Pattani Manager, Transmission System Development

Date: August 10, 2006

Disclaimers

This report has been prepared solely for the purpose of assessing the adequacy of the Hydro One Networks and Toronto Hydro-Electric System Limited facilities supplying the Central Toronto area.

The load forecast and results reported in this study are based on the information available to Hydro One and Toronto Hydro Electric System Limited, at the time of the study.

The ampacity ratings of Hydro One facilities are established based on guidelines used by Hydro One for power system planning studies. The actual ampacity ratings during operations may be determined in real-time and are based on actual system conditions, including ambient temperature, wind speed and facility loading, and may be higher or lower than those stated in this study.

Table of Contents

Executive Summary

Electrical supply to the City of Toronto is provided by thirty five 230kV and 115kV transmission and step-down stations as shown in Map 1. The eastern, northern and western parts of the City are supplied by eighteen 230/27.6kV step-down transformer stations. The central area is supplied by two 230/115kV autotransformer stations (Leaside TS and Manby TS) and fifteen 115/13.8kV and two 115/27.6kV step-down transformer stations. The summer 2005 area load of the City of Toronto was about 5000MW.

This report presents the results of a joint Hydro One Networks (HON) and Toronto Hydro-Electric System Limited (THESL) study carried out in early 2006 to review the Central Toronto Area load growth and to ensure that adequate transmission facilities are planned for and available to meet the electrical demand requirements over the next fifteen years. It recommends an action plan for ensuring that the City of Toronto continues to receive reliable electric power supply.

The Ontario Power Authority (OPA) is currently developing an Integrated Power System Plan (IPSP) for the province. The IPSP would also be addressing the need for transmission reinforcement for the Central Toronto area. The results and recommendations from this joint HON and THESL study would be provided to the OPA for consideration in developing the integrated plan.

Need Based on Adequacy Considerations

The main issue for supply to the central Toronto area is the critical nature of the area load and the adequacy of the transmission facilities. The two 230kV transmission corridors – Cherrywood TS to Leaside TS and Richview TS to Manby TS - and the Leaside 230/115kV autotransformer serving the central area are at or are approaching capacity limits. There are also internal transmission limitations on the 115kV system that require immediate relief.

The need date for the transmission reinforcement is shown in the table below. The table also shows the effect of the proposed Portlands generation and recent provincial demand management initiatives on the need date. The need date with demand management is based on the assumption that these initiatives directly effect peak demand and that the demand management initiative target is achieved.

Need Date for Transmission Reinforcement

Facilities/Corridor	Base Case	With Portlands Generation	5% Demand Management
Cherrywood x Leaside 230kV	2008	2015	2012
Leaside 230/115kV Autos	2008	2017	2011
Richview x Manby 230kV	2010	No effect	2014
Leaside x Hearn 115kV	2006	2021	No effect
Leaside x Wiltshire 115kV	2006	No effect	2007

High Impact Contingency Events

A second but equally important issue is the concern about the effect of a catastrophic event at either the transmission or the delivery point level. Even though the probability of such an event - which may be triggered by lightning strikes, flooding, equipment fire at a station, vandalism etc. - happening is relatively low, the resulting power interruption has the potential to have a extremely severe impact on both Toronto and the Province of Ontario.

At the transmission level, there is limited transfer capacity between the Leaside TS and the Manby TS supply areas. Table 2 below shows that significant amount of load would be interrupted if there were to be a high impact event which results in a loss of facilities at either the Cherrywood TS and Leaside TS or the Richview TS and Manby TS areas. This will cause a major disruption since it may take 48-72 hours or more to restore supply to the commercial, industrial and residential customers in the central area of the City.

Effect of High Impact Events

Contingency Event	Load Interrupted (1)	Restored in 2 Hrs (2) (3)	Prolonged Interruption (3) (4)
All Cherrywood TS x Leaside TS corridor circuits	2300MW	500-1200MW	1100-1800MW
All Richview TS x Manby TS corridor circuits	1500MW	1000-1100MW	400-500MW
All Leaside TS 230/115kV autotransformers	1300MW	500-600MW	700-800MW
All Manby TS 230/115kV autotransformers	700MW	500-600MW	100-200MW
Any two 115kV supply circuits	180MW by configuration	All	None
THESL 13.8kV switchgear in a downtown core station	22 – 62MW	None	22 – 62MW(5)

1. This represents the maximum load that could have been lost in 2005.
2. Customers may be subject to rotating interruptions even if the initial load is picked up within 2hrs.
3. It may take 48-72 hours for supply to be restored to most customers in the event of transmission contingencies. Customers may continue to be subject to rotating interruptions.
4. Proposed Hearn area generation would reduce the amount of load impacted by 550MW in the Leaside Sector.
5. It may take 48-72 hours to restore supply to half of the affected customers, and up to 96 hours to restore the remaining customers.

At the delivery point level, there is virtually no transfer capability between stations in the downtown core. Aside from the limited ability at John TS and Terauley TS, no built-in means exists for transferring feeders from a bus to another bus within stations in the downtown core. A mobile switchgear trailer would be the means to deal with a THESL switchgear loss. Restoration time for distribution system contingencies would depend upon cable work required and would vary from 72 to 96 hours.

Alternatives Considered

Alternatives were considered for system reinforcement in order to address adequacy and to minimize the effect of high impact outages. Two plans – Plan A and Plan B - were identified for transmission system reinforcement based on an assessment of a number of different options.

- Plan A: Build new 230/115kV autotransformer station at Hearn TS with supply from Parkway TS.
- Plan B: Build a new 230/115kV autotransformer station at Hearn TS with supply from Manby TS.

The reinforcement of the Richview TS x Manby TS corridor and the Toronto 115kV transmission network is required in all cases and is therefore common to both Plans.

Plan A is the preferred and recommended plan since it provides both load relief and increased supply diversity. It provides an independent third supply directly from the bulk network unlike Plan B where Richview and Manby TS 230kV facilities will supply the new Hearn TS and the existing Manby East and Manby West autotransformers. Outages at Richview TS and/or Manby TS could interrupt supply to all three stations.

Proposed Transmission Reinforcements to Address Adequacy

The proposed transmission reinforcements based on an assessment of the alternatives are as follows (Please see Map 2):

<u>Stage 1 – Facilities required on a priority basis</u>

- A new 3.9km long 115kV circuit between Leaside TS and Birch Jct. The new circuit will connect to an idle 115kV circuit on the L14W tower line between Birch Jct. and Bridgman TS. The earliest the new facilities can be in-service is summer 2009.

<u>Stage 2 – Facilities required by summer 2010</u>

- A new 6.5km 230kV double circuit line between Richview TS and Manby TS to be in-service by summer 2010. This work could be deferred by new generation on the circuits between Oakville TS and Manby TS (e.g. Lakeview GS site). However given the present uncertainty of the size and timing of potential new generation it is deemed prudent to proceed with this work. Even should new generation appear, this new line would substantially mitigate the risks of reliance on this generation for reliability. This new line would also reduce the likelihood of a complete loss of supply to Manby and the associated impacts described above.

Stage 3 – Facilities required by summer 2015 for adequacy

- A three circuit 230kV line from Parkway TS to Hearn TS.
- A new GIS 115kV switchyard at Hearn including 230/115 kV auto-transformation.

These facilities may be required earlier if the Portlands generation does not go into service or if necessary to mitigate the effect of high impact events as noted below.

Proposed Transmission Reinforcements to Address High Impact Events

Stage 1 and Stage 2 facilities together with Portlands generation will not be able to completely mitigate the impact of the loss of Leaside TS and/or Manby TS or other high impact contingencies that could occur.

It is therefore recommended that work on the Stage 3 facilities be initiated now with the objective of placing these facilities in-service as early as possible. It would take between 4 and 5 years to obtain the necessary approvals and to design and build the facilities, and the earliest the facilities could be built is by summer 2011 or 2012.

Given that the need date is 2015 assuming new Hearn area generation; the early in-service represents an advancement of the project by about three to four years The advancement is considered justifiable given the severe impact that a major outage would have on the City of Toronto.

Proposed Step-down capacity Reinforcement

It is proposed to provide additional 13.8kV step-down transmission capacity in the downtown area. Options considered included station expansion at Esplanade TS or building a new station at the Round House Park site.

While the new “Round House Park” TS would be more costly than the Esplanade TS expansion the Round House Park site is preferred and recommended for the following reasons:

- Provides enhanced diversity of supply to downtown Toronto load and would better mitigate the risk of high impact outages to transformer stations in the downtown core.
- It is closer to John TS and Terauley TS and would require shorter inter-station feeders to transfer loads in the event of contingencies. Proximity to John TS and Terauley TS would also permit some of the existing loads at these stations to be permanently moved to “Round House Park” TS. This will reduce the impact of a total station interruption by reducing the loading on existing transformer stations.
- The reduced loading levels on existing facilities would increase the operational flexibility to carry out necessary maintenance and thereby enhance the reliability of these assets.
- Retains the option of expanding existing stations in the long term to deal with load growth.

It is noted that the “Round House Park” property is the one of the last remaining viable sites for locating a transformer station in the downtown area. Hydro One has an option to purchase this property. This option expires in 2013. It will be very difficult, if not impossible, to find an alternate transformer station site as all available land in this area is being developed for other purposes. It is recommended that the process be initiated to obtain approvals for the Round House Park site and associated transmission facilities.

Recommendations

Because of the urgency of the need to provide relief and to have the required facilities in-service as soon as possible, the following steps are recommended:

(1) Advise the OPA of HON and THESL study results for inclusion in the IPSP.

(2) Initiate environmental assessment, preliminary engineering and project development work under Plan A for the following reinforcement projects:

   a. Leaside TS x Bridgman TS circuits.

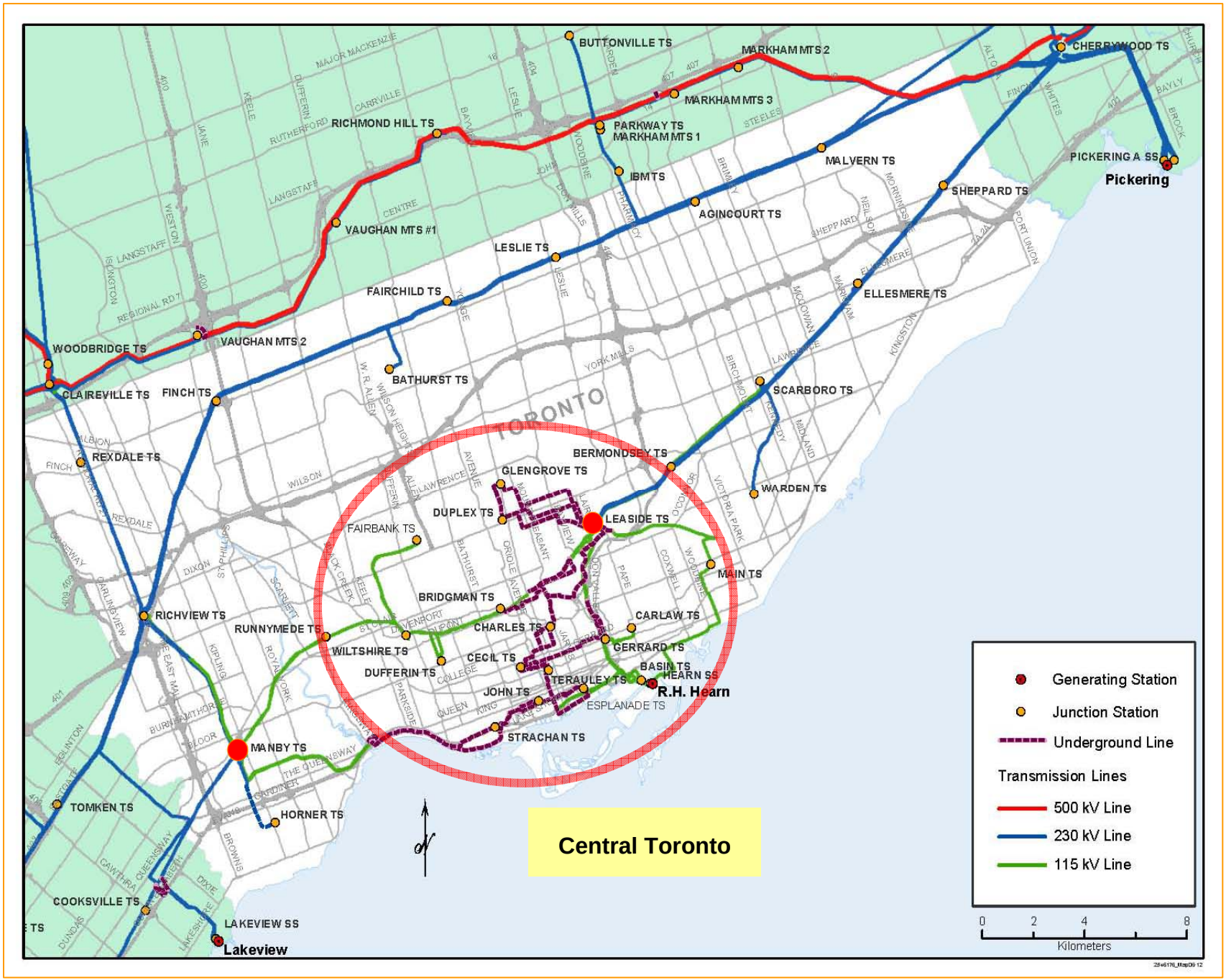
   b. Richview TS x Manby TS circuits.

   c. A new 230/115kV autotransformer at Hearn TS with 230kV supply from Parkway TS.

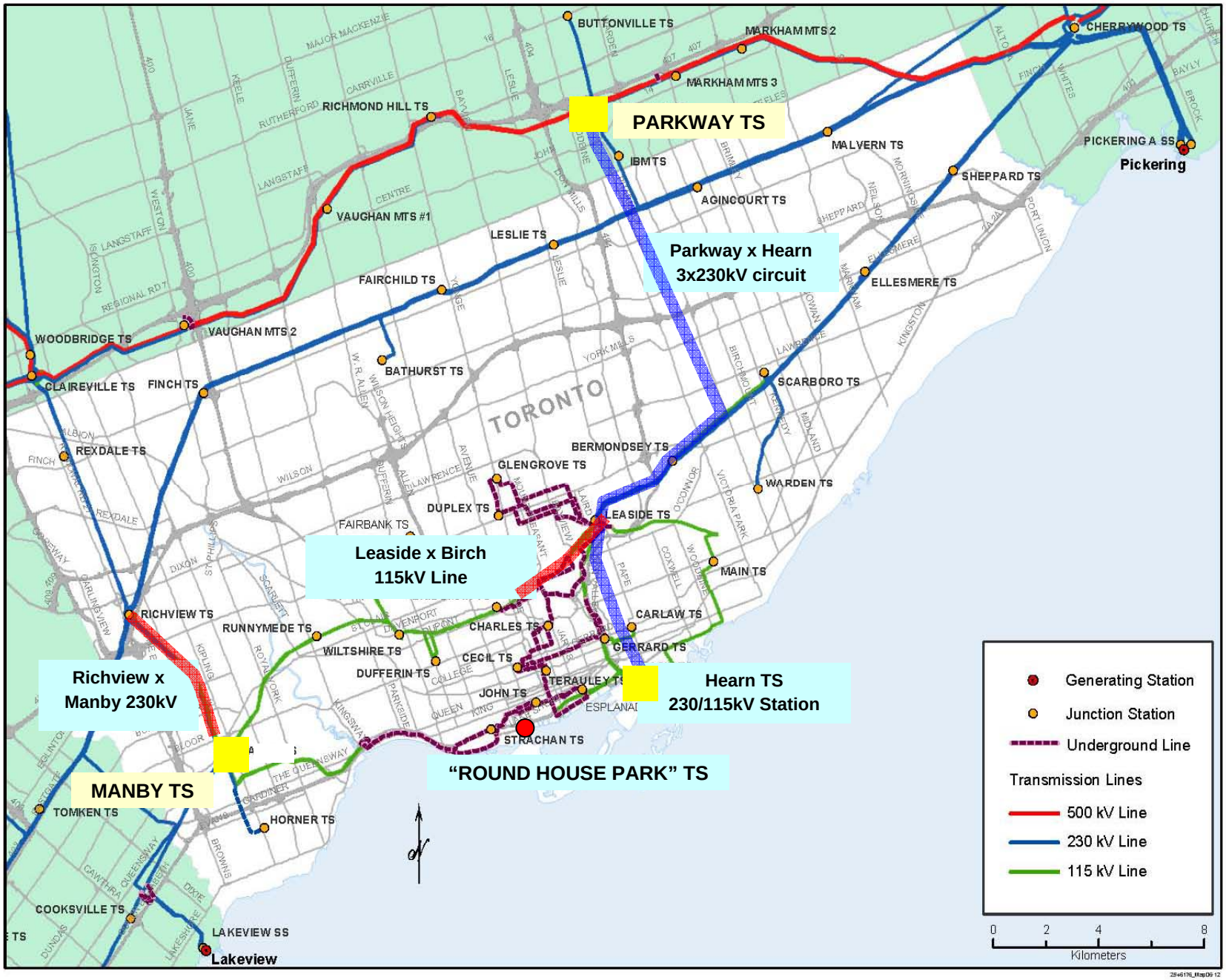
   d. Up rate the Lumsden Jct. x Main TS section (about 2.1km) of 115kV circuits H1L/H7L.

(3) THESL initiates process to obtain approvals new station on the Round House Park site.

Discussions have been initiated between the IESO, THESL and Hydro One Networks to identify measures such as load transfers, voltage reduction etc, to maintain supply reliability between now and the time the new facilities can be placed in-service.



Map 1. Transmission Facilities Supplying the City of Toronto



MAP 2. Transmission Facilities Proposed under Preferred Plan

Main Report

1.0 Introduction

Electrical supply to the City of Toronto is provided by thirty five 230kV and 115kV transmission and step-down stations as shown in Map 1. The eastern, northern and western parts of the City are supplied by eighteen 230/27.6kV step-down transformer stations. The central area is supplied by two 230/115kV autotransformer stations (Leaside TS and Manby TS and fifteen 115/13.8kV and two 115/27.6kV step-down transformer stations. The summer 2005 area load was about 5000MW.

In 2003, a joint Hydro One Networks (HON) and Toronto Hydro Hydro-Electric System Limited (THESL) Planning Study [1] identified the need for transmission reinforcement to supply forecast load demand in the central Toronto area by summer 2008. This area is supplied at 115kV from two 230/115kV auto-transformer stations at Leaside in the east and Manby in the west. It includes the City commercial and financial districts and university health care system, as well as the newly developing Portlands area along the lakeshore.

The Independent Electric System Operator (IESO) reiterated the need for transmission reinforcement in Toronto in its February 2006 Reliability Outlook [2] and the Ontario Power Authority (OPA) is negotiating with Portlands Energy Centre to build a new 550 MW-generation facility adjacent to the former Hearn GS.

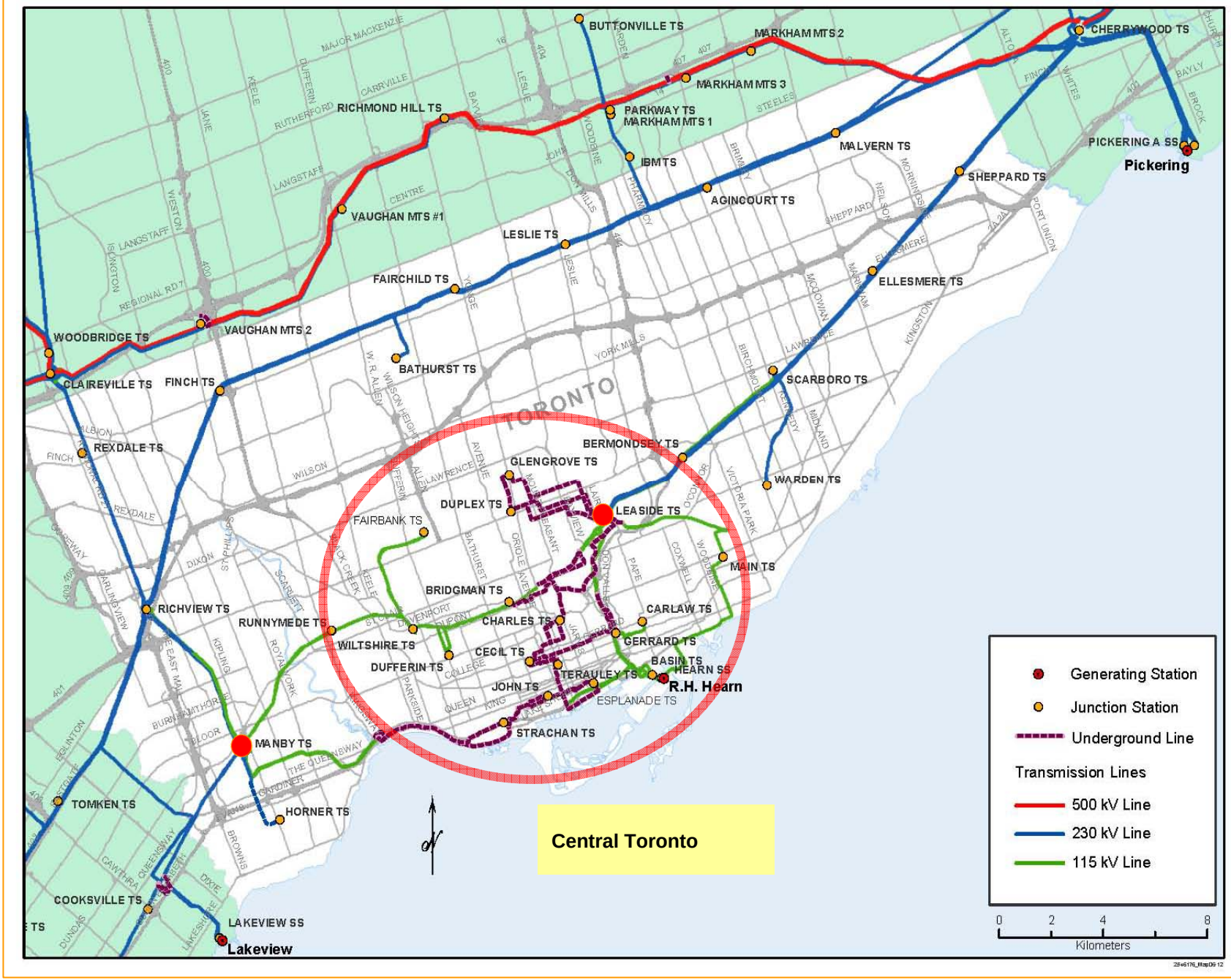
Recognizing the critical nature of this load area and to ensure that security and reliability of supply is maintained, THESL and HON began a joint study to:

- Review the adequacy of the existing transmission system based on the 2006 THESL forecast and the provincial demand reduction initiatives
- identify impact of high impact contingencies
- identify transmission facilities required to meet area needs over both the near (2006-2011) term and the long (2011-2021) term

This report presents the results of the joint study and recommends an action plan to ensure that the City of Toronto continues to receive a reliable electric power supply.

2.0 Load Forecast

The load in the City of Toronto is expected to increase at an average rate of about 1.25% annually over the long term. The growth rate varies across the City – from about 0.7% in the Scarborough area to 1.9% in the downtown district. Table 1 show the coincident peak load recorded in summer 2005 and the peak summer load forecast for stations within the City. The stations forecast were developed by projecting 2005 loads by growth rates given in the Toronto Hydro's February 2006 summer load forecast.



Map 1. Transmission Facilities Supplying the City of Toronto

Table 1. MW Summer Load Forecast for Toronto Hydro (2006-2021)

Station	2005 Actual	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Warden	138	139	140	141	142	144	145	147	148	150	151	152	154	155	157	158	160
Bermondsey	176	177	177	178	179	180	182	183	185	187	189	191	193	195	197	199	201
Sheppard	173	175	177	179	181	182	184	186	188	190	192	194	196	198	200	202	204
Scarboro	271	273	274	276	277	280	283	286	289	292	295	298	301	304	307	310	313
Leaside	135	136	138	139	141	142	143	145	146	148	149	151	152	154	156	157	159
Ellesmere	145	146	146	147	148	149	151	152	154	155	157	159	160	162	164	165	167
C x L	1038	1045	1053	1060	1067	1078	1089	1099	1110	1121	1133	1144	1156	1168	1180	1192	1204
Basin	42	42	43	43	44	44	44	45	45	46	46	47	47	48	48	49	50
Terauley	198	200	202	205	207	212	217	222	226	231	236	241	246	251	256	261	266
Bridgman	161	164	167	169	172	174	176	177	179	181	183	184	186	188	190	192	194
Carlaw	60	60	60	61	61	62	62	63	63	64	65	65	66	67	68	69	70
Cecil	134	138	143	148	153	156	160	163	166	169	173	176	179	182	185	188	192
Charles	134	137	139	142	144	146	148	149	151	153	154	156	157	159	160	161	163
Dufferin	127	131	135	139	143	144	146	147	149	150	152	153	155	156	158	159	161
Duplex	102	104	106	108	109	111	112	113	114	115	116	118	119	120	121	122	124
Main	65	65	66	66	67	67	68	69	69	70	71	71	72	73	74	75	76
Esplanade	138	140	142	144	146	149	152	155	159	162	165	168	172	175	178	182	186
Glengrove	56	57	58	58	59	60	60	60	61	61	62	63	63	64	65	65	66
Gerrard	38	38	38	38	38	38	38	39	39	39	39	40	40	40	40	40	41
Leaside 115kV	1254	1276	1298	1321	1344	1363	1382	1402	1421	1441	1461	1481	1502	1522	1544	1565	1587
Total C x L	2292	2321	2351	2381	2412	2441	2471	2501	2531	2562	2594	2625	2658	2690	2723	2757	2791
Manby	229	231	232	234	236	238	240	243	246	249	252	255	258	261	264	267	270
Horner	140	141	143	144	146	147	149	150	151	153	155	156	158	159	161	163	164
Other 230kV Loads	384	388	392	396	399	402	406	409	412	415	419	422	426	429	432	436	439
Manby 230kV	753	760	767	775	781	788	795	802	809	817	825	833	841	849	857	865	874
Wiltshire	80	80	80	80	80	81	83	85	87	88	90	92	94	96	98	100	102
Runnymede	120	121	122	123	124	125	126	128	129	130	132	133	134	136	137	138	139
Fairbanks	161	162	163	164	165	166	168	170	171	173	175	176	178	180	182	184	186
Manby East 115	361	363	365	367	368	373	378	382	387	392	397	401	406	411	416	421	427
Strachan	98	100	102	104	107	110	114	118	122	127	129	131	134	137	139	142	145
John	258	263	268	272	277	283	288	293	298	304	310	316	323	329	336	343	350
Manby West 11	356	363	370	377	384	393	402	411	421	431	439	448	457	466	475	485	494
Richview x Manby 230kV	1470	1486	1502	1518	1533	1554	1574	1595	1617	1639	1661	1682	1704	1726	1749	1772	1795

Note:
Stations supplied from the Cherrywood TS x Richview TS corridor are not shown.

Only the summer load is given as the area is summer peaking. The area summer load is higher than winter load and transmission lines ampacities and transformer station capacities are lower in the summer. This summer and winter gap is expected to widen as air-conditioning load increases in the future.

3.0 Study Assumptions

In order to study the effects of contingencies and verify the system capacity, the following assumptions are made in this report:

1. A study period of 2006 to 2021 is chosen to assess transmission requirements.

2. Forecast loads are based on the forecast growth rates provided by Toronto Hydro. The 2005 peak summer load was used as indicative of the hot and humid weather and used as the starting point for the forecast.

3. Dufferin TS is normally supplied from Leaside TS. Also, half of Terauley TS is supplied exclusively via Cecil TS while the remaining is supplied exclusively via Esplanade TS. Transfer of load at these facilities is permitted between the Leaside and Manby areas both pre or post contingency providing capacity is available in the other area.

4. Transmission adequacy is based on the following criteria:

    - Availability assumed to be in accordance with IESO availability guidelines

    - With all elements in service the system is to be capable of supplying forecast demand with equipment loading within continuous ratings and voltages within normal range. With one element out of service the system is to be capable of supplying forecast demand with circuit loading within their long-time emergency (LTE) ratings and transformers within their limited-time ratings (LTR). All voltages must be within their emergency ranges.

    - With one element out of service for maintenance or as a result of an extended forced outage, and with the subsequent loss of a second element the system must be capable of supplying the forecast peak load with circuit loadings within their LTE ratings and transformers within their LTRs. All voltages must be within their emergency ratings.

    - Single element outages are considered for the 115kV network and the Manby TS East and Manby TS West autotransformers. Loss of the second element is only considered for 230kV systems and the Leaside autotransformers.

5. Overhead equipment continuous Limited Time Ratings (LTE) are based on an ambient temperature of 35°C for summer and a wind speed of 4km/hr.

6. Maximum voltage decline is limited to 10% for a single contingency. Minimum voltages on the 115kV and 230kV transmission system under normal pre-contingency conditions are 113kV and 220kV respectively.

4.0 Adequacy of Existing Facilities

This section reviews the adequacy of the existing transmission and delivery station facilities supplying the City of Toronto based on current facilities. The impact of the John TS x Esplanade TS cables, currently under construction and scheduled to be in-service by summer 2007, is also discussed.

4.1 230kV Facilities

The 230kV facilities were assumed to be loaded in accordance with the forecast given in Figure 1. The facilities are:

1. Cherrywood TS x Leaside TS 230kV transmission circuits
2. Leaside TS 230/115kV autotransformers
3. Richview TS x Manby TS 230kV transmission circuits
4. Manby TS 230/115kV autotransformers – both east and west yards.

Table 2 summarizes the result of adequacy studies and gives the need date for transmission reinforcement for each of the above facilities.

Table 2. Adequacy of 230kV Transmission Facilities

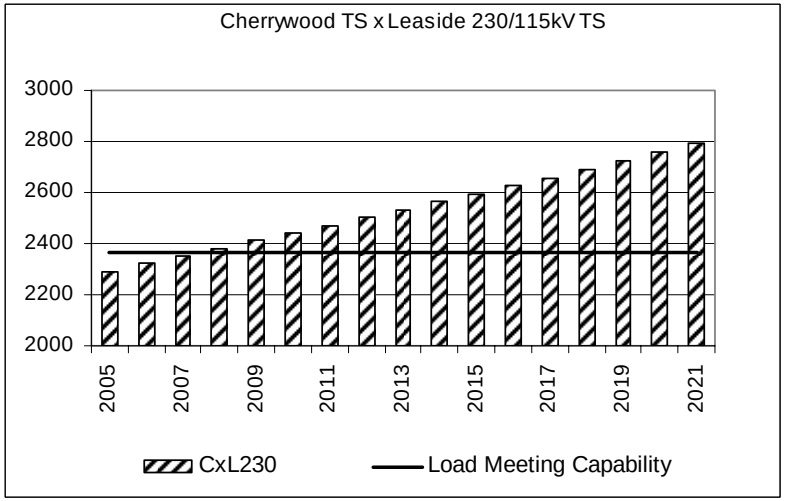
Facilities	2005 MW Load	MW Load Meeting Capability	Limiting Contingency	Need Date
Cherrywood x Leaside 230kV Corridor	2291	2368(1)	C2L/C3L	2008
Leaside autos	1253	1306(2)	T14/T15	2008
Richview x Manby 230kV Corridor	1470	1435	R1K/R2K	2010(3)
Manby E. autos Manby W. autos	356 361	523 612	T8 T1	2021+

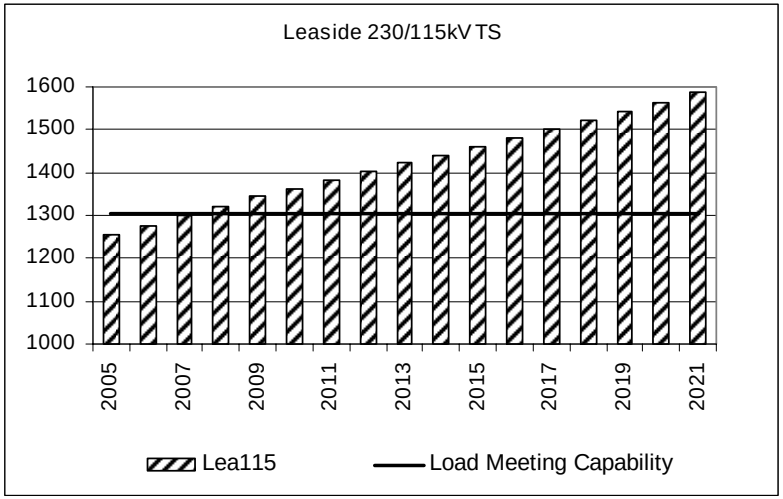
(1) Based on a tower line contingency with loss of two circuits.

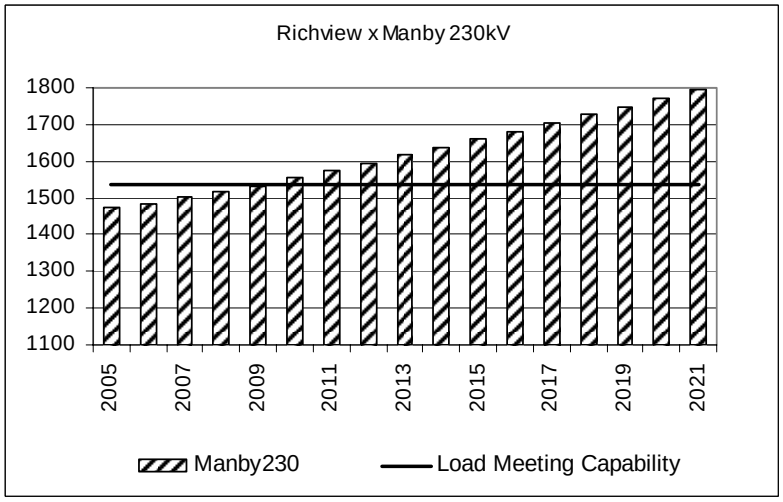
(2) With Dufferin TS transferred to Manby TS supply.

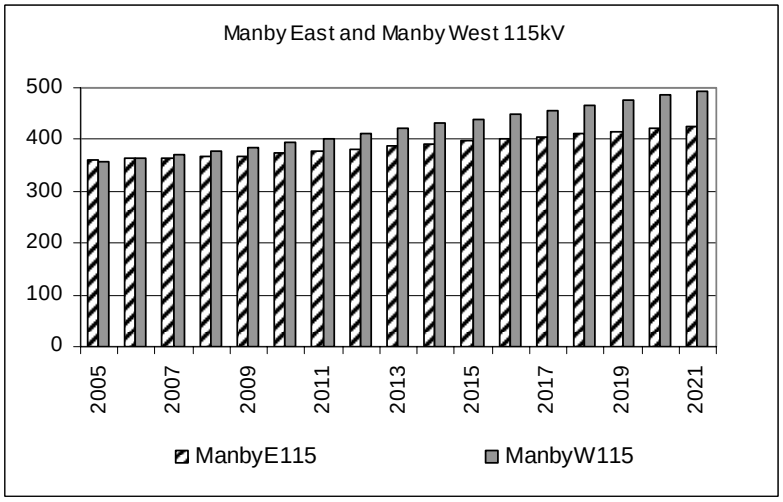
(3) Based on a tower line contingency with loss of two circuits and with the Horner TS bus tie opened pre-contingency.

Figure 1 – Load Forecast for the Cherrywood/Leaside and Richview/Manby areas









Note: The load meeting capability for Manby TS West and Manby TS East is 612 and 523MW approximately.

4.2 115kV Facilities

A single line diagram of the Toronto area 115kV network is shown in Figure 2. The network can be divided into five main corridors:

1. Leaside TS x Wiltshire TS – Three circuits L13W/L14W/L15W. Reinforcement is required on this corridor as loss of either the L13W or L15W circuits would result in the loading exceeding rating on the other circuits between Leaside TS and Bridgman TS.

2. Leaside TS x Hearn TS – Six circuits H6LC, H8LC, H1L, H3L, H7L and H11L. Loading is exceeded on Lumsden Jct. x Main TS section of the H7L/H11L circuits for loss of one of the other circuits.

3. Leaside TS x Cecil TS – Three circuits L9C, L12C and L4CS. These are expected to be adequate over the study period.

4. Manby TS East x Wiltshire TS – Four circuits K1W, K3W, K11, K12W. These circuits are adequate for the study period.

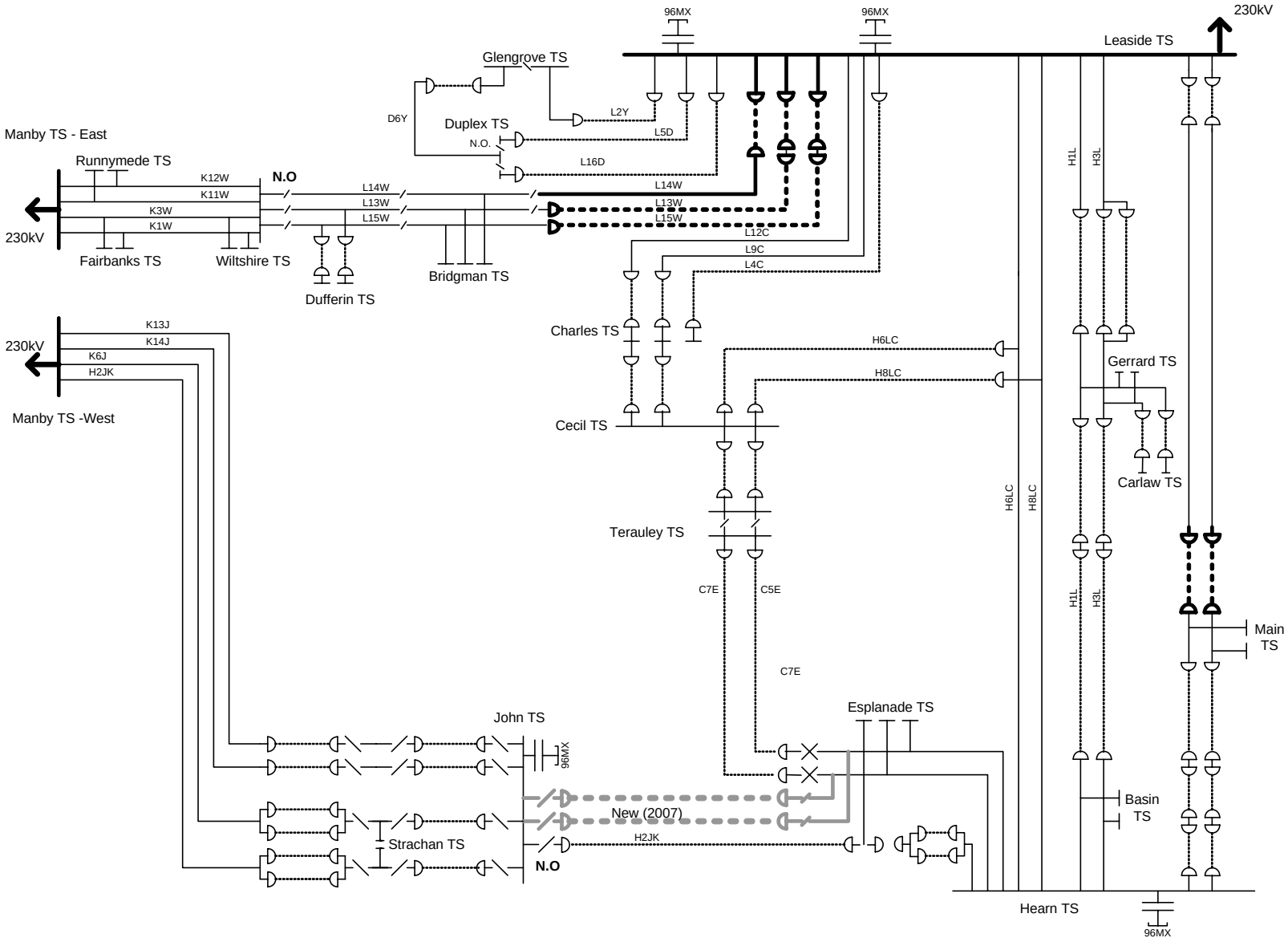
5. Manby TS West x John TS – Four circuits H2JK, K6J, K13W and K14W. These circuits are adequate over the study period.

The loading on the limiting sections is summarized in Table 3. These circuits are shown in bold in Figure 2.

Table 3. Overloaded Sections of 115kV circuits

Corridor	Section	Limiting Circuit	Rating (MW)	Contingency	2006 Loading (MW)
Leaside TS x Wiltshire TS	Leaside TS x Bridgman TS	L13W L15W	201 172	L15W L13W	213 186
Leaside TS x Hearn TS	Lumsden Jct. x Main TS	H7L H11L	95 95	H1L H1L	110 109

Figure 2. Toronto 115kV System.



4.3 Leaside – Manby Load Transfer Capability and Impact of the new John TS x Esplanade TS Cables

Relief for overloaded facilities can be provided in the event of outage conditions by transferring loads between the Leaside and Manby sectors using the Leaside TS x Wiltshire TS and the Hearn TS x Esplanade TS x John TS circuits.

Relief for either the Leaside or Manby sectors was generally provided in the past by transferring Dufferin TS between Leaside and Manby. With today's load, supplying Dufferin TS from Leaside TS would result in overloading on the L13W or L15W circuits under contingency conditions during peak periods. Similarly, supplying Dufferin TS from Manby TS would advance the need for Manby 230kV system reinforcement to 2006 even for the case of the single circuit outage. It would also advance the need to reinforce the Manby East area to 2012 from 2021.

The new John TS x Esplanade cables would allow half of Terauley TS to be picked up from Manby West. However, a permanent transfer of half of Terauley TS to Manby supply would have the same effect – increase Manby TS loading by about 100MW - and advance the need to reinforce the Richview TS x Manby TS corridor.

The summer load transfer capability based on 2006 forecast loads is as given below in Table 4. The load transfer capability assumes all facilities are in service on the side that is picking up the load.

Table 4. Load transfer Capability between Leaside and Manby

Load Transfer	From Manby to Leaside	From Leaside x Manby
On Leaside x Wiltshire 115kV circuits	120 - 150MW	250-300MW
Along Hearn x Esplanade x John 115kV circuits	100MW/250-300MW*	100MW/250-300MW*

* Increased capacity after the new John x Esplanade 115kV cables are in service. Assumes all of Terauley TS is supplied via Cecil TS

4.4 Step-Down Transformer Facilities

A detailed capacity forecast for the step-down transformer in the City of Toronto was prepared by Toronto Hydro (Toronto Hydro-Electric System Limited 2005 Station Load Forecast – dated February 4, 2006). The forecast shows:

- Four out of the five stations serving the downtown area will have inadequate capacity to meet peak demand during the next ten years. These stations are Cecil, Esplanade, Terauley and John/ Windsor. The only station that does not have capacity constraints is Strachan TS.

- The V-F bus at Manby TS will reach full capacity in the next two years. As the degree of overload is forecasted to be less than 5MVA over the next 5 years, the overload can be effectively dealt with by transferring load through the distribution system to the B-Y and Q-Z buses. Load transfers from the V-F bys to B-Y and Q-Z buses can be continued to be used to deal with V-F bus load growth for the next ten years

This report considers the provision of transformation capacity in the Terauley, Cecil, John and Esplanade stations area. Manby TS is being addressed separately and is not considered in this report.

5.0 Sensitivity Analysis - Effect of Ongoing Initiatives.

A sensitivity analysis study was carried out to determine the effect of the Provincial Government initiatives – demand management and new generation – and for changes in growth rate on the need for the transmission reinforcement.

5.1 Effect of demand side management.

Four scenarios were considered to show the effect of demand side initiatives. The result of the analysis is given in Table 5 below.

Table 5. Impact on Need Date for Transmission Reinforcement under Various Load Scenarios. Year Forecast load exceeds Load Meeting capability

Scenarios	Cherrywood x Leaside 230kV	Leaside 230/115kV Autos	Richview x Manby 230kV	Leaside x Hearn 115kV	Leaside x Wiltshire 115kV
Base case (1.25% growth Rate)	2008	2008	2010	2006	2006
Load Growth Rate (-50% base rate)	2011	2010	2013	2006	2006
Load Growth Rate (+25% base rate)	2008	2007	2009	2006	2006
5% Demand Management*	2012	2011	2014	2006	2007
10% Demand Management**	2017	2015	2018	2007	2009

* The load demand is assumed to be reduced by 5% and load is 95% of the base case value.

** The load demand is assumed to be reduced by 10% and load is 90% of the base case value.

The 5-10% demand management target assumed is very ambitious. On the Cherrywood x Leaside corridor it corresponds to a demand reduction of between 125-250MW. Given that the need dates are almost immediate it may be difficult to achieve the necessary load reduction over the short term.

5.2 Effect of Generation

Four scenarios were considered for generation in the City of Toronto. The scenarios and their effect on need date for transmission reinforcement is given in Table 6. The analysis assumes that the Toronto area generation is available and running during the peak period when required. If generation were to be unavailable then load may have to be interrupted to prevent overloading on the transmission system.

Table 6. Impact of Generation on Need Date for Transmission Reinforcement

Scenarios	Cherrywood x Leaside 230kV	Leaside 230/115kV Autos	Richview x Manby 230kV	Leaside x Hearn 115kV	Leaside x Wiltshire 115kV
Base case (1.25% growth Rate)	2008	2008	2010	2006	2006
Hearn 550MW (Firm 275MW)	2015	2017	2010	2021+	2006
Scarborough 150MW (100MW Firm)	2011*	2008	2010	2006	2006
Etobicoke 150MW (100MW Firm)	2008	2008	2015**	2006	2006
Lakeview 900MW (750MW Firm)	2008	2010	2021+	2006	2012***

* Assumes connection made to limiting circuit.

** Assumes connection on independent circuit to Manby West.

*** Assumes Dufferin transferred to Manby East and generation is available to relieve the Richview x Manby interface.

The Hearn generation helps relieve the Leaside TS x Hearn TS 115kV circuits, the Leaside TS 115kV autotransformers and the Cherrywood TS x Leaside TS 230kV circuits. New generation at Lakeview would help defer the need for reinforcement of the Richview TS x Manby TS corridor.

6.0 Infrastructure Risk Due to “High impact” Events

Customer load in the City of Toronto is supplied from the Cherrywood TS x Leaside TS 230kV circuits and the Leaside TS autotransformer station in the east and the Richview TS x Manby TS 230kV circuits and the Manby TS autotransformer station in the west.

Currently about 70% of the supply is from the east and the remaining 30% from the west. While there is some transfer capability between Leaside TS and Manby TS, there is a risk that significant amount of load may remain unsupplied if there were to be a catastrophic event which results in the loss of facilities in either the Cherrywood TS and Leaside TS or the Richview TS and Manby TS areas.

Many customers in the downtown Toronto area are supplied from only one transformer station. The supply feeders are not linked to any other transformer station feeders to provide a secondary backup

support. Therefore, in the event of a total outage at a transformer station, the customers supplied from the station would be without power; and only after the restoration of the station could customers be supplied.

This section identifies the impact of the loss of key transmission or delivery station facilities. It shows the amount of load at risk under various outage scenarios and the amount of time taken to restore supply to affected customers.

6.1 HON 230kV or 115kV Transmission Facilities

Table 7 presents the result of an assessment of the load affected and the affected outage duration following:

- the loss of entire 230kV supply corridors
- the loss of 230/115kV transformation at Leaside TS or Manby TS
- the loss of up to two 115kV supply circuits to a step-down transformer station.

Further details on load transfers and load meeting capability for various contingencies are given in Appendix A.

Table 7. Impact of Catastrophic Events and Expected outage Durations

No.	Event	Load Interrupted	Load Restored in 2 Hrs (1)	Load Subject to prolonged Interruption (2).
1	Loss of Cherrywood TS x Leaside TS Corridor	Up to 2300MW	Between 500-1200MW	Between 1100-1800MW
2	Loss of Richview TS x Manby TS Corridor	Up to 1500MW	Between 1000-1100MW	From 400-500MW
3	Loss of Leaside TS 230/115kV Autotransformers	Up to 1300MW	Between 500-600MW	Between 700-800MW
4	Loss of Manby TS 230/115kV autotransformers	Up to 700MW	Between 500-600MW	Between 100-200MW
4	Loss of up to two 115kV supply circuits	Up to 180MW by configuration	All	None

Notes:
1. Customers may be subject to rotating interruptions even if the initial load is picked up within 2hrs.
2. It may take 48-72 hours for supply to be restored to most customers.

In general Leaside area contingencies are more severe than contingencies affecting the Manby area primarily because the area load is higher. Rotating load interruptions may be necessary for periods of 48-72 hours before temporary facilities are constructed to restore load. The actual time taken to restore

facilities to their pre-contingency state may be much longer and it may take up to a year or longer for the restoration work.

6.2 Step-Down Transformer Station Facilities

The risk of a catastrophic failure of an entire transformer station (TS) in downtown Toronto is considered to be low; however the impact of such an event would be substantial. Because of the limited transfer capability between downtown transformer stations, a catastrophic event would result in a lengthy outage to critical areas of the downtown core. The length of the supply interruption would depend upon the nature of the event which caused the interruption. For example, the loss of a complete station, such as John TS which serves the area bounded by Queen Street in the North, Lake Ontario in the south, Bay Street in the east and Bathurst street in the west would disrupt the City of Toronto's commercial center and financial district.

While the partial loss of a transformer station would be less impactive, the remaining in-service elements may not be able to supply some of the load. Rotational load cuts may become necessary to prevent overloading of the remaining equipment.

As an example of the impact of such an event, if total supply from John TS were to be lost for any reason, (equipment fire, flooding etc) it may take weeks to deliver and connect new equipment to restore the 262MW load served by this facility. At this time, the load cannot be transferred to adjacent stations due to limitations on capacity of those facilities and the infrastructure required to permit the transfers.

Table 8 shows the results of preliminary assessment and load affected for outages to delivery station equipment at the five transformer stations serving the downtown district. These stations are Cecil TS, Charles TS, Esplanade/George & Duke TS, John/Windsor TS and Terauley TS. Further details are provided in Appendix B.

The following scenarios were considered:

- loss of 115kV supply to the station
- loss of a pair of HON DESN transformers
- loss of THESL switchgear

Table 8. MW Load [1] Lost for Catastrophic Events and Expected outage Durations

Station	Loss of Supply to Delivery Point [2]	Loss of Two Transformers[3]	Loss of THESL LV Equipment [4]
Cecil TS	134[5]	101	57
Charles TS	137[6]	77	40
Esplanade TS	138[7]	55	54
Terauley TS	202[8]	101	53
John TS	262[9]	135	51

1. The MW load lost represents the maximum amount of load that would be interrupted. Actual load interrupted may be less depending on when the contingency occurred.
2. Total station load is lost. The load shown is the 2005 non-coincident station summer peak.
3. Load based on THESL 2006 summer load forecast. A 0.9 power factor was used to convert MVA to MW. It may take 30 or more days to replace transformer if required.
4. THESL to utilize mobile switchgear trailer to facilitate customer connection until switchgear repaired/replaced. Typical switchgear at these locations is rated at 3000A or 72MVA. It may take 3-4 days to connect customers using mobile switchgear. (The mobile switchgear is expected by early 2007).
5. Cecil TS is 115kV indoor GIS station with five 115kV cable circuits. An event involving the 115kV bus has the potential to interrupt Cecil TS, Charles TS and Terauley TS. Both Charles and Terauley loads can be restored in 2 hrs by switching 115kV circuits. All of Cecil TS (134MW) may be affected beyond two hours till supply is restored.
6. Charles TS is supplied from three 115kV circuits. The circuits can be configured to supply Charles TS from either Cecil TS or Leaside TS. All of Charles TS load (137MW) is expected to be restored within 2 hrs.
7. Esplanade TS is supplied from three 115kV circuits from Hearn TS. Also, with the new John TS x Esplanade TS cables the entire station load can be picked up from John TS. All of Esplanade TS load (138MW) is expected to be restored within 2 hrs.
8. Terauley TS is supplied from both Cecil and Esplanade TS. Load can be restored within two hrs by switching.
9. John TS has an outdoor 115kV bus with 4 circuits to Manby and three 115kV circuits to Hearn after the new John x Esplanade cables is complete. An event involving the 115kV bus has the potential to interrupt the entire station load (262MW). All of John TS can be restored within two hours by switching and isolating faulted sections.

A similar assessment was done for the THESL owned Cavanagh TS. The result of the assessment is summarized in Table 9.

Table 9. MW Load Lost for Catastrophic Events and Expected outage Durations

Station	Loss of Supply to Delivery Point [1]	Loss of Two Transformers[1]	Loss of THESL LV Equipment [1]
Cavanagh TS	120[2]	120[3]	120[4].

1. Total station load is lost. The load shown is the 2005 non-coincident station summer peak.
2. Cavanagh TS is supplied of the Cherrywood TS x Richview TS 230kV right-of-way (230kV circuits C10A and C20R). In case of loss of the two lines supplying the station about 120MW of station load would be interrupted. It is expected that the faulted line sections will be isolated and supply restored within two hours from either Richview TS or Cherrywood TS.
3. THESL currently have no spare transformers. Arrangements need to be made to ensure that spare transformers are available for replacement if required. While some station load can be picked up from Agincourt TS and/or Scarborough TS, a majority of customers would be subject to a prolonged outage
4. The entire station load would be interrupted. Again some station load will be picked up from Agincourt TS and/or Scarborough TS. However, a majority of customers would be subject to a prolonged interruption until outage repairs are accomplished.

7.0 Need Summary

The need review shows that there is a need to reinforce the transmission facilities to supply the Central Toronto area. TS. A summary of the needs for the various areas is given below:

Leaside Area

- Cherrywood TS x Leaside TS 230kV Corridor. This corridor requires relief by summer 2008. Incorporation of new generation at Portlands TS at Hearn will help defer this need to 2015.
- Leaside TS 230/115kV Transformation. The Leaside autotransformers require relief by summer 2008. Again, incorporation of the proposed Portlands Generation would defer the need to 2017.
- Leaside TS x Hearn TS 115kV circuits. Sections of these circuits would be overloaded in the event of a contingency during summer peak periods. However, the Portlands generation would help defer the need to provide relief to beyond 2021.
- Leaside TS x Wiltshire TS 115kV circuits. Sections of these circuits would be overloaded in the event of a contingency during summer peak periods. Relief is required as soon as possible.
- Loss of the Cherrywood TS x Leaside TS corridor may result in prolonged outages to 1100-1800MW of load. Similarly loss of Leaside autotransformers could result in a prolonged interruption to 700-800MW of load.

Manby Area

- Richview TS x Manby TS 230kV Corridor. This corridor needs relief by summer 2010. New generation in the Manby-Lakeview area may defer the need date.
- Manby TS 230/115kV Transformation. These facilities are expected to be adequate over the study period. If, however Dufferin TS is moved to Manby east TS supply, then Manby East would require relief by 2012.
- Loss of the Richview corridor may result in prolonged interruption to 400-500MW of load. Loss of autotransformers at Manby TS could result in a prolonged interruption to 100-200MW of load.

Step-down transformer Stations

- Additional step-down facilities are required in the downtown area by 2016.
- While there is redundancy in HV supply to most stations, loss of multiple transformers or of the THESL switchgear at a station would result in prolonged interruptions to customers since there is no transfer capability between stations.

- Cavanagh TS is a THESL owned 230/27.6kV station. Unavailability of spare transformers or 27.6kV equipment may further delay restoration efforts at Cavanagh TS.

The need analysis shows that high impact events can result in major load loss with customers suffering prolonged interruptions. There is a need to reduce the impact of such events.

Discussions have been initiated between HON, THESL and the IESO to ensure that appropriate operational control actions and procedures are in place to meet load demand on an interim basis, in the event of contingencies.

8.0 Possible Options to Provide Adequate Supply Capacity

A number of options have been considered to meet the need to provide relief for transmission facilities. The options are as follows (please also see Map 3):

8.1 "Do Nothing"

The "Do Nothing" option will aggravate the existing overload situation. Equipment loading will continue to increase and supply reliability will be adversely impacted in case of a contingency. This alternative is not acceptable and is not considered further.

8.2 Options for Providing Relief for Cherrywood TS x Leaside TS 230kV Corridor and the Leaside 230/115kV Autotransformers

Two options were considered to provide relief for the Cherrywood TS x Leaside TS 230kV corridor.

8.2.1 Option C1 – Build a three circuit 230kV double circuit line from Parkway TS to Hearn SS and build a new 230/115kV autotransformer station at Hearn SS.

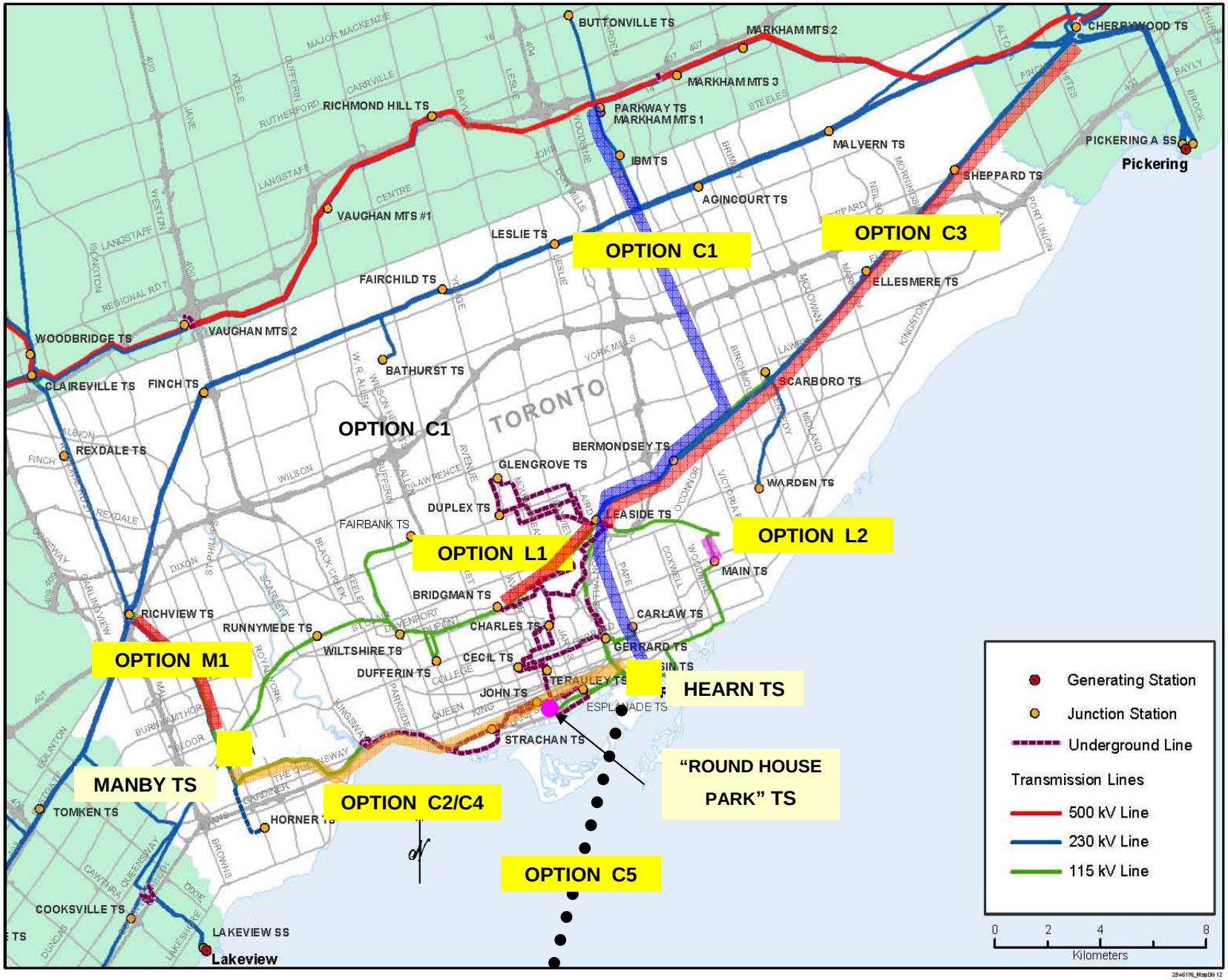
Under this option a new 3 x 230kV circuit line would be built from Parkway TS and connected to a new 230/115kV autotransformer station at Hearn SS. A number of 115kV step-down transformer stations supplied from Leaside TS would be transferred and picked up from the new Hearn station.

This option would provide 1000MW of 230kV transfer capability and 700MW of 230/115kV transformation capability.

8.2.2 Option C2 – Build a three circuit 230kV line from Manby TS to Hearn SS. Also, build a new 230/115kV autotransformer station at Hearn SS.

This option is similar to Option C1 except that 230kV supply for the new Hearn autotransformer station is provided from Manby TS instead of Parkway TS.

This option assumes adequate capacity is available at Manby TS. This condition would be fulfilled if the Richview TS x Manby TS corridor is reinforced or new generation is built at Lakeview. The option would provide 1000MW of 230kV transfer capability and 700MW of 230/115kV transformation capability.



MAP 3. Transmission Options being considered

8.2.3 Options not considered further

8.2.3.1 Option C3 - Build a double circuit 230kV line from Cherrywood TS to Leaside TS and add two 230/115kV autotransformers at Leaside TS

Under this option a new double circuit overhead 230kV line would be built from Cherrywood TS to Leaside TS and connected to two new 230/115kV autotransformers at Leaside TS. The new circuit will bring the total number of circuits between Cherrywood TS and Leaside TS to eight and increase transfer capability by 1000MW. Leaside 230/115kV transformation capacity would increase from 1206 to 1700MW.

Option C3 would provide additional capacity at Leaside TS and requires the least amount of new facilities. However, it does not address infrastructure risks since problems at Cherrywood and/or Leaside would interrupt even larger amount of loads following high impact events with no possibility for back up. It is also difficult to incorporate Portlands generations because of short circuit limitations at Leaside TS. Leaside TS would have to be rebuilt to overcome these limitations and obtaining outages for construction would be difficult. It was therefore not considered further

8.2.3.2 Option C4 - Build a double circuit 230kV double circuit line from Richview TS to Manby TS and build a three circuit 230kV line from Manby TS to Esplanade TS.

Under this option Esplanade TS and John TS would be converted to 230kV operation. The 230kV lines would also supply future stations in the downtown area (“Round House” TS in the railway lands area and “Esplanade II” TS) which are being proposed to cover the need for additional step-down transformation capacity. The existing Manby West TS would pick up half of Terauley TS and Basin TS, Carlaw TS, Main TS and Gerrard TS transformer stations.

This alternative would provide about 500MW of load relief for Leaside TS and the Cherrywood TS x Leaside TS circuits since Esplanade TS, half of Terauley TS and Basin TS, Carlaw TS, Main TS and Gerrard TS transformer stations would have been transferred over to the Manby side.

Option C4 requires converting existing stations at John TS and Esplanade TS. Both stations are heavily loaded and supply the downtown district and it would be very difficult to obtain outages. Customer load would be at risk during construction. The option relies on supply from Richview TS and Manby TS and problems at either location have the potential to interrupt the new 230kV stations as well as Manby East and Manby West loads. This option was also not considered further.

8.2.3.3 Option C5 – Provide supply from Niagara using HVDC cable circuits under Lake Ontario.

This option is similar to Option C2 and C3. However, supply instead of coming from Parkway would come from Niagara – Adam Beck 2 TS, using a two 500MW HVDC submarine cable circuits under Lake

Ontario. A second 250MW back-to-back HVDC converter would be installed and connected to a new 115kV circuit to John TS thereby deferring the need to reinforce the Richview TS x Manby TS circuits.

The option is more environmentally impactive, technically more complex and is expected to be significantly more expensive than the other alternatives. It was therefore not considered further.

8.3 Options for providing relief for Richview TS x Manby TS 230kV corridor

A number of options were considered to reinforce the Richview TS x Manby TS corridor. However, only one option- Option M1 below is recommended and considered further.

8.3.1 Option M1 – Build double circuit 230kV line between Richview TS and Manby TS

Under this option a new double circuit line would be built between Richview TS and Manby TS. One circuit would terminate in the Manby East yard and the second in the Manby West Yard.

This work would increase transfer capability into Manby by 600MW.

8.3.2 Options not considered further

Three options were evaluated but not considered further:

- Installing a second circuit on the Richview TS x Cooksville TS 230kV line R24C – This alternative provides only short term relief to 2012.
- Installing series capacitors on the Richview TS x Cooksville TS 230kV line R24C – this alternative also provides short term relief to 2012.
- Build a new double circuit line between Trafalgar TS and Oakville TS. This option would help relieve the Richview TS x Manby TS circuits as well as the Richview TS x Trafalgar TS circuits. This option requires building a line on a new right-of-way and its cost is expected to be higher than the costs under option M1. It may also necessitate reinforcement of the 500/230kV auto-transformation in the west GTA. Additional timing risks for such major facilities could delay relief for the Richview TS x Manby TS corridor.

  The OPA will be considering this option as part of its overall long term integrated plan for ensuring overall supply to the GTA area and the incorporation of new generation. However, given the relatively higher cost of this option, the added timing risks and the uncertainty over the future plans for the GTA area, it was decided not to proceed further with this option.

8.4 Options for Reinforcing the Leaside TS x115kV area

8.4.1 L1 - Reinforcement of the Leaside TS x Wiltshire TS corridor

There are two options to provide relief for the Leaside TS to Wiltshire TS corridor as follows:

- L1A – Provide a new 115kV circuit between Leaside TS and Bridgman TS by adding a third circuit to the existing L14W/L15W tower line between Leaside TS and Bayview Jct., a new underground cable between Bayview Jct. and Birch Jct. and extending the circuit to Bridgman TS by connecting to the idle 115kV line section on the L14W tower line between Birch Jct. and Bridgman TS. Approximately 3.9km of new circuit would be required.
- L1B - Build a new 5.4km long 115kV underground circuit between Leaside TS and Bridgman TS.

Option L1A is preferred because of shorter length and correspondingly lower cost.

The existing section of the L14W circuit between Bayview Jct. and Birch Jct. has been identified for replacement by 2011 and the new cable work will be coordinated with the replacement work under both options.

8.4.2 L2 - Reinforcement of the Leaside TS x Hearn circuits H7L/H11L

The limiting section on this corridor is a 2km long underground section between Lumsden Jct. x Main TS section. The proposed new Portlands TS will back off flows on the Leaside Hearn interface thereby alleviating the overloads. Again this cable section has also been identified for refurbishment over the next 5-7 years and work will be coordinated to ensure reliable supply.

8.5 Options for Additional Step-down Transformation Capacity

Two options have been considered for providing additional step-down capacity in the downtown area:

8.5.1 Option S1 – Expand Esplanade TS and add two 115/13.8kV transformers.

Under this option a second building will be built at Esplanade TS to house two 60/100MVA, 115/13.8kV transformers. This will provide 144MVA of additional capacity.

8.5.2 Option S2 – Build new “Round House Park” station

Under this option a new station will be built at the Round House site – corner of Rees Street and Bremner Blvd. The station will initially house two 60/100 MVA, 115/13.8kV transformers and will provide 144MVA of step down capacity. Two more transformers can be added in the future as required.

8.5.3 Options not considered further

An option of replacing the existing 45/75MVA transformers at Strachan TS with larger 60/100MVA units was initially considered and rejected. This alternative would provide 96MVA of additional capacity but it is limited to serving loads mainly east of Spadina Ave. Limited relief of John TS is achievable with no direct relief of Terauley TS possible.

9.0 Preferred Transmission Plan Selection

Two plans were identified for transmission system reinforcement based on an assessment of the options described above and are given in Table 10 below.

Table 10 – Transmission Plans considered

Alternate Plans	Cherrywood x Leaside Corridor and Leaside Autotransformers		Richview x Manby Corridor	Leaside x Wiltshire Corridor	Leaside x Hearn corridor
Options	C1(1)	C2(2)	M1(3)	L1A(4)	L2(5)
Timing of Options (6)	2008	2008	2010	2006	2006
Plan A	X		X	X	X
Plan B		X	X	X	X

Notes:
(1) C1 – add autotransformer capacity at Leaside TS and 230kV supply from Cherrywood TS
(2) C2 – add autotransformer capacity at Hearn TS and 230kV supply from Parkway TS.
(3) M1 – Build 230kV line from Richview TS to Manby TS
(4) L1A – Build new circuit between Leaside TS and Bridgman TS.
(5) L2 – Up rate Lumsden Jct. x Main TS section of 115kV circuits H7L/H11L.
(6) The need date for providing relief for the Cherrywood TS x Leaside Corridor and Leaside autotransformer is dependent on the availability of the proposed Portlands generation at Hearn TS. If generation goes ahead, then the required timings will be pushed back to 2015 and 2017 respectively as shown in Table 6.

The plans were compared based on their ability to meet the need for electric supply over the next fifteen years and to address the issue of infrastructure risk posed by high impact outages.

Plan A is based on adding new autotransformer capacity at Hearn TS and 230kV supply from Parkway TS. Plan B is based on a new 230/115kV autotransformer station at Hearn TS with 230kV supply coming from Richview TS and Manby TS.

Both plans are very similar in terms of requirement for major equipment and kilometres of new 230kV lines required to be constructed (see Table 11). Both plans include a need to build a new double circuit line between Richview TS and Manby TS and to reinforce the Leaside TS x Wiltshire TS corridor circuits and the H7L/H11L circuits between Leaside and Hearn TS.

Table 11 – Major Equipment and 230kV Line Requirements under Plans A and B.

Major Equipment or Line (km)	Cherrywood x Leaside Corridor and Leaside Autotransformers		Richview x Manby Corridor	Leaside x Wiltshire Corridor	Leaside x Hearn corridor	Summary of Alternative Plans requirements	
Options	C1	C2	M1	L1	L2	Plan A[1]	Plan B[2]
Timing [3]	2008	2008	2010	2006	2006	2006	2006
Autos	3	3				3	3
230kV Breakers	2	3	4			6	7
Breakers 115kV	16	16		1		17	17
Total km 230kV line	26 (3 x230kV)	20 (3 x230kV)	6.5 (2 x230kV)			32.5	26.5
230kV u/g [4] Cable (km)	Up to 26	Up to 20				26	20
New ROW required (km)	7	12				7	12
115kV line				3.9 (1 x115kV)	1.6[5] (2 x115kV)	5.5	5.5

Note:

(1) Plan A includes options C1, M1, L1 and L2
(2) Plan B includes options C2, M1, L1 and L2
(3) Need date for Options C1 and C2 would be delayed to 2015 with new generation at Hearn SS. The need for option L2 is alleviated with new generation.
(4) Indicate potential length of underground cable sections required.
(5) This is an underground cable section.

Although Plan A requires an extra six km of 230kV line work compared to Plan B, it is the preferred plan for the following reasons:

1. Plan A results in increased security as it introduces a new 230/115kV supply point for the Central Toronto area.

2. Provides greater supply diversity for all of Central Toronto load – particularly the key downtown areas. Under Plan A load would be split and supplied from three sources with the capability to easily transfer load between them as required.

   Hearn TS together with Parkway TS provides a true third source of supply for the City. It would be able to back up loads supplied from both Leaside TS and Manby TS in case of outages at either of these two stations.

   Plan B is able to back up Leaside only. Outages at Manby TS, Richview TS and/or Claireville TS would interrupt supply to Manby East and Manby West autotransformer stations as well as the new Hearn autotransformer station.

3. Even though the plan requires more line work, most of the new lines are to be located on existing Hydro One right-of-ways. Plan A would require 7 km of new right-of way compared to about 12km of new right-of-way required under Plan B. This would have significantly lower environmental impact.

4. No additional transmission line work is required under Plan A. Plan B would result in an immediate increase in flows on the Claireville autotransformers and the Trafalgar TS x Richview TS 230kV circuits and trigger the need for additional transmission reinforcement beyond Richview.

5. Plan A provides more operating flexibility – particularly with respect to maintenance and operation of the Richview TS and Manby TS areas.

10.0 Preferred Step-down Transformation Plan Selection

Both options for providing additional capacity – expanding Esplanade TS or building a new transformer station at “Round House Park” are capable of meeting the future load growth in the downtown area.

While the new “Round House Park” TS would be more costly than the Esplanade TS expansion it is preferred for the following reasons:

- Provides enhanced diversity of supply to downtown Toronto load and would help reduce the effect of high impact outages to transformer stations in the downtown core.
- It is closer to John TS and Terauley TS and would require shorter inter-station feeders to transfer loads in the event of contingencies. In addition, the existing site is attractive because of its location with respect to THESL civil and distribution infrastructure which is a key component in creating inter-station transfer capability.
- Proximity to John TS and Terauley TS would also permit some of the existing loads at these stations to be permanently moved to “Round House Park” TS. This will reduce the impact of a total station interruption by reducing the loading on existing transformer stations.
- The reduced loading levels on existing facilities would provide increased operating flexibility. It will facilitate planned maintenance, permit refurbishment and or replacement of aging equipment and thereby improve the reliability of supply from these stations.
- Retains the option of expanding existing stations in the long term to deal with area load growth.

The “Round House Park” property is the one of the last remaining viable sites for locating a transformer station in the downtown area. Hydro One has an option on this property that expires in 2013. If the

option is not exercised by 2008, this site will be lost. It will be very difficult, if not impossible, to find an alternate transformer station site as all available land in this area is being developed for other purposes.

From the perspective of mitigating risks of high impact outages to downtown stations and meeting increasing load demands in the central area, the option to build a new station at the Round House Park site is superior.

11.0 Conclusions and Recommendations

11.1 Transmission Reinforcement for Adequacy

This report has reviewed the transmission supply adequacy supply to the Central Toronto Area over the 2006-2021 study period and shows that under certain contingency conditions the existing 230/115kV auto-transformation facilities and 230kV transmission circuits would be loaded beyond their limited time rating or result in unacceptable voltage declines.

The required in-service date for the new facilities varies from an immediate need to provide relief for the Leaside TS x Wiltshire TS 115kV circuits L13W/L14W and L15W to summer 2010 for providing relief for the Richview TS x Manby TS circuits R1K/R2K and R13K/R15K.

A number of options were considered and two alternative plans developed to meet load demand over the study period. A qualitative assessment of the two plans indicates that while the two plans are similar in terms of new facilities required, Plan A provides greater operating flexibility and system security.

Plan A introduces a third point of supply for the City and eliminates reliability concerns associated with a total loss of supply from either Leaside TS or Manby TS. The proposed transmission reinforcements required under Plan A and listed in order of need dates are as follows:

<u>Stage 1 – Facilities required on a priority basis</u>

- A new 3.9km long 115kV circuit between Leaside TS and Birch Jct. The new circuit will connect to an idle 115kV circuit on the L14W tower line between Birch Jct. and Bridgman TS. The earliest the new facilities can be in-service is summer 2009.

<u>Stage 2 – Facilities required by summer 2010</u>

- A new 6.5km 230kV double circuit line between Richview TS and Manby TS to be in-service by summer 2010. (This work would be deferred by new generation at Lakeview GS site. Another alternative to this work is to build a 230kV new line from Trafalgar TS to Oakville TS. Given the increased system security with respect to generation option and the relative cost with respect to other transmission options, it is deemed prudent to proceed with building the new Richview TS x Manby TS line).

Stage 3 – Facilities required by summer 2015 based on adequacy

- A three circuit 230kV line from Parkway TS to Hearn TS
- A new GIS 115kV switchyard at Hearn including 230/115 kV auto-transformation

These facilities may be required earlier if the Portlands generation does not go into service or if necessary to mitigate the effect of high impact events as noted below.

11.2 Proposed Transmission Reinforcements to Address High Impact Events

Stage 1 and Stage 2 facilities together with Portlands generation will not be able to completely mitigate the impact of the loss of Leaside TS and/or Manby TS or other high impact contingencies that could occur.

It is therefore recommended that work on the Stage 3 facilities be initiated now with the objective of placing these facilities in-service as early as possible. It would take between 4 and 5 years to obtain the necessary approvals and to design and build the facilities, and the earliest the facilities could be built is by summer 2011 or 2012.

Given that the need date is 2015 assuming new Hearn area generation; the early in-service represents an advancement of the project by about three to four years The advancement is considered justifiable given the severe impact that a major outage would have on the City of Toronto.

11.3 Proposed Step-Down Capacity Reinforcement

It is proposed to provide additional 13.8kV step-down transmission capacity and back up switching facilities in the downtown area. The Round House Park site is preferred for future development because of it ability to address reliability concerns as well as provide capacity for future load growth.

It is recommended that process be initiated to obtain approvals for the Round House Park site and associated transmission facilities.

11.4 Recommendations

Because of the urgency of the need to provide relief and to have the required facilities in-service as soon as possible, the following steps are recommended:

(1) Advise the OPA of HON and THESL study results for inclusion in the IPSP.

(2) Initiate environmental assessment, preliminary engineering and project development work under Plan A for the following:

   a. Leaside TS x Bridgman TS circuits

   b. Richview TS x Manby TS circuits

c. A new 230/115kV autotransformer at Hearn TS with 230kV supply from Parkway TS.

d. Uprate the Lumsden Jct. x Main TS section of 115kV circuits H1L/H7L

(3) THESL initiates approval process for building the new Round House Park TS.

Appendices

Appendix A

Impact of Extreme Events and Expected Length of Outage Duration

Table A1. Impact of Loss of 230kV Supply Corridors and Expected Outage Duration

No.	Contingency	Load Interrupted immediate post contingency	Load Picked up following switching operations (May take up to two hours)	Load Not being Supplied
1	Loss the Cherrywood TS x Leaside TS 230kV corridor	About 2300MW of load would be interrupted. Includes: • 1300MW of Leaside 115kV load • Up to 1000MW of load connected at the 230kV level to C x L circuits.	115kV load • Up to 250-300MW of load would be picked up by Manby West by transferring Esplanade TS and , Terauley TS from Hearn SS to John TS • Another 250-300MW would be picked up from Manby TS by transferring Bridgman TS and Dufferin TS from Leaside TS to Manby TS supply. 230kV Load The amount of load affected depends on the location of the fault/event. There is load transfer capability between stations on the C x L corridor and the Cherrywood x Richview (Finch Ave) corridor. For a fault just outside Cherrywood TS about 100MW of the load on the C x L corridor can be picked up by stations on the Finch corridor.	Up to 1000MW of load may remain unsupplied beyond two hours. Restoration Time Depending on the contingency, it may take 48-72 hours to restore one or more of the three double circuit lines allowing the interrupted load to be picked up Material Required Steel and wood poles, conductor, and string insulators.
2	Loss of the Richview x Manby Corridor	About 1500MW of Manby area load would be interrupted. Includes: • Manby West and Manby East 115kV load • Manby TS 230kV • Horner TS	115kV Load • Currently up to 100MW of load at John may be picked up by the H2JK circuit from Hearn. With the new John TS x Esplanade TS .cables expected to be in-service by summer 2007 an additional 250MW can be picked up at John and Strachan. • Up to 200-250MW can be picked up by	About 200-300MW of load in the Fairbanks and John/Strachan supply area would be subject to rotating interruptions.

No.	Contingency	Load Interrupted immediate post contingency	Load Picked up following switching operations (May take up to two hours)	Load Not being Supplied
			transferring Runnymede and Wiltshire to Leaside Supply within ½ hours. <u>230kV load</u> • Horner/Manby 230kV load and the Mississauga/Oakville area loads would be supplied from R24C. This can supply up to 750MW	<u>Restoration Time</u> Depending on the contingency, it may take 48-72 hours to restore one or more of the three double circuit lines allowing the interrupted load to be picked up.

Table A2. Impact of Loss of 230/115kV Autotransformer Stations and Expected Outage Duration

No.	Contingency	Load Interrupted immediate post contingency	Load Picked up following switching operations (May take up to two hours)	Load Not being Supplied
1	Loss of the complete Leaside 230/115kV station and the Leaside TS 230kV station.	The entire Leaside TS load would be interrupted (about 1300MW)	115kV load • Up to 250-300MW of load would be picked up by Manby West by transferring Esplanade TS and , Terauley TS from Hearn SS to John TS • Another 250-300MW would be picked up from Manby TS by transferring Bridgman TS and Dufferin TS from Leaside TS to Manby TS supply.	About 500-800MW of load would continue to be interrupted. There would be rotating interruptions in the Cecil, Charles, Basin, Gerrard, Carlaw, supply areas. Restoration time Depending on the contingency it may take 48-72 hours to pick up the reconfigure Leaside TS and pick up the above stations.
2	Loss of the Leaside West Yard – 230/115kV autotransformers T15, T16 and T17	The entire Leaside TS load (about 1300MW would have to be interrupted as loading on the T11/T12/T14 autos would exceed the 15minutes rating. Also, the loss of 115kV circuits L4C, L9C, L12C, H6LC and H8LC results in severe over loading on the Hearn x Leaside TS circuits H1L/H3L and H7L/H11L.	115kV load • Up to 200MW of load would be picked up by Manby West by transferring Terauley TS to John TS. • Another 250-300MW would be picked up from Manby TS by transferring Bridgman TS and Dufferin TS from Leaside TS to Manby TS supply. • About 400MW would picked up by H1L/H3L and H7L/H11L	About 250-300MW of load would continue to be interrupted. There would be rotating interruptions in the Cecil, Charles, Basin, Gerrard, Carlaw, supply areas. Restoration time Depending on the contingency it may take 48-72 hours to reconfigure Leaside and provide supply to the L9C/L12C or L4C circuits.

No.	Contingency	Load Interrupted immediate post contingency	Load Picked up following switching operations (May take up to two hours)	Load Not being Supplied
				This would allow Cecil TS and Charles TS to be picked up
3	Loss of the Leaside East Yard – 230/115kV autotransformers T11, T12 and T14	The entire Leaside TS load (about 1300MW would have to be interrupted as loading on the T15/T16/T17 autos would exceed the 15minutes rating.	<u>115kV load</u> • Up to 200MW of load would be picked up by Manby West by transferring Terauley TS to John TS. • Another 250-300MW would be picked up from Manby TS by transferring Bridgman TS and Dufferin TS from Leaside TS to Manby TS supply. • About 400MW would picked up by circuits H6LC/H8LC	All 115kV load is expected to be picked up within 2 hours. Transformers T15/T16/ T17 are expected to loaded up to their 10 day limited time ratings.
4	Loss of Manby TS West Yard – 230/115kV autotransformers T6, T7 & T8	Interrupts up to 360MW of load at John TS and Strachan TS.	Currently up to 100MW of load at John may be picked up by the H2JK circuit from Hearn. With the new John TS x Esplanade TS cables expected to be in-service by summer 2007 an additional 250MW can be picked up at John and Strachan.	The amount of load picked up is dependent on the loads at Terauley and Esplanade TS. <u>Restoration time</u> Depending on the contingency it may take 48-72 hours to reconfigure Manby TS and provide supply to the K6J/H2JK and the K13J/K14J circuits.
5	Loss of Manby TS East Yard – 230/115kV	Interrupts 400MW of load.	Up to 200-250MW can be picked up by transferring Runnymede and Wiltshire to	There would be rotating interruptions in the

No.	Contingency	Load Interrupted immediate post contingency	Load Picked up following switching operations (May take up to two hours)	Load Not being Supplied
	autotransformers T6, T7 & T8		Leaside Supply within ½ hours.	Fairbanks/ Runnymede/ Wiltshire supply areas. <u>Restoration time</u> Depending on the contingency it may take 48-72 hours to reconfigure Manby TS and provide supply to the K1W/K3W and the K11W/K12W circuits to pick up Fairbanks TS.

Table A3. Impact of Loss of 115kV Transmission Circuits and Expected Outage Duration

No.	Contingency	Load Interrupted immediate post contingency	Load Picked up following switching operations (May take up to two hours)	Load Not being Supplied
1	Loss of circuits H7L and H11L	Interrupts 60MW of load at Main TS.	Load can be restored within 2 hours after identifying the faulted section and supplying the station from either Hearn or Leaside	Restoration Time May take 2-3 weeks or longer to fix cable fault. However, customers are not affected.
2.	Loss of circuits H1L and H3L	Interrupts 180MW of load at Gerrard TS, Carlaw TS and Basin TS.	Load can be restored within 2 hours after identifying the faulted section and supplying the stations from either Hearn or Leaside	Restoration Time May take 2-3 weeks or longer to fix cable fault. However, customers are not affected.
3.	Loss of circuits H6LC and H8LC	Continuous ratings exceeded on the H1L/H3L and the H7L/H11L circuits.	Esplanade TS transferred to Manby TS supply.	Restoration Time May take 18-24 hrs or longer to fix overhead line faults. However, customers are not affected.
4	Loss of circuit H1 with H7L out pre-contingency	Ratings exceeded on H11L circuit.	Open H11L at Hearn	Restoration Time May take 2-3 weeks or longer to fix cable fault. However, customers are not affected.

No.	Contingency	Load Interrupted immediate post contingency	Load Picked up following switching operations (May take up to two hours)	Load Not being Supplied
5.	Loss of circuits H1 with H6LC out pre-contingency	Ratings exceeded on H7L/H11L circuits	Transfer Esplanade TS to Manby TS supply.	Restoration Time May take 2-3 weeks or longer to fix cable fault. However, customers are not affected.
6.	Loss of two of the three Leaside TS x Wiltshire TS circuits L13W/L14W and L15W	Ratings exceeded on the remaining in-service circuit. Some load at Dufferin TS and Bridgman TS would be lost by configuration.	Depending on the location of the fault, the circuits can be split to isolate the faulted section and supply the stations from either Leaside TS or Manby TS. All customers are expected to be restored within 2 hours.	Restoration Time May take 2-3 weeks or longer to fix cable fault. However, customers are not affected.
7.	Loss of two of the four Manby TS to John TS circuits H2JK/K6J/ K13J/K14J	Remaining circuits adequate to carry 400MW of loads.	----	Restoration Time May take 2-3 weeks or longer to fix cable fault. However, customers are not affected.
8.	Loss of two of the four Manby TS to Wiltshire TS circuits K1W/K3W K11W/K12W	Remaining circuits adequate to carry 400MW of loads.	----	Restoration Time May take 12-36 hours to fix overhead line fault. However, customers are not affected.

Appendix B

Impact of Extreme Events and Expected Length of Outage Duration for Toronto Downtown

115/13.8kV Step-down Transformer Station facilities

HON/THESL Delivery Facilities (115/13.8kV step-down transformer stations)

B1.0 Introduction

The 115/13.8kV step-down transformers stations in Central Toronto are:

Basin	Duplex	John/Windsor*
Bridgman	Esplanade/ George & Duke*	Main
Carlaw	Fairbank	Runnymede
Cecil*	Gerrard	Strachan
Charles*	Glengrove	Terauley*
Dufferin		Wiltshire

* These are the five downtown core TS's

The design of the stations is based on Dual Element Spot Network (DESN) design. A station usually consists of more than one DESN bus-pairs. Each DESN bus-pair is supplied from two transformers. In the event of a single transformer failure, customer load is not interrupted.

Typically HON owns the 115kV equipment and 13.8kV transformer secondary breakers, and THESL the 13.8kV feeder breakers and other equipment in a station.

In the downtown core, Cecil TS consists of 4 DESN bus-pairs, Charles 4 DESN bus-pairs, Esplanade/George & Duke 3 DESN bus-pairs, John/Windsor 6 DESN bus-pairs (with 2 operated together) and Terauley 4 DESN bus-pairs. In John/Windsor, Terauley and Cecil, there are inter-switchgear ties between DESN bus-pairs, providing backup capacity for DESN bus-pairs within the stations. (The Cecil inter-switchgear ties are temporarily out of service until approximately the end of 2006.)

B2.0 Loss of entire delivery point

On the loss of an entire delivery point (a TS), all customers connected to feeders supplied from the station would be interrupted. Because there is little or no backup capacity between adjacent 115/13.8kV stations, customer connections can only be restored when some form of supply is re-established. In the case of loss of supply to all transformers at a stations TS, HON would reconfigure the transmission system to re-establish supply. In the case of loss to major equipment (transformers, switchgear) at the station, equipment repair/replacement may be necessary to restore supply to customers. THESL could utilize a mobile switchgear trailer and temporary cables to facilitate partial re-connection of some customer loads from spare supply capacity from nearby TS's. There may be prolonged and/or rotational interruption for some customers. (A mobile 13.8kV switchgear trailer is expected to be in service in early 2007.).

B3.0 Loss of a pair of HON DESN transformers (for the 5 downtown core HON TS's)

On the loss of a pair HON DESN transformers supplying the same DESN bus-pair, all customers connected to feeders supplied from the DESN bus pair would be interrupted. Of the 5 downtown core stations, John/Windsor, Terauley and Cecil have inter-switchgear ties providing backup supply between DESN bus-pairs in the same station. THESL could operate the inter-switchgear ties to facilitate supply restoration to the interrupted customers. Charles and Esplanade do not have inter-switchgear ties. THESL could utilize a mobile switch trailer to facilitate customer supply restoration. Please see Table B1.

B4.0 Loss of THESL switchgear (for the 5 downtown-core HON TS's)

On the loss of THESL switchgear, all customers connected to feeders supplied from the DESN bus pair would be interrupted. Customers could be reconnected with the use of a mobile switch trailer.

Some DESN bus-pairs have a double line-up of switchgear with double breakers (Windsor A11-12, Terauley A7-8) so that, depending on damage assessment, feeders connected to a damaged bus may be more easily transferred to the undamaged bus to restore supply to interrupted customers.

Some DESN units have different levels of arc-resistant metal clad switchgear to contain spread of damage (Terauley A1-2 has frontal resistance, Windsor A17-18, Esplanade A1-2, and Cecil A5-6 contain the effect of damage to the faulted switchgear). Cecil A5-6 has SF6 switchgear, which would further contain the damage to the faulted cell. Please see Table B2.

B5.0 Loss of Cavanagh DESN

Unlike other stations, Cavanagh is owned by THESL. Cavanagh TS is a 230kV/27.6kV station on the Finch Corridor. On the loss of Cavanagh, all customers connected to feeders supplied from Cavanagh would be interrupted. In the case of loss of supply to Cavanagh, HON would reconfigure the transmission system and re-establish supply. In the case of loss of major equipment, depending on damage assessment, repair/replacement would be necessary. A limited number of customers could be reconnected to supply from Agincourt and Scarborough TS's via feeder ties. HON has 2 spare feeder positions at Agincourt but without breakers. Installing the breakers may take up to 12 months or more. THESL does not have spare 125MVA transformers, and replacing the transformers may take 12-18 months. The majority of the interrupted customer load would remain unsupplied. Please see Table B3.

Table B1. Impact of Loss of Step-Down Transformers at the 115/13.8kV Transformer Station

Contingency	**Load* Interrupted immediately post contingency (* Load is forecasted 2006 Summer Peak)**	**Load Picked up following switching operations**	**Load Not Being Supplied**
1. Loss of Charles T1/T2 or T3/T4, or Esplanade T11/T12 or T12/T13 or T11/T13	All customers on feeders connected to the DESN would be interrupted (up to 85 MVA for Charles T1/T2, 67 MVA for Charles T3/T4, 60 MVA for Esplanade T11/T12, 53 MVA for Esplanade T12/T13, 57 MVA for Esplanade T11/T13).	Nil.	Interrupted customer load would remain unsupplied beyond two hours. Restoration Time: THESL to utilize mobile switch trailer to facilitate customer connection until transformer repaired/replaced. May take 3-4 days for mobile switch to reconnect customers. (mobile switch expected early 2007) HON may take up to 10 days or more to replace/repair transformers.
2. Loss of Cecil T1/T2 or T3/T4, or any two of John/Windsor T1/T2/T3/T4 or T5/T6, or Terauley T1/T4, or T2/T3.	All customers on feeders connected to the DESN would be interrupted (up to 75 MVA for Cecil T1/T2, 112 MVA for Cecil T3/T4, 104 MVA for John/Windsor T1/T2, 150 MVA for John/Windsor T1/T3, 104 MVA for John/Windsor T1/T4 or T2/T3, 139 MVA for John/Windsor T2/T4, 109 MVA for John/Windsor T5/T6, 100 MVA for Terauley T1/T4, 106 MVA for Terauley T2/T3).	THESL operates inter-switchgear ties to pick up interrupted load. (Cecil inter-switchgear ties are out of service until end of 2006.)	HON repair/replace transformers within 10 days. Customers not affected.

Table B2. Impact of Loss of THESL Switchgear

Contingency	**Load* Interrupted immediately post contingency (* Load is forecasted 2006 Summer Peak)**	**Load Picked up following switching operations**	**Load Not Being Supplied**
1. Loss of switchgear to Cecil A1-2, or A3-4, or A5-6, or A7-8, or Charles A1-2, or A3-4, or A5-6, or A7-8, or Esplanade A1-2, A1-2GD, or A5-6GD, or John/Windsor A3-4, or A5-6, or A11-12, or A13-14, or A15-16, or A17-18, or Terauley A1-2, or A3-4, or A5-6, orA7-8	All customers on feeders connected to the bus pairs would be interrupted (up to 38 MVA for Cecil A1-2, 37 MVA for Cecil A3-4, 49 MVA for Cecil A5-6, 63 MVA for Cecil A7-8, 30 MVA for Charles A1-2, 37 MVA for Charles A3-4, 44 MVA for Charles A5-6, 41 MVA for Charles A7-8, 53 MVA for Esplanade A1-2, 60 MVA for Esplanade A1-2GD, 57 MVA for Esplanade A5-6GD, 51 MVA for John/Windsor A3-4, 53 MVA for John/Windsor A5-6, 57 MVA for John/Windsor A11-12, or 35 MVA for John/Windsor A13-14, 52 MVA for John/Windsor A15-16, 46 MVA for John/Windsor A17-18, 59 MVA for Terauley A1-2, 51 MVA for Terauley A3-4, 55 MVA for Terauley A5-6, 41 MVA for Terauley A7-8.)	After damage assessment, interrupted customers on DESN units with a double lineup of switchgear with double breakers could be reconnected to the undamaged bus (up to 57 MVA for John/Windsor A11-12, and 41 MVA for Terauley A7-8).	Interrupted customer load would remain unsupplied beyond 2 hours. Restoration Time: THESL to utilize mobile switch trailer to facilitate customer connection until switchgear repaired/replaced. May take 3-4 days for mobile switch to reconnect customers. (mobile switch expected early 2007) Metalclad repair/replacement may take 6 months to over 1 year.

Table B3. Impact of Loss of Cavanagh TS

Contingency	**Load* Interrupted immediately post contingency (* Load is forecasted 2006 Summer Peak)**	**Load Picked up following switching operations**	**Load Not Being Supplied**
1. Loss of Supply to Cavanagh TS	All customers on feeders connected to Cavanagh would be interrupted (up to 123 MVA).	HON would isolate the faulted sections and supply station from either Cherrywood TS or Richview TS.	Customers not affected after reconnection.
2. Loss of all major equipment (transformers and switchgear) in Cavanagh TS	All customers on feeders connected to Cavanagh would be interrupted (up to 123 MVA).	A limited number of customers might be reconnected by switching to supply from Agincourt and Scarborough TS's, depending on the available spare capacity of the Agincourt and Scarborough feeders at the time.	Majority of interrupted customer load would remain unsupplied. Restoration Time: There are 2 spare feeder positions at Agincourt but without breakers. Installing the breakers may take up to 12 months or more. If 125 MVA transformers are lost, there is no spare transformer, new replacement in 12 to 18 months.