



IMO_REP_024

CONNECTION ASSESSMENT & APPROVAL PROCESS

PRELIMINARY ASSESSMENT REPORT

APPLICANT: Enwin Powerlines Ltd.

PROJECT: Ford Annex MTS in Windsor

CAA ID No. 2000-031

Long Term Forecasts & Assessments Department

Date: *June 8, 2001*

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PRELIMINARY ASSESSMENT REPORT

ENWIN POWERLINES LIMITED: NEW FORD ANNEX MTS IN WINDSOR

Disclaimer

This report has been prepared solely for the purpose of assessing, on a preliminary basis, whether the connection applicant's proposed connection with the IMO-controlled grid would have an adverse impact on the reliability of the integrated power system and whether a System Impact Assessment of the proposed connection should be conducted under Chapter 4, section 6 of the Market Rules. This report has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. This report has been prepared solely for use by the Connection Applicant, Hydro One and the IMO in accordance with Chapter 4, section 6 of the Market Rules. The IMO assumes no responsibility to any third party for any use which it makes of this report. Any liability which the IMO may have to the Connection Applicant in respect of this report is governed by Chapter 1, section 13 of the Market Rules. The IMO may revise this report at any time, in its sole discretion, without notice to the Connection Applicant. Although the IMO will use its best efforts to advise you of any such changes, it is the responsibility of the Connection Applicant to ensure that it is using the most recent version of this report.

PRELIMINARY ASSESSMENT REPORT

ENWIN POWERLINES LIMITED: NEW FORD ANNEX MTS IN WINDSOR

1.0 PROPOSAL

Enwin Powerlines Inc. has been contracted by the Ford Motor Company to construct, own and operate a new Ford Annex MTS in Windsor. Their proposal is to supply this MTS from the existing Hydro One 115 kV underground radial circuits E8F & E9F that originate from Essex TS. These circuits also supply Daimler Chrysler MTS, General Motors MTS and Ford Powerhouse MTS. The proposed supply arrangement is shown in Figure 1.

The new Ford Annex MTS is a 115-13.8 kV station configured as a DESN with 2 x 20.16/33.6 MVA transformers. The station is connected to the Hydro One system via two 138 kV circuit switchers and approximately 0.9 km of new 115 kV line (underground).

The planned in-service date for the new MTS is October 2001.

2.0 LOAD

The initial load on the new Ford Annex MTS is expected to be approximately 17 MW. The load growth is uncertain but may reach 30 MW within about 10 years.

The existing peak load of the other stations on the same 115 kV supply circuits E8F and E9F is approximately 100 MW.

Forecast 2001-2010 summer peak loads for the Windsor transformer stations supplied at 115kV are shown in Table 1.

3.0 REVIEW OF CONNECTION ARRANGEMENT

3.1 High Voltage Interrupters

Based on information provided by Enwin Powerlines, each transformer at the proposed Ford Annex MTS is connected to the transmission system via a 115 kV circuit switcher. This is acceptable as long the requirements listed in the Transmission System Code for this type of connection are satisfied.

3.2 Voltage Reduction

The proposed new MTS is to be equipped with facilities that would allow a 3% and a 5% voltage reduction to be initiated remotely. This requirement is meant to cover generation deficiency situations that cannot be resolved by market mechanisms and an emergency operating state exists on the IMO-controlled grid, or a neighbouring system. In this case, the IMO may request a voltage reduction.

3.3 Under-Frequency Load Shedding

Underfrequency load shedding (UFLS) is intended to prevent system-wide blackouts by restoring the balance between load and generation. The installation of UFLS facilities was one of the major outcomes of the review of the major blackout in 1965. A review of the existing UFLS facilities in the Windsor area shows that there is already sufficient load shedding capability in place. Based on this, a UFLS scheme will not be required, at this time, for the new Ford Annex MTS.

3.4 Power Factor

Market rules require that wholesale customers and distributors connected to the IMO-controlled grid shall operate at a power factor within the range of 90% lagging to 90% leading as measured at the *defined meter point*. The applicant will be required to take corrective action if the power factor is outside of this range.

3.5 Telemetry

In order to permit the IMO to direct the operations of the IMO-controlled grid, wholesale customers and distributors connected to the IMO-controlled grid shall provide the IMO with data in accordance with Chapter 4, Section 7.5 of the Market Rules.

4.0 IMPACT ASSESSMENT

4.1 Assumptions

4.1.1 Loads

Forecast 2001-2010 summer peak loads provided by Enwin Powerlines and Hydro One are shown in Table 1.

4.1.2 Existing Generation

West Windsor NUG:	120 MW
Chrysler TransAlta NUG:	65 MW

4.1.3 Proposed Sarnia-Windsor Area Generation

A recent System Impact Assessment (SIA) examined the impact of four generation projects on the transmission system in the Sarnia-Windsor Area of the IMO-controlled grid. The results of the SIA are documented in report IMO_REP_009 dated December 1, 2000 with an Addendum dated February 1, 2001. Based on the results of the SIA, "Notifications of Approval of Connection Proposal" were granted for the four projects. The projects along with their scheduled in-service dates are listed below.

Project	Generation Capacity (MVA)	Scheduled In-Service Date
TransAlta (Sarnia)	580	Fall 2002
Enron (Sarnia)	610	2001-2002
AES (near Leamington)	625	Late 2003
Atco (Windsor)	680	Mid 2003

The above mentioned SIA also considered the effect of a proposed project to install 600 MW of generation on the Detroit Edison system, scheduled for the fall of 2002.

This Preliminary Assessment includes the effect of the above generation projects, as identified in the SIA, including the system modifications required for incorporation into the IMO-controlled grid.

4.2 Impact On Reliability

With the proposed 115 kV circuit switchers on the HV side of the transformers and protections in accordance with Hydro One requirements, the connection of the proposed facilities should not have any significant detrimental impact on existing levels of supply reliability.

4.3 Impact on Load Meeting Capability

4.3.1 Windsor Area Transmission System

The proposed new MTS as well as Ford Powerhouse MTS, General Motors MTS and Daimler Chrysler MTS are supplied at 115kV via radial circuits E8F and E9F originating at Essex TS. Power is normally brought into Essex TS via 115 kV circuits J3E/J4E from Keith TS and circuits Z1E/Z7E from Lauzon TS, as shown in Figure 1.

Lauzon TS and Keith TS contain 230-115 kV transformation which tie the Windsor area transmission system to the 230 kV system at Chatham TS via 230 kV circuits C21J/C22J and C23Z/C24Z.

The 230 kV system at Keith TS is also tied to the 230 kV system in Michigan via the 230 kV interconnection circuit J5D.

4.3.2 Windsor Area Overload Protection Scheme

The Windsor transmission system has a special “Windsor Area Overload Protection Scheme”(WOLPS) which monitors current flows in the Keith TS 230-115 kV autotransformers T11 & T12 and the 115 kV circuits Z1E and Z7E. Upon activation, the WOLPS will open the terminals of either Z1E/Z7E or J3E/J4E at Essex TS to reduce the loading of the overloaded element(s).

4.3.3 Transmission Elements Affected

This Preliminary Assessment considered the effect of the proposed new load on the following facilities:

115 kV Circuits

- J3E/J4E , Keith TS x Essex TS
- Z1E/Z7E, Lauzon TS x Essex TS
- E8F/E9F, radial from Essex TS

230 kV Circuits

- C21J/C22J, Chatham TS x Keith TS
- C23Z/C24Z, Chatham TS x Lauzon TS

230/115 kV Transformation

- Keith TS autotransformers T11 and T12

4.3.4 Results of Analysis

Table 2 shows the loading of transmission system elements based on the loads in Table 1 and under various contingency conditions. This Table assumes that there is zero flow on the J5D interconnection.

Table 3 is similar to Table 2 but with a 300 MW transfer into Ontario on the J5D interconnection.

The system deficiencies from Tables 2 and 3 are described below.

It is noted that the circuit ratings are based on an ambient temperature of 35⁰C and a wind speed of 4 km/hr. At lower ambient temperatures, the ratings would increase. Short time line ratings are based on precontingency flows of 75% of continuous ratings except for the J4E circuit which is based on a precontingency current of 900 Amps (91% of continuous rating).

4.3.5 J3E/J4E Circuit Overload

Tables 2 and 3 show that without any remedial action, sections of these circuits will become overloaded under single contingency conditions and 2002 summer peak loads. The proposed new generation in the Sarnia-Windsor area will aggravate this overload situation starting in summer 2004. This problem was recognized in the SIA for the Sarnia-Windsor generation projects and an enhancement to the WOLPS, which would cover this situation, was identified as a requirement for connection.

However, as shown in Tables 2 and 3, the contingency overload problem exists even without the new Ford Annex load in 2002. The IMO will review the adequacy of the J3E/J4E circuits further and contact Hydro One to initiate any work that may be required prior to 2004 (when the Sarnia-Windsor generation is assumed in service). Possible solutions include modification of WOLPS to include coverage of overloads on 115 kV circuits J3E/J4E, establishing constraints on generation, additional transmission capacity or other alternatives that may be considered by the IMO and/or Hydro One. (It is noted that if 200 MW is transferred to Michigan over the J5D interconnection, the contingency overload problem would not occur until 2004).

Table 3 also indicates that, with transfers into Ontario of 300 MW on the J5D interconnection, the loading on circuit J4E, Keith TS x Crawford Jct, would marginally exceed the continuous rating of the circuit even precontingency under summer peak load conditions starting in 2006. It is expected that this situation can be addressed by the appropriate dispatch of generation and/or control of the flow on the J5D interconnection. Alternatively, a possible solution is to upgrade the Keith TS x Crawford TS section of circuit J4E.

4.3.6 Keith TS T11/T12 Autotransformers

The Keith TS 230-115 kV autotransformers connect the 230 and 115 kV systems and normally transfer power from the 230 kV system to the 115 kV system to supply the 115 kV transformer stations in the area.

Table 3 shows that, with transfers into Ontario of 300 MW on the J5D interconnection and the loss of C21J plus the T11 autotransformer, the Keith T12 autotransformer loading exceeds the 10-day LTR of the autotransformer. However, this contingency is covered by the existing WOLPS which can bring the loading on T12 below its continuous rating.

4.3.7 C23Z/C24Z Circuits

As shown in Table 2, the post-contingency loading on circuit C24Z marginally exceeds the continuous rating of the circuit, starting in 2009. Modifications to the WOLPS, identified as a requirement in the SIA for the Sarnia-Windsor generation projects would address this minor overload.

4.4 Impact on Transmission System Voltages

4.4.1 Abrupt Voltage Changes

Market rules require that voltage changes for capacitor switching and line switching operations shall not normally exceed:

- 4% of steady state rms voltage for capacitor switching operations
- 10% of steady state rms voltage for line switching operations.

Our studies show that this requirement is met over the entire 2001-2010 period.

4.4.2 Steady State Voltages

Under normal conditions, the steady state voltage for the nominal 115 kV and 230 kV portions of the IMO controlled grid in Southern Ontario is in the range of

- 113 – 127 kV for the 115 kV system
- 220 – 250 kV for the 230 kV system.

Our studies show that this requirement is met over the entire 2001-2010 period.

Figure 2 shows the actual measured voltage at Keith TS during the year 2000. The voltage at the location of the proposed new Ford Annex MTS is expected to be approximately 2 kV below the level at Keith TS.

5.0 REQUIREMENTS FOR CONNECTION

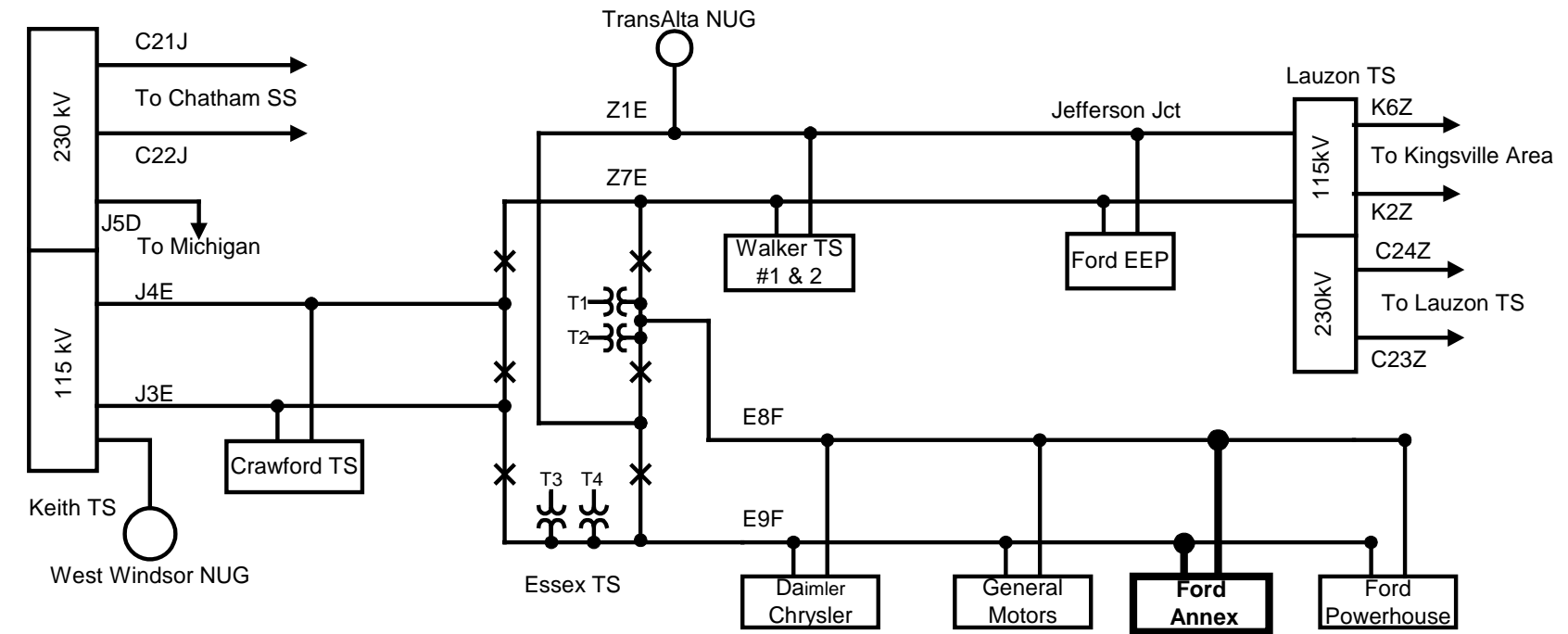
Based on the above analysis, it is concluded that the proposed Ford Annex MTS connection will not have any significant system impacts. The project may, therefore, proceed subject to meeting the requirements identified in Section 3.0 as well as all other applicable market rules and regulatory requirements. Information on Market Entry can be found at the following IMO website. <http://www.theimo.com/imoweb/marketEntry/me.asp>



6.0 SYSTEM IMPACT ASSESSMENT

Based on the results of this Preliminary Assessment, it is concluded that no further analysis is required for this project, and, it is therefore recommended that the System Impact Assessment be foregone.

7.0 NOTIFICATION OF APPROVAL OF THE CONNECTION PROPOSAL

Based on the results of this Assessment, it is recommended that the Applicant should receive a “Notification of Approval of the Connection Proposal” for this project. The Applicant is required to obtain the necessary approvals as may be required by the OEB and other regulatory authorities.



 Existing Facilities
 Proposed Facilities

DISTANCES (km)	
Essex x DaimlerChrysler Jct	0.5
DaimlerChrysler Jct x GM Jct	2.0
GM Jct x Ford Annex Jct	1.0
Ford Annex Jct x Ford Powerhouse Jct	1.5
Ford Annex Jct x Ford Annex MTS	0.9

FIGURE 1

ENWIN POWERLINES LTD: FORD ANNEX MTS PROJECT

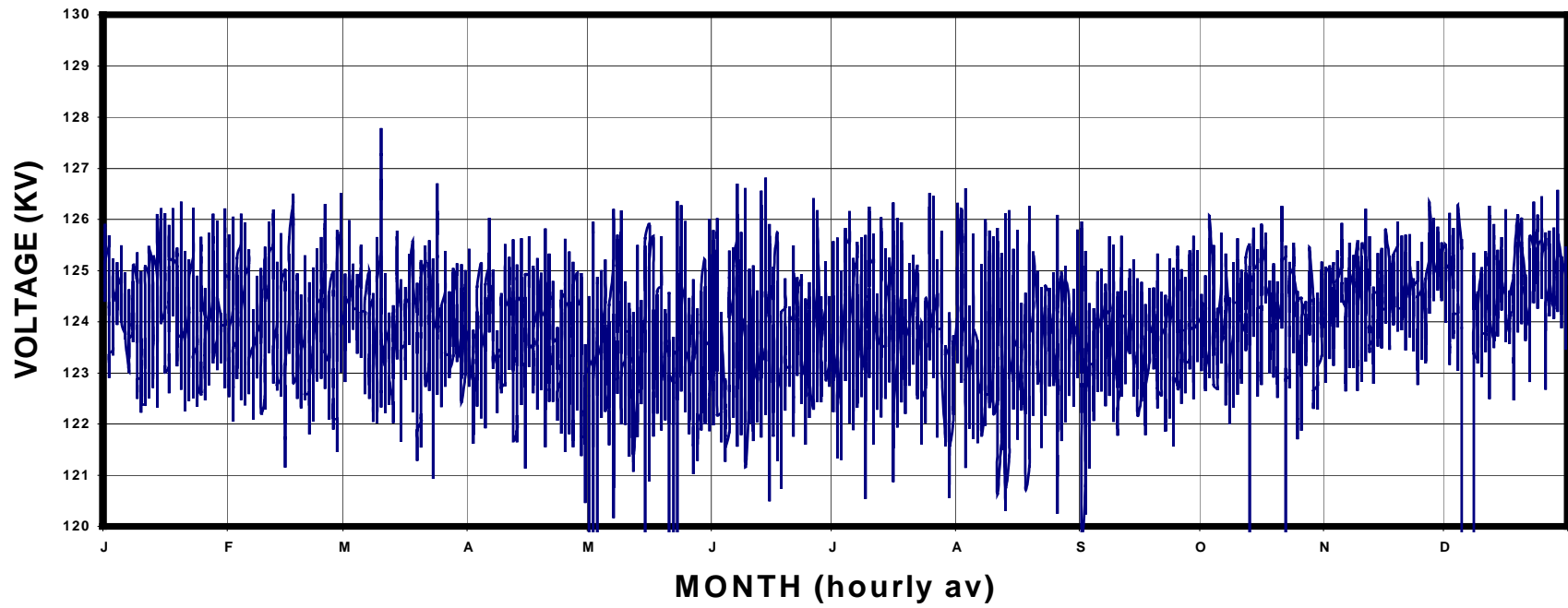


FIGURE 2

KEITH TS : YEAR 2000 MEASURED VOLTAGE

**TABLE 1
LOADS AT 115 kV TRANSFORMER STATIONS IN WINDSOR**

STATION	SUMMER PEAK LOADS									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Crawford TS										
MW	75.7	77.0	78.3	79.7	81.1	82.5	83.9	85.4	86.9	88.4
MVAR	36.7	37.3	37.9	38.6	39.3	40.0	40.6	41.4	42.1	42.8
MVA	84.1	85.6	87.0	88.6	90.1	91.7	93.3	94.9	96.5	98.2
Walker TS #1										
MW	79.7	80.6	81.6	82.5	83.5	84.5	85.5	86.6	87.6	88.6
MVAR	38.6	39.0	39.5	40.0	40.5	40.9	41.4	41.9	42.4	42.9
MVA	88.5	89.6	90.6	91.7	92.8	93.9	95.0	96.2	97.3	98.5
Walker TS #2										
MW	87.5	87.8	88.2	88.5	88.8	89.2	89.5	89.9	90.2	90.5
MVAR	42.4	42.5	42.7	42.9	43.0	43.2	43.4	43.5	43.7	43.9
MVA	97.2	97.6	97.9	98.3	98.7	99.1	99.5	99.8	100.2	100.6
Essex TS										
MW	79.6	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5
MVAR	38.5	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6
MVA	88.4	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Windsor Automotive Plant Load (Supplied via Dedicated Transformer Stations)*										
MW	143.0	144.1	145.3	146.5	147.9	149.3	150.8	152.4	154.2	156.0
MVAR	69.3	69.8	70.4	71.0	71.6	72.3	73.0	73.8	74.7	75.6
MVA	158.9	160.1	161.4	162.8	164.3	165.9	167.6	169.4	171.3	173.3

*Includes proposed new Ford Annex load

**TABLE 2
LOAD MEETING CAPABILITY ANALYSIS
(ASSUMES ZERO TRANSFER ON J5D INTERCONNECTION)**

SYSTEM FACILITIES / CONTINGENCIES	SUMMER RATING (AMPS) (cont/15min) ¹	SUMMER PEAK LOADING (AMPS) ²									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	
115 kV TRANSMISSION SYSTEM											
E8F/E9F (Companion circuit O/S)											
E8F, Essex TS x DaimlerChrysler Jct	840 / NA	634	637	641	652	663	675	686	698	710	
E9F, Essex TS x DaimlerChrysler Jct	840 / NA	634	637	641	652	663	675	686	698	710	
J3E/J4E (Companion circuit O/S)											
J3E, Keith TS x Crawford Jct (Precont)	1200 / 1350	650	671	844	845	854	863	871	878	891	
J3E, Keith TS x Crawford Jct	1200 / 1350	1100	1137	1535	1539	1557	1575	1593	1608	1634	
J3E, Crawford Jct x Essex TS	1200 / 1350	688	718	1109	1105	1115	1126	1136	1143	1161	
J4E, Keith TS x Crawford Jct (Precont)	990 / 1050	650	671	844	845	854	863	871	878	891	
J4E, Keith TS x Crawford Jct	990 / 1050	1100	1137	1535	1539	1557	1575	1593	1608	1634	
J4E, Crawford Jct x Essex TS	990 / 1050	688	718	1109	1105	1115	1126	1136	1143	1161	
J3E/J4E WITHOUT Ford Annex Load											
J3E, Keith TS x Crawford Jct	1200 / 1350	1059	1094	1489	1490	1504	1518	1532	1544	1566	
J4E, Keith TS x Crawford Jct	900 / 1050	1059 ⁵	1094	1489	1490	1504	1518	1532	1544	1566	
Z1E/Z7E (Companion circuit O/S)											
Z1E, Lauzon TS x Ford EEP Jct	1190 / ~1300	580	608	323	325	341	356	372	385	409	
Z1E, Walker TS Jct x TransAlta Jct	1190 / ~1300	255	278	714	718	734	751	768	783	808	
Z1E, TransAlta Jct x Essex TS	1190 / ~1300	23	42	426	430	447	464	481	496	521	
Z7E, Lauzon TS x Ford EEP Jct	1190 / ~1300	766	797	549	551	567	582	597	610	634	
Z7E, Ford EEP Jct x Walker TS Jct	1190 / ~1300	621	653	405	407	422	437	453	466	489	
Z7E, Walker TS Jct x Essex TS	1190 / ~1300	236	258	580	584	602	619	637	652	678	
230 KV TRANSMISSION SYSTEM AND 230-115 kV AUTOTRANSFORMERS											
C22J & Keith T12 O/S											
C21J, Chatham TS x Malden Jct	1010 / 1134	623	634	200	195	190	185	180	176	171	
C21J, Keith TS x Malden Jct	1010 / 1134	191	194	621	623	625	626	628	630	632	
Keith T11	657 / 851 / 1073 ⁵	424	450	368	369	383	397	411	423	445	
C21J & Keith T11 O/S											
C22J, Chatham TS x Malden Jct	1010 / 1134	624	635	197	193	189	185	181	178	174	
C22J, Malden Jct x Keith TS	1010 / 1134	201	204	613	614	616	617	618	620	621	
Keith T12	593 / 747 / 881 ⁵	445	471	394	394	407	420	433	443	464	
C23Z/C24Z (Companion circuit O/S)											
C23Z, Chatham TS x Lauzon TS	1400 / 1625	963	979	988	993	997	1002	1007	1011	1016	
C24Z, Chatham TS x Lauzon TS	1010 / 1134	963	979	988	993	997	1002	1007	1011	1016	
VOLTAGE ANALYSES											
Steady State Voltage Levels	Within range specified in "Grid Connection Requirements"										
Abrupt Voltage Changes											
Capacitor Switching	Less than 4% (meets "Grid Connection Requirements")										
Line Contingency	Less than 10% (meets "Grid Connection Requirements")										

NOTES

- (1) Based on 35°C ambient, 4km/hr wind, daytime. The 15 min. ratings are based on precontingency flows of 75% of continuous ratings except for the J4E circuit which is based on a precontingency current of 900 Amps (91% of continuous rating).
- (2) All loading values are post-contingency unless otherwise noted in first column. Loading values are based on summer peak loads.
- (3) Shaded areas indicate loading exceeds continuous rating of lines or 10-day LTR of transformers.
- (4) Results from 2004-2010 include generation projects already given "Notification of Approval of Proposal" (see Section 4.1 of report).
- (5) continuous / 10-day / 15 min ratings based on 33°C ambient.
- (6) This loading is within the 15-min rating of the line at 30°C ambient and within the 5-min rating for 30°C and 35°C ambient. The continuous/15min/5min ratings based on 30°C ambient and 900A preload are 1020 / 1080 / 1320 Amps.

**TABLE 3
LOAD MEETING CAPABILITY ANALYSIS
(ASSUMES 300MW TRANSFER INTO ONTARIO ON J5D INTERCONNECTION)**

SYSTEM FACILITIES / CONTINGENCIES	SUMMER RATING (AMPS) (cont/15min) ¹	SUMMER PEAK LOADING (AMPS) ²								
		2002	2003	2004	2005	2006	2007	2008	2009	2010
115 kV TRANSMISSION SYSTEM										
E8F/E9F (Companion circuit O/S)										
E8F, Essex TS x DaimlerChrysler Jct	840 / NA	634	637	641	652	663	675	686	698	710
E9F, Essex TS x DaimlerChrysler Jct	840 / NA	634	637	641	652	663	675	686	698	710
J3E/J4E (Companion circuit O/S)										
J3E, Keith TS x Crawford Jct (Precont)	1200 /1350	769	792	983	985	995	1004	1014	1022	1036
J3E, Keith TS x Crawford Jct	1200 /1350	1325	1366	1823	1828	1847	1865	1884	1899	1940
J3E, Crawford Jct x Essex TS	1200 /1350	913	947	1397	1394	1405	1416	1427	1435	1467
J4E, Keith TS x Crawford Jct (Precont)	990 /1050	769	791	983	985	995	1004	1014	1022	1036
J4E, Keith TS x Crawford Jct	990 /1050	1325	1366	1823	1828	1847	1865	1884	1899	1940
J4E, Crawford Jct x Essex TS	990 /1050	913	947	1397	1394	1405	1416	1427	1435	1467
J3E/J4E WITHOUT Ford Annex Load										
J3E, Keith TS x Crawford Jct	1200 /1350	1284	1323	1777	1778	1793	1808	1823	1835	1872
J4E, Keith TS x Crawford Jct	990 /1050	1284	1323	1777	1778	1793	1808	1823	1835	1872
J4E, Keith TS x Crawford Jct (Precont)	990 /1050	696	726	922	923	938	953	967	979	1002
Z1E/Z7E (Companion circuit O/S)										
Z1E, Lauzon TS x Ford EEP Jct	1191 /~1300	372	397	400	397	408	419	430	438	457
Z1E, Walker TS Jct x TransAlta Jct	1191 /~1300	559	587	1062	1061	1074	1087	1099	1109	1130
Z1E, TransAlta Jct x Essex TS	1191 /~1300	258	281	763	763	777	791	804	815	837
Z7E, Lauzon TS x Ford EEP Jct	1191 /~1300	517	544	526	526	539	552	565	576	597
Z7E, Ford EEP Jct x Walker TS Jct	1191 /~1300	372	400	382	381	394	408	421	431	452
Z7E, Walker TS Jct x Essex TS	1191 /~1300	405	430	903	908	925	943	961	977	1003
230 KV TRANSMISSION SYSTEM AND 230-115 kV AUTOTRANSFORMERS										
C22J & Keith T12 O/S										
C21J, Chatham TS x Malden Jct	1010 / 1134	288	293	557	551	546	540	535	529	524
C21J, Keith TS x Malden Jct	1010 / 1134	192	195	986	989	992	995	999	1002	1005
Keith T11	657 / 851 / 1073 ⁵	741	772	705	706	721	735	750	761	784
C21J & Keith T11 O/S										
C22J, Chatham TS x Malden Jct	1010 / 1134	292	297	545	540	534	529	523	518	513
C22J, Malden Jct x Keith TS	1010 / 1134	182	185	970	974	977	981	985	988	992
Keith T12	593 / 747 / 881 ⁵	780	812	752	752	766	780	794	805	827
C23Z/C24Z (Companion circuit O/S)										
C23Z, Chatham TS x Lauzon TS	1400 / 1625	823	837	840	852	864	877	889	902	915
C24Z, Chatham TS x Lauzon TS	1010 / 1134	823	837	840	852	864	877	889	902	915
VOLTAGE ANALYSES										
Steady State Voltage Levels	Within range specified in "Grid Connection Requirements"									
Abrupt Voltage Changes										
Capacitor Switching	Less than 4% (meets "Grid Connection Requirements")									
Line Contingency	Less than 10% (meets "Grid Connection Requirements")									

NOTES

(1) Based on 35°C ambient, 4km/hr wind, daytime. The 15 min. ratings are based on precontingency flows of 75% of continuous ratings except for the J4E circuit which is based on a precontingency current of 900 Amps (91% of continuous rating).

(2) All loading values are post-contingency unless otherwise noted in first column. Loading values are based on summer peak loads.

(3) Shaded areas indicate loading exceeds continuous rating of lines or 10-day LTR of transformers.

(4) Results from 2004-2010 include generation projects already given "Notification of Approval of Proposal" (see Section 4.1 of report).

(5) continuous / 10-day / 15 min ratings based on 33°C ambient.