REPORT

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System Impact Assessment Report (Addendum)

East Windsor Cogeneration Centre

CONNECTION ASSESSMENT & APPROVAL PROCESS

CAA ID 2006-234

Applicant: East Windsor Cogeneration Limited Partnership

Transmission Assessments & Performance Department

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System Impact Assessment Report

East Windsor Cogeneration Centre

Acknowledgement

The IESO wishes to acknowledge the assistance of Hydro One in completing this assessment.

Disclaimers

IESO

This report has been prepared solely for the purpose of assessing whether the connection applicant's proposed connection with the IESO-controlled grid would have an adverse impact on the reliability of the integrated power system and whether the IESO should issue a notice of approval or disapproval of the proposed connection under Chapter 4, section 6 of the Market Rules.

Approval of the proposed connection is based on information provided to the IESO by the connection applicant and the transmitter(s) at the time the assessment was carried out. The IESO assumes no responsibility for the accuracy or completeness of such information, including the results of studies carried out by the transmitter(s) at the request of the IESO. Furthermore, the connection approval is subject to further consideration due to changes to this information, or to additional information that may become available after the approval has been granted. Approval of the proposed connection means that there are no significant reliability issues or concerns that would prevent connection of the proposed facility to the IESO-controlled grid. However, connection approval does not ensure that a project will meet all connection requirements. In addition, further issues or concerns may be identified by the transmitter(s) during the detailed design phase that may require changes to equipment characteristics and/or configuration to ensure compliance with physical or equipment limitations, or with the Transmission System Code, before connection can be made.

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 and the IESO in accordance with Chapter 4, section 6 of the Market Rules. The IESO assumes no responsibility to any third party for any use, which it makes of this report. Any liability which the IESO may have to the connection applicant in respect of this report is governed by Chapter 1, section 13 of the Market Rules. In the event that the IESO provides a draft of this report to the connection applicant, you must be aware that the IESO may revise drafts of this report at any time in its sole discretion without notice to you. Although the IESO 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.

HYDRO ONE

Special Notes and Limitations of Study Results

The results reported in this study are based on the information available to Hydro One, at the time of the study, suitable for a preliminary assessment of a new generation or load connection proposal.

The short circuit and thermal loading levels have been computed based on the information available at the time of the study. These levels may be higher or lower if the connection information changes as a result of, but not limited to, subsequent design modifications or when more accurate test measurement data is available.

This study does not assess the short circuit or thermal loading impact of the proposed connection on facilities owned by other load and generation (including OPGI) customers.

In this study, short circuit adequacy is assessed only for Hydro One breakers and does not include other Hydro One facilities. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One breakers and identifying upgrades required to incorporate the proposed connection. These results should not be used in the design and engineering of new facilities for the proposed connection. The necessary data will be provided by Hydro One and discussed with the connection proponent upon request.

The ampacity ratings of Hydro One facilities are established based on assumptions used in 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.

The additional facilities or upgrades which are required to incorporate the proposed connection have been identified to the extent permitted by a preliminary assessment under the current IESO Connection Assessment and Approval process. Additional facility studies may be necessary to confirm constructability and the time required for construction. Further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.

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EAST WINDSOR COGENERATION CENTRE
IESO SYSTEM IMPACT ASSESSMENT ADDENDUM

SIA Findings

Summary

The System Impact Assessment "East Windsor Cogeneration Centre" was issued on August 3, 2007. East Windsor Cogeneration Centre (EWCC), a new generating facility in the east Windsor area consists of 2 x 71 MVA gas turbine generators. These units will produce a maximum of 50 MW each. Plans to incorporate a third unit have currently been put on hold. The System Impact Assessment examined the impact of connecting the two gas turbine generators and the existing 30 MW Ford steam generator under Ford plant shutdown periods on the IESO controlled grid.

This addendum accounts for several new developments and considerations. They include:

- Relocation of 115 kV bus tie
- Modification of Windsor Area Overload Protection Mode A and Mode AE Split operations
- Consideration of number of critical equipment outages in the area.
- Incorporation of EWCC G1 and G2 into the Windsor Area Overload Protection Scheme

Conclusions

The following are the list of new conclusions for the incorporation of EWCC:

(1) The proposed cogeneration facility does not have a negative adverse impact to the reliability of the IESO-controlled grid under all in-service and normal operating conditions.
(2) The post-contingency voltage declines are within IESO criteria.
(3) When all elements are in-service, none of the recognized contingencies cause any material adverse impact to the transient performance of the IESO-controlled grid.
(4) Under normal conditions, a single E8F or E9F can be loaded with up to 130 MW of generation. However, under rare situations such as light loads or multiple outages, a pre-contingency generation limit on EWCC output could be imposed by the IESO to prevent possible overloading.
(5) Supplementary reactive compensation is not required to satisfy IESO Market Rule requirements.
(6) Short circuit levels as a result of the new connection do not exceed the interrupting capabilities of the existing breakers in the IESO-controlled grid.
(7) The relocation of the EWCC 115 kV bus tie will not have a material adverse effect on the IESO-controlled grid.
(8) Under the current Windsor Area Overload Protection Mode A and Mode AE split operations for the loss of J3E or J4E, EWCC unit(s) may form an electrical island with its station load.
(9) EWCC incorporation into the Windsor Area Special Overload Protection Scheme will avoid possible pre-contingency output limitations under equipment outage conditions.

Under studied conditions, it was found that the flow on 115 kV circuits J3E and J4E between Keith and Essex could exceed the ratings pre-contingency. This overloading concern is an existing problem and is not the result of the proposed generation. Injection from EWCC will help alleviate this problem to a limited extent.

IESO's Requirements for Connection

The following are the list of new requirements for the incorporation of EWCC:

(1) The generation facility must be capable of operating continuously for grid frequencies in the range between 59.4 Hz and 60.6 Hz as specified in Appendix 4.2, Reference 3 of the Market Rules, as shown in **Figure 1**.
(2) Windsor Area Overload Protection Scheme will need to be modified to reject EWCC units as shown in **Figure 7**.
(3) A transfer trip signal will need to be sent to necessary EWCC unit(s) for a Windsor Area Overload Protection Scheme Mode A and Mode AE split upon detection of the loss of J3E or J4E to prevent the formation of an electrical island with its station load.
(4) The applicant is responsible for providing real-time telemetering of the following variables to the IESO on a continuous basis:

- MW and MVAr of each generator
- Net MW and MVAr injection to the IESO-controlled grid
- Statuses of 13.8 kV and 115 kV breakers and disconnect switches
- 115 kV and 13.8 kV voltages at the transformer station
- Special Protection System arming statuses of EWCC G1 and G2
- AVR and PSS statuses

The IESO will finalize items to be telemetered during the IESO Market Entry process.

(5) The registration of the new facilities will need to be completed through the IESO's facility registration process before any part of the facility can be placed in-service. It is required that the applicant initiates the facility registration process with the IESO at least six months prior to the energisation. It must be noted that if the data supplied for the registration of the facilities materially differ from those that were used for the assessment, then some of the analysis might need to be repeated to ensure that the IESO-controlled grid is not adversely affected.
(6) Protection systems must be designed to meet all the requirements of the Transmission System Code as specified in Schedules E, F and G of Appendix 1 (Version B) and any additional requirements identified by Hydro One. Where required by Hydro One, protection systems at EWCC facility must be coordinated with Hydro One protection Systems.

Notification of Conditional Approval

From the information provided, our review concludes that the proposed changes will not result in a material adverse effect on the reliability of the IESO-controlled grid. The Notification of Conditional Approval issued on June 26, 2007 remains valid.

1. Project Description

East Windsor Cogeneration Limited Partnership (EWCLP) is proposing to develop, under a "Combined Heat Project" Ontario Power Authority (OPA) contract, a new cogeneration facility, East Windsor Cogeneration Centre (EWCC) in Windsor, Ontario. EWCC, will consist of two 71 MVA gas turbine generators. Each unit will produce a maximum of 50 MW and deliver to the 115 kV circuits E9F and E8F of the Hydro-One Networks transmission system. Plans to incorporate a third unit have been currently been put on hold. A combined 130 MW of generation may be injected when the existing 30 MW Ford steam turbine generator is operated during Ford plant shutdown periods.

It is expected that commercial generation operations of EWCC will commence in the first quarter of 2009.

The System Impact Assessment was released on August 3, 2007 and examined the impact of connecting up to 130 MW of generation on the reliability of the IESO-controlled grid.

The purpose of this addendum is to account for several new developments and considerations. They include:

- Relocation of EWCC 115 kV bus tie
- Modification of Windsor Area Overload Protection Mode A and Mode AE Split operations
- Consideration of number of critical equipment outages in the area.
- Incorporation of EWCC G1 and G2 into the Windsor Area Overload Protection Scheme

– End of Section –

2. General Requirements

Models & Data

1. The Connection Applicant must complete the IESO Facility Registration process before IESO final approval for connection is granted. Final models and data, including any controls that would be operational must be provided to the IESO prior to the first energization.

2. During commissioning, the Connection Applicant must provide evidence to the IESO that the equipment installed meets the Market Rules and matches or exceeds the performance predicted. This evidence shall be either type tests done in a controlled environment or commissioning tests done on-site. In either case, the testing must be done not only in accordance with widely recognized standards, but also to the satisfaction of the IESO. Until this evidence is provided, the Applicant must accept any restrictions the IESO may impose upon their participation in IESO-administered market or connection to the IESO-controlled grid.

Generators

1. The generators must satisfy the Generator Facility requirements in Appendix 4.2 of Market Rules.

The generators must have the capability to operate ± 5 % of the nominal voltage.

The generators must have the dynamic reactive power capability to supply reactive power continuously at all active power outputs in the range of 0.9 lag to 0.95 lead power factor based on rated active power at its generator terminals for at least one constant 115 kV system voltage.

If necessary, shunt capacitors must be installed to offset the reactive power losses within the facility in excess of the maximum allowable losses. If generators do not have dynamic reactive power capabilities as described above, dynamic reactive compensation devices must be installed to make up the deficient reactive power.

2. The generators must not trip for recognized contingencies on the IESO-controlled grid that does not disconnect generators by configuration.

3. The connection and disconnection of the generators must minimize any adverse effects on the IESO-controlled grid.

Connection Equipment (Breakers, Disconnects, Transformers, Buses)

1. The 115 kV equipment connected to terminal stations must be capable of continuously operating in the range between 113 kV and 127 kV as per Appendix 4.1 of Market Rules.

Some recognized contingencies (e.g. load shedding, open line end) can cause a temporary voltage increase above the maximum continuous limit of 127 kV. For these conditions, connection equipment may be exposed to voltages slightly above its maximum continuous rating for the short period of time that it takes the IESO to direct operations to restore a normal voltage and to prepare for the next contingency. This re-preparation period will be as short as possible, but it will not take longer than 30 minutes.

The 115 kV equipment must be able to interrupt rated fault current for voltages up to the maximum continuous rating. They must remain in service, and not automatically trip for voltages up to 5% above the maximum continuous rating for up to 30 minutes to allow the system to be re-dispatched to return voltages within their normal range.

2. The Transmission System Code states that 115 kV connection equipment should have a rated 3-phase symmetrical short circuit capability of 50 kA and a rated single line to ground short circuit capability of 50 kA. It also requires that 115 kV breakers have a rated interrupting time of five cycles (83 ms) or less.

3. The connection equipment must be designed so that the adverse effects of their failure on the IESO-controlled grid are mitigated.

4. The connection equipment must be designed so that it will be fully operational in all reasonably foreseeable ambient temperature conditions. This includes ensuring that SF6 breakers are equipped with heaters to prevent freezing.

IESO Monitoring and Telemetry Data

The Appendix 4.15 and Appendix 4.19 of Market Rules list the requirements with respect to the telemetry that must be provided to the IESO and to the standards that must be achieved on a continual basis by all generators.

In accordance with the requirements for a *major generation facility*, Connection Applicant must ensure that all the equipment needed to provide the telemetry data and meet the performance standards will be installed.

The IESO will finalize items to be telemetered during the IESO Market Entry Process.

Protection Systems

1. Faults within EWCC facility must not trip 115 kV circuits E8F or E9F except for the failure of 115 kV connection breakers. After the facility begins operation, if the tripping of E8F or E9F occurs due to events within EWCC facility, the facility may be required to be disconnected until the problem is solved.

2. Protection systems must be designed to meet all the requirements of the Transmission System Code and any additional requirements identified by Hydro One.

3. The Special Protection Scheme must be fully duplicated with a separation of communication channels. It should also meet the requirements of the NPCC “Special Protection System Criteria.”

4. The facility must be capable of operating at full active power for a limited period of time for frequencies as low as 58.8 Hz. The generators must not trip for under-frequency system conditions that are below 60 Hz but above 57.0 Hz and above the curve shown in Figure 1.

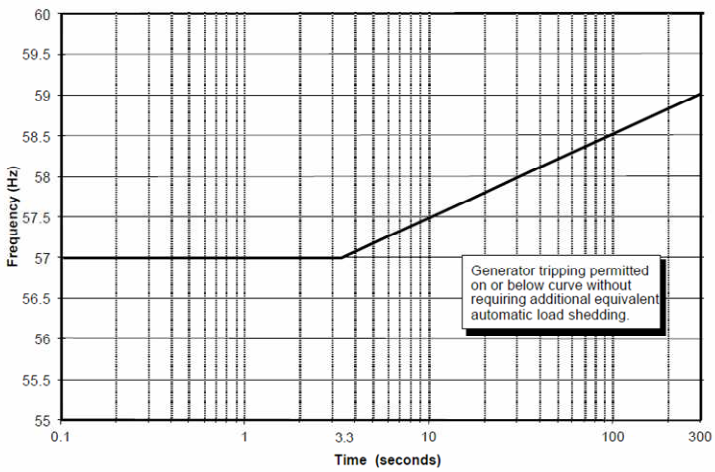

FIGURE 1: STANDARDS FOR SETTING UNDER-FREQUENCY TRIP PROTECTION FOR GENERATORS

Miscellaneous

1. The generators must be capable of operating continuously in the range between 59.4 Hz and 60.6 Hz as specified in Appendix 4.1 of Market Rules.

2. The generators must operate in the voltage control mode. Operation of the facility in power factor control or reactive power control is not acceptable.

3. All plant auxiliaries must be capable of operating continuously within the voltage range of 113 kV to 127 kV.

– End of Section –

3. Review of Modifications

3.1 Relocation of 115 kV Bus Tie

(1) Normal Conditions

Based on recommendation from Hydro One, EWCC is proposing to relocate the 115 kV bus tie breaker. **Figures 2 and 3** show the original and proposed modified 115 kV EWCC configuration respectively under normal operating conditions. Under normal operating conditions both the 115 kV and 13.8 kV tie breakers are kept open such that one generator is connected to E9F and the other is connected to E8F. A comparison shows that these two configurations appear electrically identical. As such, all contingencies that were observed under normal conditions in the original SIA are not impacted by the modification.

(2) E8F/E9F Outage Conditions

During an outage to E8F/E9F, the closing of the bus tie breaker allows for the connection of both EWCC G1 and G2 to the remaining E8F/E9F line. **Figures 4** and **5** show the original and proposed modified 115 kV EWCC configuration, respectively, under an outage to E8F. With the relocation of the 115 kV bus tie for E8F or E9F outage conditions, the out-of-service line will be isolated by the motor disconnect switch and the EWCC T1/T2 115 kV breaker.

The following table lists the EWCC breakers that would open under pre and post bus tie relocation configurations for various contingencies during an E8F outage. Although, each configuration differs in terms of which breakers open, the final state of the system still remains the same regardless of the configuration. Therefore, all contingencies that were observed under the E9F/E9F outage condition in the original SIA should not be impacted by the modification.

Contingency	Breakers Opening at EWCC Station under E8F Outage		
	EWCC 115 kV Transformer	EWCC 115 kV Bus Tie	EWCC 13.8 kV Transformer
Pre Bus Tie Relocation Configuration – Original Configuration (Figure 4)			
Loss of E9F	T2 115 kV breaker opens	115 kV tie-breaker opens	
Loss of EWCC T1	T1 115 kV breaker opens		T1 13.8 kV breaker opens
Loss of EWCC T2	T2 115 kV breaker opens		T2 13.8 kV breaker opens
Post Bus Tie Relocation Configuration – Proposed Modified Configuration (Figure 5)			
Loss of E9F	T2 115 kV breaker opens		
Loss of EWCC T1		115 kV tie-breaker opens	T1 13.8 kV breaker opens
Loss of EWCC T2	T2 115 kV breaker opens	115 kV tie-breaker opens	T2 13.8 kV breaker opens

The proposed relocation of the 115 kV bus tie breaker does not have a negative adverse impact to the reliability of the IESO-controlled grid.

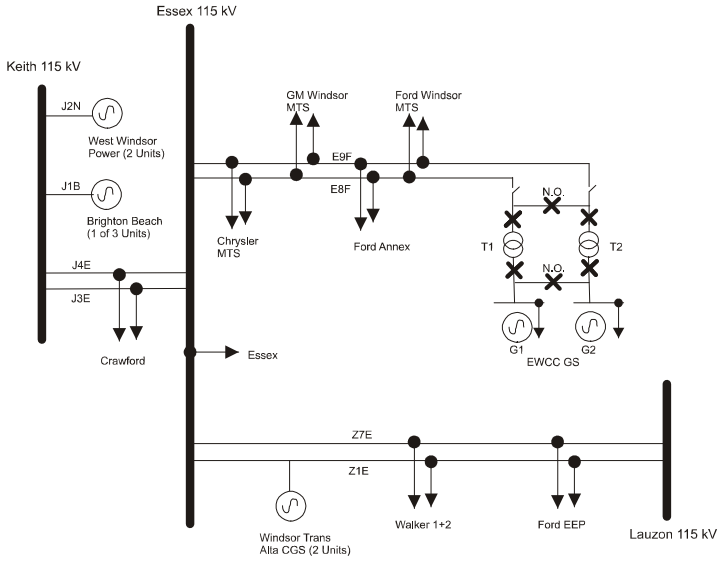

Figure 2: Original 115 kV Configuration (Normal Conditions)

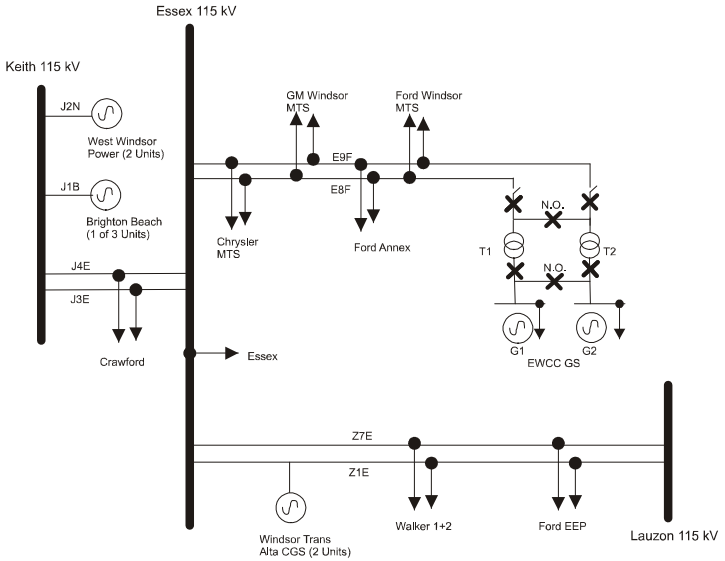

Figure 3: Proposed Modified 115 kV Configuration (Normal Conditions)

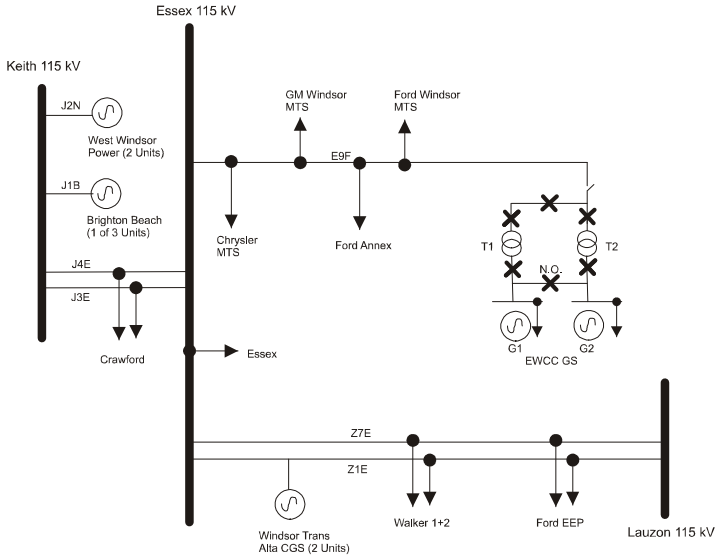

Figure 4: Original 115 kV Configuration (E8F Outage Conditions)

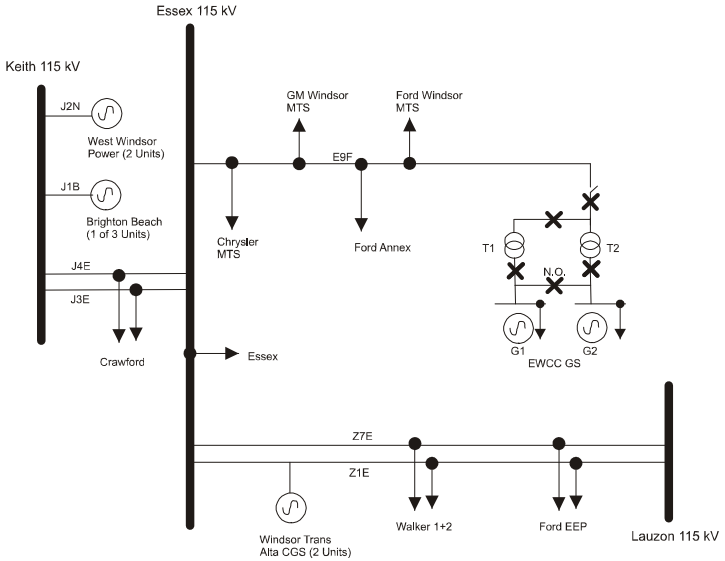

Figure 5: Proposed Modified 115 kV Configuration (E8F Outage Conditions)

3.2 Modifications to Mode A and Mode AE Split Operation

Essex 115 kV TS station has recently been reconfigured. The Z7E and E8F terminations at Essex TS have been interchanged to provide more flexibility in splitting the Essex 115 kV busbar (Mode A and Mode AE splits) for Winsor Area Overload Protection scheme related contingencies. The post-interchange Essex TS station diagram is shown in **Figure 6.** This reconfigured configuration was accounted for in the original EWCC System Impact Assessment.

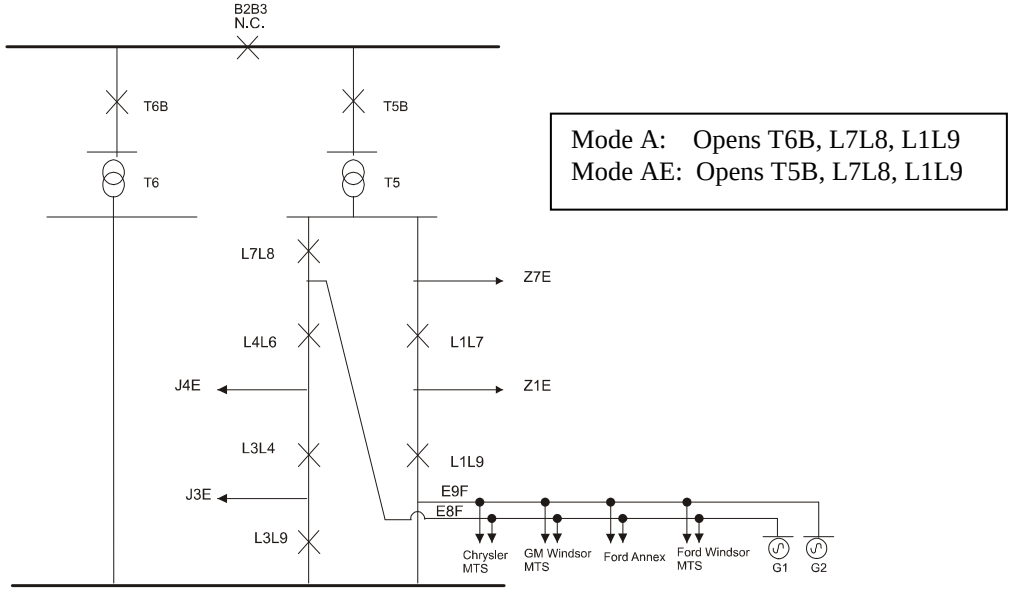

FIGURE 6: MODIFIED ESSEX TS LAYOUT

Since the release of the original SIA, modifications have been made to the Windsor Area Overload Protection Scheme to reflect the station reconfiguration. Changes have been made to the operation of Mode A and Mode AE splits for the loss of J3E or J4E. The changes are as follows:

(1) For a J3E circuit fault: If a Mode A or Mode AE split is initiated as a result of a J3E fault, a transfer trip signal is to be sent to the MTS transformers connected to E9F.

(2) For a J4E circuit fault: If a Mode A or Mode AE split is initiated as a result of a J4E fault, a transfer trip signal is to be sent to the MTS transformers connected E8F.

With the incorporation of EWCC, transfer trip signals would also need to be sent to the corresponding EWCC generator on E8F or E9F under a Mode A or Mode AE split for the loss of J3E or J4E. This would prevent any EWCC generation islanding with its station load. The *new* Mode A and Mode AE split operations requirements for the loss of J3E or J4E are summarized in the table below:

New Mode A and Mode AE Split Operating Requirements for Loss of J3E or J4E	
Contingency	Transfer Trip Signal
J3E	• Signal sent to MTS transformers connected to E9F • Signal sent to EWCC generation connected to E9F
J4E	• Signal sent to MTS transformers connected to E8F • Signal sent to EWCC generation connected to E8F

3.3 Windsor Area Overload Protection Scheme Incorporation

The IESO has recommended that EWCC be included into the Windsor Area Overload Protection Scheme for operational flexibility. It is possible that under certain operating conditions beyond the scope of the original System Impact Assessment, such as equipment outages, the pre-contingency output of each unit could be limited. By incorporating into the Windsor Area Overload Protection Scheme, these limitations can be avoided as EWCC G1 and G2 can be armed for generation rejection for critical Windsor area contingencies.

The following table lists the contingencies currently recognized by the overload protection scheme:

Contingency Scope of Windsor Overload Protection Scheme				
J5D	C21J	C22J/T12	T11/C21J	J3E
J4E	Z1E	Z7E	J1B	C21J+C22J
J3E+J4E	Z1E+Z7E			

Figure 7 shows the necessary change to the Windsor Area Overload Protection Scheme allowing for the rejection of EWCC G1 and G2. Also included in the figure is the transfer trip of EWCC units on E9F/E8F for the loss of J3E/J4E upon the initiation of Mode A and Mode AE splits.

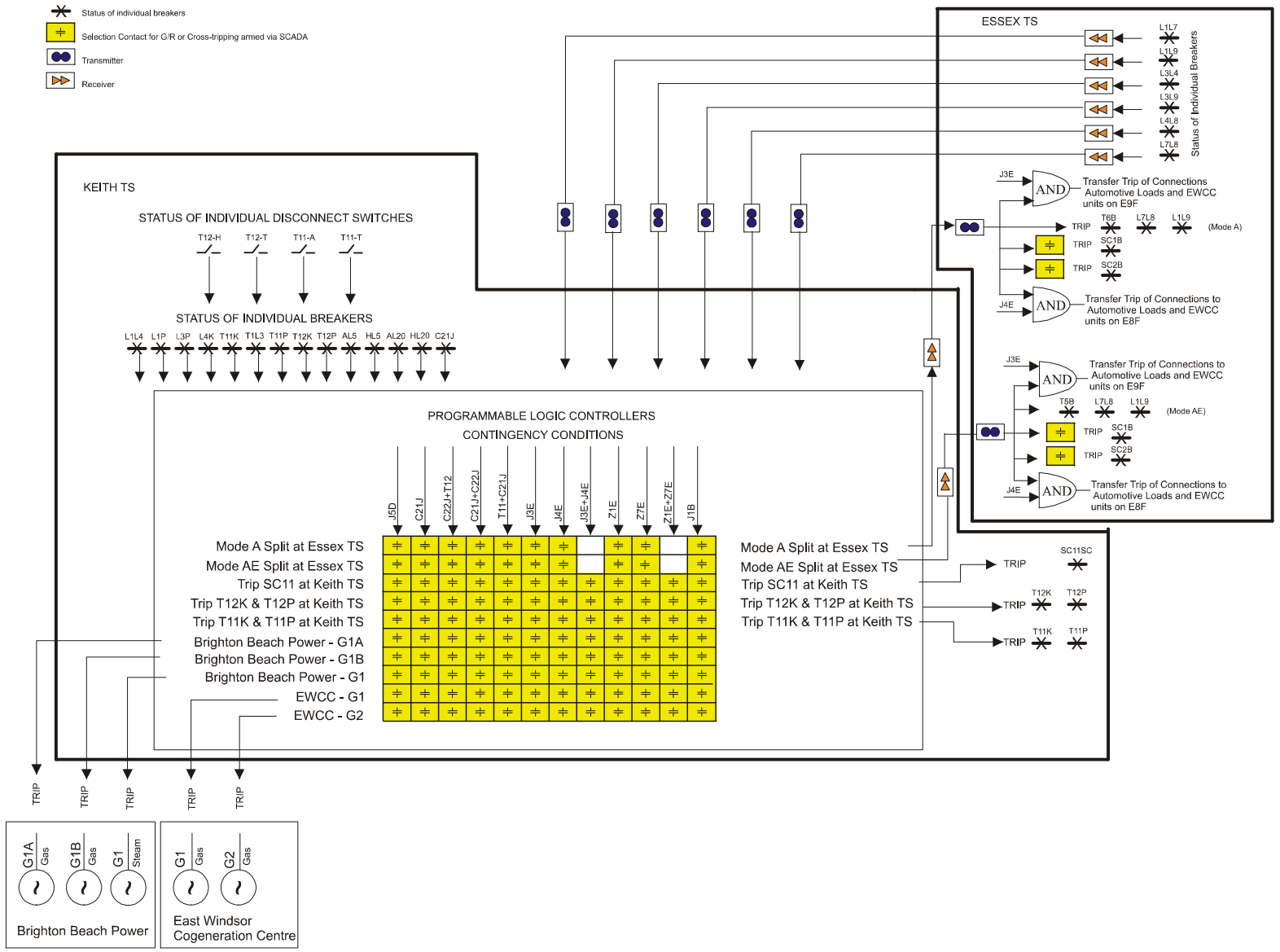

FIGURE 7: WINDSOR AREA OVERLOAD PROTECTION SCHEME (EWCC INCORPORATION)