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# System Impact Assessment Report

## CONNECTION ASSESSMENT & APPROVAL PROCESS

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### Addendum

**CAA ID:** 2006-224

**Project:** GTA West Transmission Reinforcement  
Huronario SS – Stage 1

**Applicant:** Hydro One Networks Inc.

Market Facilitation Department  
Independent Electricity System Operator

**Date:** March 25, 2010

**REPORT**

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## **System Impact Assessment Report**

### **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 conditional approval or disapproval of the proposed connection under Chapter 4, section 6 of the Market Rules.

Conditional approval of the proposed connection is based on information provided to the IESO by the connection applicant and Hydro One 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 Hydro One at the request of the IESO. Furthermore, the conditional approval is subject to further consideration due to changes to this information, or to additional information that may become available after the conditional approval has been granted.

If the connection applicant has engaged a consultant to perform connection assessment studies, the connection applicant acknowledges that the IESO will be relying on such studies in conducting its assessment and that the IESO assumes no responsibility for the accuracy or completeness of such studies including, without limitation, any changes to IESO base case models made by the consultant. The IESO reserves the right to repeat any or all connection studies performed by the consultant if necessary to meet IESO requirements.

Conditional 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, the conditional 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, the connection applicant must be aware that the IESO may revise drafts of this report at any time in its sole discretion without notice to the connection applicant. 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 the most recent version of this report is being used.

## Hydro One

The results reported in this report are based on the information available to Hydro One, at the time of the study, suitable for a preliminary assessment of this transmission system reinforcement 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 facilities on load and generation customers.

In this report, short circuit adequacy is assessed only for Hydro One circuit breakers. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One circuit breakers and identifying upgrades required to incorporate the proposed facilities. These results should not be used in the design and engineering of any new or existing facilities. The necessary data will be provided by Hydro One and discussed with any connection applicant 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 facilities 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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## Summary and Conclusions

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Hydro One is planning to construct a new 230 kV 4-breaker switching station called Hurontario SS. Stage 1 of the proposal will connect circuits V41H (formerly V72R) to R19T and V42H (formerly V73R) to R21T. Circuits V41H and V42H will be extended from Cardiff TS to Hurontario SS which will be located on the Pleasant tap of R19T/R21T. The IESO has issued the SIA report in 2006 (CAA2006-224) for this project. However, the impact on the Claireville SPS was not investigated in the original SIA. This addendum primarily assesses the impact of Hurontario SS on Claireville SPS, and identifies any adverse impact on the reliability of the IESO-controlled grid in this regard.

The following conclusions were achieved based on this assessment:

- (1) The integration of Hurontario SS requires the Sithe-Goreway Generation Runback Scheme to be enhanced by the Circuit Breaker (CB) status of V41H/V42H at Hurontario SS. The contingencies of LEO condition of V41H/ V42H need to be removed from the Scheme. However, considering the low probability of the LEO event of V41H/V42H and the cost for the enhancement, the IESO accepts the existing control logic of the Scheme and does not require any change to be implemented. However, the IESO reserve the right to reassess this situation and ask Hydro One to implement the revised Scheme as shown in Figure 3.
- (2) The connection of Hurontario SS has no significant impact on the GTAA Cross Tripping Scheme.

# 1. Introduction

Hydro One initiated an area supply study with the Local Distribution Companies (LDC's) that service GTA West with the goal of identifying options to reinforce the West GTA transmission system. Per the results of the 'GTA West Supply Study', Hydro One is planning to construct a new 230 kV 4-breaker switching station called Hurontario SS. Stage 1 of the proposal will connect circuits V41H (formerly V72R) to R19T and V42H (formerly V73R) to R21T. Circuits V41H and V42H will be extended from Cardiff TS to Hurontario SS which will be located on the Pleasant tap of R19T/R21T. Load at Pleasant TS will be supplied radially from Hurontario SS by circuits H29 and H30, connected to R19TH/V41H and R21TH/V42H, respectively. Two new 230-kV circuits will be constructed between Hurontario SS and Jim Yarrow MTS, which offload Jim Yarrow MTS from Pleasant tap on R19TH/R21TH. The GTA west system with proposed Hurontario SS is shown in Figure 1.

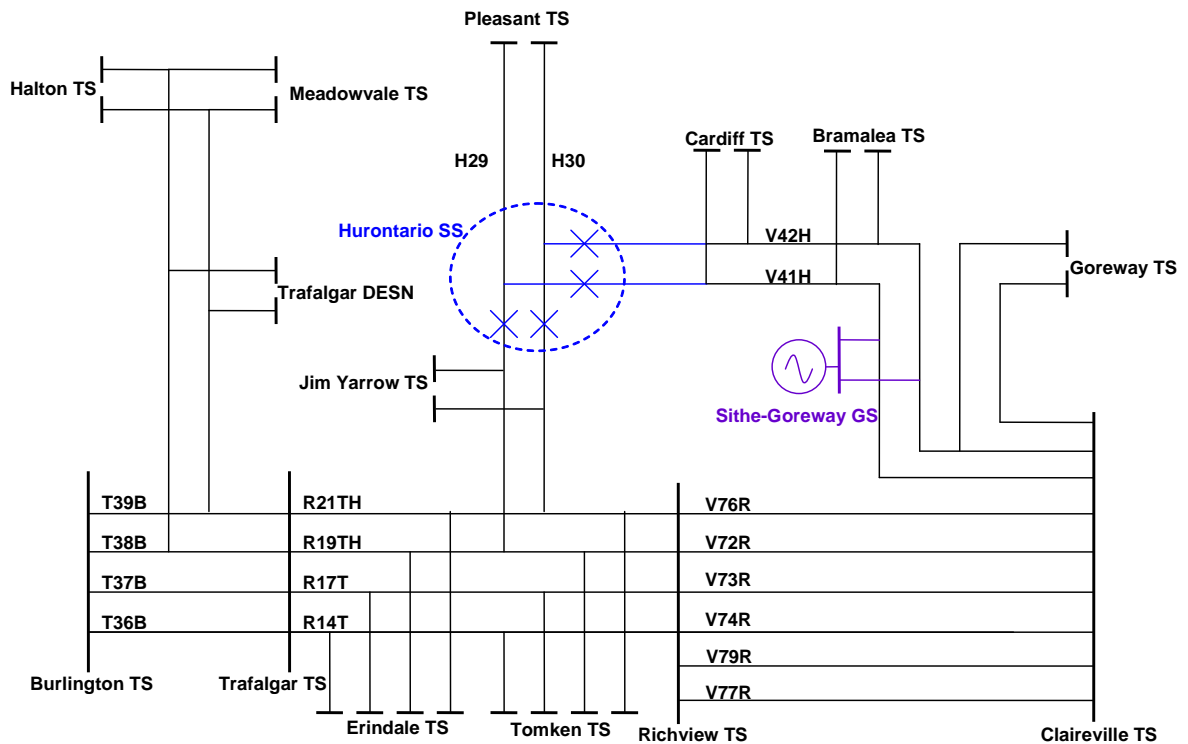


Figure 1: GTA west system with proposed Hurontario SS

The IESO has issued the SIA report in 2006 for this project (CAA2006-224). The SIA had assessed the effect of the new facilities on voltage declines, thermal loading, and system short circuit level, and identified the requirements to integrate Hurontario SS into the IESO-controlled grid. The impact on the Claireville SPS was not investigated in the original SIA.

During the IESO Market Entry/Facility Registration process for this project, the IESO has identified the need to assess the impact of Hurontario SS on Claireville SPS. This addendum will primarily assess the impact of Hurontario SS on Claireville SPS and identify any adverse impact in this regard on the reliability of the IESO-controlled grid.

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## 2. Assessments

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The assessment primarily covers the impact of new facilities at Hurontario SS on Claireville Special Protection System (SPS) and identifies any consequential adverse impact on system reliability.

### 2.1 Claireville SPS

Claireville Special Protection System (SPS) is composed of the following three schemes:

- (1) Sithe-Goreway Generation Run Back
- (2) Greater Toronto Airport Authority (GTAA) Cross Tripping
- (3) Claireville-Minden Overload Protection Scheme (VMOPS) Cross Tripping

Each of these schemes is initiated from Claireville TS in response to specific contingencies involving 230 kV elements and connections. Only the first two schemes may be impacted by the integration of Hurontario SS, thus will be discussed in this report.

#### 2.1.1 Sithe-Goreway Generation Runback Scheme

The Sithe-Goreway Generation Runback Scheme is designed to fast relieve the overloading of circuit V41H (or V42H) when a contingency occurs on the companion circuit V42H (or V41H) (either a LEO condition at Claireville TS or the loss of the circuit). The control logic of the Scheme is shown in Figure 2, which is based on the Circuit Breaker (CB) status of V41H/V42H at Claireville. The Scheme needs to be armed when the 230 kV busbar at Sithe-Goreway CGS is operated closed and the plant output is greater than 645 MW.

The sections of circuits V41H/V42H that may be overloaded under the recognized contingencies are:

- (1) Sithe-Goreway line to the Hydro One right-of-way
- (2) Line section between Sithe-Goreway CGS and Claireville TS (including both overhead-line and cable segments)

Under the contingencies, the flow on the above sections may exceed their Long Time Emergency (LTE) ratings (or continuous rating for cable section); however, the loading is below their Short Time Emergency (STE) ratings (15-min LTR).

#### 2.1.2 GTAA Cross Tripping Scheme

The GTAA Cross Tripping Scheme is to island the GTAA generating units with the local load at the Airport in the event that the pairs of 230kV connections, V41H/V42H or V44/V43, to the system are lost. The scheme will also initiate similar control actions in case the 230-kV connection to the system are severed due to the loss of transformers T3/T5 at Woodbridge TS or T5/T6 at Bramalea TS. The control logic of the Scheme is shown in Figure 2, which is based on the Circuit Breaker (CB) status of V41H/V42H and V44/V43 at Claireville.

## 2.2 Impact on Sithe-Goreway Generation Runback

Load flow study results show that, after the connection of Hurontario SS, the sections of circuits V41H/V42H that may be overloaded due to the loss of the companion circuit are:

- (1) Sithe-Goreway line to the Hydro One right-of-way
- (2) Line section between Sithe-Goreway CGS and Bramalea TS

Under the recognized contingencies, the flow on the above sections may exceed their LTE ratings; however, the loading is below their STE ratings (15-min LTR). The existing Sithe-Goreway Generation Runback Scheme could effectively relieve the above overloading situations.

However, the overloading situations of circuits V41H/V42H may only occur due to the loss of the companion circuit, i.e. breakers open at Claireville TS and Hurontario SS. Since under the new system configuration the 230 kV lines V41H and V42H are no longer radial from Claireville TS, the contingency of LEO condition of V41H/ V42H does not result in any overloading. Thus, no generation runback at Sithe-Goreway CGS is required for the contingency of LEO condition of circuits V41H/V42H.

As the existing control logic, as shown in Figure 2, responds to both loss of circuit and LEO condition of V41H/ V42H, the contingency of LEO condition needs to be removed from the Scheme. To achieve this, the CB status of V41H/V42H at Hurontario needs to be utilized to enhance the control logic. The revised control logic of the Scheme is shown in Figure 3.

The revised Scheme requires additional communication channels between Hurontario SS and Claireville TS, which are costly, as confirmed by the applicant. Without the enhancement, the existing Sithe-Goreway Generation Runback Scheme may expose to over-arming for LEO condition of V41H/ V42H, but there is an insignificant impact on the system reliability of the IESO-controlled grid.

For the V41H LEO condition to occur, one of the following situations would have to arise:

- (1) With breaker L41L77 out-of-service, a contingency involving the H2 bus occurs and the bus fault is cleared through the operation of the bus breakers including breaker H2L41.
- (2) With breaker H2L41 out-of-service, a contingency involving circuit V77R occurs and the fault is cleared through the operation of breakers L41L77 and L71L77; or a contingency involving circuit V71P occurs. Breaker L71L77 fails to operate and L41L77 opens.

Similar situations would have to arise for the V42H LEO condition. Considering these situations for the LEO condition to occur, the probability of a LEO event of V41H/V42H is quite small. Thus, the IESO accepts the existing control logic of the Scheme and does not require any change to be implemented at this time. However, the IESO reserves the right to ask Hydro One in the future to implement the revised Scheme as shown in Figure 3.

## 2.3 Impact on GTAA Cross Tripping

Following the same philosophy as in Section 2.2, the contingency of LEO condition of both V41H and V42H (including one circuit out-of-service and one circuit in LEO condition) shall not result in the GTAA Cross Tripping. For the LEO condition of both circuits V41H and V42H to occur, the following situations would have to arise:

- (1) With circuit V42H and breaker L41L77 out-of-service simultaneously, a contingency involving the H2 bus occurs and the bus fault is cleared through the operation of the bus breakers including breaker H2L41.
- (2) With circuit V42H and breaker H2L41 out-of-service simultaneously, a contingency involving circuit V77R occurs and the fault is cleared through the operation of breakers L41L77 and L71L77; or a contingency involving circuit V71P occurs. Breaker L71L77 fails to operate and L41L77 opens.
- (3) With circuit V41H and breaker L42L76 out-of-service simultaneously, a contingency involving the K1 bus occurs and the bus fault is cleared through the operation of the bus breakers including breaker K1L42.
- (4) With circuit V41H and breaker K1L42 out-of-service simultaneously, a contingency involving circuit V76R occurs and the fault is cleared through the operation of breakers L42L76 and L76L82; or a contingency involving circuit B82V occurs. Breaker L76L82 fails to operate and L42L76 opens.

Considering the above situations for the LEO condition to occur, the probability of a LEO event of both V41H and V42H could be neglected. It is concluded that no change is required for the GTAA Cross Tripping and the connection of Hurontario SS has no significant impact on the Scheme.

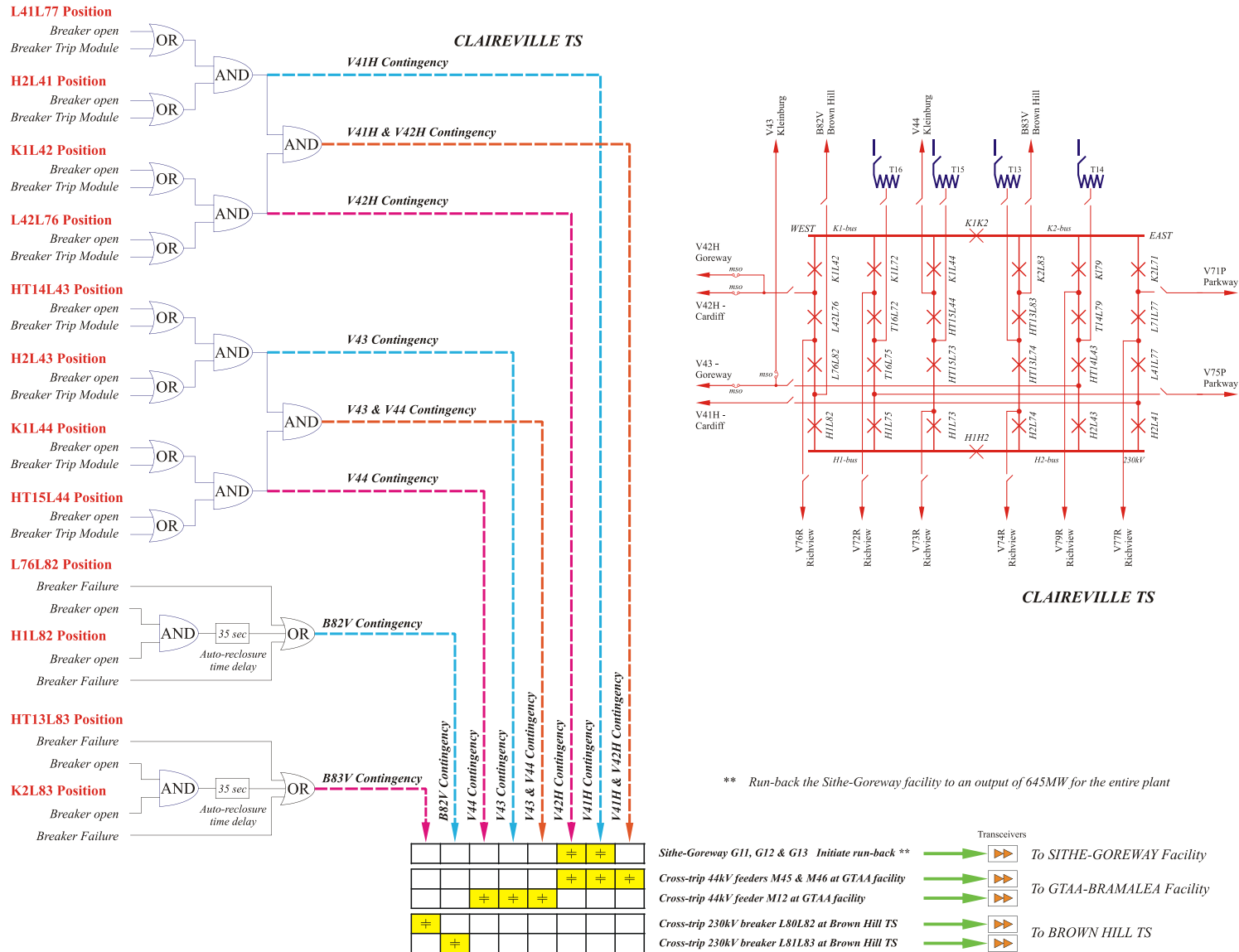


Figure 2: Claireville TS - Existing Generation Runback and Cross Tripping Schemes

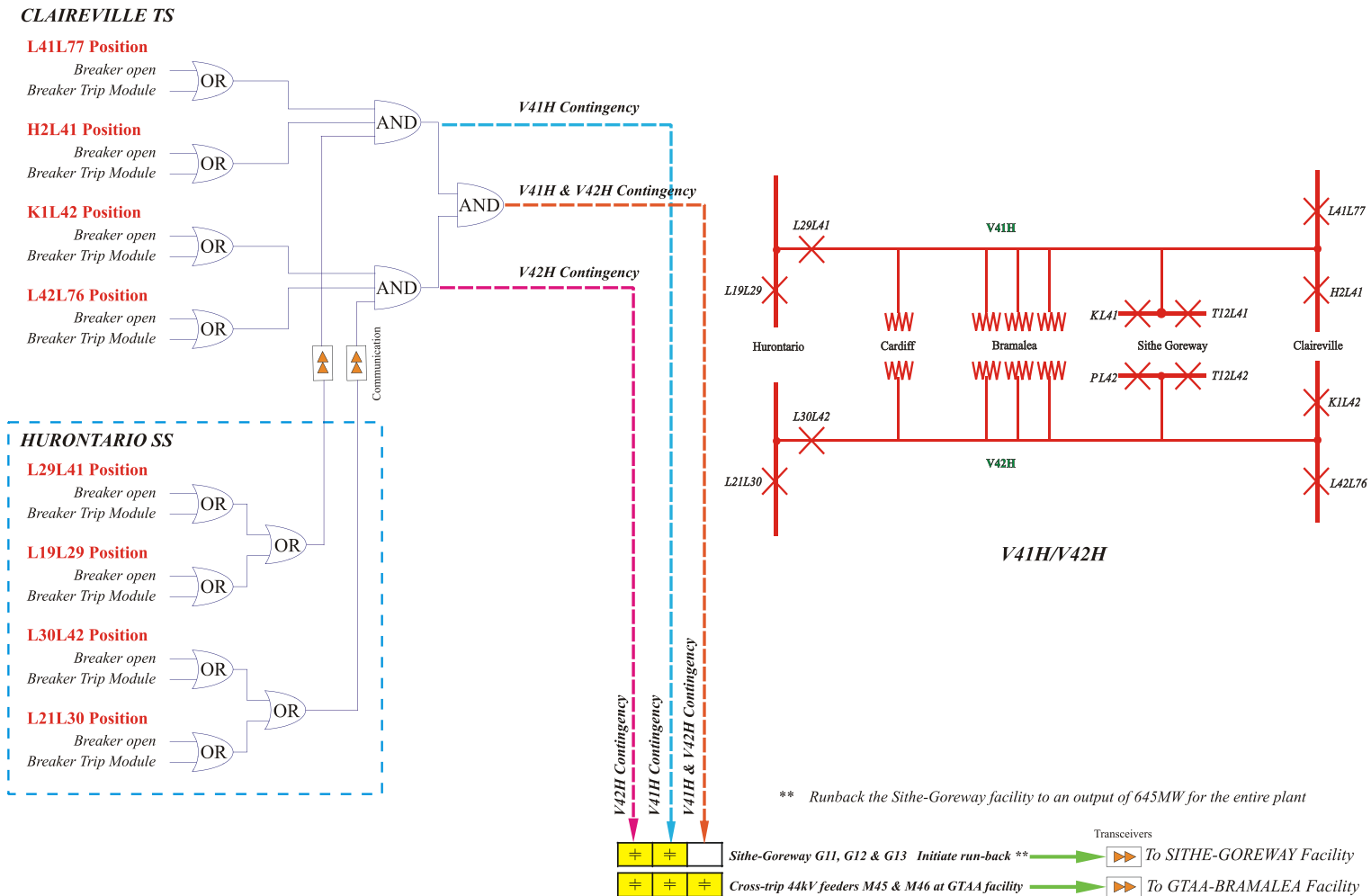


Figure 3: Revised Sithe-Goreway Generation Runback Scheme

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