

CONNECTION ASSESSMENT & APPROVAL PROCESS

PRELIMINARY ASSESSMENT REPORT

Proponent: Hydro One Networks Inc.

Project: Install a 125MVA 230/115kV Auto-transformer at Kent TS

CAA ID No. 2002-066

***Consistent Information Set Department, and
Long Term Forecasts & Assessments Department***

Final Version

Date: 11th November 2002

Preliminary Assessment Report

For the Proposal by Hydro One Networks Inc. to Install a 230/115kV Auto-transformer at Kent TS

Disclaimers

IMO

This report has been prepared solely for the purpose of assessing 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 the IMO should issue a notice of approval or disapproval of the proposed connection 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. In particular, this report does not address any other Market-related or any commercial aspects of the connection proposal. This report has been prepared solely for use by the connection applicant 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 reserves the right to revise this report at any time, at its sole discretion, without notice to the connection applicant. Although the IMO will use its best efforts to advise the connection applicant of 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

Special Notes and Limitations of Study Results

The results reported in this preliminary feasibility 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 ampacity rating 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. Additional facility studies may be necessary to confirm constructability and the time required for construction. System impact or further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.

Preliminary Assessment Report

Kent TS Project: Installation of a 230/115kV Auto-transformer

A Proposal by Hydro One Networks Inc.

1. Introduction

Kent TS is an existing 230/27.6kV DESN station, consisting of three step-down transformers, connected to the 230kV circuits, L28C & L29C, between Lambton TS and Chatham TS. A 115kV in-line circuit breaker, which interconnects the 115kV circuits K2Z & N5K, is also located within the TS site.

Hydro One Networks Inc. is proposing to install a single 125MVA 230/115kV auto-transformer at Kent TS to interconnect the existing 230kV and 115kV systems.

The proposed in-service date for the new facility is October 2003.

2. Connection Arrangement

Diagram 1 shows the existing connection arrangement for the facilities installed at Kent TS.

The 230/27.6kV step-down transformers T1 & T2 are connected to the two 230kV circuits L28C & L29C, respectively. Two 230kV circuit-switchers form a bus-tie connection between these two transformers, and the third step-down transformer, T4, is connected to their mid-point. One of these circuit-switchers is operated normally-open. This arrangement allows the step-down transformer T4 to be connected either to circuit L28C or L29C.

The present practice is for circuit-switcher T4L29 to be operated normally-open so that the step-down transformer T4 is connected to step-down transformer T1 and supplied from circuit L28C.

The 115kV circuits K2Z from Lauzon TS, and N5K from Scott TS also terminate at Kent TS on to a single in-line breaker, L2L5. However, there is no existing connection between the 230kV and 115kV transmission facilities at Kent TS.

Diagram 2 shows the existing 115kV connections and supply arrangement for Kingsville TS and the two Tilbury area supply points, Tilbury TS & Tilbury West DS. Kingsville TS is supplied by the two 115kV circuits K2Z and K6Z from Lauzon TS, while only circuit K2Z continues on from Woodslee Junction to supply the two Tilbury area loads. The section of the companion circuit, K6Z, between Belle River Junction and Tilbury Junction is presently idle, with portions of it being operated at 27.6kV as part of the local distribution system.

Circuit K2Z continues on from Woodslee Junction to Kent TS, where it is connected to circuit N5K through an in-line breaker, L2L5. Circuit N5K is operated normally-open at Wallaceburg TS, on the Kent TS side of this TS, so that the load at Wallaceburg TS is normally supplied from Scott TS.

Diagram 3 shows the geographic location of the various loads and supply points.

Diagram 4 shows the proposed connection arrangement for the new 230/115kV auto-transformer at Kent TS.

A new circuit-switcher is to be installed between the two existing circuit-switchers to form a three circuit-switcher connection between circuits L28C & L29C. This will then create a new terminal position to which the new auto-transformer, T11, is to be connected. The new circuit-switcher is to be operated normally-open so that the existing step-down transformers, T1 & T4, will be connected to circuit L28C and the new auto-transformer, together with the existing step-down transformer, T2, will be connected to circuit L29C.

While the intent is for the new auto-transformer, together with the existing step-down transformer, T2, to normally be connected to circuit L29C, the installation of the new circuit-switcher will allow the new auto-transformer to be transferred on to circuit L28C whenever conditions warrant.

A new 115kV circuit breaker is also to be installed in-series with the existing circuit breaker L2L5, that presently interconnects circuit N5K (to Sarnia-Scott TS) and circuit K2Z (to Lauzon TS). The new circuit breaker is to be installed on the N5K side of breaker L2L5 to form a terminal point for the new auto-transformer.

It is proposed to continue to operate with circuit N5K normally-open at Wallaceburg TS once the new auto-transformer is in-service at Kent TS, so that this load will remain supplied from Sarnia-Scott TS.

A new normally-open point is also to be established in circuit K2Z at Tilbury Junction, so that the loads at Tilbury West DS and Tilbury TS will be supplied by the new auto-transformer.

Diagram 5 shows the supply arrangement that will exist once the new 230/115kV auto-transformer, T11, is installed at Kent TS. While the new auto-transformer will normally be required to supply only the load at Tilbury TS and Tilbury West DS, its 125MVA rating will be sufficient to provide a back-up supply for Wallaceburg TS, as well as a back-up supply for a portion of the load at Kingsville TS.

Kent TS Automatic Transfer Scheme

A Scheme is currently in place to allow the T4 step-down transformer at Kent TS to be automatically transferred to the companion circuit should it be removed from service in the event of a contingency involving circuit L28C or L29C.

If it is Hydro One's intention to retain this Scheme in-service to allow transformer T4 and/or the auto-transformer T11 to be automatically transferred to the healthy circuit following a contingency, a revised version of the Facilities Description Document will need to be produced, once the revised Scheme has received IMO approval.

2.1 Ratings of the new facilities

230kV Circuit Switcher

The ratings for the new 230kV SF₆ circuit switcher are as follows (which match those for the two existing units):

Maximum operating voltage	250kV	
Fault interrupting capability	20kA symmetrical	(8-cycles)
Short-time rating	40kA (1 second)	
Continuous current rating	1200A	

115kV SF₆ Circuit Breaker & Disconnect Switchers

The ratings for the new 115kV SF₆ circuit breaker are as follows:

Maximum operating voltage	145kV	
Fault interrupting capability	40kA symmetrical	(3-cycles)
Continuous current rating	2000A	

The ratings for the new 115kV disconnect switches are as follows:

Maximum operating voltage	145kV	
Short-time rating	40kA (1 second)	
Continuous current rating	2000A	
Manual operation		

Comments on the Switchgear

i. Circuit Switcher Rating

The fault level at Chatham TS for a three-phase fault is expected to increase to approximately 24kA symmetrical and 25kA asymmetrical once the AES Project near Leamington is developed. If the second stage of the AGSTAR Project, that is to be connected to the 230kV circuits C21J & C22J, were also to be developed then this would result in a further increase in the fault level at Chatham TS. While the incorporation of the new generation Projects is not expected to result in the fault level at Kent TS exceeding the 20kA rating of the two existing circuit switchers and the new one that Hydro One is proposing to install, the situation will need to be monitored.

Should the fault level at Kent TS exceed the rating of the circuit switchers then these would need to be replaced with higher-rated units or the circuit switchers would need to be restricted to non-fault-interrupting duties.

While the Transmission System Code recommends a rating of 63kA for new 230kV facilities, it is understood that the maximum rating for circuit switchers that are currently available on the market is only 40kA. Since Hydro One is proposing to install a lower-rated unit, then they would be responsible for its replacement should the fault level exceed the 20kA rating of the new circuit switcher at some future date.

ii. Circuit Breaker Rating

Similarly, while the 40kA rating of the new 115kV circuit breaker that Hydro One is proposing to install at Kent TS is expected to be adequate for all future requirements, including the incorporation of Stage 1 of the AGSTAR Project, it does not meet the 50kA rating recommended in the Transmission System Code for new 115kV facilities. Consequently, should the fault levels increase so that this new circuit breaker has to be replaced with a higher-rated unit, then it is expected that Hydro One would be responsible for undertaking this work.

230/115kV Auto-transformer

Hydro One is proposing to install a new 125MVA 230/115kV auto-transformer at Kent TS that will only be equipped with an off-load tap-changer with the following tap positions:

248.6kV 242.7kV 236.8kV 231.1kV 225.5kV 220.1kV

While this range of tap positions is expected to be adequate for the voltage variation that is likely to be experienced at Kent TS, Hydro One is relying on the under-load tap-changers on the local 115kV step-down transformers to meet the requirements of Clause 7.1.1 of the Transmission System Code, which states:

A Transmitter's tapped transformer stations, excluding those that are deemed compliant under Section 2.6 of this Code, shall have adequate on-load tap-changer or other voltage-regulating facilities to operate continuously within normal variations on the transmission system as set out in the Market Rules and to operate in emergencies with a further transmission system voltage variation of +/- six percent (+/-6%).

However, should it be necessary to make changes to the tap-position of the new auto-transformer, then with only a single auto-transformer installed at Kent TS and with no suitable switching device at Tilbury Junction to permit parallelling of the Kent TS and Lauzon TS supplies, this will necessitate a supply interruption to the Tilbury area loads.

The auto-transformer is to be equipped with a 13.4kV delta-tertiary winding that is to be operated closed. The tertiary winding is rated at 40MVA.

Monitoring

Facilities are to be installed at Kent TS to meet the IMO's monitoring requirements as detailed in Appendix 4.16 of the Market Rules.

3. Thermal Ratings

The following thermal ratings for an ambient temperature of 30°C and a wind speed of 4km/hr were assumed in all the subsequent analysis discussed below:

115kV Circuit N5K: Sarnia-Scott TS to Kent TS					<i>Continuous rating at 93°C or at sag temp., if lower</i>	
Sarnia-Scott TS	Kimball Junction	16.01km	336.4kcmil	93°C	500A	104MVA at 120kV
Kimball Junction	Wallaceburg TS	24.08km				
Wallaceburg TS	Kent TS	25.03km		97°C		
115kV Circuit K2Z: Lauzon TS to Kent TS						
Lauzon TS	Woodslee Junction	18.51km	477kcmil	150°C	620A	129MVA at 120kV
Woodslee Junction	Tilbury Junction	21.90km		90°C	600A	125MVA at 120kV
Tilbury Junction	Kent Junction	27.68km		82°C	550A	114MVA at 120kV
Kent Junction	Kent TS	5.18km		60°C	420A	87MVA at 120kV
Woodslee Junction	Kingsville TS	23.95km		133°C	620A	129MVA at 120kV
115kV Circuit K6Z: Lauzon TS to Kingsville TS						
Lauzon TS	Belle River Junction	17.77km	795kcmil	127°C	850A	177MVA at 120kV
Belle River Junction	Kingsville TS	26.23km	336.4kcmil	150°C	500A	104MVA at 120kV

4. System Performance

4.1 Existing System Arrangement

For the existing system arrangement, with the Tilbury area loads supplied via the 115kV system from Lauzon TS, the respective transfers on circuits L28C & L29C at Lambton TS are approximately equal.

After supplying the load at Kent TS, the transfers on these two circuits between Lynwood Junction and Chatham TS show a difference of approximately 20MW due to the uneven distribution of the load. Kent TS has two step-down transformers connected to circuit L28C while only a single transformer is connected to circuit L29C.

For the particular condition examined, the voltages at Kingsville TS and Tilbury TS were only 112.5kV and 113.3kV, respectively. Since the Market Rules require a minimum voltage of 113kV to be maintained on the 115kV system, with all elements in-service, the voltage at Kingsville TS would not comply, while that at Tilbury TS would be only marginally acceptable.

4.2 With the new 230/115kV Auto-transformer In-service at Kent TS

With the new auto-transformer installed at Kent TS supplying only the Tilbury area loads, the transfers on circuits L28C and L29C at Lambton TS remain essentially unchanged. Furthermore, the flows into Chatham TS from Longwood TS/Buchanan TS via circuits W44LC & W45LC also remain unchanged. However, since the flow on circuit L29C into Chatham TS is reduced by an amount that is approximately equal to the load that is now supplied from the new auto-transformer, the net result is that the flows on these two circuits between Lynwood Junction and Chatham TS become approximately equal.

Transferring the Tilbury area load to the new auto-transformer therefore reduces the flows between Chatham TS and Lauzon TS, via circuits C23Z & C24Z, resulting in an improved voltage profile on the 115kV system supplied from Lauzon TS. The voltage at Kingsville TS increases from 112.5kV for the present supply arrangement, to 115.1kV with the new auto-transformer supplying the Tilbury area load.

Furthermore, with the Tilbury area loads supplied from Kent TS and with the tap-changer of the new auto-transformer set to the mid-position (231.1kV), the voltage at Tilbury TS showed an increase of approximately 8% to 122.9kV.

4.3 With the new Auto-transformer providing an Emergency Supply to Wallaceburg TS

The load at Wallaceburg TS is normally supplied from Sarnia-Scott TS via the 40km northern section of 115kV circuit N5K. The 25km southern section of this circuit to Kent TS is operated normally-open via the disconnect switch 1N5K-5 at Wallaceburg TS.

While the primary purpose of the new auto-transformer at Kent TS is to supply the Tilbury area loads, it is also intended to provide an emergency back-up supply to Wallaceburg TS via the southern section of circuit N5K. Since the loads at Tilbury TS are approximately 30MVA and those at Wallaceburg TS are approximately 50MVA, the 125MVA auto-transformer that is to be installed at Kent TS will have adequate capacity.

Transferring the load at Wallaceburg TS on to the Kent auto-transformer would result in a marginal reduction in the voltage at Tilbury TS to 122.1kV, while producing an improved voltage of 122.7kV at Wallaceburg TS (compared to a voltage of 115kV obtained for the normal arrangement with this load supplied from Sarnia-Scott TS). However, since this supply arrangement would increase the loading on the Lambton TS to Chatham TS circuits, L28C & L29C, it is proposed that it be used only when necessary.

With circuit N5K operated closed between Sarnia-Scott TS and Kent TS

While it is acknowledged that operating with circuit N5K, between Sarnia-Scott TS and Kent TS, permanently closed would result in increased exposure to possible contingencies unless intermediate switching were to be installed at Wallaceburg TS, studies were conducted to determine whether there would be any operational benefits from this arrangement.

With circuit N5K operated closed, there was a substantial increase in the MW flow from Sarnia-Scott TS together with a corresponding reduction in the flow through the new auto-transformer. This would result in all of the load in the Tilbury area being supplied from Sarnia-Scott TS, rather than from the auto-transformer at Kent TS. However, while the MW flow through the auto-transformer was close to zero, the reactive power flow increased from 15MVAR, when supplying only the Tilbury area loads, to 50MVAR with circuit N5K closed. This arrangement also resulted in an improved voltage of 119.5kV at Wallaceburg TS, while that at Tilbury TS decreased to 119.0kV.

Although operating with circuit N5K closed would result in an increased flow from Sarnia-Scott TS, it would remain within its continuous rating of 104MVA. In addition, the reduced transfers through the Kent auto-transformer would reduce the flows from Lambton TS on circuits L28C & L29C, which would be beneficial.

However, since contingency conditions involving circuits L28C and/or L29C would result in overloading of circuit N5K, facilities would need to be installed to initiate automatic cross-tripping in response to a contingency involving these circuits to interrupt the parallel 115kV connection provided through circuit N5K.

4.4 With the new Auto-transformer providing an Emergency Supply to Kingsville TS

Since the continuous rating of the section of circuit K2Z between Kent TS and Kent Junction is limited to approximately 87MVA (for an ambient temperature of 30°C), there would be sufficient capacity to supply only approximately 50MVA of the Kingsville TS load, after allowing for the Tilbury area loads.

Studies were conducted with this amount of the Kingsville area load supplied radially from Kent TS, in addition to the Tilbury area loads. Voltages of 119.6kV and 116.0kV were recorded at Tilbury TS and on that portion of the Kingsville busbar connected to Kent TS, respectively.

Since these voltages are well above the 113kV minimum specified in the Market Rules, transferring this amount of the Kingsville area load on to Kent TS would be acceptable.

Since the limiting section of circuit K2Z involves just the initial 5.2km portion of the line from Kent TS, further studies were conducted to examine the impact of uprating this section to the same 82°C operating temperature as the adjoining section of circuit K2Z to Tilbury Junction. With this section uprated to provide the same continuous rating of approximately 114MVA, this would allow approximately 80MVA of the Kingsville area load to be transferred to the Kent supply.

With 80MVA of the Kingsville area load supplied from Kent TS, together with all of the Tilbury area loads, a voltage of 118.4kV was recorded at Tilbury TS, while that on the portion of the Kingsville busbar connected to Kent TS was 114.6kV.

Again, since these voltages would be above the minimum voltage of 113kV specified in the Market Rules, uprating the section of circuit K2Z between Kent TS and Kent Junction to the same rating as the remainder of the circuit to Tilbury Junction, would therefore allow approximately 80MVA of the Kingsville area load to be transferred to the new auto-transformer at Kent TS under emergency conditions.

However, it should be noted that it was assumed that all four step-down transformers at Kingsville TS would be retained in-service to provide this emergency supply. With fewer transformers in-service the voltage declines at Kingsville TS would be greater, and the amount of load that could be supplied from Kent TS would be correspondingly smaller.

With circuit K2Z operated closed between Kent TS and Lauzon TS

Additional studies were also conducted to determine whether there would be any operational benefits from operating with circuit K2Z closed between Lauzon TS and Kent TS. As with the situation with circuit N5K, this arrangement would result in an increased exposure to possible contingencies unless intermediate switching were to be installed at Tilbury Junction (or possibly Woodslee Junction).

These studies showed that with circuit K2Z closed, the auto-transformer at Kent TS would pick up approximately 40MVA of the load at Kingsville TS, while the voltage at Tilbury TS would fall to 121.0kV (from 122.9kV) and that at Kingsville TS would increase to 116.8kV (from 115.1kV). The transfers on circuit K2Z would also remain within all of the *existing* continuous thermal ratings. There would also be no material change in the transfers on circuits L28C & L29C from Lambton TS.

i. Response to 115kV Contingencies

Contingency conditions involving circuit K6Z would initiate operation of the Kingsville High-Voltage Switching Scheme and leave three step-down transformers connected to circuit K2Z. The studies for this condition indicated that the voltage at Kingsville TS would decline below the 106kV threshold at which load rejection would be triggered.

The studies also showed that approximately 80MVA of load at Kingsville TS could be retained in-service (with three step-down transformers in-service) while maintaining a minimum voltage of 113kV. However, retaining this amount of load in-service would result in overloading of the section of circuit K2Z between Kent TS and Kent Junction, unless it is uprated.

One possible option, particularly if a breaker were to be installed at Tilbury Junction to reduce the exposure of the loads in the Kingsville and Tilbury areas to possible supply interruptions in the event of contingencies involving circuit K2Z, would be to initiate cross-tripping of this breaker. This would leave the Tilbury area loads connected to the auto-transformer at Kent TS, while the Kingsville area loads would be connected radially to Lauzon TS via circuit K2Z. While this would be expected to result in operation of the Kingsville Load Rejection Scheme, less load would be lost than would occur for the present situation, since the Tilbury area loads would then be supplied from the new auto-transformer at Kent TS.

ii. Response to 230kV Contingencies

Operating with circuit K2Z closed would, however, provide significant benefits under both single- and double-circuit contingency conditions involving the 230kV circuits C23Z and C24Z.

230kV Single-circuit Contingencies

With circuit K2Z operated closed, and with the section of circuit K2Z between Kent TS and Kent Junction uprated, approximately 54MVA of the Kingsville area load would be supplied from the auto-transformer at Kent TS. This would reduce the post-contingency loading on the companion 230kV circuit (which would still be required to supply the 230kV-connected DESN stations), while helping to maintain a healthy voltage of 117.3kV at Kingsville TS.

230kV Double-circuit Contingencies

For the present supply arrangement (with both the Kingsville and Tilbury area loads supplied from Lauzon TS), it is current operating practice to initiate cross-tripping of circuits K2Z & K6Z for the complete loss of the 230/115kV connection at Lauzon TS. This results in the automatic rejection of the entire Kingsville and Tilbury area loads and avoids overloading circuits J3E & J4E between Keith TS and Essex TS.

With the new auto-transformer in-service at Kent TS supplying the Tilbury area load, and with circuit K2Z operated *open*, a double-circuit contingency involving circuits C23Z & C24Z would leave the Kingsville area load supplied radially from Keith TS. Although the amount of load to be supplied from Keith TS would be reduced, it would still be sufficient to cause circuits J3E & J4E to be overloaded. The Load Rejection Scheme for the loss of the 230/115kV connection at Lauzon TS would therefore still need to be deployed, to automatically cross-trip circuits K2Z & K6Z.

However, on the assumption that circuits J3E & J4E, between Keith TS and Essex TS, may be uprated as recommended in the Connection Assessment for the new Pillette Road Substation at DaimlerChrysler Canada Inc., studies were performed for the situation with Kingsville TS supplied radially from Keith TS. These studies showed that even with the Tilbury area load transferred to Kent TS, the decline in the Kingsville TS voltage would be still be sufficient to initiate operation of the under-voltage protection and cause load to be rejected.

However, with circuit K2Z operated *closed*, and with the section of circuit K2Z between Kent TS and Kent Junction uprated, then approximately 60MVA of the Kingsville area load would be supplied from the Kent auto-transformer. This would be sufficient to allow a post-contingency voltage of 113.3kV to be maintained at Kingsville TS and so that no load would be rejected.

4.5 Summary of Analysis

- Transferring the Tilbury area loads to the new auto-transformer that it is proposed to install at Kent TS would benefit not only the Tilbury area but also the Kingsville area by improving the voltages at both locations.
- A new auto-transformer at Kent TS would also allow a back-up supply to be provided to Wallaceburg TS under outage conditions involving the section of circuit N5K between Sarnia-Scott TS and Wallaceburg TS.

The analysis has also shown that there would be benefits from operating with circuit N5K permanently closed between Sarnia-Scott TS and Kent TS, since this would not only improve the voltage at Wallaceburg TS but would reduce the loading on circuits L28C & L29C. However, it would require the installation of a cross-tripping scheme to avoid overloading circuit N5K for contingencies involving circuits L28C and/or L29C. Furthermore, intermediate switching at Wallaceburg would be beneficial if the present exposure to line faults is not to be increased.

- The new auto-transformer at Kent TS, with no uprating of the section of circuit K2Z between Kent Junction and Kent TS, would provide a capability to transfer approximately 50MVA of the Kingsville area load to Kent TS under emergency conditions

Uprating the section of circuit K2Z between Kent TS and Kent Junction, to match the rating of the remainder of the circuit to Tilbury Junction, would increase the transfer capability to approximately 80MVA.

The analysis has also shown that there would be benefits from operating with circuit K2Z permanently closed between Kent TS and Lauzon TS, since this would avoid load rejection at Kingsville TS for contingencies involving either, or both, the 230kV circuits, C23Z & C24Z. However, it would require the following system upgrades to be completed:

- Upgrading of circuits J3E & J4E between Keith TS and Essex TS.
- Upgrading of the section of circuit K2Z between Kent TS and Kent Junction.
- the installation of a 115kV circuit breaker at Tilbury Junction together with a cross-tripping scheme for contingencies involving the companion 115kV circuit K6Z.

5. *The AGSTAR Project*

AGSTAR has received approval to incorporate a single 102.8MVA generating unit on to circuit K2Z. At the time this approval was granted it was assumed that circuit K2Z would be operated radially from Lauzon TS, and the new generating facility would therefore supply the Tilbury area loads, together with a portion of the loads at Kingsville TS.

AGSTAR is presently reviewing their plans and the expectation is that they may reduce the capacity of their new facility to 50MW, comprising a number of generating units. With Hydro One's proposal to install a new auto-transformer at Kent TS, one option would be for circuit K2Z to continue to be operated open at Tilbury Junction and for the new generating facility to supply a portion of the load at Kingsville TS.

Alternatively, circuit K2Z could be operated closed, with intermediate switching installed, so that the new generating facility would be able to supply a portion of both the Tilbury area and the Kingsville area loads.

Studies were performed for the operating arrangement shown in Diagram 6.

These showed that the output from the AGSTAR Project would split, with approximately 20MW flowing towards Tilbury Junction, backing-off the transfers through the auto-transformer at Kent TS, and with the remaining 30MW flowing towards Woodslee Junction, backing-off the flows from Lauzon TS.

Furthermore, under contingency conditions involving the 115kV circuit K6Z, the presence of the AGSTAR Project would provide voltage support to the Kingsville 115kV busbar and reduce the possibility of the Load Rejection Scheme being triggered. In addition, the output from the generation facility would reduce the post-contingency flows on the section of circuit K2Z between Kent TS and Tilbury Junction. This would limit the need to cross-trip circuit K2Z, thereby allowing the maximum benefit to be derived from the new auto-transformer at Kent TS.

It has therefore been concluded that should AGSTAR decide to proceed with a 50MW facility connected to the 115kV system, then it would be expected to complement Hydro One's proposal to install a 230/115kV auto-transformer at Kent TS.

6. *Impact on Reliability*

This assessment has concluded that the installation of the new 125MVA 230/115kV auto-transformer at Kent TS, to supply the Tilbury area loads, will have a beneficial impact on the IMO-controlled grid by reducing the transfers on the 115kV circuits K2Z & K6Z from Lauzon TS. This will result in a subsequent improvement in the voltage at Kingsville TS.

The new auto-transformer will also be able to provide a valuable back-up supply for Wallaceburg TS and for a portion of the load at Kingsville TS, under emergency conditions.

However, the IMO has concluded that additional benefits could be obtained from operating circuit K2Z normally-closed between Lauzon TS and Kent TS. While this would require the installation of a new 115kV circuit breaker at Tilbury Junction (or possibly at Woodslee Junction), together with the uprating of the section of circuit K2Z between Kent Junction and Kent TS, it would have significant benefits for the supply to Kingsville TS under contingency conditions involving the 230kV circuits C23Z & C24Z. Hydro One is therefore encouraged to pursue this as a possible mode of future operation.

7. *Need for a System Impact Assessment*

Based on the results of this assessment it has been concluded that all the necessary analysis to determine the impact of installing a 125MVA 230/115kV auto-transformer at Kent TS would have on the IMO-controlled grid has been undertaken.

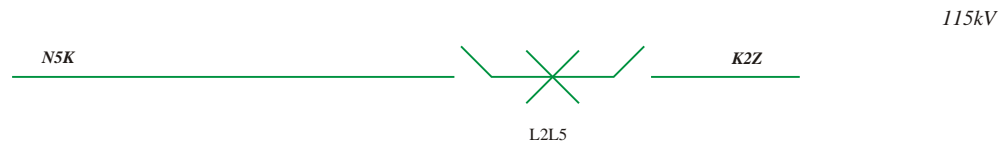
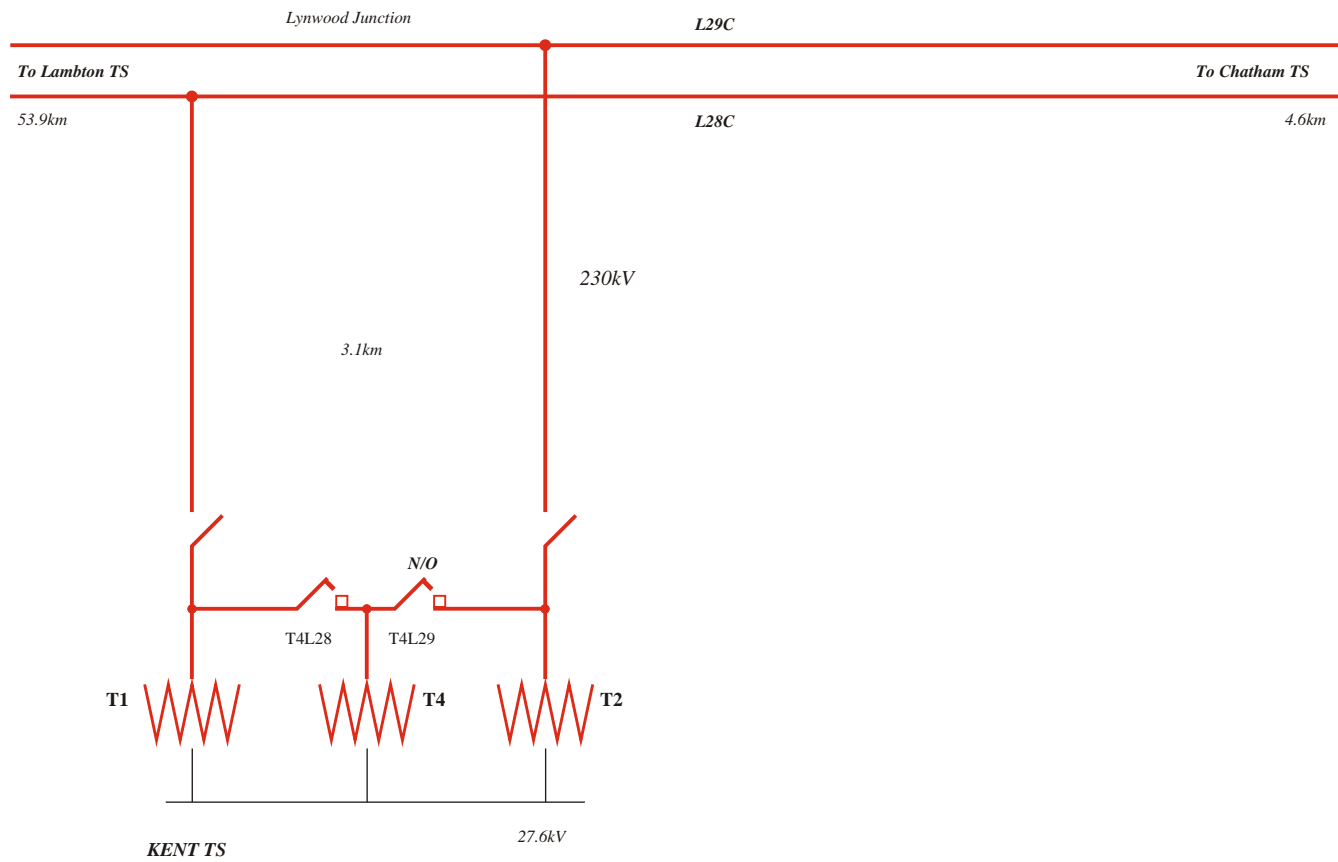
A separate System Impact Assessment is therefore not considered to be necessary for this Project.

8. *Customer Impact Assessment*

Hydro One Networks Inc., in consultation with the IMO, has concluded that this Project will have no adverse impact on any other customers in the area and that a detailed Customer Impact Assessment will not be required.

9. *Notification of Approval of the Connection Proposal*

Based on the results of this Assessment it is recommended that a *Notification of Approval for Connection* be issued for this Project.



Existing Connection Arrangement at Kent TS

DIAGRAM 1

29th October 2002

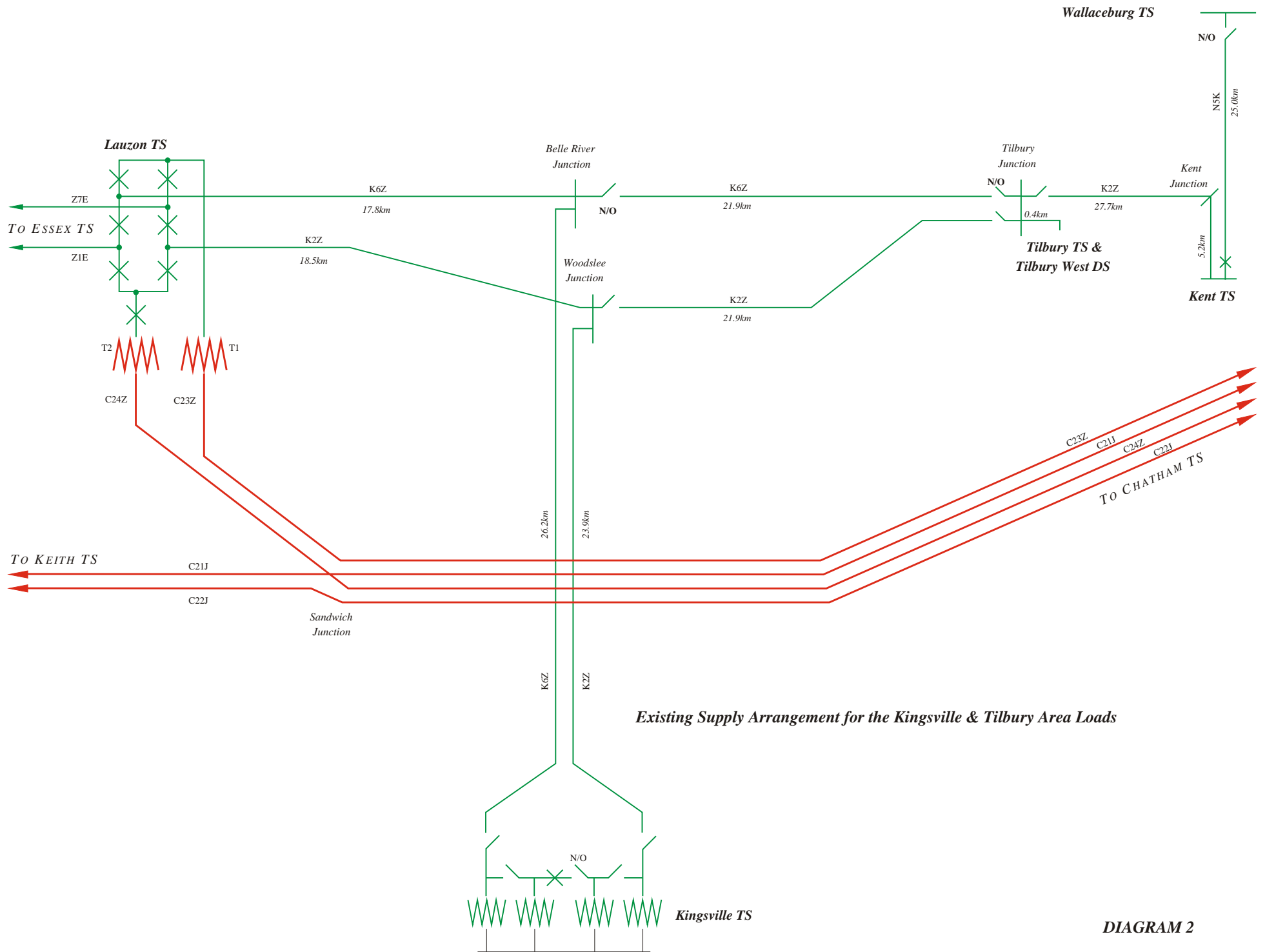
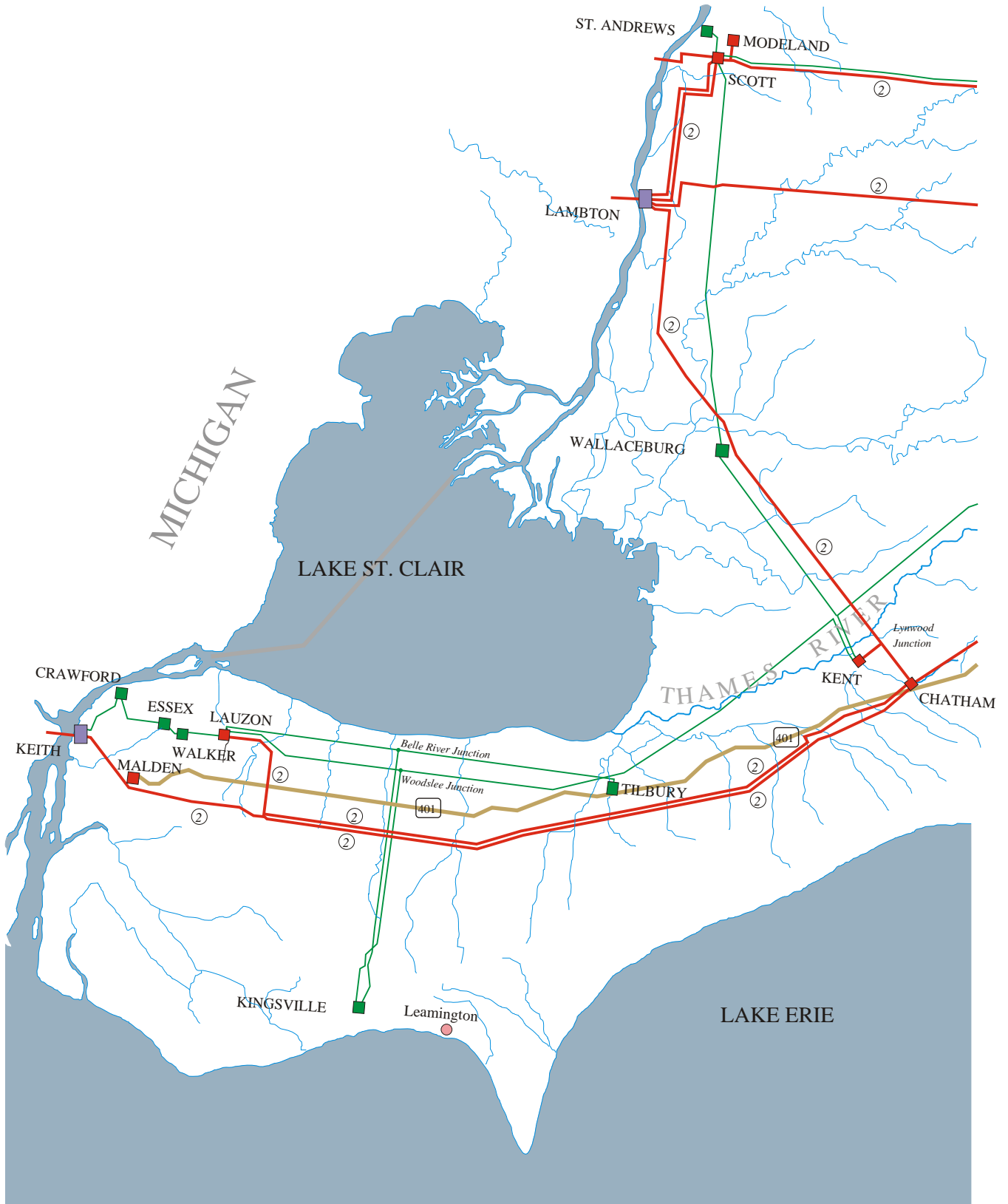


DIAGRAM 2

5th October 2002

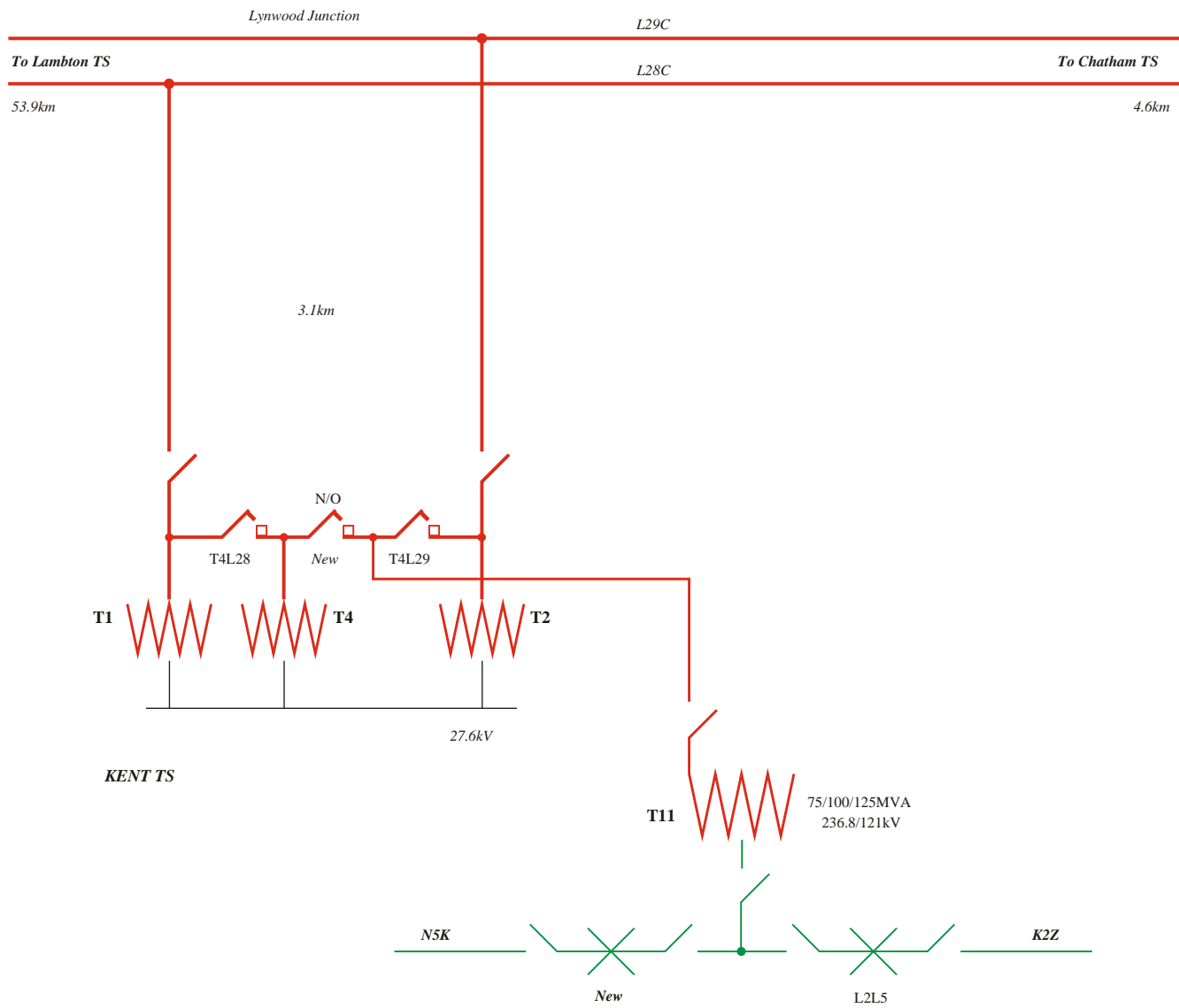
② No. of circuits in parallel



Location of Transmission Facilities in the Windsor Area

DIAGRAM 3

29th October 2002



Proposed Arrangement for Connecting the New Auto-transformer

DIAGRAM 4

29th October 2002

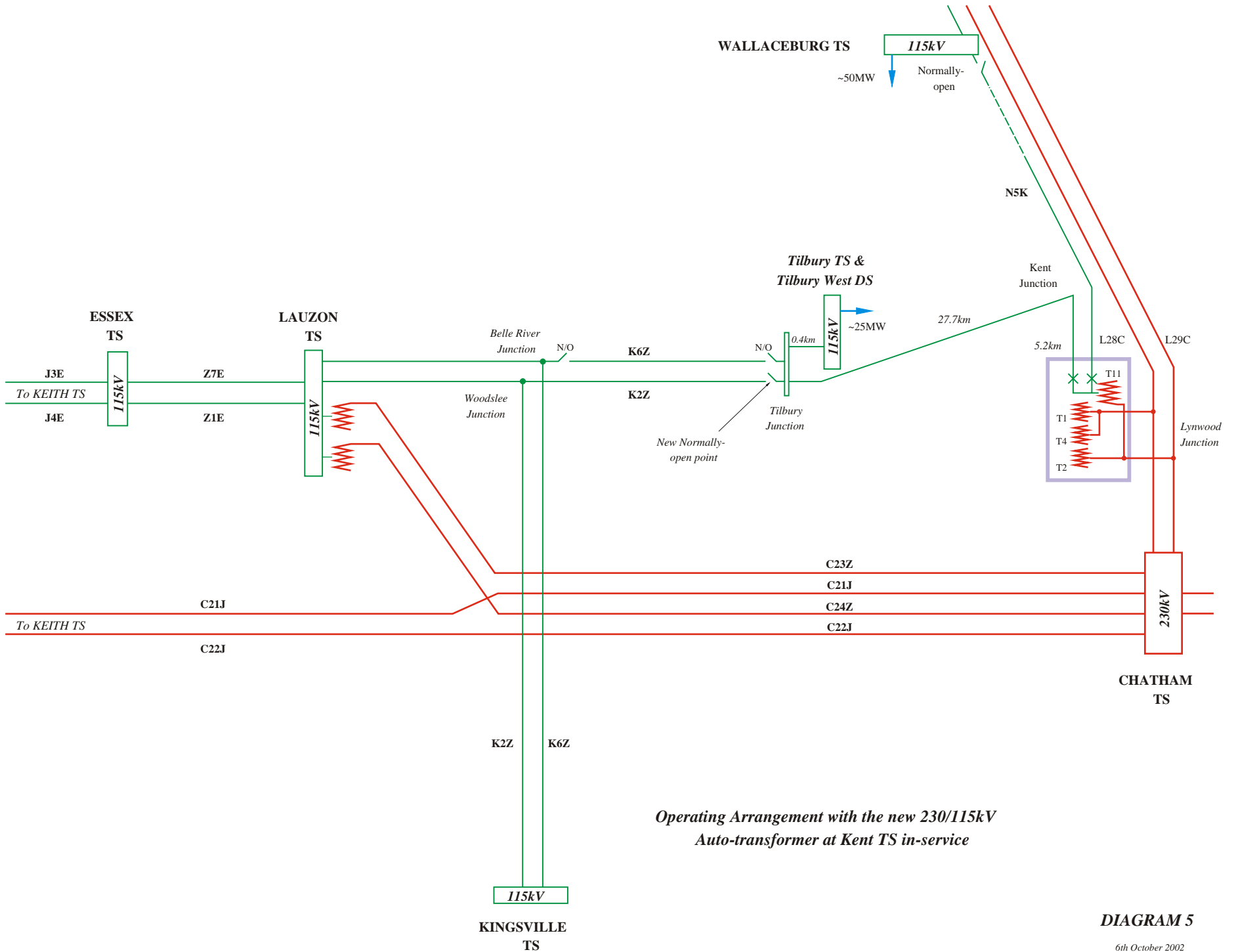
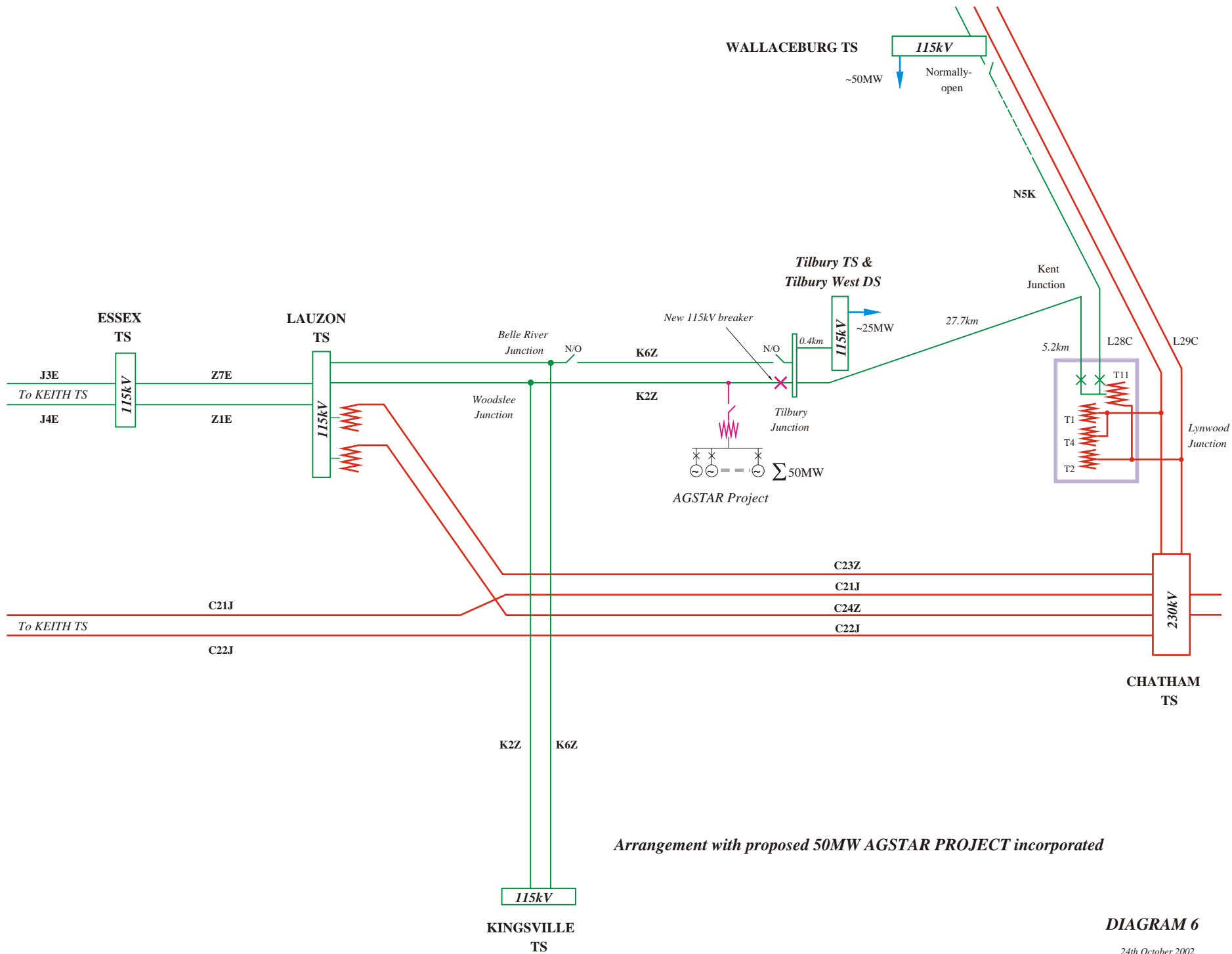


DIAGRAM 5

6th October 2002



Arrangement with proposed 50MW AGSTAR PROJECT incorporated

DIAGRAM 6