Application of TLRI versus ADQh for Export Curtailments for Adequacy

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The following paper is intended to provide a discussion on the use of the TLRi and ADQh codes for export curtailments. The paper provides the methodology to determine which export curtailments are coded with TLRi versus ADQh that has been used since market opening and a proposal for a more efficient, more accurate method going forward.

Background

In the spring of 2010, a request was made of the IESO to provide the methodology that is used to determine the use of the TLRi versus ADQh code when curtailing exports for adequacy.

Market Manual 4.3 Appendix C states that the TLRi code is used for "IESO Curtailments for Adequacy Actions for Internal Security concerns leading to an adequacy concern" and ADQh code is used for "IESO Curtailments for IESO Adequacy actions".

A presentation was made at the Intertie Jurisdictional Trading Standing Committee (IJTSC) on June 2, 2010, which discussed the methodologies used since market opening. Following that presentation the IESO was requested to document the methodology in a Market Manual and to provide two examples of the analysis.

A brief synopsis of the discussion that took place at the IJTSC presentation follows:

When exports are curtailed for adequacy one of the following codes are used:

- TLRi
  - used when adequacy issue is caused by internal constraints
  - removes transactions only from the constrained schedule
  - Transactions eligible for CMSC

- ADQh
  - used for system wide adequacy issue, market schedule is deficient
  - removes transactions from both schedules
  - Transactions not eligible for CMSC

Real Time

In real time the Control Room makes an assessment of the number of MWs that are bottled, to the nearest 100 MW, based on the current system configuration, ramping and security limitations. They consider the amount of generation that is available to generate, but is unavailable to the system due to transmission constraints to be the amount that is bottled. Another way to think about it is that there are

MWs available to be scheduled in the market (unconstrained) schedule, but not in the constrained schedule.

- If the number of MWs bottled is greater than the number of exports curtailed the CRO will use the TLRi code, the reason being that the curtailment is necessitated by an internal limitation on the system.
- If the number of MWs bottled is less than the number of exports curtailed the CRO will use TLRi for the most economic MWs up to the amount of MWs bottled, and will use ADQh for the remainder on a best effort economic basis.

Post Operational Analysis

In the post operational analysis the use of the code is validated three different ways.

1. By looking at the price in the market schedule and a number of other factors at the time of the curtailment. If the price is less than or equal to $2000, if there were other units offered but not scheduled and if the tool did not "solve short[1]" for OR then it is determined that the system was adequate from a market schedule perspective and the adequacy issue was in the dispatch (constrained) schedule only, the appropriate code would be TLRi. If the tool did "solve short" the appropriate code would be ADQh.

2. By calculating the bottled MWs as the calculation of:
   - the difference between all unconstrained energy schedules versus constrained energy schedules at the time of the curtailment, including imports, this represents MWs that are available and economic but are not able to generate due to internal security constraints (not transmission only);
   - plus any additional MWs offered that were not scheduled, but would not have been available due to system constraints;
   - minus MWs counted as bottled that were scheduled for OR in the constrained schedule.

   It is understood that there are other reasons why the unconstrained and constrained schedules would differ that are not related to security constraints:

[1] If the DSO detects that there are insufficient energy and operating reserve offers (including the CAOR offers) in the market to fully meet energy demand and the various operating reserve requirements, the DSO will first determine the magnitude of the shortage(s). The DSO will then automatically rerun with the reserve requirements lowered by the amount of the identified shortfall(s) and an additional 2 MW buffer to ensure that the DSO can find a solution. This "rerunning" of the DSO is performed independently in each of the constrained and unconstrained sequences. In this manner the market clearing prices (unconstrained sequence) will be set with the energy price reflecting the value of the last MW of energy that is dispatchable and the operating reserve price being the higher of the energy price or the highest operating reserve offer. When this happens, the amount of the shortfall in market supplied operating reserve is determined and assessed against available control actions that may qualify as operating reserve. In order to meet its NPCC and NERC requirements, the IMO is implicitly carrying control action(s) as operating reserve in such instances.

a) ramp limitations due to 3 times ramp rate: by looking at the previous hour if the security constraint had held the unit at a lower MW for previous hours the difference in this hour is still believed to be associated with the constraint.

b) non-compliance to dispatch: if a unit is ramping up and did not comply with it's dispatch the constrained schedule will only be able to schedule the unit based on the ramp offered from it's actual output, the market schedule will still schedule to the MW amount it dispatched it to in the last interval. We believe that if the unit was in non-compliance to dispatch and MWs were available somewhere else in the constrained schedule they would be dispatched appropriately, which would net out the effect of the constrained off MWs.

c) NISL binding: This is considered to be a constraint on the system for security.

d) Reserve Constraints: This is considered to be a constraint on the system for security.

e) Co-optimization: This is accounted for by subtracting any MWs considered as bottled that were scheduled for OR in the constrained schedule.

3. By calculating the bottled MWs on a Zone by Zone Basis
   - Calculate the MWs available to "export" from each zone by comparing the Generation Capacity available for dispatch in the area to the demand in the area;
   - subtract any transmission limitations to "export" that energy
   - add any imports that were constrained off from entering that zone.
   - The IESO takes into account any units that are ramp limited as unavailable for dispatch, however as in the previous calculation, if that unit was constrained down for many hours due to transmission limitations, the generation capacity is calculated as bottled as it would not have been ramp limited without the constraints.
   - This is done for all zones in the province and the all zones are totalled for the bottled MW amount.

The calculated bottled numbers are then compared against the number of exports curtailed. TLRi will be applied when the amount of bottled MWs is greater than the MW amount curtailed, ADQh will be applied in all other cases.

Proposal

As noted above there are a number of moving parts to this analysis and the analysis can be extremely time consuming. In the past the results of the analysis done in Methods 2 and 3 have proven consistent with the results from the simplified approach of looking at the market schedule results (price, OR shortages and available offers) as in Method 1.

After reviewing stakeholder and IESO work priorities and in an ongoing effort to improve efficiencies at the IESO we are proposing that the post operational analysis methodology on the appropriateness of TLRi versus ADQh be simplified as follows:

If TLRi was used the MWs will have remained in the market schedule and will have been removed only from the constrained schedule. If the market schedule was able to support the market demand (for Energy and OR) with available offers and if there were additional offers available that were not scheduled that is a clear indication that the unconstrained schedule was adequate and the adequacy issue was caused by a security concern which exists in the dispatch (constrained schedule) only.

If ADQh was used to curtail the exports, the MWs will have been removed from the market and dispatch schedule. The IESO proposes that a snapshot of the predispatch/dispatch algorithm be taken from the time of the curtailment and that the export MWs be put back into the schedule and both schedules be recalculated.

If the curtailment was made prior to the hour, the saved case from the predispatch algorithm will be used with the most up to date data known at the time of the curtailment. For example: any generation losses, import or export curtailments known at the time of the adequacy issue would be reflected in the saved case. If the curtailment was made in the hour, the saved case from the dispatch algorithm at the time of the curtailment would be used.

If the market schedule does not indicate a shortage for energy and/or OR, the code will be changed to TLRi. If the resultant market schedule indicates a shortage in either market, the IESO will apply TLRi to the amount of exports that the market schedule could have supported, and the remaining exports will remain as ADQh.

Proposed IMDC Wording

The following is the proposed wording to be included in Market Manual 4.3 under a new section titled: Transaction Coding. The section will include the following subsections;

1. Principles of Coding
2. Application of Interchange Schedule Codes (the existing Appendix C)
3. Methodology for Code Application

<u>Methodology for Code Application</u>

<u>TLRi or ADQh when curtailing Exports for Adequacy.</u>

When exports are curtailed for adequacy there are two conditions to be considered; an adequacy concern that is caused by an internal security limitation, and a global adequacy issue seen in the market schedule.

When an export transaction is curtailed for an IESO adequacy issues which is caused by a security limitation the TLRi code will be applied. The rationale being that the adequacy issue is caused by internal transmission constraints on the system which are limiting the amount of generation available to dispatch, this is termed as bottled generation. In real time, the TLRi code will be applied based on the amount of MWs which are determined to be bottled in the current system configuration.

In post operational analysis, this code will be verified by referring to the market schedule for the duration of the curtailment hour. Through the use of TLRi the MWs will only have been removed from the constrained schedule, but will have remained in the unconstrained schedule. No indication of a shortage for any product in the market schedule will indicate that TLRi was the correct code to apply. If a subsequent change occurred during the curtailment hour, which caused a subsequent adequacy issue this will not be considered.

When an export transaction is curtailed for IESO adequacy issues which are seen in the market schedule the ADQh code will be applied. These adequacy issues would be seen in both the market and dispatch schedules. This will be determined in real time based on the current system configuration.

Through the use of ADQh the MWs curtailed will have been removed from the market schedule. In post operational analysis, the code will be verified by rerunning the sequence with the amount of curtailed MWs in the unconstrained schedule and looking at the resulting market schedules. If the curtailment was made prior to the hour, the saved case predispatch algorithm will be used with the most up to date data known at the time of the curtailment. For example: any generation losses, import curtailments would be reflected in the snapshot. If the curtailment was made in hour, the saved case of the real time algorithm at the time of the curtailment would be used. If the resultant market schedule does not indicate a shortage for energy or OR, the code will be changed to TLRi as appropriate. If the resultant market schedules indicates a shortage in the energy or OR market, the IESO will apply TLRi to the export transactions which equal the amount of MWs that could be supported by the market schedule without shortages, and will apply ADQh to the remainder.