

## **Control Actions as a Source of Operating Reserve**

**#13-1**

This discussion paper provides a summary of the current use of control actions as a source of operating reserve and the issues or concerns that have been raised regarding this approach. A list of approaches for using control actions as reserve are described along with the advantages and disadvantages of each approach. A list of the different control actions available to the IMO is provided in Appendix 1.

### **Current Approach**

Currently, control actions are used as a source of operating reserve to meet NPCC and NERC standards in three ways. Each of these is discussed below.

#### a) **CAOR**

As of October 15, 2003, 400 MW of control actions have been implemented in the market as a source of operating reserve. Under market rule amendment MR-00235-R00-R05 ([www.ieso.ca/imoweb/pubs/mr/mr\\_00235-R00-R05\\_BA.pdf](http://www.ieso.ca/imoweb/pubs/mr/mr_00235-R00-R05_BA.pdf)), the IMO is authorised to include standing offers in the market for the following control action sources:

- § the load that would be reduced if the IMO implemented a 3% voltage reduction;
- § the load that would be reduced if the IMO implemented a 5% voltage reduction;
- and
- § not meeting the thirty-minute reserve requirements in accordance with reliability standards.

The current CAOR is limited to 250 MW of 3% voltage reductions and 150 MW of 5% voltage reductions. While the CAOR amount was based on the demand reduction available by reducing voltage and CAOR has been characterised as being the same, it may be better to consider the CAOR as a market implementation of manual control actions that are available to system operators in general (listed in Appendix 1). When CAOR is scheduled by the final pre-dispatch sequence, exports up to the amount of CAOR scheduled are made recallable if possible. This in fact ties the use of CAOR (in pre-dispatch) to the manual control action of recallable exports, and not voltage reductions. The CAOR is offered as operating reserve at a price of \$30.00 for 30 minute reserve and \$30.10 as 10 minute reserve. The reserve offers also have an associated energy offer which is the Maximum Market Clearing Price (MMCP) of \$2000. The CAOR offers are selected (automatically via the Dispatch Scheduling Optimizer (DSO) based on its operating reserve offer price and carried as reserve when it is most economic (relative to other market operating reserve offers). The CAOR can be selected in all four sequences: it can be selected both in pre-dispatch and in real-time and in both the constrained and unconstrained sequences. The amounts of CAOR selected can vary across each sequence based on the relative supply and demand conditions of each sequence. As is the case for all scheduled operating reserve offers, this reserve will be

activated (in the real-time constrained sequence only) as energy in the event of a contingency, in merit order based on its associated energy offer in the reserve stack (which in the case of CAOR is priced at \$2000).

b) Manual Intervention

Whenever the IMO identifies an actual or forecast shortage of energy and reserve offers (including the CAOR offers) to meet the energy demand and reserve requirements in the real-time constrained schedule, it will (manually) lower the operating reserve requirement by the amount of the shortage. The IMO does so provided that it can meet its NPCC and NERC requirements by means of one or more of the remaining available control actions on the IMO's emergency control actions list (see Appendix 1). Note that the available control actions will not include the control actions that are already being scheduled as CAOR. As a consequence of the DSO design, the same lowered operating reserve requirement is used in the unconstrained or market schedule calculations. Thus, the market clearing prices (unconstrained) will also be established based on the very same lower reserve requirement. Often the shortages that exist in the constrained schedule will not exist in the unconstrained schedule. Consequently, when the reserve requirement is manually lowered, the market clearing price (unconstrained) will often fall, even though the overall supply demand balance is growing tighter.

c) Automatic Resolution of Reserve Shortages via the DSO

The DSO is programmed to automatically deal with reserve shortages in the following manner. 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.

***Experience Under the Current Approach***

- § Control actions are relied upon as a source of reserve most often via the scheduling of CAOR. Since the implementation of CAOR, the number of manual interventions has declined.
- § Instances in which the DSO automatically resolves reserve shortages occur infrequently and only when the IMO does not anticipate the shortage. This event typically lasts for only one or two intervals before the IMO will respond with a manual intervention (b above).
- § At the time that the CAOR was introduced into the market, the IMO adopted a procedure whereby when the CAOR is scheduled in the final (constrained) pre-dispatch, the IMO will make scheduled exports recallable, up to the amount of the CAOR scheduled if this amount of exports is available. This practice provides the IMO with more assurance that it will have sufficient control actions available in the event that a contingency occurs in real-time. The practice reduces the probability that voltage reductions will be implemented, as exports will be cut first (as per the control action list).
- § The implementation of CAOR has had several advantageous consequences on the market outcomes. These include:
  - § The automatic scheduling of the 400 MW of CAOR has contributed to a reduction in the number of times that the IMO has had to manually intervene to implement control actions as a source of reserve. This has improved the quality of the real-time price as a signal of the relative supply demand balance. As discussed above (see also the Market Pricing issue document for Issue 13), the manual intervention approach to using control actions as reserve typically leads to a "counter-intuitive" price outcome where the market price falls, even though demand increases.
  - § The inclusion of CAOR in both the pre-dispatch and real-time sequences, and the subsequent reduction of the manual interventions in real-time, have contributed to a general convergence between the pre-dispatch price and the real-time price (HOEP). This improves the overall signalling quality of the pre-dispatch price.
  - § In contrast to the use of control actions as reserve via manual intervention, the use of control actions as a source of reserve via CAOR permits a separate scheduling of control actions in the unconstrained and constrained sequences. That is, when the supply/demand balances differ between the constrained and unconstrained sequences, the amount of control actions carried as reserve in the constrained sequence can differ from the amount of control actions carried for reserve in the unconstrained schedule, if it is economic or efficient to do so. Furthermore, prices (shadow prices and the market prices) are independently determined based on the specific demand/supply conditions in two sequences. This has contributed towards an improved convergence between the real-time shadow price and the real-time (unconstrained) MCP.
- § However, the current (three-part) approach to the use of control actions as a source of reserve has raised several concerns. These include:

- § The continued use of control actions as a source of reserve via manual intervention, while reduced in frequency, causes "counter-intuitive" pricing events and a divergence between the pre-dispatch and real-time prices. This manual intervention has been an issue repeatedly identified by the Market Surveillance Panel.
- § The offer price of CAOR is somewhat arbitrarily set and it may not necessarily reflect the value that loads place on the underlying control action; therefore market-clearing prices may not be "correct".
- § When the DSO automatically identifies and solves for a reserve shortage, it values the last MW of reserve at a price that may be higher than the value that loads may place on the use of specific control actions as reserve such as voltage reductions. Furthermore, when this occurs, the price may be set by a "strategic" bid or offer whose price reflects a desire to be scheduled (or not scheduled) rather than a value or cost based bid or offer (i.e., one that reflects the bidders real reservation value or the supplier's real incremental cost).

### *Other Approaches to the Use of control actions as a Source of Reserve*

While the IMO could continue with the current approach (the "do nothing option"), there may be several other approaches to the use of control actions as a source of reserve that could be investigated. These may include:

a) Manual Intervention Only

This is essentially a return to the process employed prior to the implementation of the CAOR.

*Advantages:*

- § Reduces price volatility and contributes to a lower price (benefit to the load)

*Disadvantages:*

- § Contributes to counter-intuitive pricing (prices falling) in times of high stress in the system
- § Contributes to differences between pre-dispatch and real-time prices.

*Related Options:*

- § Manual intervention in the constrained sequence only (if possible)
- § Manual intervention only if the shortages exceed a certain threshold amount.

b) Automatic Resolution of Shortages via the DSO Only

This would involve the elimination of 1) the CAOR and 2) the manual intervention by the IMO to reduce operating reserve requirements during shortages of market reserve.

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**Control Actions as a Source of Operating Reserve**

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*Advantages:*

- § The implicit use of control actions does not have any counter-intuitive price effects.
- § There is no interchange between the unconstrained and constrained schedule calculations. Thus, prices are independently determined based on the specific demand/supply conditions in two sequences.
- § Ensures that all energy and operating reserve offers in the market are utilized first.

*Disadvantages:*

- § Values the last MW of reserve at a price that may be higher than the value that loads may place on the use of control actions as reserve such as voltage reductions.
- § Price may be set by a "strategic" or "administrative" bid or offer whose price reflects a desire to be scheduled (or not scheduled) rather than a value or cost based bid or offer (i.e., one that reflects the bidders real reservation value or the supplier's real incremental cost).

c) Continue with the Current Approach but change the offer prices of CAOR

This could be a one-time permanent change to the current prices of \$30 and \$30.10, or it could involve more dynamic pricing for CAOR.

*Advantages:*

- § Promises to have a more accurate reflection of the implicit costs of using the control actions as reserve and the cost of actually ordering the control actions as energy.

*Disadvantages:*

- § Will be a complicated exercise
- § The implicit cost may differ amongst loads making a "one-price fits all" approach difficult.

d) CAOR and the Automatic Resolution of Shortages via the DSO (no Manual Interventions)

Continue with implementation of 400 MW of CAOR but then rely on the DSO to automatically solve for shortages. (This approach would essentially preclude the IMO from manually reducing the reserve requirement in times of actual or perceived shortages).

See advantages/disadvantages of b) above.

e) Increase the Quantity of CAOR

Maintain the existing CAOR and include another quantity of CAOR at a higher reserve offer price that would represent further manual control actions. This could be combined with the reliance on the DSO to automatically solve for shortages (I.e. no manual reserve requirement reductions).

*Advantages:*

- § Reduces the need for manual intervention and hence all the disadvantageous market outcomes associated with manual intervention.

*Disadvantages:*

- § The current CAOR implementation allows the CAOR offers to be used in both the real-time and pre-dispatch sequences. The scheduling of CAOR in pre-dispatch will result in less import offers being scheduled during reserve shortage situations, and therefore the system will be closer to a potential shortfall situation than if the CAOR was not scheduled. The IESO has a reliability concern with any increased potential for shortfall situations. An implementation of increased CAOR that only allows its use in real-time and not in pre-dispatch is possible but would require software and procedure changes that may not be insignificant.

### Appendix 1: Control Actions that can be used as operating reserve to meet NPCC and NERC standards

The following lists some of the control actions available to ISOs in the NPCC region. A more complete list of IESO control actions is provided in Appendix E of the IESO's Market Manual 7.4, which was provided to Market Pricing WG members at the June 25, 2004 meeting.

Control Action	Type of OR	Counting as OR	Activating as OR
Recallable Exports	10NS & 30 minute	Agree with neighbouring ISO(s) to make export(s) recallable during the transaction checkout process. Reduce reserve requirement(s) by amount equal to recallable exports. IMO practice is to make exports recallable (when available) in the final pre-dispatch by the amount of CAOR that is scheduled in the final pre-dispatch.	Curtail export in real-time
3% Voltage Reduction <sup>1</sup>	10NS & 30 minute	Include X MW as reserve (approx. 250 MW). Done automatically as CAOR.	Order lowering of distribution voltages by 3%
5% Voltage Reduction <sup>2</sup>	10NS & 30 minute	Include Y MW as reserve (approx. 150 additional MW). Done automatically as CAOR.	Order lowering of distribution voltages by 5%
Disregard 30 minute OR requirement for up to 4 hours <sup>3</sup>	30 minute	Reduce 30 minute reserve requirement to zero.	N/A – a source of reserve only, not energy.
Shared activation of reserve	N/A	Not counted as reserve. Only used following a contingency of at least 500 MW.	Up to 500 MW imported immediately from NYISO, ISONE and PJM if available.
Emergency Energy Purchase	N/A	Not counted as reserve. Energy purchased to free up other sources of reserve.	
Emergency Demand Response Program	N/A	Not counted as reserve. Implemented only just prior to non-dispatchable load cuts.	

<sup>1</sup> The use of voltage reductions as a source of OR is allowed under NERC and the more stringent NPCC policies (NPCC documents A-06 – Operating Reserve Criteria and A-07 – Glossary of Terms). The only restriction on its use as OR is that it cannot be used to meet the synchronized OR requirement. The amount of voltage reduction is not specified by NERC or NPCC and the amounts used by the IESO (3 & 5%) have not changed in many years and are based on good utility practice. There are also no time or "amount of use" restrictions on any particular source of OR.

<sup>2</sup> Same as 1 above.

<sup>3</sup> This cannot be used in any planning timeframe.