PUBLIC

PROCEDURE

Market Manual 14: Market Power Mitigation

Part 14.1: Market Power Mitigation Procedures

Issue ~~2~~3.0

March 15, 2022

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This procedure describes the activities to be undertaken by the *IESO* and *market participants* to complete the market power mitigation procedures required to participate in the *day-ahead market* and the *real-time market*.

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Document Change History

Issue	Reason for Issue	Date
1.0	Draft for Stakeholder Review	August 12, 2021
2.0	Updated after considering external stakeholder review	December 17, 2012
3.0	Updated after considering external stakeholder review	March 15, 2022

Related Documents

Document ID	Document Title
TBD	Market Manual 14.2: Reference Level and Reference Quantity Procedures

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Conventions

This *market manual* uses the following standard conventions:

- The word 'shall' denotes a mandatory requirement;
- Terms and acronyms used in this *market manual* including all Parts thereto that are italicized have the meanings ascribed thereto in Chapter 11 of the *market rules*
- All user interface labels and options that appear on the *IESO* portals and tools are formatted with the bold font style;
- Double quotation marks are used to indicate titles of legislation, publications, forms and other documents; and

Any procedure-specific convention(s) shall be identified within the procedure document itself.

1. Introduction

This *market manual* describes the market power mitigation framework and the processes by which the *IESO* shall assess the exercise of global market power and local market power, and specifically the:

- designation of constrained areas;
- designation of uncompetitive *intertie zones*;
- determination of *global market power reference intertie zones*;
- ex-post mitigation for *physical withholding*; and
- ex-post mitigation of *intertie economic withholding* on an uncompetitive *intertie zone*.

The *IESO's* assessment and mitigation of the exercise of market power, including testing and any related step by the *IESO*, shall not constitute a review for compliance with any *market rule*, including Chapter 1, Section 10A or Section 11.

1.1. Purpose

This *market manual* provides more detailed descriptions of requirements for various activities than are specified in the *market rules*, and describes the activities performed by the *IESO* as they relate to market power mitigation processes. The procedures detailed in this manual must be read in conjunction with the *market rules* and describe how the *market rules* will be implemented. Where there is a discrepancy between a *market manual* and the *market rules*, the *market rules* shall prevail.

1.2. Scope

1.2.1. Reference Levels and Reference Quantities

This manual describes how *reference levels* and *reference quantities* are used in some of the *IESO's* ex-ante and ex-post market power mitigation processes. For a detailed description of the processes used to establish and calculate *reference levels* and *reference quantities*, refer to Market Manual 14, Part 14.2: Reference Level and Reference Quantity Procedures.

1.2.2. Designation of Constrained Areas and Global Market Power Reference Intertie Zones

This manual describes the processes the *IESO* uses to designate *potential constrained areas*, *narrow constrained areas*, *dynamic constrained areas* and *global market power reference intertie zones* used in ex-ante market power mitigation. For the *market rules* that apply to the

ex-ante market power mitigation processes, refer to Chapter 7, section 22.1~~3~~4, Appendix 7.1A and Appendix 7.2A of the *market rules*.

Section 2 describes the designation of constrained areas, which affect when *offers* are tested for ex-ante mitigation and which conduct and impact thresholds are used in these tests.

Section 4 describes the designation of *global market power reference interties*, which affect when *offers* are tested for ex-ante mitigation for global market power.

1.2.3. Ex-Post Mitigation

This manual describes processes the *IESO* uses to assess *physical withholding* and *intertie economic withholding.*

Section 5 describes how ex-post mitigation for *physical withholding* is carried out by the *IESO* including conditions for testing, conduct and impact thresholds, opportunities for *market participant* input and potential outcomes of a finding of *physical withholding*.

Section 6 describes how ex-post mitigation for *intertie economic withholding* is carried out by the *IESO*, including conditions for testing, conduct and impact thresholds, opportunities for *market participant* input and potential outcomes of a finding of *intertie economic withholding*.

Section 3 describes the designation of uncompetitive *intertie zones*, which affect when *offers* or *bids* from *intertie* traders are tested for ex-post mitigation for *intertie economic withholding*.

1.2.4. Settlement Mitigation

This manual describes the conduct and impact thresholds used in make-whole payment mitigation. Refer to Market Manual 5: Settlements, 5.5: Physical Market Settlement Statements for more details on make-whole payments that are subject to *settlement* mitigation.

1.3. Roles and Responsibilities

The following subsections describe how the responsibility for activities related to the market power mitigation process are shared between a *market participant* and the *IESO*.

1.3.1. IESO

The responsibilities of the *IESO* include the following activities:

- *publish* and update reports related to the designation of:
  - constrained areas;
  - uncompetitive *intertie zones;* and
  - *global market power reference intertie zones*;
- provide notifications to *market participants* that are related to the assessment of:
  - *physical withholding*; and

- *intertie economic withholding* on an uncompetitive *intertie zone*; and

- review and assess *market participant* submissions related to:
  - *physical withholding*; and
  - *intertie economic withholding* on an uncompetitive *intertie zone*.

1.3.2. Market Participants

The responsibilities of a *market participant* include one or more of the following activities:

- review *published* reports related to the designation of:
  - constrained areas;
  - uncompetitive *intertie zones*; and
  - *global market power reference intertie zones*; and
- review notifications related to, and provide information, if necessary, on the assessment of:
  - *physical withholding*; and
  - *intertie economic withholding* on an uncompetitive *intertie zone*.

1.4. Contact Information

To contact the *IESO*, you can email IESO Customer Relations at customer.relations@ieso.ca or use telephone or mail. Telephone numbers and the mailing address can be found on the IESO website (IESO Corporate Contact Information). The IESO Customer Relations staff will respond as soon as possible.

– End of Section –

2. Designation of Constrained Areas

The *IESO* identifies circumstances when competition may be restricted in localized areas and designates these areas as *potential constrained areas*. The *IESO* identifies *potential constrained areas* that are regularly impacted by binding transmission constraints. Depending on how frequently the transmission constraints bind in an area, a *potential constrained area* may be subsequently designated as one of the following:

- a *narrow constrained area* (*NCA*); or
- a *dynamic constrained area* (*DCA*).

2.1. Potential Constrained Area Designations

(Market Rules: Chapter 7, section 22.10.1)

When identifying and revising *potential constrained area* designations, the *IESO* will consider relevant configuration changes to the *IESO controlled-grid*, which can include, but are not limited to:

- network model build updates, such as the addition or removal of a transmission *facility* or a *resource*;
- system configuration changes that can affect a *potential constrained area*, such as new or removed transmission *facilities* and changed OSLs;
- the need to add or remove a *dispatchable resource* to a *potential constrained area*;
- a long-term *outage* that could affect a *potential constrained area*, such as a transmission facility *outage* or a *generation facility outage*; and
- system element transmission line, *resource*, or OSL name changes that may impact corresponding element names used in *potential constrained areas*.

2.1.1. Input Data

The data that the *IESO* will consult when identifying and revising *potential constrained area* designations may include but not be limited to:

- the real-time *locational marginal price* (*LMP*) congestion component (based on five-minute intervals) for the previous 365 days;
- the sensitivity factors or generation shift factors (GSFs) of different *resources* on different transmission line constraints and OSLs;

- the Zone ID for each *resource*, which represents the zone the *resource* belongs to among the 10 zones in Ontario (e.g. Toronto, East, Northwest, etc.);
- the list of exisiting transmission *facilities*, OSLs and previously identified *potential constrained area*s;
- the real-time five-minute historical binding data including shadow prices for transmission *facilities* and OSLs, *outages*, and the GSFs for the previous 365 days; and
- the impact of actual or expected material configuration changes to the *IESO-controlled grid* in the next 365 days on the congestion component of *LMPs*, sensitivity factors or GSFs and OSLs.

2.1.2. Methodology

The process by which the *IESO* identifies and revises *potential constrained area* designations consists of two activities:

1. grouping *resources* whose *real-time market LMP* congestion components are closely correlated into a *potential constrained area*; and
2. identifying the transmission *facilities* and/or related OSLs for that *potential constrained area*, where the *resources* identified in the first activity can resolve import congestion on those constraints.

Inputs:

The *IESO* relies on various inputs in order to carry out activities 1 and 2 above. These inputs include but are not limited to the following:

- analysis of the historical and prospective *resources'* annual real-time congestion *LMP* component; specifically:
  - the frequency that real-time congestion components are greater than zero; and
  - in areas with negative congestion components, the difference between real-time congestion components.
- temporal correlations between the real-time congestion *LMP* components; and
- other information that identifies relative electrical proximity of *resources*.

Activity 1: Grouping Resources into Potential Constrained Areas

The *IESO* may group the resources according to *potential constrained area* by:

- determining the electrical zone that each *resource* is located within;
- comparing annual average of the congestion LMPs;
- calculating the mean square error of the congestion LMP probability density functions;

- calculating the temporal correlation coefficient for all *resources* against other *resources* to identify occasions when congestion at one *resource* moves similarly to congestion at other *resources*;
- comparing sensitivity factors of *resources* on the same *transmission facilities* or OSLs to determine the electrical proximity of *resources* to other *resources* and the direction of their power injection.

The above analysis will be jointly considered to identify which *resources* should be grouped into each *potential constrained area.*

Activity 2: Identifying Transmission Facilities and OSLs for each Potential Constrained Area

The *IESO* will determine the transmission facilities and OSLs for each *potential constrained area* by first calculating the temporal correlation between the congestion LMP component and the real-time five-minute historical and prospective shadow prices for *transmission facilities* and OSLs.

This will identify a list of prospective *transmission facilities* and OSLs that may be added to a particular *potential constrained area.*

The *IESO* will then identify the sensitivity factors that apply for each *resource* in each group for each *transmission facility* and OSL.

Where the group of *resources* in a *potential constrained area* have a significantly high sensitivity factor against a particular *transmission facility* or OSL, that constraint will be added to the *potential constrained area.*

To supplement this analysis, the *IESO* may confirm the relationship between a particular OSL or *transmission facility* and a *resource* through historical analysis. This involves comparing the sensitivity factor of a resource against the *transmission facility* or OSL to the historical congestion component that occurred at a *resource*. Where this historical analysis shows that the *transmission facility* or OSL is not strongly related to the congestion component at a *resource*, that *transmission facility* or OSL will not be included in the *potential constrained area.*

2.2. Narrow Constrained Area Designation

Potential constrained areas are designated as *NCAs* by the *IESO* when they meet certain criteria.

2.2.1. Applying Designation Criteria

(Market Rules: Chapter 7, section 22.10.2~~.1~~)

A *potential constrained area* is considered import constrained if at least one transmission *facility* or OSL is binding in either the *day-ahead market* or the *real-time market*. A transmission facility or OSL is considered to be binding when the shadow price on the relevant constraint is non-zero.

When multiple transmission *facilities* or OSLs in a *potential constrained area* are binding in the same hour, a single hour will be counted toward the 4% condition for *narrow constrained area* designation (see Figure 2-1).

The assessment of whether a *potential constrained area* is import constrained in the *day-ahead market* is done on an hourly basis. For the *real-time market*, if the *potential constrained area* was import constrained for one interval within an hour, the entire hour will be considered to have been import constrained.

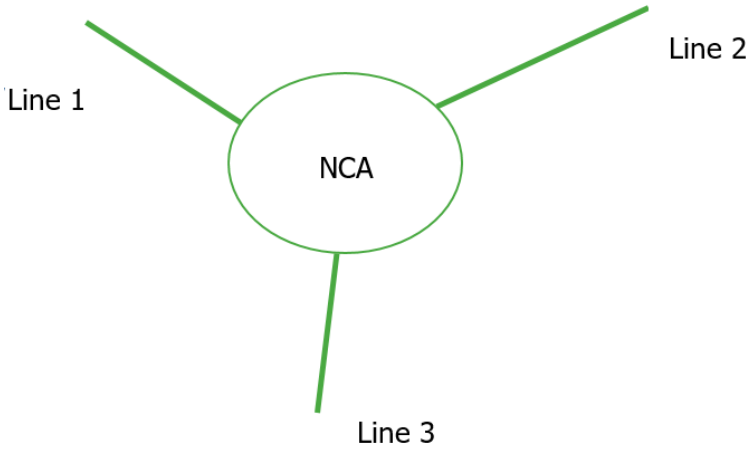

Figure 2-1: Sample NCA

2.2.2. Publication

(Market Rules: Chapter 7, sections 22.10.2.2, 22.10.2.3 and 22.10.2.4)

The *IESO*'s report on *NCA* designations will be published annually and include the following information:

- version number;
- *publication* date and the dates upon which the *NCA* designation or removal takes effect;
- the *dispatchable* and *non-dispatchable generation resources* and *dispatchable loads* within each *NCA*;
- a description of the geographical boundaries of each *NCA* and the transmission lines connected to it;
- a list of the transmission *facilities* and OSLs that make up each *NCA* including the number of binding hours for each transmission *facility*; and
- the congestion frequency data that the *IESO* used to determine such designation.

NCA designations in the *IESO*'s report on *NCA* designations will come into effect no sooner than thirty *business days* following the *publication* of the *IESO's* report on *NCA* designations.

The *IESO* may *publish* an updated *NCA* report on an ad-hoc basis to:

- remove a *resource* from an existing *NCA*, if that *resource* is no longer covered by section 22.1.1 of Chapter 7; and
- update the name of for any system element (transmission facility, *resource*, or OSL) used in existing *NCAs*.

Transmission *facilities* and OSLs cannot be added or removed from an *NCA* during an ad-hoc update, nor can *NCA* designations be changed. Any changes made during an ad-hoc update will come into effect no later than two *business days* following their *publication*.

2.3. Dynamic Constrained Area Designation

Potential constrained areas are designated as *DCAs* by the *IESO* when they meet certain criteria.

2.3.1. Applying Designation Criteria

(Market Rules: Chapter 7, section 22.10.3)

A *potential constrained area* is considered import constrained if at least one transmission *facility* or OSL is binding for a *dispatch hour*. A transmission facility or OSL is considered to be binding when the shadow price on the relevant constraint is non-zero.

The *IESO* will remove the designation of a *DCA* in the first hour after the next 120 hours, unless the *DCA* still meets the conditions required to be designated.

When multiple transmission *facilities* or OSLs in a *potential constrained area* are binding in the same hour, a single hour will be counted toward the 4% condition for NCA designation.

For the *real-time market*, if the *potential constrained area* was import constrained for one interval within an hour, the entire hour will be considered to have been import constrained.

For example, Table 2-1 displays the designation for a hypothetical *DCA* in the *day-ahead market* based on the accumulated hours for a period of 12 days. The table shows that the area was binding for five days in a row (Day-1 to Day-5), and in each day, the area was binding for four hours.

At 06:00 on Day-6, 20 hours were binding in the previous 120 hours (Day-1 to Day-5). As this is more than 15% of the number of previous 120 hours (i.e. 18 hours), the criterion for designating the *DCA* is satisfied.

The *DCA* was designated from Day-6 onward from Day-6 to Day-10 (i.e., for five days), regardless of the number of binding hours in those days because 120 hours must pass before the designation will be reassessed.

After the first 120 hours following a *DCA* designation, the status of the designation is reassessed every day on a rolling basis. For the *DAM*, the status is assessed at 06:00 every day for the next *dispatch day*.

At 06:00 on Day 10, the status of the designation is determined for Day-11. At that time the number of binding hours is calculated for the preceding 120 hours, which in this case was 21 hours (higher than 18 hours). Therefore, the *DCA* designation is extended for Day-11 in the *DAM*.

At 06:00 on Day 11, the status of the designation is determined for Day-12. At that time, the number of binding hours for the last 120 hours was only 14 hours (lower than 18 hours), so the *DCA designation* is removed for Day-12 in the *DAM*.

Table 2-1: Designation of DCAs in DAM Based on the Accumulated Hours

Day	Day-1	Day-2	Day-3	Day-4	Day-5	Day-6	Day-7	Day-8	Day-9	Day-10	Day-11	Day-12
Number of Binding Hours	4	4	4	4	4	7	0	4	5	5	0	7
Accumulated Binding Hours (for the last 120 hours)	0	4	8	12	16	20	23	19	19	20	21	14
DCA Active	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No

2.3.2. Publication

(Market Rules: Chapter 7, section 22.10.3.2)

The *IESO* publishes the DAM DCA Designation Report daily and the RTM DCA Designation Report hourly.

The designation of new *DCAs* in the RTM DCA Designation Report will take effect no sooner than four hours after *publication* of the report. Both the DAM DCA Designation Report and the RTM DCA Designation Report include the following information:

- version number;
- *publication* and effective dates; *publication* date and the date and time when the *DCA* designation or removal of designation takes effect;
- information that indicates whether the *DCA* designations in that report apply to the *DAM* or the *RTM*
- information that indicates that a *potential constrained area* is designated as a *DCA*;
- information that indicates if a *potential constrained area* that was previously designated as a *DCA* has had that designation removed;
- the *dispatchable* and *non-dispatchable generation resources* and *dispatchable loads* within each *DCA*;

- a list of the transmission *facilities* and OSLs that make up the *DCA* including the number of binding hours for each transmission *facility*; and
- the congestion frequency data that the *IESO* used to determine such designation.

– End of Section –

3. Designation and Removal of Designation for Uncompetitive Intertie Zones

(Market Rules: Chapter 7, section 22.12)

This section provides additional details with respect to the processes the *IESO* uses to designate and remove designations for uncompetitive *intertie zones* in accordance with Chapter 7, section 22.12 of the *market rules*.

The process that the *IESO* uses to assess *intertie economic withholding* on an uncompetitive *intertie zone* is further detailed in section 6 of this manual.

3.1. Conditions Restricting Competition in an Intertie Zone

(Market Rules: Chapter 7, section 22.12.1)

The conditions for designating an *intertie zone* as uncompetitive are provided in Chapter 7, section 22.12.1 of the *market rules.*

The *IESO* considers the following conditions as restricting competition when determining whether effective competition in an *intertie zone* is or will be restricted (Chapter 7, section 22.12.1.2 of the *market rules*):

- lack of a market for supply of imports or demand for exports with open access to transmission in the neighbouring *control area*;
- the existence of institutional or regulatory barriers to trading in the neighbouring *control area*;
- the existence of physical barriers to trading in the neighbouring *control area*, such as limited transmission controlled by one party or captive load at the *intertie zone*; and
- the existence of economic barriers to trading in the neighbouring *control area*, such as substantial transmission access fees.

If, following the *IESO's* assessment, an *intertie zone* that is designated as uncompetitive no longer meets the criteria that resulted in the designation, but the *IESO* reasonably expects that the criteria will be met following a transitory period, the designation will not be removed.

If the IESO designates an intertie zone as uncompetitive under Chapter 7, section 22.12.1.2 due to an expected future restriction to competition on that intertie zone, then the effective date for the designation will be no sooner than the date when competition is expected to be restricted.

~~3.3.~~3.2. Publication

(Market Rules: Chapter 7, section 22.12.~~32~~4)

The *IESO publishes* the following information regarding a change to an *intertie zone*'s designation status:

- the relevant *intertie zone*;
- whether the *intertie zone* was designated as uncompetitive or had its designation removed;
- *boundary entity resources* associated with the designated *intertie zone*;
- the *publication* date of the change;
- the effective date of the change;
- the criteria the *IESO* used in its decision to designate the *intertie zone* as uncompetitive or to remove such designation, as the case may be.

– End of Section –

4. Determination of Global Market Power Reference Intertie Zones

(Market Rules: Chapter 7, section 22.11)

This section provides additional details with respect to processes the *IESO* uses to designate *global market power reference intertie zones*.

4.1. Evaluating Designations of Global Market Power Reference Intertie Zones

(Market Rules: Chapter 7, section 22.11.1~~.2~~)

The criteria with respect to which the *IESO* may designate an *intertie zone* as a *global market power reference intertie zone* are set out in Chapter 7, section 22.11.1 of the *market rules*.

The *IESO* considers *intertie zones* that have at least 500 MW of total transfer capacity absent de-rates, *outages* or effects of ambient conditions, to be of sufficient size relative to the *IESO-administered markets* to be able to provide effective competitive discipline.

The *IESO* may modify and evaluate the designation of *global market power reference intertie zones* when:

- a new *intertie zone* is added;
- there is a material change in the amount of electricity trade that an existing *intertie zone* can accommodate; or
- there is a material change in market structure or regulation in a neighbouring *control area*.

4.2. Publication

(Market Rules, Chapter 7, section 22.11.3)

The *IESO publishes* the following information regarding a change to a *global market power reference intertie zone* designation status:

- the relevant *global market power reference intertie zone*;
- the criteria that resulted in a change to a designation;
- the *publication* date of the change; and
- the effective date of the change.

Designations remain in effect until a new designation takes effect.

– End of Section –

5. Ex-Post Mitigation for Physical Withholding

(Market Rules: Chapter 7, section 22.15)

The *IESO* tests *market participants offering energy* or *operating reserve* for a *dispatchable generation resource* or *dispatchable load resource* in the *day-ahead market* and the *real-time market* for *physical withholding* using a conduct test and an impact test. If a *market participant* fails these tests, the *IESO* may apply a *settlement* charge for that *instance of physical withholding.*

5.1. Sample Physical Withholding Timeline

Figure 5-1 illustrates the timeline associated with *physical withholding* assessment activities described above.

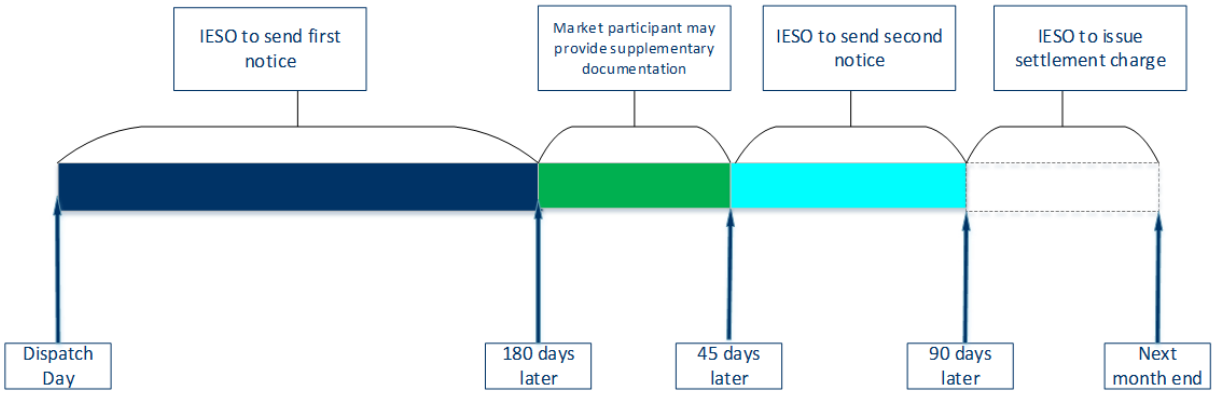

Figure 5-1: Sample Physical Withholding Assessment Timeline

If the *IESO* discontinues an assessment after sending a first notice to the *market participant*, the *IESO* will notify the *market participant* of the discontinuation.

5.2. Using Reference Quantities

The day-ahead *reference quantity* is used to assess *physical withholding* in the *day-ahead market.*

The real-time *reference quantity* is used to carry out the assessment of *physical withholding* in the *real-time market.*[1]

[1] For more information on how *reference quantities* are determined, refer to Market Manual 14, Part 14.2: Reference Level and Reference Quantity Procedures.

5.3. Determining Which Dispatchable Resources Meet the Conditions to Test for Physical Withholding

(Market Rules: Chapter 7, sections 22.15.~~3~~ 4 and 22.15.~~10~~11)

The *IESO* considers the conditions in the final run of the *DAM* and the hour-ahead pre-dispatch run of the *pre-dispatch calculation engine* when determining which *dispatchable resources* meet the conditions for testing for *physical withholding* of *energy* (Chapter 7, section 22.15.~~3~~ 4 of the *market rules*) or *operating reserve* (Chapter 7, section 22.15.~~10~~ 11 of the *market rules*).

In addition, to assess *physical withholding* that can impact a commitment decision for a *GOG-eligible resource*, the *IESO* considers the conditions in the pre-dispatch run that was the last opportunity to operationally commit that *GOG-eligible resource* for a given *dispatch hour*. In these cases, a *GOG-eligible resource* must meet conditions for a given *dispatch hour* in both of these pre-dispatch runs.

5.4. Conduct Test for Energy: Example

(Market Rules: Chapter 7, sections 22.15.~~3~~45, 22.15.6 and 22.15.~~4~~57)

The following examples illustrate the conduct test for a set of hypothetical *resources* that share a common *market control entity for physical withholding*:

Table 5-1 represents the hypothetical *resources* assessed in accordance with the '*resource* conduct test', related to Chapter 7, sections 22.15.~~4~~53.1.1 and 22.15.5.2.1 of the *market rules*.

Table 5-2 represents the same hypothetical *resources* assessed in accordance with the *'market control entity* conduct test', related to Chapter 7, sections 22.15.~~3~~45.~~2~~ 1.2 and 22.15.5.2.2 of the *market rules*.

Note that the same *resources* may be assessed with respect to both the *resource* conduct test and the *market control entity* conduct test.

Table 5-1: Resource Conduct Test (Energy)

Resource Name	Constrained Area Condition	Eligible to be Tested for Resource Conduct Test?	Resource's Offered Energy Quantity	Resource's Reference Quantity	Resource Conduct Test Outcome
GENERATOR A	BCA	Yes	999 MW	1000 MW	Pass
GENERATOR B	None	No	N/A	N/A	N/A
GENERATOR C	NCA	Yes	0 MW	100 MW	Fail

Resource Name	Constrained Area Condition	Eligible to be Tested for Resource Conduct Test?	Resource's Offered Energy Quantity	Resource's Reference Quantity	Resource Conduct Test Outcome
GENERATOR D	NCA	Yes	198 MW	200 MW	Pass
GENERATOR E	DCA	Yes	198 MW	200 MW	Pass
GENERATOR F	DCA	Yes	198 MW	200 MW	Pass
GENERATOR G	DCA	Yes	198 MW	200 MW	Pass
GENERATOR H	DCA	Yes	0 MW	1000 MW	Fail
GENERATOR I	DCA	Yes	198 MW	200 MW	Pass
GENERATOR J	DCA	Yes	198 MW	200 MW	Pass

All of the *dispatchable resources* listed above (Generators A through J) are registered under the same *market control entity for physical withholding*.

GENERATOR B is not eligible to be tested for *physical withholding* as it has not met any constrained area condition.

GENERATOR C and GENERATOR H failed the *resource* conduct test and therefore will be tested under the impact test regardless of the outcome of the *market control entity* conduct test.

GENERATOR A and GENERATOR D have passed the *resource* conduct test with respect to the constrained area conditions that they have met but are still subject to be tested under the *market control entity* conduct test.

Seven *dispatchable resources* passed the *resource* conduct test and are, therefore, subject to be tested under the *market control entity* test. Of these seven, five (E, F, G, I and J) are tested under the *market control entity* test for DCA, one is tested under the *market control entity* test for BCA and one is tested under the *market control entity* test for NCA.

Table 5-2: Market Control Entity Conduct Test (Energy)

Resource Name	Constrained Area Condition	Eligible to be Tested for MCE Conduct Test?	Resources' Aggregate Offered Energy Quantity	Resources' Aggregate Reference Quantity	MCE Conduct Test Outcome
GENERATOR E, GENERATOR F, GENERATOR G, GENERATOR I, GENERATOR J	DCA	Yes	990 MW	1000 MW	Fail
GENERATOR A	BCA	Yes	999	1000	Pass
GENERATOR D	NCA	Yes	198	200	Pass

Each of the five *resources* (E, F, G, I and J) have failed the *market control entity* conduct test for the DCA constrained area condition. This is because these *resources'* aggregated *energy offer* quantities were less than the applicable conduct threshold.

Resource A passes the *market control entity* conduct test for the BCA constrained area condition as *resource* (A)'s *energy offer* quantity was equal to or greater than the applicable conduct threshold.

Similarly, *resource* D passes the *market control entity* conduct test for the NCA constrained area condition as *resource* (D)'s *energy offer* quantity was equal to or greater than the applicable conduct threshold.

5.5. Conduct Test for Operating Reserve: Example

(Market Rules: Chapter 7, section 22.15.1~~1~~3~~2~~)

Table 5-3 shows how the conduct test for *operating reserve* treat *offers* of different classes of *operating reserve*.

Note that the *resource* conduct test for *offers* for *operating reserve* is applied for each class of *operating reserve*. With respect to the classes of *operating reserve*:

- 10S *operating reserve* is counted as 10S, 10N and 30R for the purposes of the conduct test;
- 10N *operating reserve* is counted as 10N and 30R *operating reserve* for the purposes of the conduct test; and

- 30R *operating reserve* is counted as only 30R for the purposes of the conduct test.

Table 5-3: Adjusted Operating Reserve Offer

Reserve Class	Adjusted Operating Reserve Offer for Physical Withholding Conduct Test
10-minute synchronized (10S)	= 10S OR Offer
10-minute non-synchronized (10NS)	• **For NQS Resources** = MIN (10S OR Offer + 10NS OR Offer, Maximum Generator Resource Active Power Capability - Min Loading Point) • **For QS Resources** = MIN (10S OR Offer + 10NS OR Offer, Maximum Generator Resource Active Power Capability) • **For Dispatchable Load Resources** = MIN (10S OR Offer + 10NS OR Offer, Maximum Registered Dispatchable Load)
30-minute synchronized (30R)	• **For NQS Resources** = MIN (10S OR Offer + 10NS OR Offer + 30R OR Offer, Maximum Generator Resource Active Power Capability - Min Loading Point) • **For QS Resources** = MIN (10S OR Offer + 10NS OR Offer + 30R OR Offer, Maximum Generator Resource Active Power Capability) • **For Dispatchable Load Resources** = MIN (10S OR Offer + 10NS OR Offer + 30R OR Offer, Maximum Registered Dispatchable Load)

Table 5-4 illustrates an example of *offers* of *operating reserve* and how these *offers* would be reflected as inputs to the conduct test for *physical withholding* for *operating reserve*.:

Table 5-4: Adjusted Operating Reserve Offer Example

Market Participant Operating Reserve Offers	Adjusted Operating Reserve Offer for Physical Withholding Conduct Test
40 MW of 10S	= 10S OR Offer = 40 MW
50 MW of 10NS	= 10S OR Offer + 10NS OR Offer = 40 MW + 50 MW = 90 MW
60 MW of 30R	= 10S OR Offer + 10NS OR Offer + 30R OR Offer = 40 MW + 50 MW + 60 MW = 150 MW

5.6. Impact Tests: Procedural Steps and Timelines

(Market Rules: Chapter 7, sections 22.15.~~18~~19-22.15.2~~7~~6)

The *IESO* applies impact tests for *energy* and *operating reserve* in accordance with the conditions set out in Chapter 7, section 22.15.~~8~~7-22.15.109, and Chapter 7, section 22.15.1~~6~~5-22.15.1~~8~~7 of the *market rules*, respectively.

Details with respect to the procedural steps and timelines associated with impact tests, including timelines related to first and second notices of *physical withholding* assessments, are set out in Chapter 7, section 22.15.1~~9~~8-22.15.2~~7~~6 of the *market rules*.

5.7. Determining the Settlement Charges

(Market Rules: Chapter 7, section~~s~~ 22.15.2~~7~~6)

The *IESO* determines a *settlement* charge for *energy* and *operating reserve* for each hour where the impact test was failed. The *settlement* charges are comprised of a mitigation amount (based on *LMPs* and quantities withheld) and a persistence multiplier (based on the previous findings of *physical withholding* per each *market control entity for physical withholding*).

If a *resource* fails the conduct test and impact test for a *dispatch hour* in both the *day-ahead market* and the *real-time market*, the *IESO* determines the *day-ahead market* base *settlement* charge and the *real-time market* base *settlement* charge for that *dispatch hour* and applies the higher of these two base *settlement* charges.

The equations in the following subsections are used to calculate the mitigation amount related to an *instance of physical withholding*:

For Energy:

$$\begin{aligned} &Physical\ Withholding\ Mitigation\ Amount\ (Energy) \\ &= \sum^{H} Max(Hourly\ DAM\ Physical\ Withholding\ Charge\ , \\ &\qquad Hourly\ RTM\ Physical\ Withholding\ Charge) \end{aligned}$$

Where:

- 'H' is the set of *dispatch hours* in a *dispatch day* in which an *offer* that failed the impact test was submitted

For Operating Reserve:

$$Physical\ Withholding\ Mitigation\ Amount\ (Operating\ Reserve)$$

$$= \sum^{H} Max(Hourly\ DAM\ Physical\ Withholding\ Charge\ ,\ Hourly\ RTM\ Physical\ Withholding\ Charge)$$

Where:

- 'H' is the set of *dispatch hours* in a *dispatch day* in which an *offer* that failed the impact test was submitted.

The following table illustrates an example for calculating the daily Physical Withholding Mitigation Amount (Energy) for both the *real-time market* and *day-ahead market* timeframes.

Table 5-5: Example of Calculating Physical Withholding Mitigation Amount

Dispatch Hour	DAM Energy Settlement Charge	RT Energy Settlement Charge	Final Settlement Charge
1	$100	$0	$100
2	$100	$50	$100
3	$100	$500	$500
24	$0	$0	$0

The Physical Withholding Mitigation Amount (Energy) totalled $700 for that *dispatch day*. *Dispatch hours* 4 to 24 resulted in no Physical Withholding Mitigation Amount (Energy).

5.7.1. Hourly DAM Physical Withholding Charge

The *day-ahead market* base *settlement* charge is calculated using the MWh quantity of *energy* or *operating reserve* for each hour in the *day-ahead market* that failed the impact test for *physical withholding* for a *dispatch day* multiplied by 1.5 and the relevant *day-ahead market LMP*.

The *day-ahead market* LMP used is the *resource's energy* or *operating reserve day-ahead market LMP* for each hour. The quantity that failed the impact test in each hour will be multiplied by the corresponding hourly *LMP* to yield the *settlement* charge for the hour.

The hourly *day-ahead market* base *settlement* charges for *energy* and *operating reserve* are determined using the following formulas:

For Energy:

$$Hourly\ DAM\ Physical\ Withholding\ Charge\ (Energy)$$
$$= 1.5 \times (MWhs\ Failed_h) \times (DAM\_LMP_h)$$

Where:

- 'h' is the *dispatch hour* that failed the impact test in the *dispatch day.*
- 'MWhs Failed' is the *energy reference quantity value* for the *day-ahead market* less the *energy offer* for the relevant *dispatch hour*.

For Operating Reserve:

$$Hourly\ DAM\ Physical\ Withholding\ Charge\ (Operating\ Reserve)$$
$$= 1.5 \times \left(MWhs\ Failed_{r,h}\right) \times (DAM\_PROR_{r,h})$$

Where:

- 'r' is the set of each class 'r' of *operating reserve*.
- 'h' is the *dispatch hour* that failed the impact test in the *dispatch day.*
- 'MWhs Failed' is the *operating reserve reference quantity value* for the *day-ahead market* less the *operating reserve offer* for the relevant *dispatch hour*.

5.7.2. Hourly RTM Physical Withholding Charge

The *real-time market* base *settlement* charge is calculated using the MWh quantity of *energy* or *operating reserve* for each *dispatch interval* that failed the impact test for *physical withholding* for a *dispatch day* multiplied by 1.5 and the relevant *real-time market LMP*.

The *real-time market LMPs* used are the *resource's energy* or *operating reserve real-time market LMP* for each *dispatch interval*. The quantity that failed the impact tests in each *dispatch interval* will be multiplied by the corresponding real-time *LMP* to yield a *settlement* charge for the *dispatch interval*.

The hourly *real-time market* base *settlement* charges for *energy* and *operating reserve* are determined using the following formulas.

For Energy:

$$Hourly\ RTM\ Physical\ Withholding\ Charge\ (Energy)$$
$$= 1.5 \times \sum_{H}^{T}\left(MWhs\ Failed_{h}^{t}\right) \times (RT\_LMP_{h}^{t})$$

Where:

- 'T' is the set of all the *dispatch intervals* 'T' in the *dispatch hour* 'H' that failed the conduct and impact test.
- 'MWhs Failed' is the *energy reference quantity value* for the *real-time market* less the *energy offer* for the relevant *dispatch hour*.

For Operating Reserve:

$$Hourly\ RTM\ Withholding\ Charge\ (Operating\ Reserve)$$
$$= 1.5 \times \sum_{H,R}^{T}\left(MWhs\ Failed_{h,r}^{t}\right) \times (RT\_LMP_{h,r}^{t})$$

Where:

- 'T' is the set of all the *dispatch intervals* 'T' in the *dispatch hour* 'H' that failed the conduct and impact test.
- 'R' is the set of each class 'R' of *operating reserve*.
- 'MWhs Failed' is the *operating reserve reference quantity value* for the *real-time market* less the *operating reserve offer* for the relevant *dispatch hour*.

5.7.3. Persistence Multipliers

The Hourly DAM Physical Withholding Charge or the Hourly RTM Physical Withholding Charge is multiplied by a persistence multiplier to determine the applicable *settlement* charge.

The persistence multiplier is determined based on repeat failures of the impact test for *physical withholding* by a *market control entity for physical withholding*.

A persistence multiplier is used when determining a *settlement* charge in a first and second notice of *physical withholding*. The persistence multiplier starts at a value of 1 and increases by 1 for each additional second notice issued to any *resources* that share a relevant *market control entity for physical withholding* in the 18-month period prior to the *instance of physical withholding* being assessed. The maximum value for the persistence multiplier is 3. Calculation of the persistence multiplier excludes instances when a *settlement* charge resulting from an *instance of physical withholding* is reversed as a result of a *notice of disagreement*.

The following examples outline several scenarios.

Scenario 1: One Instance

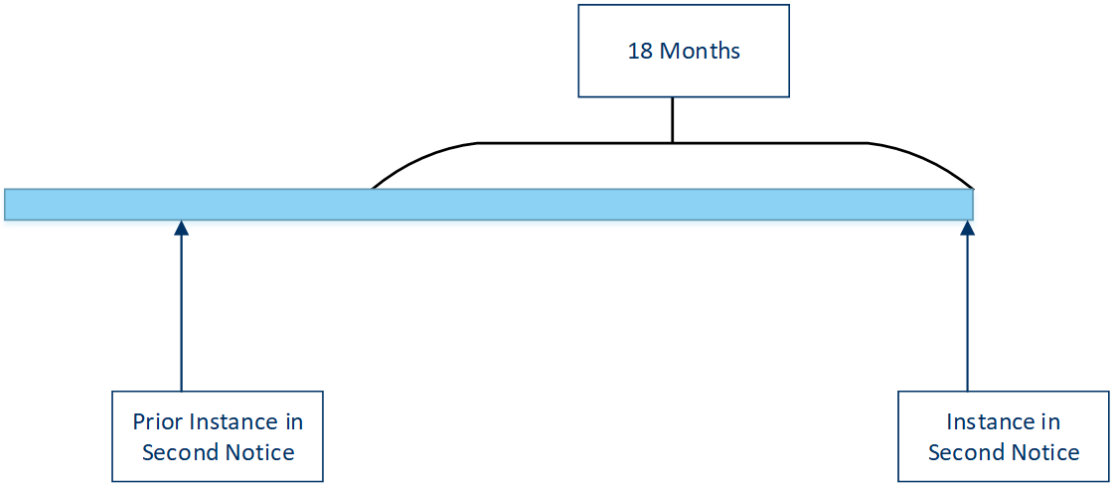

Figure 5-2: Scenario 1 with One Instance of Physical Withholding

Because there were no previously issued second notices in the 18 months prior to the current second notice, the persistence multiplier is equal to 1.

Scenario 2: Two Instances

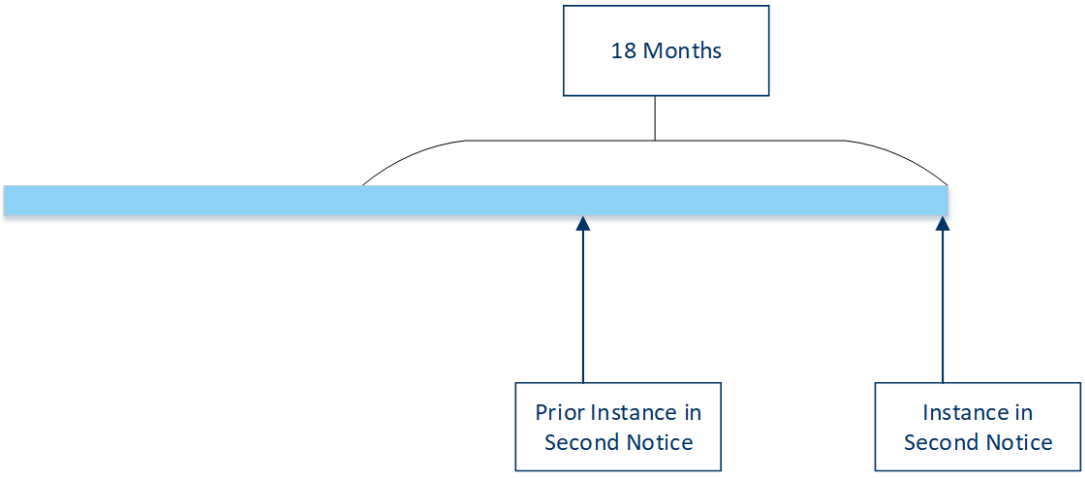

Figure 5-3: Scenario 2 with Two Instances of Physical Withholding

Because there was a second notice issued in the 18-month period prior to the current second notice, the persistence multiplier is equal to 2.

Scenario 3: One Instance

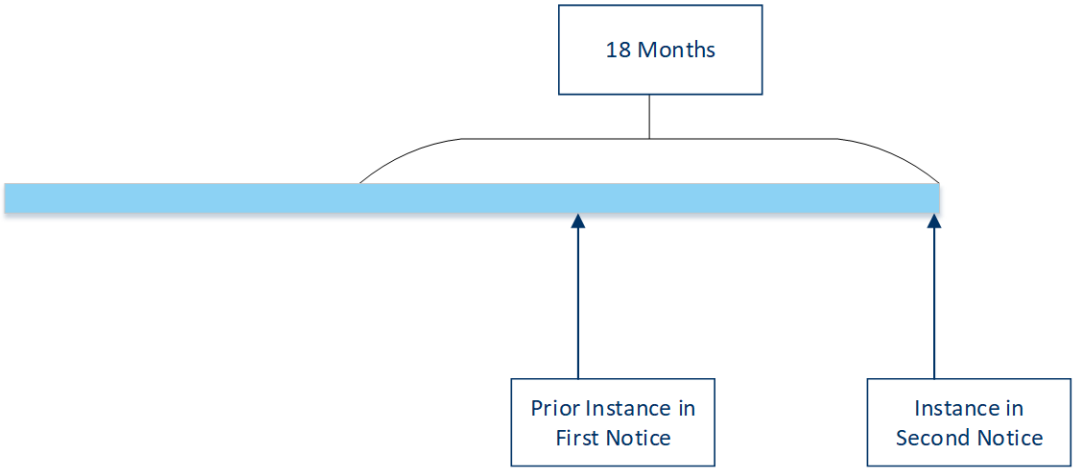

Figure 5-4: Scenario 3 with One Instance of Physical Withholding

The previously issued second notice within the 18-month period was only determined as part of the first notice. The persistence multiplier is therefore equal to 1.

5.8. Supporting Documentation for Alternative Reference Quantity Value Requests

(Market Rules: Chapter 7, section 22.15.21~~0~~, 22.15.21~~0~~.1)

Market participants submitting requests that the *IESO* use an *alternative reference quantity value* must include documentation with their request to support any *resource*-specific considerations that were not accounted for in the *resource's reference quantities* in use during the *instance of physical withholding*. This supporting documentation may include, but may not be limited to, data regarding:

- ambient temperature;
- relative humidity;
- water conditions (water flow, water level etc.);
- *reliability* and safety operations of the *facility*;
- other *resource*-specific considerations that were not accounted for in the registered *energy* or *operating reserve reference quantity* formula;
- *planned outages* and equipment de-ratings; and
- *forced outages* and equipment de-ratings.

5.9. Second Notice of Physical Withholding

(Market Rules: Chapter 7, sections 22.15.24~~3~~-22.15.26~~5~~)

If the conduct test and impact test are failed using an *alternative reference quantity value*, then the *IESO* will send a second notice of *physical withholding* that will contain updates to the information that was provided in the first notice.

5.10. Settlement Charges

(Market Rules: Chapter 7, section 22.15.27~~6~~)

Settlement charges related to *physical withholding* are applied no later than the next month-end after the date on which the *IESO* issued the second notice of *physical withholding* to the *market participant*.[2]

5.11. Reporting on Physical Withholding

The *IESO publishes* a report each month with the following information:

- number of second notices of *physical withholding* sent during a given month and year;
- the market (*day-ahead market* or *real-time market*) for which the second notice of *physical withholding* was sent;
- posting date, month, and year; and
- version number.

– End of Section –

[2] For more information, refer to Market Manual 5: Settlements Part 5.5: Physical Markets Settlement Statements, Appendix C.

6. Ex-Post Mitigation for Intertie Economic Withholding on an Uncompetitive Intertie Zone

Market Rules: Chapter 7, sections 22.17-22.19

This section provides details on the process for assessing *intertie economic withholding* on uncompetitive *intertie zones* using the relevant conduct tests and impact tests.

6.1. Sample Intertie Economic Withholding Timeline

Figure 6-1 illustrates the activities associated with *intertie economic withholding* on uncompetitive *intertie* zones:

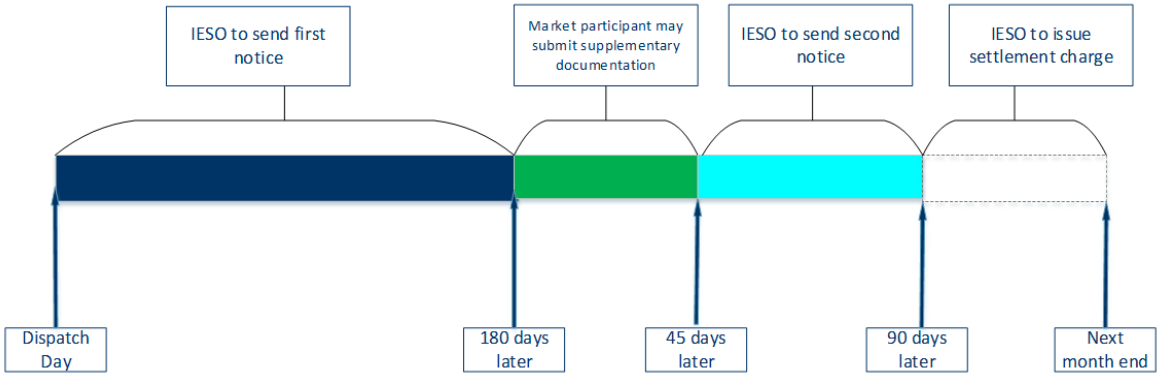

Figure 6-1: Timeline of Ex-Post Mitigation for Intertie Economic Withholding on Uncompetitive Intertie Zones

6.2. Determining the Intertie Economic Withholding Settlement Charge

(Market Rules: Chapter 7, sections 22.19.7-22.19.8)

The *IESO* determines a mitigation amount for each hour where the impact test was failed, calculated in accordance with this section.

The *IESO* determines a mitigation amount for each hour where the impact test for *energy* or *operating reserve* were failed in the *day-ahead market* and the *real-time market*. For each relevant hour in the *dispatch day*, the *IESO* determines the *day-ahead market* and *real-time market* mitigation amount and uses the higher of these two values. The *settlement* charge

issued for a *dispatch day* is the total of all the *day-ahead market* and *real-time market* mitigation amounts determined for each hour in the *dispatch day*.

Table 6-1 provides an example of how the daily mitigation amount for the *energy market* is calculated. In this example, the mitigation amount associated with that *instance of intertie economic withholding* is $700.

Table 6-1: Example of Mitigation Amount Calculation

Dispatch Hour	Hourly DAM Intertie Economic Withholding Charge (Energy)	Hourly RTM Intertie Economic Withholding Charge (Energy)	Mitigation Amount Used for Settlement Charge
1	$100	$0	$100
2	$100	$500	$500
3	$100	$100	$100

The following subsections set out the equations used to calculate the mitigation amount related to an *instance of intertie economic withholding*.

6.2.1. Energy Intertie Economic Withholding Mitigation Amount

The *IESO* calculates the *intertie economic withholding* mitigation amount for *energy* as follows:

$$Energy\ Intertie\ Economic\ Withholding\ Mitigation\ Amount$$

$$= \sum^{H} Max(Hourly\ DAM\ Economic\ Withholding\ Charge\ ,\ Hourly\ RTM\ Economic\ Withholding\ Charge)$$

Where:

- 'H' is the set of *dispatch hours* that failed the conduct test and impact test in the *dispatch day*.

The Hourly DAM Intertie Economic Withholding Charge for *energy* is calculated as follows:

$$Hourly\ DAM\ Economic\ Withholding\ Charge\ (Energy)$$
$$= \left(MWhs\ Failed_h^i\right) \times (DAM\_LMP_h^i)$$

Where:

- 'MWhs Failed' is the amount of *energy*, in MWhs, in each *dispatch hour* associated with the *offer* or *bid* that failed the conduct test and impact test for *intertie economic withholding* in the *day-ahead market;*
- 'DAM_LMP' is the *resource*'s *energy day-ahead market LMP* for each hour;
- 'i' is the set of all *intertie metering points* 'i'; and
- 'h' is the *dispatch hour* that failed the conduct test and impact test in the *dispatch day*.

The Hourly RTM Intertie Economic Withholding Charge for *energy* is calculated as follows:

$$Hourly\ RTM\ Economic\ Withholding\ Charge\ (Energy)$$
$$= \sum_{H}^{T}\left(MWhs\ Failed^{i,t}\right) \times (RT\_LMP^{i,t})$$

Where:

- 'MWhs Failed' is the amount of *energy*, in MWhs, in each five-minute interval associated with the *offer* or *bid* that failed the conduct test and impact test for *intertie economic withholding* in the *real-time market*;
- 'RT_LMP' is the *resource's energy real-time market LMP* for each interval;
- 'T' is the set of all the dispatch intervals 't' in *dispatch hour* 'H' that failed the conduct and impact test;
- 'H' is the set of *dispatch hours* that failed the conduct test and impact test in the *dispatch day*; and
- 'i' is the set of all *intertie metering points* 'i'.

6.2.2. Operating Reserve Intertie Economic Withholding Mitigation Amount

The *IESO* calculates the *intertie economic withholding* mitigation amount for *operating reserve* as follows:

$$Intertie\ Economic\ Withholding\ Mitigation\ Amount\ (Operating\ Reserve)$$
$$= \sum^{H} Max(Hourly\ DAM\ Economic\ Withholding\ Charge\,,$$
$$Hourly\ RTM\ Economic\ Withholding\ Charge)$$

Where 'H' is the set of *dispatch hours* that failed the conduct test and impact test in the *dispatch day*.

The Hourly DAM Intertie Economic Withholding Charge for *operating reserve* is calculated as follows:

$$Hourly\ DAM\ Withholding\ Charge\ (Operating\ Reserve)$$
$$= \left(MWs\ Failed_{r,h}^{i}\right) \times (DAM\_PROR_{r,h}^{i})$$

Where:

- 'MWs Failed' is the amount of *operating reserve*, in MW, in each *dispatch hour* associated with the *offer* that failed the conduct test and impact test for *intertie economic withholding* in the *day-ahead market;*
- 'DAM_PROR' is the *resource*'s *operating reserve day-ahead market LMP* for each hour;
- 'i' is the set of all *intertie metering points* 'i';
- 'r' is the class 'r' of *operating reserve*; and
- 'h' is the *dispatch hour* that failed the conduct test and impact test in the *dispatch day*.

The Hourly RTM Intertie Economic Withholding Charge for *operating reserve* is calculated as follows:

$$Hourly\ RTM\ Economic\ Withholding\ Charge\ (Operating\ Reserve)$$
$$= \sum_{H,R}^{T}\left(MWs\ Failed_{r}^{i,t}\right) \times (RT\_LMP_{r}^{i,t})$$

Where:

- 'MWs Failed' is the amount of *operating reserve*, in MW, in each 5-minute interval associated with the *offer* that failed the conduct test and impact test for *intertie economic withholding* in the *real-time market*;
- 'RT_LMP' is the *resource's operating reserve real-time market LMP* for each interval; and
- 'T' is the set of all the *dispatch intervals* 't' in *dispatch hour* 'H' that failed the conduct and impact test.
- 'H' is [the set of *dispatch hours* that failed the conduct test and impact test in the dispatch *day*];
- 'R' is the set of all classes 'r' of *operating reserve*; and
- 'i' is the set of all *intertie metering points* 'i'.

6.2.3. Make-Whole Payment Intertie Economic Withholding Mitigation Amount

(Market Rules: Chapter 7, section 22.18~~6~~)

If a *boundary entity resource* is tested for make-whole payment impact and fails the impact test, then make-whole payments for the *day-ahead market* or *real-time market* for that *boundary entity resource* will be adjusted. These adjustments are equal to the difference between the actual make-whole payment and the *intertie reference level* make-whole payment.

The following *settlement amounts* are subject to make-whole payment adjustment as part of the *intertie economic withholding* assessment:

- DAM_MWP – as applicable to *boundary entity resources* only;
- RT_MWP – as applicable to *boundary entity resources* only; and
- RT_IOG.

The following table illustrates how the *settlement* charge adjustment for make-whole payments is calculated:

Table 6-2: Example of Make-Whole Payment Settlement Charge Calculation

Dispatch Hour	Actual DAM-MWP	Intertie Reference Level DAM-MWP	Actual RT-MWP	Intertie Reference Level RT-MWP	Final Make-Whole Payment Mitigation Amount
1	$200	$100	$100.00	$50	$150.00

Based on the above table, the *IESO* would apply a *settlement* charge totalling $150.00 for that *instance of intertie economic withholding*.

6.3. Supporting Documentation for Requests for Alternative Intertie Reference Level Value

(Market Rules: Chapter 7, section 22.19.2)

The *IESO* evaluates the supporting documentation provided to determine whether it is consistent with the *alternative intertie reference level value* requested.

Alternative intertie reference level values are based on *short-run marginal costs* for importers and *short-run marginal benefits* for exporters.

With respect to importers, the *short-run marginal cost* is the cost of the power purchased or produced to serve Ontario taking into account the transaction costs. With respect to exporters, the *short-run marginal benefit* is the price the exporter received or would have received on the

sale of the power purchased from Ontario, taking into account the transaction costs. The *IESO* only considers actual after-the-fact costs.

The *IESO* will not consider fixed costs, sunk costs or operational expenses that are not directly incurred to undertake any specific transaction nor benefits that are not a direct result of undertaking any specific transaction.

If the *IESO* determines an *alternative intertie reference level value*, the *IESO* shall perform the conduct test and impact test using the *alternative intertie reference level value*. If the conduct test and impact test still fail using the *alternative intertie reference level value*, the *IESO* will issue a second notice of *intertie economic withholding*. If the conduct and impact tests do not fail when using the *alternative intertie reference level value*, the assessment concludes and no mitigation is applied.

6.4. Applying Settlement Charge

(Market Rules: Chapter 7, section 22.19.7)

The *settlement* charge relating to the *instance of intertie economic withholding* detailed in the second notice shall be applied no later than the next month-end after the date on which the *IESO* issued the second notice to the *market participant.*[3]

6.5. Publication of Summary Data on Intertie Economic Withholding

The *IESO publishes* a report each month with the following information:

- number of second notices of *intertie economic withholding* sent during a given month and year;
- the market (*day-ahead market* or *real-time market*) for which the second notice of *intertie economic withholding* was sent;
- posting date, month, and year; and
- version number.

– End of Section –

[3] For more information, refer to Market Manual 5: Settlements Part 5.5: Physical Markets Settlement Statements, Appendix C.

List of Acronyms

Acronym	Term
DCA	*Dynamic constrained area*
GOG	*Generator Offer Guarantee*
GSF	Generation shift factor
LMP	*Locational marginal price*
MR	*Market rule*
NCA	*Narrow constrained area*
NQS	*Non-quick start*
OSL	Operating *security limit*
QS	*Quick-start*
SF	Sensitivity factor

– End of Section –

References

Document ID & Link	Document Title
MDP_RUL_0002	Market Rules
IMP_GDE_0088	Market Manual 1.3: Identity Management Operations Guide
MDP_PRO_0033	Market Manual ~~5: Settlements Part~~ 5.5: Physical Markets Settlement Statements
~~Market Manual 14, Part 14.2~~	~~Part 14.2: Reference Level and Reference Quantity Procedures~~

– End of Document –