Reference Levels and Reference Quantities

RLRQ Workbook Instructions and Frequently Asked Questions
March 2023

Disclaimer

This document provides an overview of the steps that must be taken to register reference levels and reference quantities for a resource and must be read in the context of the related market rules and market manuals.

The information in this document shall not be relied upon as a basis for any commitment, expectation, interpretation and/or decision made by any market participant or other interested party and is subject to on-going revision.

The posting of this design document is made exclusively for the convenience of market participants and other interested parties. The market rules and market manuals, applicable laws, and other related documents will govern the future market. In the event of any conflict between this document and the market rules or market manuals, the market rules or market manual shall govern.

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1. Introduction

This document (RLRQ FAQ) describes the process of how one-on-one consultations will be used to determine reference levels and reference quantities for a resource in support of the IESO's market power mitigation framework prior to go-live of Market Renewal Program (MRP). RLRQ FAQ also provides instructions for how market participants will communicate reference level and reference quantity submissions to the IESO for one-on-one consultations prior to MRP go-live. The IESO will provide its preliminary view of a resource's reference levels and reference quantities following the one-on-one consultations.

The enduring processes and solutions that will be used to facilitate one-on-one consultations after MRP go-live are still in development, including the way that information is exchanged and the timing around exchanges of information.

These instructions are organized into four categories:

i.   Reference Levels for Financial Dispatch Data Parameters: How to request reference levels for financial dispatch data parameters using the reference levels and reference quantities workbook ("RLRQ workbook").

ii.   Additional Opportunity Costs: How to request an additional opportunity cost when the opportunity costs found in Section 6.4 of Market Manual 14.2 do not address a relevant operational characteristic of a resource.

iii. Reference Levels for Non-Financial Dispatch Data Parameters: How to request reference levels for non-financial dispatch data parameters using the RLRQ workbook.

iv.   Reference Quantities: How to request a modification to the reference quantity calculation methodology for a particular resource, if that resource has operational characteristics that are not reasonably accounted for in the technology-specific approach to determine reference quantity.

This document organizes the FAQs for each topic by the technology type. RLRQ FAQ may be updated by the IESO while the reference level consultation process is carried out. Doing so will allow the IESO and market participants to benefit from the lessons learned from the one-on-one consultations and improve the efficiency of the process on an ongoing basis.

The independent review process to address any outstanding technical questions following the IESO's communication of its preliminary view of a resource's reference levels and reference quantities is outside the scope of RLRQ FAQ. The IESO is currently developing the market manuals, processes and solutions for the independent review process and for the registration process and will have further discussions with market participants on these items.

2. One-on-One Consultation for Reference levels and Reference Quantities

This section describes the five steps involved in an one-on-one consultation: (i) initiation of the consultation through an email followed by a meeting if needed; (ii) information gathering; (iii) submission of the RLRQ workbook and supporting materials; (iv) IESO review; and (v) communication of the IESO's preliminary view. Topics described include the parties involved at each step, the tasks required to complete each step, the time allotted and the output of each step.

2.1. Initiation

This step involves a kick-off meeting between the market participant and the IESO.

The purpose of this meeting is for the IESO to provide the market participant with all the materials required to prepare their reference level and quantity submission, including the RLRQ workbook and required supporting materials and to answer any questions that the market participant may have about the process.

This step is complete once the following activities are done:

- the kick-off meeting has occurred;

- the IESO has provided all required materials to the market participant; and

- if a market participant has multiple resources, the resource order that will sequence the the reference level consultation has been determined.

The kick-off meeting is expected to last approximately one hour.

2.2. Information Gathering by the Market Participant

This step involves the market participant completing the following tasks:

- determining the cost items that will be included in its reference level submission;
- determining the relevant values for the reference levels (financial and non-financial) to be requested for the particular resource;
- preparing the required supporting materials;
- inserting the values for the requested reference levels into the RLRQ workbook;
- preparing any submissions related to additional opportunity costs it wishes to request, if applicable; and
- preparing any requested modifications to the reference quantity calculation for the resources at the facility.

The information gathering step is primarily carried out by the market participant. During the information gathering step, IESO staff will be available to answer questions and provide support to enable the market participant to prepare the required submissions.

This step is expected to take approximately eight weeks for the resources in the first facility of a particular technology type for each market participant and four weeks for the resources in each subsequent facility of the same technology type.

The output of the information gathering step is a complete reference level and reference quantity submission materials, including the RLRQ workbook, supporting materials, requests for additional opportunity costs and requests to vary the default methodology for reference quantity.

2.3. Submission of Reference Level and Reference Quantity Materials

The submission will include the RLRQ workbook, supporting materials, and any requests for additional opportunity costs for reference levels or modifications to the technology-specific methodology for determining reference quantities.

Market participants may make their submissions through Blackberry Workspaces, email or by direct file transfer if necessary. The submission will be provided to the IESO after the information gathering step is complete.

The IESO is obligated to maintain the confidentiality of information in its possession or control under section 5.2.1 of Chapter 3 of the market rules and may not disclose confidential information except in accordance with the market rules.

2.4. IESO Review

The IESO will review the submission for completeness and correctness. The reference levels requested in the RLRQ workbook will be reviewed to determine if the reference levels requested are consistent with the supplementary information submitted. The IESO will also review the methodology that the market participant used to amortize submitted line item costs into each relevant reference level and will review the eligibility of the submitted line item costs to be included in a reference level. Requests for additional opportunity costs and requests to vary the default methodology for determining reference quantities will also be reviewed.

During this step, the IESO may contact the market participant for clarifications, to identify methodological issues with the reference level and reference quantity submission, or to request additional supporting information.

This step is expected to take approximately eight weeks following receipt of the submission.

2.5. Communication of IESO's Preliminary Views on Reference Levels and Reference Quantities

The purpose of this step is to provide the market participant with the reference levels and reference quantities that the IESO intends to register in the future, given the information reviewed in the above steps.

Once the IESO review step is complete, the IESO will communicate, in writing, a preliminary view of the resource's reference levels and reference quantities. The IESO will provide a rationale to the market participant if the IESO's determination of a reference level or reference quantity in the preliminary view differs from the requested reference level or reference quantity.

Following this communication, the market participant may elect to have the preliminary reference levels or reference quantity reviewed using the independent review process. This process will occur before the IESO registers the reference levels and reference quantities.

3. Reference Levels for Financial Dispatch Data Parameters

This section describes the instructions for completing a submission to request reference levels for financial dispatch data parameters and relevant FAQs.

3.1. Instructions for Reference Levels for Financial Dispatch Data Parameters

The RLRQ workbook is intended to be used by market participants to submit reference levels for financial dispatch data parameters and cost information to the IESO. The RLRQ workbook and the supporting materials will be used by the IESO to determine reference levels for the financial dispatch data parameters that are expressed in monetary units of measurement (e.g. $/MWh, $/start) as part of the IESO's Market Power Mitigation framework.

The financial dispatch data parameters relevant to each technology type are listed in the **FinDispatchDataParameters** tab of the RLRQ workbook. This tab also contains the formulae that will be used to determine energy offer reference levels. Cost components of the financial dispatch data parameters are listed in the **Reference Level Cost Components** tab.

Market participants are required to fill out each relevant line item and submit the completed RLRQ workbook for the resources in a facility with applicable supporting documentation to the IESO.

 If the cost components vary relative to energy or operating reserve production, then the market participant must identify the cost component and the range of production that the costs relate to. For example, incremental fuel costs for the energy offer reference level may be $10/MWh for a range of 1-15MW of production and $14/MWh for a range of 16-30MW of production.

Market participants will be required to provide supporting documentation for every cost that they would like to have reflected in the resource's reference level. No supporting materials are required to establish $0 reference level for a financial dispatch data parameter.

Market participants can opt to request reference level for a financial dispatch data parameter that is lower than the actual short-run marginal costs of the resource, they are not obligated under the market rules to provide all relevant costs.

Requesting a given reference level for financial dispatch data parameter does not prohibit a market participant from submitting a reference level change request or a reference level change request for a higher value in the future where warranted based on the short-run marginal costs of the resource; The IESO will assess the costs submitted in the RLRQ workbook for eligibility. Costs must vary in provision of incremental supply, increasing as the provided supply increases, to be eligible.

Registering a reference level for a financial dispatch data parameter at a particular value does not obligate a market participant to offer at or below that value. Registration of reference levels for financial dispatch data parameters does not create an obligation to offer at a particular value.

When completing the RLRQ workbook, the market participant should complete or insert values for all fields shaded in yellow. If a requested value is 0, that number should be inserted into the relevant field. If a particular field does not apply to that resource, the market participant should insert "N/A" into the relevant field.

Each non-zero cost in the RLRQ workbook requires supporting information that include references to attachments and page numbers.

The RLRQ workbook provides the requested reference levels – these requested reference levels are reviewed and the IESO's view on reference levels is communicated via the preliminary view.

3.1.1.   Introduction Tab

Market participants must provide the following information in the **Introduction** tab:

- Resource name
- Resource ID
- Technology type of resource (e.g. hydroelectric, thermal, solar, energy storage, etc.)
- Date of the reference levels and reference quantities workbook completion (in Year/Month/Date format)
- Proposed effective date of the requested reference levels and reference quantities (in Year/Month/Date format)

Figure 1 shows the fields included in this tab and the suggested formats.

Resource Information	
Resource Name	
Resource ID	
Technology type of Resource	
Date of the Reference Levels and Reference Quantities Workbook Completion	YYYY/MM/DD
Proposed Effective Date of the Requested Reference Levels and Reference Quantities	YYYY/MM/DD

Figure 1: Fields under Resource Information in Introduction tab

For the purpose of preparing for MRP go-live, the proposed effective date can be left blank. This information will be required for requests to change a reference level following MRP go-live and will be completed as part of the submission by the market participant.

The **Introduction** tab has a section in gray intended for IESO-staff use only, as displayed in Figure 2, below. This section is intended to be completed by IESO staff during the consultation and discussion with market participants if necessary.

During the process of determining reference levels for financial dispatch data parameters for a resource, the market participant may indicate to the IESO if this resource requires an alternate cost-profile to represent its short-run marginal costs. The IESO will consult with the market participant to

identify the form and content of supporting documentation that will be required to request temporary use of an alternate cost-profile for use for a particular dispatch day.

The section below this line is intended for IESO staff-use only. Please do **NOT** enter any information in this section.			
Attribute	Applicability (Y/N)	Description	Applicable Supporting Documentation
Multiple Cost-Profile Establishment		The market participant requests to establish an additional reference level cost-profile for its financial reference levels.	
Ex-Ante Multiple Cost Profile Supporting Documentation Type		For an established cost-profile, the IESO and market participant identifies the type of supporting documentation in support of temporary reference level cost-profile change at the time of the request.	
Ex-Post Multiple Cost Profile Supporting Documentation Type		For an established cost-profile, the IESO and market participant identifies the type of supporting	

Figure 2: Fields Highlighted in Gray in the Introduction Tab

3.1.2.   Reference Level Cost Components Tab

The **Reference Level Cost Components** tab includes a list of cost categories that are applicable to a particular technology type. Figure 3 shows the different columns that are present in this tab.

Cost Component	I. Units of measurement/ Additional Information	II. Applicability - Resource Type	III.Time-Based Applicability	IV. Input	V. Supporting Documentation Reference	VI. Comments

Figure 3: Columns in the Reference Level Cost Component tab

For each technology type, market participants must provide the following information:

- In the **Cost Component** column, market participants fill out the different cost components that can be used to determine reference levels for resources of that particular technology type.
- In the **Applicability/Resource Technology Type** column, market participants fill out the applicable resource technology type (for example, solar, wind, pumped storage, hydro etc.).
- In the **Time-Based Applicability** column, market participants specify if each input value applies on a seasonal basis or is applicable to all time periods. For seasonal applicability, market participants indicate the season for which the input value is applicable.
- In the **Input** column, market participants enter the values for each cost component, as applicable. Where a cost component is not applicable, market participants enter "N/A". Where a cost component is zero, market participants enter "$0".
- In the **Supporting Documentation Reference** column, market participants submitting non-zero costs include the list of supporting documents that they are using to support that specific cost.

Where available, market participants should use historical cost information spanning the suggested historical study period from Section 3.1 of Market Manual 14.2: Reference Levels and Reference Quantities Procedures when determining the contribution of a cost to a reference level. That section also describes the approach to be used if that data sample is not available.

- In the **Comments** column, market participants detail how they calculated the cost, e.g. historical cost for the last 5 years/historical generation over the last 5 years. This detail should include:
  - o any assumptions made
  - o steps taken to use the information in the supporting materials to arrive to the requested reference level
  - o any information related to the cost component that is necessary to conduct a thorough review

If the comment field is too small to fit all required detail, the market participant may indicate a reference to a supporting memo (also provided in the reference level submission) that provides this information.

3.1.3.   Definition of Cost Components Tab

The **Definition of Cost Components** tab includes a description of each cost category listed in the **Reference Level Cost Components** tab. This tab also includes the types of supporting documents that market participants may provide.

Note that this tab is for reference purposes only and market participants are not required to input information into this tab. The information provided in this tab is to help market participants refer to and cross-check the supporting documents that are eligible to support each cost category.

Figure 4 shows the different columns present in the **Definition of Cost Components** tab.

#	Cost Category	Description	Types of Supporting Documentation

Figure 4: Columns in the Definition of Cost Components tab

This tab includes the following columns:

- The **Cost Category** column includes the list of different cost categories that are listed in the **Reference Level Cost Components** tab for the technology type of resource.
- The **Description** column includes the detailed description of each cost category. For example, the description of the incremental heat rate cost category includes the components that make up this category (i.e. change in heat going in divided by total energy coming out).
- The **Type of Supporting Documentation** column includes examples of supporting documents that market participants can refer to when submitting documents to support the costs for each cost category. For example, a seller's quote or invoice could support the heat content of fuel.

3.1.4.   Financial Dispatch Data Parameters Tab

In this tab, the IESO provides the applicable financial dispatch data parameters and the formulae used to derive the requested reference level. Market participants must calculate the relevant reference level using the information and formulae in the **FinDispatchDataParameters** tab.

Figure 5 shows the different columns present in this tab.

#	Parameter	Unit	Description	Formula	Reference value/cost curve

Figure 5: Columns in the Financial Dispatch Data Parameters tab

The **FinDispatchDataParameters** tab includes the following columns:

- The **Parameter** column lists all the financial dispatch data parameters that are applicable to each technology type. Depending on the registered operational characteristics of the resource, one or more of the following reference levels will be required:

  o   Energy offer reference level

  o   Speed no-load offer reference level

  o   Start-up offer reference level

  o   Operating reserve offer reference level

- The **Unit** column provides the unit of measurement that corresponds to each parameter.

  - The **Description** column includes a brief description of each of the parameters.

  - The **Formula** column includes the formulae that market participants can use to calculate the reference levels for each financial dispatch data parameter that is applicable to the resource.

  - The **Reference value/cost curve** column must be filled out by the market participants. Market participants are required to calculate and fill in this information by using the formulae provided in the **Formula** column and the **Input** column values from the **Reference Level Cost Components** tab.

For non-quick start (NQS) thermal resources that are registered as pseudo-units (PSU), market participants must establish PSU reference levels for one of the configurations for combined cycle mode (i.e. 1x1, 2x1, etc.), and 1x0 configuration for single cycle mode, as applicable. 1x0 reference levels are applicable to resources that have a bypass stack or can otherwise operate in single cycle mode absent the steam turbine (ST).

Figure 7

Figure 6 shows that market participants can add information for PSUs in the corresponding column of the Financial Dispatch Data Parameters – PSU tab.

PSEUDO UNIT REFERENCE LEVELS (ASSUME IDENTICAL CTs)								
Reference value/cost - Summer *MP to specify here which one of the possible combined cycle mode (e.g. 1x1 or 2x1) was used for calculating pseudo unit reference levels*					**Reference value/cost - Winter** *MP to specify here which one of the possible combined cycle mode (e.g. 1x1 or 2x1) was used for calculating pseudo unit reference levels*			
Operating Load (MW)					**Operating Load (MW)**			

Figure 6: Reference levels for financial dispatch data parameters for different PSU configurations

3.1.5.   Supporting Documentation List Tab

The **Supporting Documentation List** tab includes a summary table listing all of the supporting documentation provided by the market participant. In this tab, market participants provide the attachment number, document name and description for each supporting document.

Figure 7 shows an example of how to fill out the list of supporting document name and description.

Attachment #	Supporting Document Name	Supporting Document Description
Attachment 1	Invoice 1.pdf	Refer to page 10, for cost to support input into the behind the meter standby cost
Attachment 2	Invoice 2.pdf	Refer to page 4, for cost to support input into the behind the meter standby cost
Attachment 3	*[etc. to be filled by Market participant to substantiate all inputs into reference levels]*	*[etc. to be filled by Market participant to substantiate all inputs into reference levels]*

Figure 7: Example of a completed Supporting Documentation List tab

This tab includes the following columns:

- In **Attachment #** column, market participants are required to fill out the numerical reference number of the attachment. This attachment number should be the same as the value entered in the **Supporting Document Reference** column of the **Reference Level Cost Components** tab.

- In the **Supporting Document Name** column, market participants must enter the file name of the attachment and extension (for e.g. "Resource AB_OEM.pdf).

- In the **Supporting Document Description** column, market participants must provide the specific information within an attachment (e.g. page number, line item, etc.) and explain how it supports the inputs for reference levels. Market participants may include information on how this supporting information is used and what cost or reference level

the document is used to support. Market participants are encouraged to add supplementary notes and description of the information submitted.

3.2. FAQs for Reference Levels for Financial Dispatch Data Parameters

This section contains FAQs relevant to the process for determining reference levels for financial dispatch data parameters and answer to those questions. There is a general section for questions that are not specific to any one technology type and additional sections for questions specific to a given technology type.

3.2.1. General

Q1: Is there flexibility on the type of supporting documents that will be considered acceptable?

A1: The IESO will consider eligibility of supporting documentation on a case-by-case basis. Section 3.2 of Market Manual 14.2 includes a list of acceptable forms of supporting documentation. Where the documentation from the list is not available, documentation developed by the market participant may be submitted. These documents will be evaluated on a case-by-case basis by the IESO. Market participants should discuss the specific documentation developed by the market participant with the IESO prior to submission.

Q2: Does major maintenance include fixed and variable major maintenance? What qualifies as major maintenance?

A2: Fixed costs are not eligible to contribute to reference levels. Section 6.3 of Market Manual 14.2 includes a non-exhaustive list of eligible and ineligible major maintenance costs. Any items that are not specifically addressed in Market Manual 14.2 may be submitted for IESO review. Eligibility of these costs will be evaluated on the same basis as any other cost. Costs must vary with supply of energy or operating reserve to be eligible.

Q3: If a market participant requests a reference level of $0/MWh for financial dispatch data parameter, does that mean that the market participant is stating that they have no costs?

A3: A request for a reference level of $0/MWh does not imply any conclusions regarding the underlying costs of the resource in accordance with section 22.2.2 of Chapter 7. The market participant is not restricted from submitting a request to change a reference level to reflect positive costs in the future. Rather, it indicates that the market participant is requesting a reference level of $0/MWh be used.

Q4: How does an energy offer no-look threshold of $25/MWh and an operating reserve no-look threshold of $5/MW relate to the respective reference levels for financial dispatch data parameters that a market participant establishes?

A4: A market participant could register an energy offer reference level of $0/MWh in accordance with section 22.2.2 of Chapter 7. If that market participant subsequently submits energy offers at prices above $25/MWh, and the resource is tested for mitigation, it will likely fail the conduct test. However, if a market participant submits energy offers under $25/MWh, then those offers will always pass the conduct test as they are below the no-look threshold. A parallel consideration exists for operating reserve offers, operating reserve offer reference levels and the operating reserve no-look threshold of $5/MW.

Q5: Is a resource obligated to offer at its registered reference level?

A5: No, registering a reference level of a particular value does not create an obligation in regards to offer prices.

Q6: Once MRP goes live, can market participants update their reference levels whenever they want?

A6: Market participants may update the reference levels or reference quantities for their resource using the registration process as outlined in Section 3.3 of Market Manual 14.2.

Q7: How do market participants fill in the RLRQ workbook to request reference levels for an aggregate resource where more than one generation unit is modeled by the IESO as a single resource?

A7: The market participant will construct the resources reference level based on aggregating the eligible costs as appropriate for their resource. Market participants should determine the configuration of generation units that should be used to establish the reference level for their resource and discuss the specific approach for their resource with the IESO in the early stages of the reference level consultation.

For example, for a thermal aggregated resource, instead of filling out both combustion turbine (CT) and ST tabs, market participants should only fill out the CT tabs with aggregated reference level values for financial and non-financial dispatch data parameters for both steam and gas turbines.

Q8: If the ownership of a facility gets transferred to a new market participant, how will the registered reference levels be shared?

A8: If there is a transfer of ownership of a facility, the new owner will be able to view the currently registered reference levels or reference quantities through Online IESO, similar to other registered data for the facility.

Q9: If the ownership of a facility gets transferred to a new market participant, can the new owner access supporting documents that were submitted by the previous owner of the facility as part of a reference level or reference quantity submission?

A9: No. If there is a transfer of ownership of a facility, IESO will not provide access to the new owner to view the supporting documents that were uploaded by the previous owner as doing so could result

in the IESO violating obligations regarding treatment of confidential information. It is up to the new owner to directly request the supporting documents from the previous owner of the facility.

3.2.2.   Hydro

Q1: Do market participants need to register energy offer reference levels for all resources that are part of a cascade?

A1: For dispatchable hydroelectric resources that are part of a registered cascade group, market participants determine energy offer reference levels for the resources that are associated with the forebay at the top of the cascade group as well as required cascade information regarding the resources downstream in the cascade group. The IESO then derives energy offer reference level values for the downstream resources in accordance with section 7.2.4 of Market Manual 14.2.

Q2: Do market participants need to register operating reserve offer reference levels or reference levels for non-financial dispatch data parameters for all resources that are part of a cascade

A2: Dispatchable hydroelectric resources that are eligible to participate in operating reserve require operating reserve offer reference levels regardless of whether they belong to a cascade group. Dispatchable hydroelectric resources require reference levels for non-financial dispatch data parameters regardless of whether they belong to a cascade group.

3.2.3.   Thermal

Q1: How do market participants identify the reference level for specific financial dispatch data parameter to which they should allocate a particular operating and maintenance (O&M) cost for a thermal resource?

A1: Market Manual 14.2, Section 6.3 describes which O&M costs can be allocated to reference levels for which financial dispatch data parameters. For example, some O&M costs can be allocated to either the energy offer reference level, start-up offer reference level or speed no-load offer reference level. Regardless of allocation, the same cost cannot be allocated to more than one reference level.

Q2: How do market participants identify reference levels for which financial dispatch data parameters are required for a thermal resource?

A2: Thermal resources are categorized into variants A through D according to the registered data for the resource and the facility. In general, if a resource is able to submit dispatch data for which there exists a corresponding reference level, that reference level must be determined. For example, if a thermal resource can submit start-up offers and speed no load offers, then the IESO must determine start-up offer reference levels and a speed no load offer reference level for that resource.

Section 7.1 of Market Manual 14.2 outlines the variants of thermal resources and Sections 7.1, 8.1 and 9.1 describe the reference levels and reference quantities required for each variant.

Q3: How can resources establish more than one set of reference levels for financial dispatch data parameters?

A3: As per Section 2.1.3 of Market Manual 14.2, resources that have alternative cost profiles may request two reference level cost profiles for financial dispatch data parameters. The cost profile determined as the lower cost for the dispatch day will be used by the relevant calculation engines by default.

Q4: What supporting documents are required if a market participant submits the final Pre-Approved Real Time Generation Cost Guarantee (RT-GCG) Values (PAVs), as the dollar values for O&M cost component of the start-up offer reference levels?

A4: Market participants that have final approved PAVs for start-up costs can choose to submit these same dollar values for their pre-approved RT-GCG hot, warm and cold start-up costs as the O&M components of the hot, warm and cold start-up offer reference levels. If the market participants indicate to the IESO that they are using the final approved PAVs, they must submit the final approved PAV report as supporting documentation for that component of the start-up offer reference level.

For example, consider that the pre-approved dollar value for a hot start under the RT-GCG program is $5,000. If the market participant inserts $5,000 into the cell of the thermal RLRQ workbook that communicates the desired O&M component for the hot start-up offer reference level, and communicates to the IESO that this $5,000 O&M value is the final approved PAV in the reference level submission, the market participant is required to provide the final approved PAV report as supporting documentation for the requested start-up offer reference level submission. The IESO may request further information, as needed, to ensure that the reference level is appropriately set.

If a final approved PAV changes following the reference level submission and before MRP goes live, market participants are required to request an update to the O&M component of their start-up offer reference levels so they are consistent with the values in the updated final approved PAV report.

If market participants choose this option, O&M costs that are submitted for the energy offer reference levels and speed no-load offer reference levels will be reviewed to confirm that the same costs have not been included in more than one reference level for a financial dispatch data parameter.

This option is afforded in response to requests by market participants in order to determine reference levels in an efficient manner (i.e. reducing additional information burden, where reasonably possible). The IESO notes that the PAVs are prepared for specific use in the current RT-GCG program and that the RT-GCG program is a cost recovery program that differs in many significant ways from the approach to scheduling and settling NQS resources under the MRP. Among the many significant distinguishing features between the RT-GCG program and the commitment and settlement for NQS resources under MRP are the method of committing a resource, the revenue offset that is considered when determining any make-whole payment and the portion of costs considered to be eligible for recovery under RT-GCG program (i.e. the defined recoverable period). As such, a submitted PAV is still subject to review and validation by the IESO for its specific application within related to reference levels.

In allowing the use of information derived for the purposes of the RT-GCG program as part of submissions for the reference levels, the IESO is not indicating or agreeing that it has changed its view on costs eligible for recovery under the RT-GCG program or the established PAV(s), unless otherwise expressly stated in respect of those matters.

Q5: If a market participant has a final Pre-Approved RT-GCG Values (PAV) Report that shows the IESO's review of the validated costs submitted to support its final approved PAVs, can that final approved PAV Report be submitted as supporting documentation for a reference level submission?

A5: Market participants may submit the final approved PAV Report as supporting documentation for a reference level submission. If a market participant does so, it can submit the costs that were verified in that final approved PAV Report for O&M costs in the reference level submission. The final approved PAV Report can be used to identify the dollar value of eligible O&M costs that can be allocated by the market participant to an energy offer reference level, start-up offer reference level or speed no load offer reference level in accordance with section 6.3 of Market Manual 14.2.

For example, if the final approved PAV Report identifies $200 as a verified cost, then the market participant can include that line-item cost, with a value of $200, as the reference level submission, even if only a portion of the $200 verified cost is eligible under the RT-GCG program due to its specific cost recovery parameters in the applicable market rules. The market participant can allocate that $200 in accordance with section 6.3 of Market Manual 14.2 to either the energy offers reference level, start-up offer reference level or speed no load offer reference level. The market participant will provide the final approved PAV Report as supporting materials for that line-item cost and identify the page reference that shows that verified cost. The IESO may request further information, as needed, to ensure that the reference level is appropriately set.

If the final approved PAV Report is updated following the reference level submission and before MRP goes live, market participants are required to re-submit values consistent with the updated final approved PAV Report.

If market participants choose this option, O&M costs that do not rely on the final approved PAV Report that are submitted for reference levels for financial dispatch data parameters will be reviewed to confirm that the same costs have not been included in more than one reference level for a financial dispatch data parameter.

This option is afforded in response to requests by market participants, in order to determine reference levels in an efficient manner (i.e., reducing additional information burden, where reasonably possible). The IESO notes that the PAV Reports are prepared for specific use in the current RT-GCG program and that the RT-GCG program is a cost recovery program that differs in many significant ways from the approach to scheduling and settling NQS resources under the MRP. Among the many significant distinguishing features between the RT-GCG program and the commitment and settlement for NQS resources under MRP are the method of committing a resource, the revenue offset that is considered when determining any make-whole payment and the portion of costs considered to be eligible for recovery under RT-GCG program (i.e., the defined recoverable period). As such, a submitted PAV Report is still subject to review and validation by the IESO for its specific application within the CBRL framework.

In allowing the use of information derived for the purposes of the RT-GCG program as part of submissions for the reference levels, the IESO is not indicating or agreeing that it has changed its view on costs eligible for recovery under the RT-GCG program or the established PAV(s), unless otherwise expressly stated in respect of those matters.

Q6: How are the heat rate calculations used when determining the fuel cost component for energy offer reference levels?

A6: Market participants use the heat rate calculations in two ways: to determine the fuel consumption at each step of the energy offer reference level and to determine the performance factors that account for seasonal changes in the efficiency of the resource.

Q7: What break points on the heat rate curve do market participants set to determine the energy offer reference level?

A7: Market participants must provide data that describes heat rate at minimum loading point (MLP), baseload, and duct firing for resources that have duct firing capabilities that is used to support production at the highest output levels. For resources that do not have duct firing capability, or if they do not use the duct firing capability to support production at the highest output levels, market participants must provide data that describes the heat rate at MLP and baseload. Submitting data that shows at least two data points for heat rate shows whether the resource is more or less efficient when production increases and allows the IESO to identify whether the reference level should increase with production.

If a market participant used only a single data point, they could set their reference level based on the most inefficient heat rate, which could allow market participants to exercise market power by producing at a more efficient heat rate. Market participants are allowed to use additional data points, if appropriate. A data point is required for each step in the energy offer reference level, where each data point shows the heat input at that MW output.

Q8: What price should be used when submitting station service costs in the start-up offer reference level?

A8: The price used to determine the eligible cost of station service power will be as follows:
- Resources with PAVs can submit their pre-approved values for station service costs, along with the RT-GCG pre-approved value report as the supporting materials.
- Resources that have less than 12 months historical locational marginal price (LMP) on record can use Regulated Price Plan (RPP) which is commodity cost plus Global Adjustment (GA) + variance line item) to determine their station service price.
- Resources that have at least 12 months of historical LMPs available should use a combination of the following items to determine their station service price: LMP + GA (from RPP report) + variance line item (from RPP report).

For example, if a resource does not participate in the generation station service rebate program, then you may calculate station service rate as:

Commodity cost + GA + variance line item from the Regulated Price Plan Price Report
= 103.54 $/MWh

**Table ES-1: Average RPP Supply Cost Summary (for the period from November 1, 2021
through October 31, 2022)**

RPP Supply Cost Summary		
for the period from November 1, 2021 through October 31, 2022		$/MWh
Forecast Wholesale Electricity Price - Simple Average		$31.11
Load-Weighted Costs for RPP Consumers		
Wholesale Electricity Cost - RPP-Weighted		$33.75
Global Adjustment	+	$68.78
Adjustment to Clear Existing Variances	+	$0.01
Adjustment to Address Bias Towards Unfavourable Variance	+	$1.00
Average Supply Cost for RPP Consumers	=	**$103.54**

Source: Power Advisory

Q9: How are performance factor and speed no load fuel costs derived?

A9: The following text shows an illustrative example of how performance factor and speed no load
fuel costs can be derived:

Step 1: Developing a Heat Rate Curve

Each resource will develop a heat input curve that will be used as the basis for determining the
incremental heat consumption. The following figure provides an example of the heat input curve for a
gas turbine resource. In this example, the market participant has decided that the energy offer
reference level will have 3 output steps, one at each of the data points. The graph shows the total
heat input of the resource required for each hour of operation at each output step of the reference
level. The heat input curve will be used a basis to determine the energy offer reference level after
first determining the incremental heat rate curve and the performance factors.

The graph shows Heat Input (GJ) on the y-axis (0 to 1500) versus Output (MW) on the x-axis (0 to 160), with the equation $y = 0.0066x^2 + 5.0183x + 447.23$
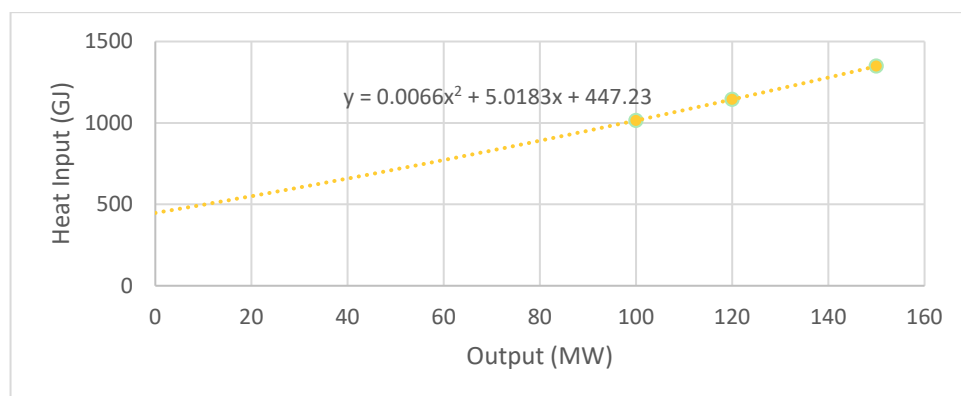
Figure 8: Heat Rate Curve for a Steam Turbine

Each data point from the curve can be determined by market participants based on either:

1.   Design heat input data provided by the Original Equipment Manufacturer (OEM)
2.   Data calculated by the heat balance models of the resource
3.   Measured data by the market participant under the same ambient conditions or corrected to the same set of ambient conditions using OEM-provided ambient correction curves.
       Note: The minimum amount of data to determine heat rate curve is 4 hours at a stable and consistent operation at the MW output that the market participant is representing.

In generating the heat rate curve, the market participant at a minimum must provide the heat input at MLP and base load. If applicable, duct firing capabilities must also be shown on the incremental heat rate curve with a step-wise change for incremental heat input. Each data point in the curve is meant to represent the heat input for the energy offer reference level that they wish to represent to reflect their incremental cost curve.

In the example illustrated in the above figure, a regression analysis would be conducted to determine the heat rate curve as follows:

$$\text{Heat input} = 0.066 * MW^2 + 5.0183 MW + 447.23$$

The heat rate curve is also used to calculate the theoretical fuel consumption for the determination of the performance factor.

Step 2: Calculating the Incremental Heat Rate Curve

Based on the calculated heat rate curve, the incremental heat rate curve can be determined based on heat rate curve determined as defined in section 7.1.4 of Market Manual 14.2.

$$\text{Incremental Heat Rate (GJ/MWh)} = \text{(Change in Fuel In)} / \text{(Change in Energy Out)}$$

$$= (dy/dx) \text{ Heat Rate Curve}$$

Based on the heat input curve determined in Step 1, the incremental heat rate curve will be calculated by determining the derivative function of the equation heat input curve:

$$\text{Incremental Heat Rate} = 0.0132 MW + 5.183$$

Step 3: Determining the Speed No Load Heat Consumption

The Speed No Load Heat consumption can be determined based on the heat rate curve as 447.23 GJ/hr. The speed no load heat consumption is only used for commitment decisions by the calculation engine. The speed no load dispatch data is one of the costs that the dispatch engine evaluates when deciding to commit an NQS resource. It does not represent a physical model of operation of the

resource – when an NQS resource is not committed and injecting, the speed no load cost does not impact scheduling or settlement.

The fuel cost component of the speed no load offer reference level is determined by the y-intercept from the results of the regression analysis developed in Step 1.

$$y = 0.0066x^2 + 5.0183x + 447.23$$
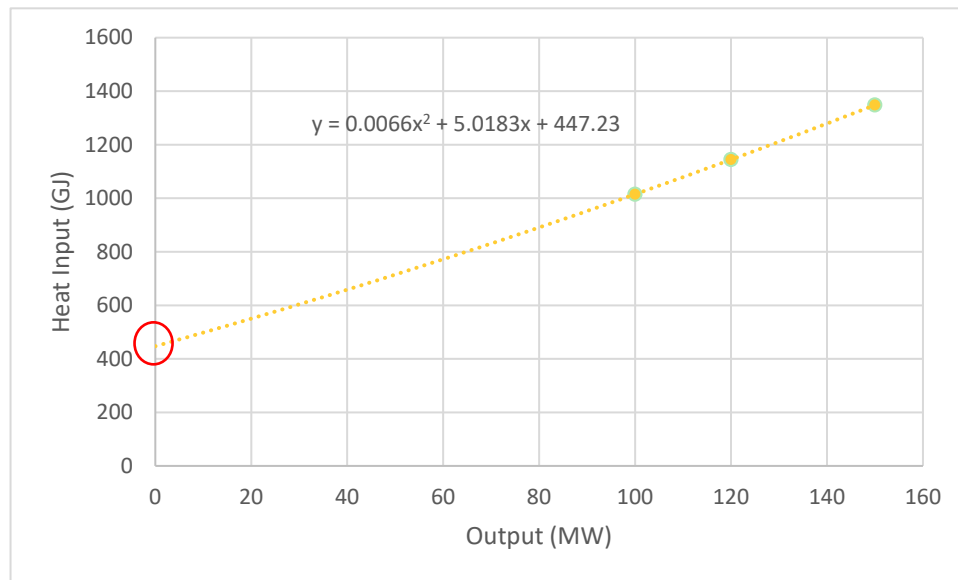
Figure 9: Regression Analysis Results of Heat Rate Curve

Step 4: Calculating the Performance Factor

The performance factor is used to adjust the fuel consumption amount to account for changes in ambient conditions and degradation. The market participant is to use the heat input curve determined in Step 1 and historic information to determine the appropriate performance factor that will be applied in the reference level.

The market participant will provide at least 5 years of historic data of actual fuel consumption and energy output for resource in 5 minute intervals. During each interval, the market participant will calculate a theoretical fuel consumption based on the heat input curve determined in step 1 for both summer and winter.

Table 1: Sample Performance Calculation for Winter Season

Date	Hour Ending	Interval	Quantity of Energy Injected (MWh)	Actual Fuel Consumption (GJ)	Calculated Theoretical Fuel Consumption (GJ)
01/01/2020	12	1	11	94	100
01/01/2020	12	2	11	96	100
01/01/2020	12	3	11	98	100

Date	Hour Ending	Interval	Quantity of Energy Injected (MWh)	Actual Fuel Consumption (GJ)	Calculated Theoretical Fuel Consumption (GJ)
01/01/2020	12	4	11	95	100
….					
Total				Sum of all periods	Sum of all periods

Table 2: Sample Performance Calculation for Summer Season

Date	Hour Ending	Interval	Quantity of Energy Injected (MWh)	Actual Fuel Consumption (GJ)	Calculated Theoretical Fuel Consumption (GJ)
06/01/2020	12	1	11	102	100
06/01/2020	12	2	11	101	100
06/01/2020	12	3	11	105	100
06/01/2020	12	4	11	103	100
…					
Total				Sum of all periods	Sum of all periods

The market participant will sum the actual fuel consumption and theoretical fuel consumption for each season. The ratio of actual fuel consumption to the theoretical fuel consumption will be used to determine the performance factor.

Q10: For resources at facilities that use the PSU modeling, is it necessary to determine reference levels for all possible configurations for the PSU resources?

A10: Pseudo unit resources that can operate in combined cycle mode are only required to establish reference levels for one configuration for combined cycle mode (i.e. 1x1, 2x1, etc.) and may choose the configuration to be used for their combined cycle energy offer reference level. In addition, PSU resources that have a bypass stack or can otherwise operate in single cycle mode, without the ST, need to establish a reference level for the single cycle mode in their1x0 configuration.

Q11: How will financial reference levels for variant C steam turbines that are modeled as standalone resources be determined?

A11: Variant C steam turbines that are modeled as standalone resources rather than as part of an aggregate of more than one type of turbine, will determine certain of their financial reference levels based on the reference levels of the combustion turbine resources at the relevant facility.

Under this approach, the relevant financial reference level for the steam turbine resource is the relevant reference level for a combustion turbine resource at the facility plus an adder. Market participants are free to select the combustion turbine resource at the facility to use in this process.

The adders that should be used for each financial reference level are as follows:

- Energy offer reference level adder = $0.10/MWh
- Start up offer reference level adder = $1/start
- Speed no load offer reference level adder = $1/hour

In other words, for the steam turbine:

- Speed-no-load reference level = Combustion turbine speed-no-load offer reference level + $1/hour
- Energy offer reference level = Combustion turbine energy offer reference level + $0.10/MWh
- Start-up Offer reference level = Combustion turbine start-up offer reference level + $1/hour

The energy offer reference level adder will be applied to the highest cost energy reference level lamination for the selected combustion turbine resource. The resulting energy reference level for the steam turbine shall apply to its entire output.

The following provides an illustrative example of how this could work in practice.

CT:

- Max capacity = 100 MW
- MLP = 20 MW

Table 3: CT Energy Offer Reference Level

Lamination	Start of MW range	End of MW range	Price
1	0	20	$40
2	20.1	100	$90

- CT Start up offer reference level (hot): $6000/start
- CT Start up offer reference level (warm): $8000/start
- CT Start up offer reference level (cold): $10000/start
- CT Speed no load offer reference level: $500/hour

ST:

- Max capacity = 260 MW

- MLP = 60 MW

Table 4: ST Energy Offer Reference Level

Lamination	Start of MW range	End of MW range	Price
1	0	260	$90.10

- ST Start up offer reference level (hot): $6,001/start
- ST Start up offer reference level (warm): $8,001/start
- ST Start up offer reference level (cold): $10,001/start
- ST Speed no load offer reference level: $501/hour

3.2.4.   Dispatchable Loads

Q1: Are market participants requesting an operating reserve offer reference level of $0/MWh for a dispatchable load resource required to submit supporting documentation?

A1: No, market participants requesting an operating reserve offer reference level of $0/MWh are not required to submit supporting documentation for their requested operating reserve offer reference level. However, market participants are required to provide written confirmation regarding the requested operating reserve offer reference levels of $0/MWh and are still required to set an operating reserve ramp rate reference level as per section 8.8 of Market Manual 14.2.

3.2.5.   Wind

[Intentionally left blank.]

3.2.6.   Solar

Q1: Market participants may wish to request significantly different reference levels in the future. Are market participants free to do so as they see fit?

A1: Market participants may request a change to their registered reference levels as per Section 3.3 of Market Manual 14.2. Registering a $0/MWh reference level does not restrict a market participant's ability to request a positive reference level in the future.

3.2.7.   Energy Storage

Q1: How can market participants account for degradation of the efficiency factor for energy storage as it changes over time?

A1: Market participants can request changes to reference levels to reflect changes to their efficiency factor over time. They can use the registration processes to update the efficiency factor as per Section 3.3 of Market Manual 14.2.

Q2: What are the requirements to establish energy offer reference levels for the load resource of the energy storage resource?

A2: The IESO does not test energy bids for mitigation and therefore, does not need to set reference levels for energy bids for the load resource of an energy storage resource.

Q3: What opportunity costs are included in an energy storage resource's reference level?

A3: The generator resource of a dispatchable energy storage resource is eligible to have the intraday opportunity cost included into its energy offer reference level. The intraday opportunity cost accounts for the opportunity cost of shifting production for a dispatch hour after day-ahead market schedules and prices are determined for resources that have limited ability to supply energy in a dispatch day. This opportunity cost captures the potential cost of two-settlement risks when the RTM schedule differs from the DAM schedule resulting in the resource being unable to fulfill its day-ahead schedule due to its limited availability of fuel.

Q4: Which reference levels for financial dispatch data parameters need to be determined for an energy storage resource that is registered as two individual resources: a dispatchable load and a dispatchable generator?

A4: The dispatchable generation resource will require an energy offer reference level and operating reserve offer reference levels for any class of operating reserve it is registered to provide.

The dispatchable load resource will require an operating reserve offer reference level only for the eligible class of operating reserve it is registered to provide.

If the resources are not eligible to provide operating reserve, then no operating reserve offer reference levels are required to be established.

Q5: How should the station service costs be used in calculation of the energy offer reference level if a resource does not have a separate meter for the station service costs?

A5: If the station services are supplied behind the meter (i.e., not separately metered), with a tap off the low voltage side of the step-up transformer, the effect of station services will be captured in the round-trip efficiency calculation. For more details, please refer to Section 7.6.1.2 of Market Manual 14.2: Reference Levels and Reference Quantities Procedures.

Q6: What approach should be used for a load resource of an energy storage resource that does not have sufficient locational marginal price (LMP) history to determine the resource's charging costs (Average Electricity Purchase Price) for calculating the energy offer reference level?

A6: For a load resource of an energy storage resource that does not have sufficient historical LMPs to complete the monthly Average Electricity Purchase Price calculation, the market participant may use whatever pricing it incurred (i.e., hourly Ontario energy price) for the historical study period. Once the load resource develops sufficient LMP history, the market participant may initiate a request with the IESO to update the reference levels it established. Alternatively, if the energy storage resource has been operating for less than one year or if there is no charging data for a particular calendar month in the historical study period, it is assumed the energy storage resource is charging overnight between 23:00 and 07:00 and the market participant shall create a mock charging profile to complete the monthly Average Electricity Purchase Price Calculation. This charging profile and associated calculations is required to be submitted to the IESO for review.

3.2.8.   Nuclear

[Intentionally left blank.]

4. Opportunity Costs

4.1. FAQs for Opportunity Costs

4.1.1.   General

Q1: How can a market participant demonstrate to the IESO that a resource is eligible for the intraday opportunity cost adder and/or the storage horizon opportunity cost?

A1: By default, dispatchable hydroelectric resources and electricity storage resources are eligible for the intraday opportunity cost. Dispatchable hydroelectric resources with a storage horizon greater than one day are eligible for the storage horizon opportunity cost as well. Any other dispatchable resource may demonstrate that it is energy-limited by submitting relevant supporting documentation for IESO review.

Q2: Does the intraday opportunity cost adder apply to the day-ahead market and real-time market energy offer reference levels?

A2: Energy-limited hydroelectric resources that submit a maximum daily energy limit that is less than the maximum capacity of the resource across the dispatch day will have the intraday opportunity cost applied to its energy offer reference level for the dispatch day. Generation resources of an energy storage resource are, by default, eligible to include the intraday opportunity cost into its energy offer reference level.

The intraday opportunity cost adder applies only to the real-time market energy offer reference level as it is intended to account for costs associated with two-settlement risk that do not exist in the day-ahead market.

Q3: For a resource that has additional opportunity costs not captured by any of IESO's currently published opportunity costs, how would a market participant request a new opportunity cost as a component of the reference levels?

A3: If a resource's operational characteristics are such that an additional opportunity cost related to material amounts of foregone energy or operating reserve revenues is incurred that is not already reasonably addressed by market design, a market participant may request an additional opportunity cost in the reference level submission for that resource. Refer to Section 6.4.1 of Market Manual 14.2 for more details on how to request an additional opportunity cost.

4.1.2.   Hydro

Q1: How does the IESO capture costs associated with a hydroelectric resource's lost output efficiency when the IESO dispatches a resource above its best efficiency point?

A1: Trade-offs of being dispatched above efficiency are addressed by the storage horizon opportunity cost calculations. Please refer to Section 6.4.4.3 of Market Manual 14.2: Reference Levels and Reference Quantities Procedures. The default value of 7% efficiency adjustment is used for the

Storage Horizon opportunity costs calculation. Any requests for use of a higher efficiency adjustment should be submitted to the IESO with relevant supporting documentation.

Q2: How do I request use of an established forebay refill opportunity cost for a particular dispatch day?

A2: Once the forebay refill opportunity cost is established for a resource, it is not automatically added for use in the energy market. To apply the forebay refill opportunity cost to the energy offer reference level value for a particular dispatch hour, the market participant will need to request use of the higher cost-profile prior to the day-ahead market or real-time market run and prior to the close of the respective dispatch data submission windows. For more information on temporary reference level change requests, refer to Section 5 of Market Manual 14.2: Reference Levels and Reference Quantities Procedures.

Q3: What are the differences between Option 1 and Option 2 of the storage horizon opportunity cost approach?

A3: Under Option 1, the base LMPs for the resource are determined based on the historical hourly LMPs at the resource from the previous year. Option 1 captures seasonal pricing trends that occur year-over-year. Option 2 determines the base LMPs for the resource based on the historical hourly LMPs at the resource from the 28 days prior to the calculation date. Refer to Section 6.4.4.3 of Market Manual 14.2: Reference Levels and Reference Quantities Procedures for details on the calculations.

Q4: How can a market participant change the election of Option 1 or Option 2 approach to base LMPs for the storage horizon opportunity cost calculations?

A4: A market participant is permitted to update the election for a resource's base LMPs no more than once every 365 days. The request to update the election must be made via the registration process to determine reference levels.

4.1.3.   Thermal

[Intentionally left blank.]

4.1.4.   Storage

[Intentionally left blank.]

5. Reference Levels for Non-Financial Dispatch Data Parameters

The following section describes the instructions for completing a submission to request reference levels for non-financial dispatch data parameters and relevant FAQs.

5.1. Instructions for Reference Levels for Non-Financial Dispatch Data Parameters

Reference levels for non-financial dispatch data parameters represent a resource's operating characteristics in a competitive environment. The IESO compares the market participants' submitted dispatch data values to the relevant reference level value to validate the submitted dispatch data.

Reference levels for non-financial dispatch data parameters describe operational characteristics that are measured in units that are not financial, such as hours (e.g., minimum generation block run-time, lead time) and MWs/min (e.g. ramp rates).

Reference levels for non-financial dispatch data parameters are registered on a seasonal basis. The summer period is from May 1st to October 31st and the winter period is from November 1st to April 30th of the following year. If a reference level does not vary according to season, market participants should register the same value for both seasons.

Market participants must complete the following steps to establish reference levels for non-financial dispatch data parameters and provide supporting documentation to the IESO:

- market participants must submit reference levels for non-financial dispatch data parameters using the RLRQ workbook spreadsheets prior to the MRP go-live date;

- supporting documentation for reference level values for non-financial dispatch data parameters must be attached and submitted along with the RLRQ workbook. Refer to Section 3.1.5 of this instructions document for more information on logging and attaching supporting documentation with the RLRQ workbook; and

- thermal resources are required to register reference levels for non-financial dispatch data parameter based on the registered characteristics associated with the resource. These differences are categorized through the classification of thermal resources into variants A, B, C and D. Refer to Section 8.2 of Market Manual 14.2: Reference Levels and Reference Quantities Procedures for more details.

5.1.1. Energy Ramp Rate Reference Level

Energy ramp rate reference levels are required for solar, wind, hydroelectric, energy storage, nuclear and thermal resources (variants A, B, C, and D).

This reference level contains up to five quantity-ramp rate sets. Each set includes the applicable MW quantity range, and ramp up and down rates (MW/min) for that MW quantity range. The ramp up

and ramp down rates are how the resource is expected to operate during normal operation across the MW quantity range – not the fastest ramp rate for this MW quantity range.

If a resource can have different ramp rates depending on some operational configuration – and this configuration is not modeled in the IESO dispatch engines, the reference level should be based on the slowest possible ramp rate for that MW quantity range.

Energy ramp rate reference levels are found in the **Non-finDispatchParameters** tab of the RLRQ workbook.

Market participants must update the value in the cell corresponding to the summer and winter value which is a positive number up to one decimal place. The MW Range columns are required to be filled in up to one decimal place for each set of ramp rate reference level values. A minimum of one quantity-ramp rate set must be established.

Figure 10 shows an example of a resource that has one energy ramp up rate reference level value and one energy ramp down rate reference level value (MW/min) for its entire MW range for the summer and winter seasons. Empty MW Ranges input means the applicable ramp rate applies to the entire generation capability of a resource.

#	Non-Financial Reference Level	Unit	Description	Start of MW Range	End of MW Range	Ramp Up Rate (Summer)	Ramp Up Rate (Winter)	Ramp Down Rate (Summer)	Ramp Up Down Rate (Winter)	Supporting Documentation
1	*Energy Ramp Rate*	MW/min	The energy ramp rate profile across the dispatchable range that the resource expects to meet during normal operation.			100	100	100	100	Example 100MW wind farm. Ramp-down is instantaneous. Values are for ramp-up. Winter is after units are warmed up.

Figure 10: Example of a resource with single energy ramp rate

Figure 11 shows an example of a 100 MW resource that has multiple energy ramp rate reference levels and corresponding MW ranges. The MW Range describes where the specified energy ramp rates will apply. The MW quantity values must increase monotonically. The maximum value for the MW Range must be equal to the maximum generating capability of the resource.

	A	B	C	D	E	F	G	H	I	J
1	#	Non-Financial Reference Level	Unit	Description	Start of MW Range	End of MW Range	Ramp Up Rate (Summer)	Ramp Up Rate (Winter)	Ramp Down Rate (Summer)	Ramp Up Down Rate (Winter)
2	1	*Energy Ramp Rate 1*	MW/min	The energy ramp rate profile across the dispatchable range that the resource expects to meet during normal operation.	0	50	20	20	20	20
3	2	*Energy Ramp Rate 2*	MW/min	The energy ramp rate profile across the dispatchable range that the resource expects to meet during normal operation.	50.1	100	25	25	25	25

Figure 11: Example of a resource with varying energy ramp rates

The energy ramp rate reference level must be accompanied by supporting documentation unless the following supporting documentation exemption applies: market participants requesting energy ramp rate reference levels that are at least 1/5 of the resource's maximum generating capacity are not required to submit supporting documentation.

5.1.2.   Operating Reserve Ramp Rate Reference Level

Operating reserve ramp rate reference levels are applicable for all resources that are eligible to participate in a class or classes of operating reserve through registration including: dispatchable loads, hydroelectric, and all variants of thermal and energy storage resources.

The operating reserve ramp rate reference level has one quantity-ramp rate set for the entire dispatchable range. This set is the ramp up and down rate (MW/min), during normal operation, at which a resource can increase or decrease its output upon the activation of operating reserve. The operating reserve ramp rate reference level is applicable to the three classes of operating reserve: 10-minute synchronized (10S), 10-minute non-synchronized (10N) and 30-minute synchronized (30R).

Operating reserve ramp rate reference levels are found in the **Non-finDispatchParameters** tab on the RLRQ workbook. Operating reserve ramp rate reference levels only contain a single value that covers the entire MW range of the resource for summer and another one for winter.

Market participants must update the value in the cell corresponding to the summer and winter value to a positive number with up to one decimal place.

Figure 12 shows the operating reserve ramp rate value is entered in the **Summer Value** and **Winter Value** columns.

A	B	C	D	E	F
#	Non-Financial Reference Level	Unit	Description	Summer Value	Winter Value
2	*Operating Reserve Ramp Rate*	MW/min	The rate that a resource can respond to an operating reserve activation during normal operation.	20	25

Figure 12: Example of operating reserve ramp rate value of a resource

The operating reserve ramp rate reference levels can be the same as the energy ramp rate reference levels and the market participant may provide the same supporting documentation to validate both reference levels. The market participant must provide the description in the **Supporting Documentation List** tab so the IESO reviewer is made aware that the same document supports the energy ramp rate reference level and the operating reserve ramp rate reference level.

A requested operating reserve ramp rate reference level shall be accompanied with supporting materials demonstrating the operating reserve ramp rate reference level for a dispatchable range. If a market participant requests a ramp rate reference level that is equal to or greater than 1/5th of the maximum resource capacity, then no supporting documentation is required. In addition, if the requested operating reserve ramp rate reference level value is the same as the energy ramp rate reference level value, then no additional supporting materials, beyond those provided to support the requested energy ramp rate reference level, are required.

5.1.3.   Lead Time Reference Level

Lead time reference levels are required for dispatchable NQS thermal resources (variant B resources, variant C resources, and variant D non-PSU resources). For NQS resources that are PSUs, each lead time reference level is equal to the lead time reference level of the CT from each PSU.

In the thermal RLRQ workbooks for variant B, C and D non-PSU thermal resources, the **Non-finDispatchParameters - CT** and **Non-finDispatchParameters - ST** tab shows the **Lead Time – Hot/Warm/Cold** parameter for the physical CT and ST. Market participants must update the value in the cell corresponding to the summer and winter value to a non-negative whole number less than or equal to 18 hours.

Supporting documentation are to be listed in the **Supporting Documentation List** tab of the RLRQ workbook and identified in the format described in Section 3.1.5.

Non-Financial Reference Level	Unit	Description	MW Quantity	Summer Value	Winter Value	Types of Supporting Documentation
Lead Time - Hot	Hours	The amount of time needed during normal operation for a NQS to start up and reach its MLP from an offline state if the thermal state of the unit is hot.	N/A	6	6	Manufacturer data from contract or performance test
Lead Time - Warm	Hours	The amount of time needed during normal operation for a NQS to start up and reach its MLP from an offline state if the thermal state of the unit is warm.	N/A	12	12	Manufacturer data from contract or performance test
Lead Time - Cold	Hours	The amount of time needed during normal operation for a NQS to start up and reach its MLP from an offline state if the thermal state of the unit is cold.	N/A	18	18	Manufacturer data from contract or performance test

Figure 13: Example of lead time reference value for a resource

Figure 13 shows an example of input values for a thermal resource in three states: hot, warm and cold. Lead time values are entered for both the summer and winter seasons.

5.1.4.   Minimum Loading Point Reference Level

A minimum loading point (MLP) reference level is required for dispatchable NQS thermal resources (variant B resources, variant C resources, and variant D non-PSU resources) as per Market Manual 14.2. MLP is the minimum MW output that a resource must maintain to remain stable without the support of ignition.

Supporting documentation must be listed in the **Supporting Documentation List** tab of the RLRQ workbook and identified in the format described in Section 3.1.5 of this instructions document.

In the thermal RLRQ workbook for variants B, C, and D, the **Non-finDispatchParameters - CT** and **Non-finDispatchParameters - ST**' tabs list the **Minimum Loading Point** reference level parameter for the physical CT and ST. Market participants must update the value in the cell corresponding to the summer and winter values, which must be non-negative numbers between 0.0 and the registered maximum active power capability and must not exceed one decimal place.

In the **Non-finDispatchParameters - ST**' tab, the market participant will also be required to create minimum loading point reference levels for all configurations for combined cycle mode (e.g. 1x1, 2x1, etc.).

Figure 14 shows that the requested values for MLP reference levels may be different for the summer and winter periods.

Non-Financial Reference Level	Unit	Description	MW Quantity	Summer Value	Winter Value	Types of Supporting Documentation
Minimum Loading Point	MW	The minimum MW output that a resource must maintain to remain stable without the support of ignition during normal operation.		33.8	39.4	Manufacturer data from contract or performance test

Figure 14: Example of minimum loading point reference level for a resource

5.1.5.   Minimum Generation Block Run Time Reference Level

A minimum generation block run-time (MGBRT) reference level is required for dispatchable NQS thermal resources (variant B resources, variant C resources, and variant D non-PSU resources), as per Market Manual 14.2. It represents the minimum number of consecutive hours a resource must be scheduled to its MLP, in accordance with the technical requirements of the resource.

In the thermal RLRQ workbook for variants B, C and D, the **Non-finDispatchParameters - CT** and **Non-finDispatchParameters - ST** tab lists the **Minimum Generation Block Run-Time** reference level parameter for the physical CT and ST. Market participants must update the value in the cell corresponding to the summer and winter values to a whole number that is greater than or equal to 0 and less than or equal to 24 hours (i.e. 0 =< MGBRT =< 24). Supporting documentation must be listed in the **Supporting Documentation List** tab of the RLRQ workbook and identified in the format described in Section 8.2.5 of Market Manual 14.2. If a registered **Minimum Generation Block Run Time** parameter already exists for this resource and the requested summer and winter MGBRT reference levels are equal to the registered value, market participants are not required to submit supporting documentation in support of the MGBRT reference level values.

Figure 15 shows that the MGBRT values are entered in these cells for the summer and winter period.

Non-Financial Reference Level	Unit	Description	Load Range	Summer Value	Winter Value
Minimum Generation Block Run Time	Hours	The minimum number of consecutive hours a generation unit must be scheduled to its MLP during normal operation.		5	5

Figure 15: Example of minimum generation block run time reference level for a resource

5.1.6.   Minimum Generation Block Down Time Reference Level

The minimum generation block down time (MGBDT) reference levels are required for dispatchable NQS thermal resources (variant B resources, variant C resources, and variant D non-PSU resources), as per Market Manual 14.2. MGBDT the time between when a resource was last at its MLP before de-synchronization and the time the resource can be scheduled back to its MLP after re-synchronizing for a given thermal state. Separate MGBDT reference levels are required for each thermal operating state: MGBDT (hot), MGBDT (warm) and MGBDT (cold).

Supporting documentation must be listed in the **Supporting Documentation List** tab of the RLRQ workbook and identified in the format described in Section 3.1.5 of this instructions document.

In the thermal combined cycle RLRQ workbook, the **Non-finDispatchParameters - CT** and **Non-finDispatchParameters - ST** tab lists the **Minimum Generation Block Down-Time Reference Level** parameter for the physical CT and ST. Market participants must update the value in the cell corresponding to the summer and winter values to a non-negative whole number less than or equal to 24 hours for MGBDT (hot), and less than or equal to 99 hours for MGBDT (warm) and MGBDT (cold). The MGBDT is a value that is equal to or greater than the lead time for an associated thermal state.

Figure 16 shows that minimum generation block down time requested values must be entered in these cells for the summer and winter periods.

#	Non-Financial Reference Level	Unit	Description	MW Quantity	Summer Value	Winter Value	Types of Supporting Documentation
17	*Minimum Generation Block Down Time (Hot)*	Hours	The minimum number of hours between the time when a generation unit was last at its MLP before de-synchronization and the time the generation unit can be scheduled back to its MLP after re-synchronizing during normal operation.	N/A	6	6	Relevant extract from the operating and maintenance manual for their resource that states the minimum time after shutdown when the resource can be restarted.
18	*Minimum Generation Block Down Time (Warm)*	Hours	The minimum number of hours between the time when a generation unit was last at its MLP before de-synchronization and the time the generation unit can be scheduled back to its MLP after re-synchronizing during normal operation.	N/A	10	10	Relevant extract from the operating and maintenance manual for their resource that states the minimum time after shutdown when the resource can be restarted.
19	*Minimum Generation Block Down Time (Cold)*	Hours	The minimum number of hours between the time when a generation unit was last at its MLP before de-synchronization and the time the generation unit can be scheduled back to its MLP after re-synchronizing during normal operation.	N/A	13	13	Relevant extract from the operating and maintenance manual for their resource that states the minimum time after shutdown when the resource can be restarted.

Figure 16: Example of minimum generation block down time for a resource

5.1.7.   Maximum Number of Starts per Day Reference Level

For dispatchable hydroelectric resources that intend to submit the maximum number of starts per day (MNSPD) dispatch data parameters, and for all dispatchable NQS thermal resources (variant B resources, variant C resources, and variant D non-PSU resources), a market participant must submit the maximum number of starts per day reference level and supporting documentation as per Market Manual 14.2. Maximum number of starts per day is an optional daily dispatch data parameter to reflect the number of times that the generation units that are modeled in a single resource can start up and shut down within a given dispatch day to avoid equipment failure. The day-ahead and pre-dispatch calculation engines will respect the maximum starts per day for each resource. During facility registration, the market participant will register the quantity of MWs that correspond to the start of one or more generation units in the resource. These registered MW quantities will be referred to as start indication values. When the resource is scheduled, the engine counts the number of starts that occur based on the number of times the resource schedule crosses a registered start indication value during the dispatch day. Submitted MNSPD (the daily dispatch data parameter) must be a positive whole number and as such, the MNSPD reference level must also be a positive number of starts per day. In the hydroelectric RLRQ workbook, the **Non-finDispatchParameters** tab lists the

Maximum Number of Starts Per Day reference level parameter for the resource. Market participants must update the value in the cell corresponding to the summer and winter reference level value to a positive whole number.

Figure 17 shows that the MNSPD requested values must be entered in these cells for the summer and winter periods.

Non-Financial Reference Level	Unit	Description	Summer Value	Winter Value
Maximum Number of Starts per Day	#	The maximum number of times a generation unit can be started within a dispatch day during normal operation.	1	1

Figure 17: Example of maximum number of starts per day for a resource

5.1.8.   Ramp Up Energy to Minimum Loading Point (Upper Bound) Reference Level

Ramp up energy to the MLP (upper bound) reference level is required for dispatchable NQS thermal resources (variant B resources, variant C resources, and variant D non-PSU resources), as per Market Manual 14.2. It is the maximum quantity of energy, in MWh, a resource is expected to produce in any single hour from the time of synchronization to the time it reaches its MLP during normal operation. Ramp up energy to MLP (upper bound) is required for the hot, warm and cold thermal operating states of the resource.

#	Non-Financial Reference Level	Unit	Description	MW Quantity	Summer Value	Winter Value	Types of Supporting Documentation
21	*Ramp Up Energy to MLP*						
	Ramp hours to MLP - Hot	Hours	The number of hours required for the resource to ramp from synchronization to its MLP during normal operation when the resource is in a hot thermal state.	N/A	1	1	Manufacturer data from contract or performance test
	Energy per ramp hour - Hot (Upper Bound)	MW	The upper bound average quantity of energy in MWh that the resource is expected to produce in each ramp hour during normal operation when the resource is in a hot thermal state.	N/A	60	60	Manufacturer data from contract or performance test
	Energy per ramp hour - Hot (Lower Bound)	MW	The lower bound average quantity of energy in MWh that the resource is expected to produce in each ramp hour during normal operation when the resource is in a hot thermal state.	N/A	55	55	Manufacturer data from contract or performance test

Figure 18: Example of ramp up energy to MLP (upper bound) reference level for a resource

In the thermal combined cycle RLRQ workbook, the **Non-finDispatchParameters - CT** and **Non-finDispatchParameters - ST** tabs show the **Ramp Up Energy to MLP Upper Bound** parameter for the CT and ST. Market participants must set the values in the cells corresponding to the summer and winter values for each thermal state up to one decimal place. Supporting documentation must be listed in the **Supporting Documentation List** tab of the RLRQ workbook and identified in the format described in Section 3.1.5 of this instructions document.

5.1.9.   Ramp Up Energy to Minimum Loading Point (Lower Bound) Reference Level

The ramp up energy to the MLP (lower bound) reference level is required for dispatchable NQS thermal resources (variant B resources, variant C resources, and variant D non-PSU resources), as per Market Manual 14.2. It is the minimum quantity of energy, in MWh, a resource is expected to produce in any single hour from the time of synchronization to the time it reaches its MLP during normal operation. Ramp up energy to MLP (lower bound) is required for the hot, warm and cold thermal operating states of the resource.

#	Non-Financial Reference Level	Unit	Description	MW Quantity	Summer Value	Winter Value	Types of Supporting Documentation
21	*Ramp Up Energy to MLP*						
	Ramp hours to MLP - Hot	Hours	The number of hours required for the resource to ramp from synchronization to its MLP during normal operation when the resource is in a hot thermal state.	N/A	1	1	Manufacturer data from contract or performance test
	Energy per ramp hour - Hot (Upper Bound)	MW	The upper bound average quantity of energy in MWh that the resource is expected to produce in each ramp hour during normal operation when the resource is in a hot thermal state.	N/A	60	60	Manufacturer data from contract or performance test
	Energy per ramp hour - Hot (Lower Bound)	MW	The lower bound average quantity of energy in MWh that the resource is expected to produce in each ramp hour during normal operation when the resource is in a hot thermal state.	N/A	55	55	Manufacturer data from contract or performance test

Figure 19: Example of ramp up energy to MLP (lower bound) reference level for a resource

In the thermal combined cycle workbook, the **Non-finDispatchParameters - CT** and **Non-finDispatchParameters - ST** tabs show the **Ramp Up Energy to Lower Bound** parameter for the CT and ST. Market participants must update the values in the cells corresponding to the summer and winter values up to one decimal place for each thermal state. Supporting documentation must be listed in the **Supporting Documentation List** tab of the RLRQ workbook and identified in the format described in Section 3.1.5.

5.1.10.   Ramp Hours to Minimum Loading Point Reference Level

The ramp hours to MLP reference level is required for dispatchable NQS thermal resources of (variant B resources, variant C resources, and variant D non-PSU resources), as per Market Manual 14.2. It is the number of hours required for the resource to ramp from synchronization to its MLP during normal operation. Ramp hours to MLP is required for the hot, warm and cold thermal operating states of the resource.

In the thermal combined cycle RLRQ workbook, the **Non-finDispatchParameters - CT** and **Non-finDispatchParameters - ST** tabs show the **Ramp Up Hours to MLP** parameter for the combustion and steam turbines. Market participants must update the value in the cell corresponding to the summer and winter value and the number of hours to ramp from synchronization to its MLP must be an integer between the values of 0 and 12 and be less than or equal to the number of hours for lead time reference level.

Supporting documentation must be listed in the **Supporting Documentation List** tab of the RLRQ workbook and identified in the format described in Section 3.1.5.

Figure 20 shows that the ramp hours to MLP and energy per ramp hour of each thermal state must be entered in these cells for the summer and winter periods.

#	Non-Financial Reference Level	Unit	Description	MW Quantity	Summer Value	Winter Value	Types of Supporting Documentation
21	Ramp Up Energy to MLP						
	Ramp hours to MLP - Hot	Hours	The number of hours required for the resource to ramp from synchronization to its MLP during normal operation when the resource is in a hot thermal state.	N/A	1	1	Manufacturer data from contract or performance test
	Energy per ramp hour - Hot (Upper Bound)	MW	The upper bound average quantity of energy in MWh that the resource is expected to produce in each ramp hour during normal operation when the resource is in a hot thermal state.	N/A	60	60	Manufacturer data from contract or performance test
	Energy per ramp hour - Hot (Lower Bound)	MW	The lower bound average quantity of energy in MWh that the resource is expected to produce in each ramp hour during normal operation when the resource is in a hot thermal state.	N/A	55	55	Manufacturer data from contract or performance test

Figure 20: Example of ramp up hours to MLP reference level for a resource

5.2. FAQs for Reference Levels for Non-Financial Dispatch Data Parameters

5.2.1. General

Q1: If the required supporting documentation is outdated or unavailable (e.g. original equipment manufacturers' manuals), what alternative supporting documentation may be submitted?

A1: As per Section 3.2 of Market Manual 14.2, in cases where the prescribed supporting documents are unavailable, market participants may request to submit alternative supporting documentation. The IESO will review the eligibility of the submitted supporting documentation on a case-by-case basis. Market participants are asked to submit clear and succinct information to aide in the IESO's assessment of the eligibility of alternative supporting documentation.

Q2: Are there any examples where no supporting documentation is required for energy ramp rate reference levels?

A2: Supporting documentation is not required to establish reference levels for non-financial dispatch data parameters where the requested value does not limit the resource to producing energy below its maximum generating capability for an interval. If the submitted energy ramp rate reference level value is greater than or equal to 1/5th of the maximum resource capacity, then supporting documents are not needed (see Section 8.1.1. of Market Manual 14.2). Supporting documentation is also not required to establish an energy ramp rate reference level where the requested value is equal to the resource's registered maximum offer ramp rate.

Q3: Are there any examples where no supporting documentation is required for operating reserve ramp rate reference levels?

A3: Supporting documentation is not required to establish reference levels for non-financial dispatch data parameters where the requested value does not limit the resource to supplying operating reserve below its maximum generating capability for an interval.

For a resource that is registered as being able to supply 10-minute operating reserve, if the submitted operating reserve ramp rate reference level value is greater than or equal to 1/10th of the maximum resource capacity, then supporting documents are not needed (see Section 8.1.2 of Market Manual 14.2).

For a resource that is registered as being able to supply only 30-minute operating reserve (but is not registered to provide 10-minute operating reserve), if the submitted operating reserve ramp rate reference level value is greater than or equal to 1/30th of the maximum resource capacity, then supporting documents are not needed (see Section 8.1.2 of Market Manual 14.2).

Supporting documentation is also not required to establish operating reserve ramp rate reference level where the requested value is equal to the resource's registered maximum bid ramp rate.

Q4: As some operating parameters vary across the day, do reference levels for non-financial dispatch data parameters vary across the day as well?

A4: Daily variations are captured by the conduct thresholds used in the mitigation of reference levels for non-financial dispatch data parameters. For more information of these conduct thresholds, please refer to the relevant appendix in Market Manual 14.1. Market participants can set seasonal (winter and summer) reference level values for non-financial dispatch data parameters and update these values via the registration process where the underlying operation capability of the resource changes over time.

Q5: For each technology, what site conditions (such as ambient temperature) will the IESO be using when reviewing the requested reference level for non-financial dispatch data parameter.?

A5: Market participants must submit their reference levels and communicate any underlying assumptions used to determine that value as part of the submission. This includes information, as applicable, about the site conditions contributing to requested reference level. The IESO will then use this information in reviewing the submission.

Q6: If the energy ramp rates at a resource can vary depending on ambient conditions, configuration of the resource or other relevant factors that are not inputs to the DSO, what ramp rates should be requested for that resource?

A6: For all MWs from 0 to the maximum capacity of the resource, market participants should request the slowest possible ramp rate that could apply, accounting for ambient conditions, configuration of the resource or other relevant factors that are not inputs to the DSO. For example, if a 100 MW resource can ramp in the following manner depending on ambient conditions, then the ramp rate reference levels should be requested as reflected in this table:

Table 5: Ramp Rate Capability and Reference Level

MW range	Ramp Capability (Under condition A)	Ramp Capability (Under condition B)	Ramp rate reference level that should be requested
0 – 50	2 MW/min	4 MW/min	2 MW/min
51 – 100	3 MW/min	3 MW/min	3 MW/min

Q7: Ramp rates are highly confidential and commercially sensitive. Can the IESO confirm it has the appropriate data handling and control procedures in place and provide information on them?

A7: The IESO maintains the confidentiality of information provided by market participants as required by the Market Rules. The IESO has strong procedures and measures in place to assure confidentiality of market participant information.

The IESO uses software designed for secure file transfer and storage to receive and store market participant information submitted during the process of determining reference levels and reference quantities. Supporting documents submitted to the IESO to determine reference levels and reference quantities are kept separate from the registered reference levels and access to the supporting documents is given only to employees with a business need for it (e.g., the market power mitigation team).

Q8: How can a market participant establish a maximum number of starts per day reference level for a resource?

A8: The maximum number of starts per day dispatch data parameter is an optional dispatch data parameter for use by market participants to indicate when there is a physical equipment limitation on the number of start-ups that the resource may be dispatched to in a day. It is intended to communicate that if the resource were to be dispatched beyond that point equipment failure would result. This reference level only needs to be established if the market participant wishes to have the capability to submit the maximum number of starts per day dispatch data parameter.

Supporting documentation to support a requested maximum number of starts per day reference level include:

- recommendations from OEM data along with relevant sections from the O&M manuals for the resource;
- equipment specification from procurement of equipment;
- design basis for the resource; or
- historical outage data showing forced outages at the resource that are caused by the resource not being able to start any more times during the dispatch day;

Q9: How will operating reserve ramp rate reference levels be established for a dispatchable resource?

A9: The operating reserve ramp rate reference levels will be set for all dispatchable resources that participate in the operating reserve market. The operating reserve ramp rate reference level will be set to the lowest energy ramp rate reference level of the resource for the entire dispatchable MW range.

5.2.2.   Hydro

[Intentionally left blank.]

5.2.3.   Thermal

Q1: What supporting documentation do market participants need to provide to support a minimum generation block run-time (MGBRT) reference level value?

A1: The documentation provided to support a MGBRT reference level should be consistent with the documentation that is submitted today to register the MGBRT of a resource. For more information, refer to Section 8.2.5 of Market Manual 14.2.

Q2: If a market participant wants to use its registered MLP or MGBRT as its MLP or MGBRT reference level, does it need to submit any additional supporting material?

A2: If a market participant already has a registered MLP or MGBRT and is satisfied with the same MLP or MGBRT reference value for winter and summer, it can request the same values for the relevant reference levels. For these reference levels, no additional supporting materials will be required.

Q3: Describe the thermal state transition points and how they impact dispatch data parameters and reference levels.

A3: For thermal resources variants B, C, and D, market participants are required to determine three thermal state transition points. Each of the transition points maps to potentially different dispatch data and corresponding reference levels.

The thermal state for the resource impacts a number of dispatch data parameters and reference levels, including lead time, minimum generation block down time (MGBDT), and start-up costs. For example, if the resource is in a hot thermal state, the IESO uses the lead time, MGBDT, and start-up cost for the hot thermal state.

Market participants must use the same transition points for following non-financial reference levels that involve thermals states:
o   Lead time
o   MGBDT
o   Ramp hours to MLP
o   Energy per ramp hour – Upper bound, lower bound

Table 6: Thermal State Transition Points

Thermal state transition point #1	Thermal state transition point #2	Thermal state transition point #3
This transition point represents the shortest time between a resource ramping below MLP and coming back to MLP.	This transition point determines the point at which a resource is no longer considered to be in a hot thermal state and starts to be considered in a warm Thermal state.	This transition point determines the point at which a resource is no longer considered to be in a warm thermal state and starts to be considered in a cold thermal state.

Thermal state transition point #1	Thermal state transition point #2	Thermal state transition point #3
This transition point is represented in the dispatch data as: • MGBDT – Hot • Lead time – Hot • Ramp hours to MLP – Hot • Energy per ramp hour (upper bound and lower bound) – Hot	This transition point is represented in the dispatch data as: • MGBDT – Warm • Lead time – Warm • Ramp hours to MLP – Warm • Energy per ramp hour (upper bound and lower bound) – Warm	This transition point is represented in the dispatch data as: • MGBDT – Cold • Lead time – Cold • Ramp hours to MLP – Cold • Energy per ramp hour (upper bound and lower bound) – Cold

Q4: What are the steps to determine MGBDT reference level for a resource?

A4: Market participants can refer to following steps when determine duration for MGBDT reference level:

Step 1: Determine the Temperatures

Determine the temperatures that define the hot, warm and cold starts as established by the OEM. Supporting documentation would include the O&M Manual for the Steam Turbine or HRSG.

For Example:

Hot Start: > 350°C

Warm Start: 150°C to 350°C

Cold Start: < 150°C

Step 2: Determine the Duration for each Start

Show how long it takes to reach the temperatures establishing each start type. Supporting data should include historical data showing the time elapsed and temperature of the Steam Turbine or heat recovery steam generator (HRSG) for each start type.

Notes:

• This involves calculating the total time from historical data based on temperature trend for the ST for each type of start (hot, warm and cold).
  o Historical data that shows the temperature for the HRSG or ST over time is sufficient.
• Ambient conditions around the ST would impact the duration it takes for the equipment to cool

    o   Average values for the times should be calculated based on season (summer or winter) and start type (hot, warm and cold).

Q5: How will operating reserve ramp rate reference levels be established for a thermal resource?

A5: Operating reserve ramp rate reference levels will be set for all dispatchable thermal resources that participate in operating reserve market, as follows:

- Variant A - The operating reserve ramp rate reference level for quick-start resources will be set to the lowest energy ramp rate reference level of the resource for the entire dispatchable MW range.
- Variants B, C, a- The operating reserve ramp rate reference level will be set to the lowest energy ramp rate reference level of the resource for the dispatchable MW range above the MLP reference level.
- Variant D (PSU) - The operating reserve ramp rate reference level for a PSU will be set to the lowest energy ramp rate reference level of the associated non-PSU resources for their dispatchable MW ranges above their MLP reference level.

Example 1: Establishing operating reserve ramp rate reference level for a non-quick start pseudo-unit resource (Variant D)

In this example:
- Resource A is the CT
- Resource B is the ST
- Resource C is the PSU

The following table shows the energy ramp rates for Resource A and Resource B, where the MLP reference level for Resource A is 100MW and the MLP reference level for Resource B is 75MW.
The operating reserve ramp rate reference level for Resource C can be determined by identifying the lowest ramp rate of the energy ramp rates for the physical units Resource A and Resource B for the dispatchable MW range above MLP.

Energy ramp rates above MLP are highlighted in orange, and the lowest ramp rate out of these is 4MW/min.

Therefore, the operating reserve ramp rate reference level for Resource C is 4MW/min.

	Resource A				Resource B			
Type of resource	Combustion Turbine				Steam Turbine			
MLP	100 MW				75 MW			
Energy Ramp rates	MW range (MW)	0-30	30-100	100-150 (MLP@100)	150-200	MW range (MW)	0-75	75-100 (MLP@75)	100-150
	Energy ramp rate reference level (MW/min)	10	5	20	4	Energy ramp rate reference level (MW/min)	10	5	20

5.2.4.   Dispatchable Loads

[Intentionally left blank.]

5.2.5.   Wind

Q1: Please confirm if screenshots of the operating software to show max/min ranges satisfy the supporting documentation requirements to establish ramp rate reference levels.

A1: Market participants should provide documentation that shows the minimum and maximum wind farm ramp rate configuration that can be set into the wind farm controller.

This documentation could be screenshots of the wind farm controller configuration page, product description, parameters descriptions, parameter range or statements from the wind farm control system manufacturer stating that it only is possible for the wind farm to ramp in a controlled manner between X and Y kW/s or kW/min or %/s or %/min, when external conditions permit, such as wind speed.

Screenshots will need to be supplemented with OEM manuals and/or other appropriate documentation that enables the IESO to understand the information provided in the screenshots. Market participants need to provide sufficient explanation of the link between the ramp rate reference levels requested and the maximum technical capability of the resource as extracted from the relevant documentation provided.

Q2: Many wind owners do not have official documentation to support their current ramp rates, how does the IESO plan to address this?

A2: The ramping limitation of the wind turbine is defined in the wind farm power controller that has minimum and maximum threshold. Settings on the controller should be set based on OEM

recommendations or other technical limitations that corresponds to the maximum theoretical technical capability. Where this documentation is not available, the market participant should notify the IESO of this during reference level consultations. The IESO will then work with the market participant to identify a suitable alternative given the specific information that is available in that case.

5.2.6.   Solar

[Intentionally left blank.]

5.2.7.   Storage

[Intentionally left blank.]

5.2.8.   Nuclear

[Intentionally left blank.]

6. Reference Quantities

The following section describes the instructions for completing a submission to request a variance from the default technology-specific methodology for determining reference quantities and FAQs regarding such requests.

6.1. Instructions for Reference Quantities

Section 9 of Market Manual 14.2 describes the default approach the IESO uses to determine reference quantities for resources of different generation technologies.

Market participants must provide information about a resource that the IESO requires to determine the reference quantity for the resource as per the default approach for that technology type provided in Section 9 of Market Manual 14.2.

For example, to determine the reference quantity for hydroelectric resources, the IESO uses the minimum head-based capability of the resource provided and supported by the market participant.

6.1.1. Additional Information Required to Calculate Reference Quantities According to the Default Methodology

The following sections describe the additional information for each technology type that market participants must submit to the IESO to determine energy reference quantities and operating reserve reference quantities according to the default methodology found in Section 9 of Market Manual 14.2.

Inputs required for the calculation of reference quantities may vary seasonally. Market participants must provide summer and winter values for parameters and inputs used in the determination of reference quantities where applicable.

Technology types with a description of 'no additional information is required' means that the IESO has no need for additional data to create reference quantities in accordance with the default methodology found in Section 9 of Market Manual 14.2.

Thermal

No additional information is required.

Hydroelectric

For energy reference quantities, market participants must indicate and provide documentation that shows the minimum head-based capability for each generation resource. This documentation is used by the IESO to verify the indicated numerical value of the maximum production for each resource when the head is at its minimum level. Market participants must provide the supporting documentation as an attachment to the RLRQ workbook. In the **Supporting Documentation List**

tab, indicate the title of the document and provide a description of what this documentation is, the requested value and what pages or sections the IESO can refer to find this value.

Hydroelectric operating reserve reference quantities are also equal to the minimum head-based capability approach discussed above.

Solar

No additional information is required.

Wind

No additional information is required.

Nuclear

No additional information is required.

Dispatchable Load

No additional information is required if the resource is eligible to provide operating reserve of a quantity equal to its full load reduction capacity. Market participants who are not able to provide their full load reduction capacity shall provide the IESO with an explanation of the limitations for the provision of operating reserve and the relevant supporting documentation that can be used to calculate a resource-specific reference quantity.

Market participants must provide the relevant supporting documentation as an attachment to the RLRQ workbook. In the **Supporting Documentation List** tab, the market participant must indicate the title of the document and provide a description of what this documentation is, the limitation value and what pages or sections the IESO can refer to find this value.

6.1.2.   Request to Vary the Default Methodology

If the default methodology for calculating reference quantity in Section 9 of Market Manual 14.2 does not account for the specific operational characteristics of a resource in a reasonably complete manner, market participants may submit requests for a request for reference quantity modifiers.

6.1.3.   Modifications to Reference Quantities

To update the reference quantity for a resource, the market participant initiates the Facility Registration request in accordance to Section 3.3 of Market Manual 14.2: Reference Levels and Reference Quantities Procedures. The IESO will allow market participants to request a reference quantity modifier. Market participants can request modifiers per calendar month to reflect the resource-specific limits. If the limit affects the resource year-round, the same modifier may be requested for 12 months of the year. Supporting documentation must be provided for IESO review and approval in support of the requested modifier(s).

6.2. FAQs for Reference Quantities

6.2.1. General

Q1: How will reference quantities be determined for a resource that has constraints where, at certain periods of the year, the energy and/or operating reserve capability is not at its maximum potential output?

A1: Market participants may request reference quantity modifiers to adjust the IESO's reference quantity approach to reflect relevant constraints on the resource.

Q2: Are reference quantities for day-ahead market the same reference quantities in real-time?

A2: Day-ahead market reference quantities are calculated based on current information available at the initiation of the day-ahead market engine. Real-time reference quantities are calculated after the dispatch day and account for real-time events which may have affected a resource's generating capability such as forced outages.

6.2.2. Hydro

Q1: Is the reference quantity representative of the maximum instantaneous capability of the resource at its lowest allowable head or is it the capability for a length of time?

A1: The minimum head-based capability is the maximum instantaneous capability of the resource at its lowest allowable head.

6.2.3. Thermal

[Intentionally left blank.]

6.2.4. Dispatchable Loads

[Intentionally left blank.]

6.2.5. Wind

[Intentionally left blank.]

6.2.6. Solar

[Intentionally left blank.]

6.2.7. Storage

[Intentionally left blank.]

6.2.8.   Nuclear
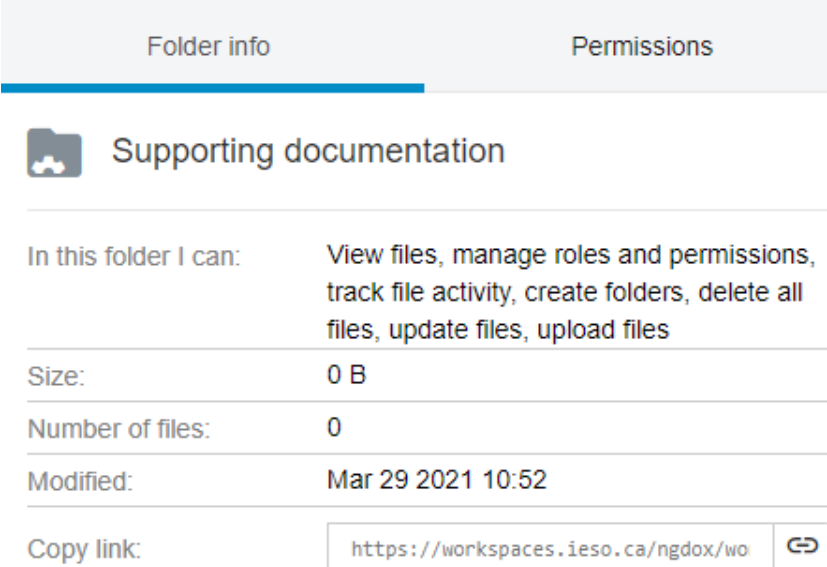
[Intentionally left blank.]

Appendix A: Overview of the Workspaces Process

To complete a reference level and reference quantity submission to the IESO, the market participant will be required to access the application using the IESO Gateway here: https://gateway.ieso.ca/. The IESO recommends the use of the Microsoft Edge or Google Chrome browser when using Workspace. If you do not have access to the IESO Gateway, email the Market Power Mitigation team for next steps.

Once your account is set up and you have access to the Workspace application in the IESO Gateway, the Market Power Mitigation team will provide you with access to the Reference Levels and Quantities Workspace.

When you are able to access the workspace for your organization, you will see that your role is listed as a Contributor. This means that you can upload documents to the relevant folders in the workspace. Please do not change the folder structure by adding or removing any folders.

Figure 21: Workspace info tab

The folder structure first lists the organization name and the next level lists the facilities and sub-folders. Market participants may upload a completed RLRQ workbook to the **Workbook** sub-folder and may also upload any relevant supporting documentation in the **Supporting Documentation** sub-folder. The **Supporting Documentation** folder separates out materials relevant to reference levels for financial dispatch data parameters and reference levels for non-financial dispatch data parameters in different sub-folders.

Figure 22: Shared Workspace folder structure

Click **Upload** inside the folder where you want to upload the documents. In the dialog box, select the required files, and then click **OK** to upload.

When you upload a document, please email the MPM team to let us know that the document has been uploaded.

For any questions related to gaining access to Workspace or uploading files, please contact IESO customer relations at IESOCustomerRelations@ieso.ca

Appendix A   Market Power Mitigation Thresholds

The following table shows all conduct thresholds for all relevant dispatch data for ex-ante and settlement mitigation. The conduct test is failed for the dispatch data as described below in the columns titled "Conduct Thresholds".

A.1. Thresholds for Validation of Non-Financial Dispatch Data

A.1.1. Conduct Thresholds

Table A-1: Conduct Thresholds for Non-Financial Dispatch Data

Dispatch Data	Conduct Threshold
Minimum Generation Block Run-Time (MGBRT)	Submitted MGBRT is higher than the MGBRT reference level times 2. OR Submitted MGBRT is higher than the MGBRT reference level plus 3 hours.
Minimum Generation Block Down Time (MGBDT) - HOT	Submitted MGBDT is higher than the MGBDT (hot) reference level times 2. OR Submitted MGBDT is higher than the MGBDT (hot) reference level plus 3 hours
Minimum Generation Block Down Time (MGBDT) - WARM	Submitted MGBDT is lower than the MGBDT (warm) reference level times 0.5. OR Submitted MGBDT is lower than the MGBDT (warm) reference level minus 3 hours
Minimum Generation Block Down Time (MGBDT) - COLD	Submitted MGBDT is lower than the MGBDT (cold) reference level times 0.5. OR Submitted MGBDT is lower than the MGBDT (cold) reference level minus 3 hours
Minimum Loading Point (MLP)	Submitted MLP is higher than the MLP reference level times 2.

Dispatch Data	Conduct Threshold
Energy Ramp Rate	The submitted energy ramp rate for any MW is lower than the energy ramp rate reference level times 0.5 for the corresponding MW.
Operating Reserve Ramp Rate	Submitted operating reserve ramp rate is lower than the operating reserve ramp rate reference level times 0.5.
Lead Time	Submitted lead time for a particular thermal state is higher than the lead time reference level for that thermal state times 2. OR Submitted lead time for a particular thermal state is higher than the lead time reference level for that thermal state plus 3 hours. OR The sum of all of the submitted lead times (hot, warm and cold) is higher than the sum of all lead time reference levels (hot, warm and cold) plus 6 hours.
Ramp Hours To MLP	Submitted ramp hours to MLP for a particular thermal state is higher than the ramp hours to MLP reference level for that thermal state times 2 OR Submitted ramp hours to MLP for a particular thermal state is higher than the ramp hours to MLP reference level for that thermal state plus 3 hours
Energy Per Ramp Hour	Submitted energy per ramp hour for any ramp hour for a particular thermal state is higher than the Energy Per Ramp Hour upper bound reference level for that thermal state times 1.5 OR Submitted energy per ramp hour for any ramp hour for a particular thermal state is higher than the energy Per Ramp Hour lower bound reference level for that thermal state times 0.5
Maximum Number Of Starts Per Day	Submitted maximum number of starts per day is lower than the maximum number of starts per day reference level times 0.5 OR Submitted maximum number of starts per day is lower than 1

A.2. Thresholds for Ex-Ante Mitigation for Economic Withholding

A.2.1. Energy

Conduct Thresholds

Energy offers less than or equal to $25/MWh are assumed to pass economic withholding tests as described in the tables below.

Narrow Constrained Area

Table A-2: Energy Conduct Thresholds for Narrow Constrained Area

Dispatch Data	Conduct Threshold
Energy Offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value times 1.5. OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.
Start-Up Offer	Submitted start-up offer is higher than the start-up offer reference level value times 1.25
Speed No-Load Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 1.25

Dynamic Constrained Area

Table A-3: Energy Conduct Thresholds for Dynamic Constrained Area

Dispatch Data	Conduct Threshold
Energy Offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value times 1.5. OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.
Start-Up Offer	Submitted start-up offer is higher than the start-up offer reference level value times 1.25
Speed No-Load Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 1.25

Broad Constrained Area

Table A-4: Energy Conduct Thresholds for Broad Constrained Area

Dispatch Data	Conduct Threshold
Energy Offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value times 4 OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $100/MWh.
Start-Up Offer	Submitted start-up offer is higher than the start-up offer reference level value times 2.
Speed No-Load Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 2.

Global Market Power (Energy)

Table A-5: Energy Conduct Thresholds for Global Market Power

Dispatch Data	Conduct Threshold
Energy Offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value times 4 OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $100/MWh.
Start-Up Offer	Submitted start-up offer is higher than the start-up offer reference level value times 2
Speed No-Load Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 2

Impact Thresholds

Narrow Constrained Area

Table A-6: Energy Impact Thresholds for Narrow Constrained Area

Dispatch Data	Impact Threshold
NCA Energy Offer	Energy LMP in the as-offered pricing algorithm of the relevant calculation engine is higher than the energy LMP from the reference level pricing algorithm times 1.5. OR Energy LMP in the as-offered pricing algorithm of the relevant calculation engine is higher than the energy LMP from the reference level pricing algorithm plus $25/MWh.

Dynamic Constrained Area

Table A-7: Energy Impact Thresholds for Dynamic Constrained Area

Dispatch Data	Impact Threshold
DCA Energy Offer	Energy LMP in the as-offered pricing algorithm of the relevant calculation engine is higher than the energy LMP from the reference level pricing algorithm times 1.5 OR Energy LMP in the as-offered pricing algorithm of the relevant calculation engine is higher than the energy LMP from the reference level pricing algorithm plus $25/MWh.

Broad Constrained Area

Table A-8: Energy Impact Thresholds for Broad Constrained Area

Dispatch Data	Impact Threshold
BCA Energy Offer	Energy LMP in the as-offered pricing algorithm of the relevant calculation engine is higher than the energy LMP from the reference level pricing algorithm times 2 OR Energy LMP in the as-offered pricing algorithm of the relevant calculation engine is higher than the energy LMP from the reference level pricing algorithm plus $50/MWh.

Global Market Power (Energy)

Table A-9: Energy Impact Thresholds for Global Market Power

Condition	Impact Threshold
Global (Energy)	Energy LMP at each of the Global Market Power Reference Interties in the as-offered pricing algorithm of the relevant calculation engine is higher than the energy LMP at the same Global Market Power Reference Intertie in the Reference Level Pricing Algorithm times 2 OR Energy LMP at each of the Global Market Power Reference Interties in the as-offered pricing algorithm of the relevant calculation engine is higher than the energy LMP at the same Global Market Power Reference Intertie in the Reference Level Pricing Algorithm plus $50/MWh.

A.2.2. Operating Reserve

Conduct Thresholds

Operating Reserve Offers less than or equal to $5/MW are assumed to pass economic withholding tests as described in the tables below.

Energy Offers less than or equal to $25/MWh are assumed to pass economic withholding tests as described in the tables below.

Local Market Power (Operating Reserve)

Table A-10: Operating Reserve Conduct Thresholds for Local Market Power

Dispatch Data	Conduct Threshold
Operating Reserve Offer	The price component of any MW in a submitted operating reserve offer is higher than the price component of the corresponding MW in the operating reserve reference level value times 1.1 OR Any submitted operating reserve offer price is higher than the operating reserve reference level value plus $25/MW.
Speed No-Load Offer	Submitted start-up offer is higher than the start-up offer reference level value times 1.1
Start-Up Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 1.1

Dispatch Data	Conduct Threshold
Energy Offers For The Range Of Production Up To MLP	Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value times 1.1 OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.

Global Market Power (Operating Reserve)

Table A-11: Operating Reserve Conduct Thresholds for Global Market Power

Dispatch Data	Conduct Threshold
Operating Reserve Offer	The price component of any MW in a submitted operating reserve offer is higher than the price component of the corresponding MW in the operating reserve reference level value times 1.5 OR Any submitted operating reserve offer price is higher than the operating reserve reference level value plus $25/MW.
Speed No-Load Offer	Submitted start-up offer is higher than the start-up offer reference level value times 1.25
Start-Up Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 1.25
Energy Offers For The Range Of Production Up To MLP	Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value times 1.5 OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.

Impact Thresholds

Local Market Power (Operating Reserve)

Table A-12: Operating Reserve Impact Thresholds for Local Market Power

Condition	Impact Threshold
Local (Operating Reserve)	Operating Reserve LMP in the as-offered pricing algorithm of the relevant calculation engine is higher than the Operating Reserve LMP from the reference level pricing algorithm

Global Market Power (Operating Reserve)

Table A-13: Operating Reserve Impact Thresholds for Global Market Power

Condition	Impact Threshold
Global (Operating Reserve)	Operating Reserve LMP in the as-offered pricing algorithm of the relevant calculation engine is higher than the Operating Reserve LMP from the reference level pricing algorithm times 1.5 OR Operating Reserve LMP in the as-offered pricing algorithm of the relevant calculation engine is higher than the Operating Reserve LMP from the reference level pricing algorithm plus $25/MW.

A.3. Thresholds for Settlement Mitigation for Economic Withholding

A.3.1. Energy

Conduct Thresholds

Energy Offers less than or equal to $25/MWh are assumed to pass economic withholding tests as described in the tables below.

Narrow Constrained Area

Table A-14: Energy Conduct Thresholds for Narrow Constrained Area

Dispatch Data	Conduct Threshold
Energy Offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value times 1.5. OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.
Start-Up Offer	Submitted start-up offer is higher than the start-up offer reference level value times 1.25.
Speed No-Load Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 1.25.

Dynamic Constrained Area

Table A-15: Energy Conduct Thresholds for Dynamic Constrained Area

Dispatch Data	Conduct Threshold
Energy Offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value times 1.5. OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.
Start-Up Offer	Submitted start-up offer is higher than the start-up offer reference level value times 1.25.
Speed No-Load Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 1.25.

Broad Constrained Area

Table A-16: Energy Conduct Thresholds for Broad Constrained Area

Dispatch Data	Conduct Threshold
Energy Offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value 4. OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $100/MWh.
Start-Up Offer	Submitted start-up offer is higher than the start-up offer reference level value times 2
Speed No-Load Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 2

Reliability Constraints

Table A-17: Energy Conduct Thresholds for Reliability Constraints

Dispatch Data	Conduct Threshold
Energy Offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value 1.1. OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.
Start-Up Offer	Submitted start-up offer is higher than the start-up offer reference level value times 1.1
Speed No-Load Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 1.1

Global Market Power (Energy)

Table A-18: Energy Conduct Thresholds for Global Market Power

Dispatch Data	Conduct Threshold
Energy Offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value 4. OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $100/MWh.
Start-Up Offer	Submitted start-up offer is higher than the start-up offer reference level value times 2
Speed No-Load Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 2

Impact Thresholds

Narrow Constrained Area

Table A-19: Energy Impact Thresholds for Narrow Constrained Area

Condition	Impact Threshold
NCAs and DCAs (Energy)	Make-whole payment based on the dispatch data used to set schedules and prices is higher than the make-whole payment based on reference level values for offers parameters which failed the conduct test times 1.1.

Dynamic Constrained Area

Table A-20: Energy Impact Thresholds for Dynamic Constrained Area

Condition	Impact Threshold
NCAs and DCAs (Energy)	Make-whole payment based on the dispatch data used to set schedules and prices is higher than the make-whole payment based on reference level values for offers parameters which failed the conduct test times 1.1.

Broad Constrained Area

Table A-21: Energy Impact Thresholds for Broad Constrained Area

Condition	Impact Threshold
BCAs (Energy)	Make-whole payment based on the dispatch data used to set schedules and prices is higher than the make-whole payment based on reference level values for offers parameters which failed the conduct test times 1.2.

Reliability Constraints

Table A-22: Energy Impact Thresholds for Reliability Constraints

Dispatch Data	Impact Threshold
Reliability Constraint	Make-whole payment based on the dispatch data used to set schedules and prices is higher than the make-whole payment based on reference level values for parameters which failed the conduct test.

Global Market Power (Energy)

Table A-23: Energy Impact Thresholds for Global Market Power

Condition	Impact Threshold
Global (Energy)	Make-whole payment based on the dispatch data used to set schedules and prices is higher than the make-whole payment based on reference level values for offers parameters which failed the conduct test times 1.2.

A.3.2. Operating Reserve

Conduct Thresholds

Operating Reserve Offers less than or equal to $5/MW are assumed to pass economic withholding tests as described in the tables below.

Energy Offers less than or equal to $25/MW are assumed to pass economic withholding tests as described in the tables below.

Local Market Power (Operating Reserve)

Table A-24: Operating Reserve Conduct Thresholds for Local Market Power

Dispatch Data	Conduct Threshold
Operating Reserve Offer	The price component of any MW in a submitted operating reserve offer is higher than the price component of the corresponding MW in the operating reserve reference level value times 1.1 OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.
Speed No-Load Offer	Submitted start-up offer is higher than the start-up offer reference level value times 1.1.
Start-Up Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 1.1.
Energy Offers For The Range Of Production Up To MLP	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value 1.1. OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.

Global Market Power (Operating Reserve)

Table A-25: Operating Reserve Conduct Thresholds for Global Market Power

Dispatch Data	Conduct Threshold
Operating Reserve Offer	The price component of any MW in a submitted operating reserve offer is higher than the price component of the corresponding MW in the operating reserve reference level value times 1.5. OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.
Speed No-Load Offer	Submitted start-up offer is higher than the start-up offer reference level value times 1.25.
Start-Up Offer	Submitted speed-no-load offer is higher than the speed-no-load offer reference level value times 1.25.
Energy Offers For The Range Of Production Up To MLP	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy reference level value 1.5. OR Any submitted energy offer price is higher than the price of the corresponding MW in the energy reference level value plus $25/MWh.

Impact Thresholds

Local Market Power (Operating Reserve)

Table A-26: Operating Reserve Impact Thresholds for Local Market Power

Dispatch Data	Impact Threshold
Local (Operating Reserve)	Make-whole payment based on the dispatch data used to set schedules and prices is higher than the make-whole payment based on reference level values for parameters which failed the conduct test.

Global Market Power (Operating Reserve)

Table A-27: Operating Reserve Impact Thresholds for Global Market Power

Condition	Impact Threshold
Global (Operating Reserve)	Make-whole payment based on the dispatch data used to set schedules and prices is higher than the make-whole payment based on reference level values for offers parameters which failed the conduct test times 1.1.

A.4. Thresholds for Ex-Post Mitigation for Physical Withholding

A.4.1. Energy

Conduct Thresholds

For resources with Energy Offers less than or equal to $25/MWh and has an installed capacity less than 10 MW are assumed to pass physical withholding tests as described in the tables below.

Individual Resource Thresholds

Narrow Constrained Area

<div align="center">

Table A-28: Energy Conduct Thresholds for Narrow Constrained Areas

</div>

Dispatch Data	Conduct Threshold
Energy Offer	The maximum quantity of the submitted energy offer is lower than the energy reference quantity value times 0.98. OR The maximum quantity of the submitted energy offer is lower than the energy reference quantity value minus 5 MW.

Dynamic Constrained Area

<div align="center">

Table A-29: Energy Conduct Thresholds for Dynamic Constrained Areas

</div>

Dispatch Data	Conduct Threshold
Energy Offer	The maximum quantity of the submitted energy offer is lower than the energy reference quantity value times 0.98. OR The maximum quantity of the submitted energy offer is lower than the energy reference quantity value minus 5 MW.

Broad Constrained Area

<div align="center">

Table A-30: Energy Conduct Thresholds for Broad Constrained Areas

</div>

Dispatch Data	Conduct Threshold
Energy Offer	The maximum quantity of the submitted energy offer is lower than the energy reference quantity value times 0.9. OR

Dispatch Data	Conduct Threshold
	The maximum quantity of the submitted energy offer is lower than the energy reference quantity value minus 100 MW.

Global Market Power (Energy)

Table A-31: Energy Conduct Thresholds for Global Market Power

Dispatch Data	Conduct Threshold
Energy Offer	The maximum quantity of the submitted energy offer is lower than the energy reference quantity value times 0.9. OR The maximum quantity of the submitted energy offer is lower than the energy reference quantity value minus 100 MW.

Market Control Entity Conduct Thresholds

Resources with energy offers less than or equal to $25/MWh and whose market control entity for physical withholding has an aggregate installed capacity of less than 10 MWs for all of its resources are assumed to pass physical withholding tests as described in Table X.X. The following resources will be excluded from the market control entity for physical withholding tests described in Table X.X:

- resources that offer at least their corresponding reference quantity value; and
- resources that pass the individual resource-level conduct test.

Narrow Constrained Area

Table A-32: Energy Conduct Thresholds for Narrow Constrained Area

Dispatch Data	Conduct Threshold
Energy offers	The sum of the maximum quantity of the submitted energy offers for at least two resources that share the same market control entity for physical withholding is lower than the sum of the energy reference quantity values minus 5 MW.

Dynamic Constrained Area

Table A-33: Energy Conduct Thresholds for Dynamic Constrained Area

Dispatch Data	Conduct Threshold
Energy offers	The sum of the maximum quantity of the submitted energy offers for at least two resources that share the same market control entity for physical withholding is lower than the sum of the energy reference quantity values minus 5 MW.

Broad Constrained Area

Table A-34: Energy Conduct Thresholds for Broad Constrained Area

Dispatch Data	Conduct Threshold
Energy offers	The sum of the maximum quantity of the submitted energy offers for at least two resources that share the same market control entity for physical withholding is lower than the sum of the energy reference quantity values times 0.95. OR The sum of the maximum quantity of the submitted energy offers for at least two resources that share the same market control entity for physical withholding is lower than the sum of the energy reference quantity values minus 200 MW.

Global Market Power (Energy)

Table A-35: Energy Conduct Thresholds for Global Market Power

Dispatch Data	Conduct Threshold
Energy offers	The sum of the maximum quantity of the submitted energy offers for at least two resources that share the same market control entity for physical withholding is lower than the sum of the energy reference quantity values times 0.95. OR The sum of the maximum quantity of the submitted energy offers for at least two resources that share the same market control entity for physical withholding is lower than the sum of the energy reference quantity values minus 200 MW.

Impact Thresholds

Narrow Constrained Area

Table A-36: Energy Impact Thresholds for Narrow Constrained Area

Dispatch Data	Impact Threshold
NCA Energy Offer	Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP times 1.5. OR Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP plus $25/MWh.

Dynamic Constrained Area

Table A-37: Energy Impact Thresholds for Dynamic Constrained Area

Dispatch Data	Impact Threshold
DCA Energy Offer	Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP times 1.5. OR Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP plus $25/MWh.

Broad Constrained Area

Table A-38: Energy Impact Thresholds for Broad Constrained Area

Dispatch Data	Impact Threshold
BCA Energy Offer	Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP times 2. OR Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP plus $50/MWh.

Global Market Power (Energy)

Table A-39: Energy Impact Thresholds for Global Market Power

Condition	Impact Threshold
Global (Energy) Energy Offers	Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP times 2. OR Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP plus $50/MWh.

Narrow Constrained Area

Table A-40: Energy Impact Thresholds for Narrow Constrained Areas

Dispatch Data	Impact Threshold
NCA energy offers	Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP times 1.5. OR Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP plus $25/MWh.

Dynamic Constrained Area

Table A-41: Energy Impact Thresholds for Dynamic Constrained Areas

Dispatch Data	Impact Threshold
DCA energy offers	Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP times 1.5. OR Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP plus $25/MWh.

Broad Constrained Area

Table A-42: Energy Impact Thresholds for Broad Constrained Areas

Dispatch Data	Impact Threshold
BCA energy offers	Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP times 2. OR Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP plus $50/MWh.

Global Market Power (Energy)

Table A-43: Energy Impact Thresholds for Global Market Power

Condition	Impact Threshold
Global (Energy) energy offers	Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP times 2. OR Simulated as-offered energy LMP is higher than the simulated reference quantity energy LMP plus $50/MWh.

A.4.2. Operating Reserve

Conduct Thresholds

Individual Resource Conduct Thresholds

For resources with Operating Reserve Offers less than or equal to $5/MWh and has an installed capacity less than 10 MW are assumed to pass physical withholding tests as described in the tables below.

Local Market Power (Operating Reserve)

Table A-44: Operating Reserve Conduct Thresholds for Local Market Power

Dispatch Data	Conduct Threshold
Operating Reserve Offer	The maximum quantity of the submitted operating reserve offer is lower than the operating reserve reference quantity value times 0.98. OR The maximum quantity of the submitted operating reserve offer is lower the operating reserve reference quantity value minus 5 MW.

Global Market Power (Operating Reserve)

Table A-45: Operating Reserve Conduct Thresholds for Global Market Power

Dispatch Data	Conduct Threshold
Operating Reserve Offer	The maximum quantity of the submitted operating reserve offer is lower than the operating reserve reference quantity value times 0.9. OR The maximum quantity of the submitted operating reserve offer is lower than the operating reserve reference quantity value minus 100 MW.

Market Control Entity Conduct Thresholds

For resources with Operating Reserve Offers less than or equal to $5/MWh and the market control entity for physical withholding for the resource has an aggregate installed capacity less than 10 MWs for all of its resources are assumed to pass physical withholding tests as described in the tables below.

Resources that offer at least their corresponding reference quantity value will be excluded from the market control entity for physical withholding tests described in the table below.

Resources that pass the individual resource level conduct test will be excluded from the market control entity for physical withholding tests described in the table below.

Local Market Power (Operating Reserve)

<div align="center">

Table A-46: Operating Reserve Conduct Thresholds for Local Market Power

</div>

Dispatch Data	Conduct Threshold
Operating Reserve offer	The sum of the maximum quantity of the submitted operating reserve offers for at least two resources that share the same market control entity for physical withholding is lower than the sum of the operating reserve reference quantity values minus 5 MW.

Global Market Power (Operating Reserve)

<div align="center">

Table A-47: Operating Reserve Conduct Thresholds for Global Market Power

</div>

Dispatch Data	Conduct Threshold
Operating Reserve offer	The sum of the maximum quantity of the submitted operating reserve offers for at least two resources that share the same market control entity for physical withholding is lower than the sum of the operating reserve reference quantity values times 0.95. OR The sum of the maximum quantity of the submitted operating reserve offers for at least two resources that share the same market control entity for physical withholding is lower than the sum of the operating reserve reference quantity values minus 200 MW.

Impact Thresholds – Individual Resource

Local Market Power (Operating Reserve)

<div align="center">

Table A-48: Operating Reserve Impact Thresholds for Local Market Power

</div>

Dispatch Data	Impact Threshold
Local Market Power Operating Reserve Offer	Simulated as-offered operating reserve LMP is higher than the simulated reference quantity operating reserve LMP

Global Market Power (Operating Reserve)

<div align="center">

Table A-49: Operating Reserve Impact Thresholds for Global Market Power

</div>

Dispatch Data	Impact Threshold
Global Market Power Operating Reserve Offer	Simulated as-offered operating reserve LMP is higher than the simulated reference quantity operating reserve LMP times 1.5. OR

Dispatch Data	Impact Threshold
	Simulated as-offered operating reserve LMP is higher than the simulated reference quantity operating reserve LMP plus $25/MWh.

Local Market Power (Operating Reserve)

Table A-50: Operating Reserve Impact Thresholds for Local Market Power

Dispatch Data	Impact Threshold
NCA Operating Reserve offer	Simulated as-offered operating reserve LMP is higher than the simulated reference quantity operating reserve LMP

Global Market Power (Operating Reserve)

Table A-51: Operating Reserve Impact Thresholds for Global Market Power

Dispatch Data	Impact Threshold
DCA Operating Reserve offer	Simulated as-offered operating reserve LMP is higher than the simulated reference quantity operating reserve LMP times 1.5. OR Simulated as-offered operating reserve LMP is higher than the simulated reference quantity operating reserve LMP plus $25/MWh.

A.5. Thresholds for Ex-Post Mitigation for Intertie Economic Withholding

A.5.1. Energy

Conduct Thresholds

Energy Offers less than or equal to $25/MWh are assumed to pass the intertie economic withholding test as described in the tables below.

Uncompetitive Intertie Zone (UIZ)

Table A-52: Energy Conduct Thresholds for Uncompetitive Intertie Zone

Dispatch Data	Conduct Threshold
Energy offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy offer intertie reference level level value times 4. OR

Dispatch Data	Conduct Threshold
	Any submitted energy offer price is higher than the price of the corresponding MW in the energy offer intertie reference level value plus $100/MWh.
Energy bid	The price component of any MW in a submitted energy bid is higher than the price component of the corresponding MW in the energy bid intertie reference level level value times 4.

OR

Any submitted energy bid price is higher than the price of the corresponding MW in the energy bid intertie reference level value plus $100/MWh. |

Impact Thresholds

Uncompetitive Intertie Zone

Table A-53: Energy Impact Thresholds for Uncompetitive Intertie Zone

Dispatch Data	Impact Threshold
UIZ energy offer	Simulated as-offered energy LMP is higher than the simulated intertie reference level energy LMP times 2.

OR

Simulated as-offered energy LMP is higher than the simulated intertie reference level energy LMP plus $50/MWh. |
| UIZ energy bid | Simulated as-offered energy LMP is higher than the simulated intertie reference level energy LMP times 2.

OR

Simulated as-offered energy LMP is higher than the simulated intertie reference level energy LMP plus $50/MWh. |

A.5.2. Operating Reserve

Conduct Thresholds

Operating Reserve Offers less than or equal to $5/MWh are assumed to pass the intertie economic withholding test as described in the tables below.

Uncompetitive Intertie Zone (UIZ)

<p align="center">Table A-54: Operating Reserve Conduct Thresholds for Uncompetitive Intertie Zone</p>

Dispatch Data	Conduct Threshold
Operating reserve offer	The price component of any MW in a submitted operating reserve offer is higher than the price component of the corresponding MW in the operating reserve offer intertie reference level level value times 1.5. OR Any submitted operating reserve offer price is higher than the price of the corresponding MW in the operating reserve offer intertie reference level value plus $25/MWh.

Impact Thresholds

Uncompetitive Intertie Zone

<p align="center">Table A-55: Operating Reserve Impact Thresholds for Uncompetitive Intertie Zone</p>

Dispatch Data	Impact Threshold
UIZ operating reserve offer	Simulated as-offered operating reserve LMP is higher than the simulated intertie reference level operating reserve LMP times 1.5. OR Simulated as-offered operating reserve LMP is higher than the simulated intertie reference level operating reserve LMP plus $25/MWh.

A.5.3. Make-Whole Payment

Conduct Thresholds

Energy Offers less than or equal to $25/MWh are assumed to pass the intertie economic withholding test as described in the tables below.

Operating Reserve Offers less than or equal to $5/MWh are assumed to pass the intertie economic withholding test as described in the tables below.

Uncompetitive Intertie Zone (UIZ)

<p align="center">Table A-56: Make-Whole Payment Conduct Thresholds</p>

Dispatch Data	Conduct Threshold
Energy offer	The price component of any MW in a submitted energy offer is higher than the price component of the corresponding MW in the energy offer intertie reference level level value times 4. OR

Dispatch Data	Conduct Threshold
	Any submitted energy offer price is higher than the price of the corresponding MW in the energy offer intertie reference level value plus $100/MWh.
Operating Reserve Offer	The price component of any MW in a submitted operating reserve offer is higher than the price component of the corresponding MW in the operating reserve offer intertie reference level level value times 1.5. OR Any submitted operating reserve offer price is higher than the price of the corresponding MW in the operating reserve offer intertie reference level value plus $25/MWh.

Impact Thresholds

Uncompetitive Intertie Zone

Table A-57: Make-Whole Payment Impact Thresholds

Dispatch Data	Conduct Threshold

Dispatch Data	Impact Threshold
Make-Whole Payment	The make-whole payment based on the dispatch data used in the relevant calculation engine is more is higher than the make-whole payment based on the intertie reference level values for offer parameters that failed the conduct test times 1.1.

A.6. – Impact Test Simulation Examples

A.6.1. Simulated Reference Quantity Locational Marginal Price

Example: Combined offer-reference level curve that does not violate price monotonicity

The following example illustrates this scenario for a hypothetical 100 MW thermal resource. The submitted energy offer and the reference level values for this resource are also shown below. The resource's submitted offer's maximum quantity is 50 MW and the maximum quantity in its reference level values is equal to its reference quantity value of 100 MW. The combined offer-reference level curve prices the MWs beyond the submitted maximum quantity of 50 MWs at the corresponding reference level value of $80, which is greater than the price of the submitted offer's maximum price of $70. Pricing the remaining MWs at $80 preserves price monotonicity in the combined offer-reference level curve.

Table A-58: Submitted Offer Curve

PQ pair number	Price	Quantity
1	50	0
2	50	20
3	70	50

Table A-59: Reference Level Curve

PQ pair number	Price	Quantity
1	50	0
2	50	20
3	80	100

Table A-60: Combined Offer-Reference Level Curve

PQ pair number	Price	Quantity
1	50	0
2	50	20
3	70	50

PQ pair number	Price	Quantity
4	80	100

The following example illustrates this scenario for a hypothetical 100 MW thermal resource.

Example: Combined offer-reference level curve that would otherwise violate price monotonicity

The submitted energy offer and the reference level values for this resource are shown below. The resource submitted a maximum energy offer quantity of 50 MW. The reference quantity value of the resource is 100 MW.

Table A-61: Offer Curve

PQ pair number	Price	Quantity
1	60	0
2	60	20
3	70	30
4	90	50

Table A-62: Reference Level Curve

PQ pair number	Price	Quantity
1	50	0
2	50	20
3	60	60
4	100	80
5	110	100

For reference level curve tranches where the above approach to create the combined offer-reference level curve would otherwise violate price monotonicity, the IESO will replace the relevant tranche of the reference level curve with the maximum offer price from the energy offer.

As the price from the reference level curve for MWs 61 – 100 is above the maximum energy offer price, the reference level prices for those MWs are used. In this example, the IESO replaces the $60 reference level curve price for MWs 51 – 60 with the maximum offer price from the submitted energy offer, $90. This results in a combined offer-reference level curve that is equal to the submitted offer for MWs 0 – 50, equal to the maximum submitted energy offer price for MWs 51 – 60 and equal to the reference level curve prices for MWs from 61 – 100.

Table A-63: Combined Offer-Reference Level Curve

PQ pair number	Price	Quantity
1	60	0
2	60	20
3	70	30
4	90	60
5	100	80
6	110	100

Example 1: Two resources (GEN A and GEN B) met the BCA condition and failed a conduct test for physical withholding in a dispatch hour, but do not share a market control entity for physical withholding. The IESO will determine a simulated reference quantity locational marginal price for GEN A and GEN B in two separate simulations as shown in the table below.

Table A-64: Simulated Reference Quantity LMPs – Example 1

Resource Name	MCE PW	Constrained Area Condition	Constrained Area	Simulation Number
GEN A	MCE 1	BCA	N/A	1
GEN B	MCE 2	BCA	N/A	2

Example 2: Three resources (GEN A, GEN B, and GEN C) met the BCA condition and failed a conduct test for physical withholding in a dispatch hour. GEN A's market control entity for physical withholding is MCE PW 1, whereas GEN B and GEN C share MCE PW 2 as their market control entity for physical withholding. The IESO will determine a simulated reference quantity locational marginal price for GEN A in one simulation and for GEN B and GEN C simultaneously in another simulation as shown in the table below.

Table A-65: Simulated Reference Quantity LMPs – Example 2

Resource Name	MCE PW	Constrained Area Condition	Constrained Area	Simulation Number
GEN A	MCE 1	BCA	N/A	1
GEN B	MCE 2	BCA	N/A	2
GEN C	MCE 2	BCA	N/A	2

Grouping by Constrained Area for DCA, NCA and Local Market Power Operating Reserve

The following examples illustrate the methodology that the IESO will use to group resources for simulations to assess physical withholding:

Example 3: Four resources (GEN A, GEN B, GEN C, and GEN D) met the NCA condition in the same NCA and failed a conduct test for physical withholding in a dispatch hour. GEN A and GEN B share a market control entity for physical withholding (MCE 1). GEN C and GEN D share a different market control entity for physical withholding (MCE 2).

The simulated reference quantity locational marginal prices will be determined for NCA 1 using two different simulations with GEN A and GEN B in one simulation and GEN B and GEN C in another simulation, as shown in the table below.

Table A-66: Simulated Reference Quantity LMPs – Example 3

Resource Name	MCE PW	Constrained Area Condition	Constrained Area	Simulation Number
GEN A	MCE 1	NCA	NCA 1	1
GEN B	MCE 1	NCA	NCA 1	1
GEN C	MCE 2	NCA	NCA 1	2
GEN D	MCE 2	NCA	NCA 1	2

Example 4: Four resources (GEN A, GEN B, GEN C, and GEN D) met the NCA condition and failed a conduct test for physical withholding in a dispatch hour. GEN A and GEN B are part of the same NCA (NCA 1). GEN C and GEN D are part of a second NCA (NCA 2). GEN A and GEN C share a market control entity for physical withholding (MCE 1). GEN B and GEN D share a different market control entity for physical withholding (MCE 2). The IESO will determine simulated reference quantity locational marginal prices for the resources as follows:

For NCA 1, two different simulations will be done: one for GEN A and another for GEN B

For NCA 2, two different simulations will be done: one for GEN C and another for GEN D

The following table shows the details of the example described above.

Table A-67: Simulated Reference Quantity LMPs – Example 4

Resource Name	MCE PW	Constrained Area Condition	Constrained Area	Simulation Number
GEN A	MCE 1	NCA	NCA 1	1
GEN B	MCE 2	NCA	NCA 1	2
GEN C	MCE 1	NCA	NCA 2	3
GEN D	MCE 2	NCA	NCA 2	4

The following example covers the resources that appear in more than one NCA, DCA or local operating reserve area:

Example 5: Three resources (GEN A, GEN B, and GEN C) met the NCA condition in the same NCA and failed a conduct test for physical withholding in a dispatch hour. GEN A and GEN B are part of the same NCA (NCA 1). GEN A and GEN C are part of a second NCA (NCA 2). GEN A, GEN B, and GEN C share a market control entity for physical withholding. The simulated reference quantity locational marginal prices for each resource will be determined as follows:

- NCA 1 using one simulation for GEN A and GEN B

- NCA 2 using one simulation for GEN A and GEN C

The following table shows the details of the example described above.

Table A-68: Simulated Reference Quantity LMPs – Example 5

Resource Name	MCE PW	Constrained Area Condition	Constrained Area	Simulation Number
GEN A	MCE 1	NCA	NCA 1, NCA 2	1,2
GEN B	MCE 1	NCA	NCA 1	1
GEN C	MCE 1	NCA	NCA 2	2

Because the IESO only issues a single first notice of physical withholding to a resource for each dispatch day, even if GEN A fails the impact test in both Simulation 1 and Simulation 2, it will only receive one first notice.

Conduct Test Example for Intertie Economic Withholding

The following example illustrates a conduct test for a hypothetical boundary entity resource (BER A), where a market participant (MP A) has submitted the following energy offer for a given hour in the day-ahead market at an uncompetitive intertie zone:

Table A-69: Conduct Test Example for Intertie Economic Withholding

PQ pair number	Price	Quantity
1	40	0
2	40	20
3	100	30
4	200	60
5	250	80

For this hour, the day-ahead market energy offer intertie reference level value for MP A for BER A is $50/MWh. The conduct test will be applied to every lamination of the submitted offer. The following table shows the results of the conduct test for each lamination.

Table A-70: Conduct Test Results for Each Lamination

PQ pair number	Price	Quantity	Conduct Threshold ($50+$100)	Conduct Test Result
1	40	0	$150	Pass
2	40	20	$150	Pass
3	100	30	$150	Pass
4	200	60	$150	Fail
5	250	80	$150	Fail

Because at least one lamination was above the conduct threshold, the offer fails the conduct test.

Continuing with the example illustrated in section 6.2, the following steps outline how a combined offer/bid intertie reference level curve is created.

The submitted offer curve laminations that failed the conduct test will have the price components replaced by the intertie reference level (i.e., $50) and then the curve will be combined to respect price monotonicity.

Table A-71: Replacement of Failed Offer Curve Laminations with Intertie Reference Levels

PQ pair number	Price	Quantity	Conduct Test Result
1	40	0	Pass
2	40	20	Pass
4	50	50	Fail
5	50	70	Fail
3	100	80	Pass

The following table is the combined offer/bid-intertie reference level curve. All offer laminations that have the same price will then have their quantity components aggregated into a single lamination (i.e., the new PQ pair number 3 below).

Table A-72: Combined Offer/Bid-Intertie Reference Level Curve

PQ pair number	Price	Quantity	Conduct Test Result
1	40	0	Pass
2	40	20	Pass
3	50	70	Fail
4	100	80	Pass

This combined offer/bid-intertie reference level curve will be used to determine the simulated intertie reference level energy locational marginal price.

The following two examples highlights these concepts for intertie A for the same dispatch hour and dispatch day:

Example 1: Three boundary entity resources (BER A, BER B, and BER C) failed the intertie economic withholding conduct test. BER A, BER B, and BER C are used by the same market participant (MP A) for the same dispatch hour. BER A is an import and BER B and BER C are exports. BER A and BER B are at the same uncompetitive intertie zone (UIZ 1) and BER C is at another uncompetitive intertie zone (UIZ 2). The IESO will determine a simulated intertie reference level locational marginal price for UIZ 1 in one simulation and for UIZ 2 in another simulation as shown in the following table.

Table A-73: Simulated Intertie Reference Level LMPs – Example 1

Resources used by MP A	Market Participant	Uncompetitive Intertie Zone	Simulation Number
BER A	MP A	UIZ 1	1
BER B	MP A	UIZ 1	1
BER C	MP A	UIZ 2	2

Example 2: Two boundary entity resources (BER A and BER B) are part of the same uncompetitive intertie zone (UIZ 1). Two other boundary entity resources (BER C and BER D) are part of another uncompetitive intertie zone (UIZ 2). BER A, BER B, BER C, and BER D are all imports. BER A and BER C are used by the same market participant (MP A) for the same dispatch hour, and BER B and BER D are used by another market participant (MP B) for the same dispatch hour. A simulated intertie reference level locational marginal price will be determined twice for each uncompetitive intertie zone as follows:

- For UIZ 1, two different simulations will be done: one for BER A and another for BER B
- For UIZ 2, two different simulations will be done: one for BER C and another for BER D.

The table below shows the details of the example described above.

Table A-74: Simulated Intertie Reference Level LMPs – Example 2

Resources used by MP A	Market Participant	Uncompetitive Intertie Zone	Simulation Number
BER A	MP A	UIZ 1	1
BER B	MP B	UIZ 1	2
BER C	MP A	UIZ 2	3

Resources used by MP A	Market Participant	Uncompetitive Intertie Zone	Simulation Number
BER D	MP B	UIZ 2	4

End of Section