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Market Manual

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Market Manual 4: Market Operations

Part 4.1: Submitting Dispatch Data in the Physical Markets

Issue 6.0

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This procedure provides guidance to *market participants* on the submission of *dispatch data* in the *physical markets.*

Document Change History

Issue	Reason for Issue	Date
Refer to Issue 68.0 (MDP_PRO_0027) for changes prior to Market Transition.		
1.0	Market Transition	November 11, 2024
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Related Documents

Document ID	Document Title
MAN-110	Market Manual 4.2: Operation of the Day-Ahead Market
MAN-111	Market Manual 4.3: Operation of the Real-Time Market

2 Dispatch Data to Supply and Consume Energy

2.1 Dispatchable Generation and Dispatchable Electricity Storage Resources

(MR Ch.7 s.3.5)

This section sets out the *dispatch data* parameters submitted by *registered market participants* as part of its *offer* to provide *energy* on *dispatchable generation resources* or *dispatchable electricity storage resources* intending to inject.

Overview – Dispatch *data* parameters for *dispatchable generation resources* or *dispatchable electricity storage resources* intending to inject consist of a combination of:

- hourly *dispatch data* parameters listed in **MR Ch.7 ss.3.5.3-3.5.4**, which apply to a specific *dispatch hour*; and
- daily *dispatch data* parameters described in **MR Ch.7 ss.3.5.21-3.5.22**, which apply to an entire *dispatch day* or the remainder of a *dispatch day* if it is submitted as a revision during a *dispatch day*.

Hourly dispatch data parameters – Hourly *dispatch data* is submitted to apply for one hour on a given *dispatch day*.

Daily dispatch data – Daily *dispatch data* are submitted as a single value applicable to an entire *dispatch day.*

Thermal states – When submitted, *start-up offer*, *minimum generation block down-time*, *lead time*, and *ramp up energy to minimum loading point* are *dispatch data* parameters that are submitted for each *thermal state*.

Table 2-1 summarizes the *dispatch data* applicable to each *dispatchable generation resource* and *dispatchable electricity storage resource* intending to inject by type.

Table 2-1: Applicable Dispatch Data for Dispatchable Generation and Electricity Storage Resources

Dispatch Data Parameter	Data Interval	Nuclear Generation	Non-Quick Start Generation	Variable Generation	Hydro Electric Generation	Other Quick Start Generation and Electricity Storage Intending to Inject
Price-Quantity Pairs	Hourly	x	x	x	x	x
Start-up offer	Hourly		x			
Speed no-load offer	Hourly		x			
Energy ramp rate	Daily & Hourly	x	x	x	x	x
Minimum hourly output	Hourly				x	
Hourly must run	Hourly				x	
Variable generator forecast quantity	Hourly			x		
Linked forebay, time lag and *MWh ratio*	Daily				x	
Forbidden regions	Daily				x	
Maximum daily energy limit	Daily		x	x	x	x
Minimum daily energy limit	Daily				x	
Maximum number of starts per day	Daily		x		x	
Minimum loading point	Daily		x			
Minimum generation block run-time	Daily		x			
Minimum generation block down-time	Daily		x			
Single cycle mode	Daily		x			
Lead time	Daily		x			
Ramp up energy to minimum loading point	Daily		x			
Thermal state	Daily		x			

2.1.1 Price-Quantity Pairs

(MR Ch.7 ss.3.5.3.1, 3.5.5, and 3.9)

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.5**, for a *pseudo-unit*, the *price-quantity pairs* are submitted on the *pseudo-unit* rather than on the *resources* associated with the combustion and steam turbine *generation units* used to model the *pseudo-unit*.

2.1.1.1 Resource-Specific Requirements

(MR Ch.7 ss.1.6.2 and 3.5.6)

Overview – Registered *market participants* submitting *price-quantity* pairs on *non-quick start resources* that are not nuclear *generation resources*, resources providing *energy* generated by *flexible nuclear generation*, and *variable generation resources*, are subject to additional requirements.

Non-quick start resource excluding nuclear – The *IESO* tool does not automatically validate for compliance with **MR Ch.7 s.3.5.5.7**.

Flexible nuclear generation – For the purposes of **MR Ch.7 s.3.5.5.8**, the price offered in a *price-quantity pair* on a *resource* that is offering to provide *energy* generated by *flexible nuclear generation* must be no less than -$5/MWh.

Variable generation resources – For the purposes of **MR Ch.7 s.3.5.5.8**, *offers* on *variable generation resources* are to be submitted in the following manner:

- the *price* offered in a *price-quantity pair* on a solar *resource* or wind *resource*, excluding the last 10% of the available capacity of a wind *resource*, must be no less than -$3/MWh; and
- the *price* offered in the *price-quantity pair* corresponding to the last 10% of the available capacity of a wind *resource* must be no less than -$15/MWh.

Related provisions – In addition to *variable generation price-quantity pairs*, the *registered market participant* may, at its sole discretion, submit *variable generation forecast quantities* in the *day-ahead market* with respect to the *offers* in accordance with **MR Ch.7 s.3.5.18**. Refer to section 2.1.7 for more information.

2.1.1.2 Planned Testing

(MR Ch.5 s.6.6)

Criteria for IESO approval – For the purposes of approving planned tests under **MR Ch.5 s.6.6.4**, the *IESO* will attempt to provide *registered market participants* with flexibility for all *IESO*-approved planned testing, provided:

- there are no *reliability* concerns; and

- the scope of the test (including the scope of any potential changes to the test plan) has been identified by the *registered market participant* at the time of the original submission.

Offer prices – *Dispatchable generators* and *dispatchable electricity storage participants* are expected to *offer* at a price to be scheduled for the full capability of the test unit.

Energy Offer quantities – *Dispatchable generators* and *dispatchable electricity storage participants* are expected to submit *outage* requests to derate the test unit to the required test output levels.

When a *registered market participant* whose *generation resource* is expected to undergo a test[1] submits *dispatch data* for any hour of the test, the *registered market participant* must *offer* a quantity that equals the expected hourly average *energy* delivery of the *resource*.

Solar and wind resources – To ensure full capability for the test, the *offer* price in the *price-quantity pair* corresponding to solar and wind *resources* during an *IESO*-approved planned test may be less than -$3/MWh and -$15/MWh, respectively, for the duration of the test.

Operating reserve quantities – Where the test is instantly recallable, the *generation resource* or *electricity storage resource* registered to inject may participate in the *operating reserve market*. A *registered market participant* may *offer operating reserve* provided that it ensures that the sum of the maximum *energy* expected to be produced during the hour and the *operating reserve* quantity *offered* for the *dispatch hour* does not exceed the maximum amount of *energy* that the *resource* can produce that hour.

2.1.1.3 Energy Offer Price Revisions

(MR Ch.7 ss.3.3.3 and 3.5)

Pseudo-units – For the purposes of **MR Ch.7 ss.3.3.3.4**, **3.3.3.5** and **3.3.3.8**, for a *pseudo-unit*, the *minimum loading point* applicable to *energy offer* price revision restrictions is the computed parameter referred to as *pseudo-unit minimum loading point*. Refer to section 2.2.2 for information on how the *pseudo-unit minimum loading point* is derived.

Timing of revisions – After the *pre-dispatch calculation engine* has initialized at the top of each hour, in accordance with **MR Ch.7 s.3.3.3.14,** revisions to increase *energy offer* prices for *GOG-eligible resources* for quantities above the *minimum loading point* by the *registered market participant* are prohibited until 30 minutes

[1] For more on *dispatch data* submission for *generator* tests with immediate recall, refer to **MM 7.3 s.4.1.2**.

past the hour when a *binding pre-dispatch advisory schedule* would be issued. Revisions after 30 minutes past the hour are subject to **MR Ch.7 ss.3.3.3.8** and **3.3.3.10.** Such *energy offer* price revision restrictions are based on the latest *dispatch data* accepted and approved in the system at the top of each hour when the *pre-dispatch calculation engine* is initialized.

Offering additional energy quantities previously not offered in hours subject to price restrictions – A *registered market participant* for *GOG-eligible resources* may *offer* additional MW quantities previously not offered for a *dispatch hour* that is subject to *energy offer* price revision restrictions in **MR Ch.7 s.3.3.3.10**. The *offer* price for additional MW quantities previously not offered must not exceed the maximum *offer* price submitted for the *dispatch hour* at the time the revision restriction is applied, unless circumstances exist whereby the *market participant* may increase the *energy offer* price. If the additional MW quantities expand the *availability declaration envelope*, refer to section 7.5 for more information.

Conditions for energy price increase after a commitment – **MR Ch.7 ss.3.3.3.9** and **3.3.3.11** set out the conditions required for a *market participant* to increase its *energy offer* price after receiving a commitment. All submissions are subject to the restrictions applicable in the real-time unrestricted and mandatory window. The procedures for submitting and revising *dispatch data* for the *real-time market* must be followed. Refer to section 7.3.

Related provision – Refer to Appendix A for content requirements of *dispatch data*.

2.1.2 Start-Up Offer

(MR Ch.7 s.3.5.12)

Default submission – For the purposes of **MR Ch.7 s.3.5.12**, where no *start-up offer* is submitted for any of the *thermal states*, a default value of zero will apply.

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.12**, for a *pseudo-unit*, the *start-up offer* is submitted on the *pseudo-unit* rather than on the *resources* associated with the combustion and steam turbine *generation units* used to model the *pseudo-unit*.

Additional submission instructions – In compliance with **MR Ch.7 s.3.5.35**, a *registered market participant* must identify a *thermal state* applicable to its *start-up offer* in the *day-ahead market*. Refer to section 2.1.19.

A *registered market participant* may submit escalating *start-up offers*[2] into the *day-ahead market* and *pre-dispatch process* to reflect the *commitment cost parameters* associated with the completion of *minimum generation block run-time* over midnight The *generator offer* guarantee calculation does not guarantee commitment costs after

[2] An escalating *start-up offer* is created by including, in the *start-up offers* for the hour, the *speed-no-load offers* and *energy offers* up to MLP for the hour(s) required to satisfy the completion of the MGBRT in the following day.

midnight for *minimum generation block run-times* that extend across two days. Therefore, the *market participant* may include those commitment costs in the hours prior to midnight as escalating *start-up offers* to ensure those costs are included in the guarantee.

Revisions to start-up offers – The *market rules* provide obligations related to - *start-up offer* revisions in **MR Ch.7 ss.3.3.3.6** and **3.3.3.7**.

2.1.3 Speed No-Load Offer

(MR Ch.7 s.3.5.13)

Default submission – For the purposes of **MR Ch.7 s.3.5.13**, where no *speed no-load offer* is submitted, a default value of zero will apply.

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.13**, for a *pseudo-unit*, the *speed no-load offer* is submitted on the *pseudo-unit* rather than on the *resources* associated with the combustion and steam turbine *generation units* used to model the *pseudo-unit*.

Revisions to speed no-load offers – The *market rules* provide obligations related to *speed no-load offer* revisions in **MR Ch.7 ss.3.3.3.4** and **3.3.3.5**.

2.1.4 Energy Ramp Rate

(MR Ch.7 ss.3.5.7 and 3.5.34)

This subsection includes additional information related to submitting hourly and daily *energy ramp rates* from **MR Ch.7 ss.3.5.7** and **3.5.34**, respectively.

Additional submission instructions – For the purposes of **MR Ch.7 ss.3.5.7** and **3.5.34**, *registered market participants* may submit laminations that are different from those of the *price-quantity pairs* included in each *energy bid* or *energy offer*.

Pseudo-units – For the purposes of **MR Ch.7 ss.3.5.7** and **3.5.34**, for a *pseudo-unit*, the *energy* ramp rate is submitted on the *pseudo-unit* rather than on the *resources* associated with the combustion and steam turbine *generation units* used to model the *pseudo-unit*.

Electricity Storage Resources – For clarity, the ramp up and ramp down rates submitted in accordance with **MR Ch.7 s.3.5.7.4A** are only applicable to *energy*. *Electricity storage resources* may specify a different ramp rate for *operating reserve offers* in accordance with MR Ch.7 Appendix 7.3 s.1.1.8.

Related provisions – Ramp rates for *resources* that are registered for compliance aggregation must meet the additional requirements as specified in the

interpretation bulletin, Compliance with Dispatch Instructions Issued to Dispatchable Facilities, IMO_MKRI_0001 v.7.0, which may be amended from time to time.

2.1.5 Minimum Hourly Output

(MR Ch.7 ss.3.5.14 and 3.5.15)

Default submission – For the purposes of **MR Ch.7 s.3.5.15**, where no *minimum hourly output* is submitted, a default value of zero will apply.

2.1.6 Hourly Must-Run

(MR Ch.7 ss.3.5.16 and 3.5.17)

Default submission – For the purposes of **MR Ch.7 s.3.5.17**, where no *hourly must-run* is submitted, a default value of zero will apply.

2.1.7 Variable Generation Forecast Quantity

(MR Ch.7 s.3.5.18)

Effect of submission – A *registered market participant* associated with a *dispatchable variable generation resource* may submit, to the *day-ahead market* only, a *variable generation forecast quantity* for each *dispatch hour*. The *variable generation forecast quantity*, if submitted for the *dispatch hour*, replaces the *IESO's* centralized *f*orecast quantity for the *resource* for the *dispatch hour*.

Default submission – For the purposes of **MR Ch.7 s.3.5.18**, where no *variable generation forecast quantity* is submitted, the *IESO's* centralized forecast quantity for the resource will continue to be used for the *dispatch hour*.

2.1.8 Linked Forebays

(MR Ch.7 s.3.5.23)

Additional submission instructions – To establish *linked forebays* under **MR Ch.7 s.3.5.23**, a *registered market participant* must submit the downstream *linked forebay, time lag* and *MWh ratio* on a *forebay* that is not located between another set of *linked forebays*. Once these *dispatch data* parameters are submitted, the *forebay* that is the subject of the submission becomes the upstream *linked forebay* for the applicable *dispatch day*.

2.1.8.1 Downstream Linked Forebays

(MR Ch.7 s.3.5.23.1)

Additional submission instructions – For the purposes of **MR Ch.7 s.3.5.23.1**, when submitting a *downstream linked forebay*, *registered market participants* must respect the following requirements:

- it must be located downstream relative to the upstream *linked forebay* (i.e, it must have a *forebay* sequence ID greater than that of the *forebay* upon which it is submitted);
- it must not be submitted on more than one upstream *linked forebay* in a *dispatch day*; and
- it must not be located between another set of *linked forebays*.

2.1.8.2 Time Lag

(MR Ch.7 s.3.5.23.2)

Additional submission instructions – For the purposes of **MR Ch.7 s.3.5.23.2**, *registered market participants* may submit a *time lag* of zero to indicate there is no delay in the water discharge between the *linked forebays*.

2.1.8.3 MWh Ratio

(MR Ch.7 s.3.5.23.3)

Additional submission instructions – For the purposes of **MR Ch.7 s.3.5.23.3**, the schedule for the upstream *resource(s)* and downstream *resource(s)* will respect the ratio in the following manner:

- a ratio less than one indicates less *energy* is required to be scheduled at the downstream *linked forebay*;
- a ratio equal to one indicates the same quantity of *energy* is required to be scheduled at the downstream *linked forebay*; and
- a ratio greater than one indicates more *energy* is required to be scheduled at the downstream *linked forebay*.

2.1.9 Forbidden Regions

(MR Ch.7 s.3.5.24)

Additional submission instructions – For the purposes of **MR Ch.7 s.3.5.24**, each *forbidden region* registered during the equipment registration process is identified by a number from 1 to 5 (refer to **MM 1.5 s.3.3.2.1**). For the purposes of **MR Ch.7 s.3.5.24**, any submitted *forbidden region* must be within an acceptable range for any *forbidden region* registered for the *resource*. The numerical identifier used in the submission of *forbidden region* may be different from the numerical identifier used in registration.

2.1.10 Maximum Daily Energy Limit

(MR Ch.7 s.3.5.25)

Forebays – For the purposes of **MR Ch.7 s.3.5.25**, for a *dispatchable* hydroelectric *generation resource* that is registered to a *forebay*, the *maximum daily energy limit* is submitted on the *forebay* rather than on the individual *resources* registered to the *forebay*[3].

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.25**, for a *pseudo-unit*, the *maximum daily energy limit* is submitted on the *pseudo-unit* rather than on the *resources* associated with the combustion and steam turbine *generation units* used to model the *pseudo-unit*. For the purposes of **MR Ch.7 s.3.5.25.3**, the *maximum daily energy limit* submitted on the *pseudo-unit* is validated against the *pseudo-unit minimum loading point* as described section 2.2.2.

Dispatchable electricity storage – *Electricity storage participants* who are *offering energy* from an *electricity storage resource* should use the *maximum daily energy limit* to reflect their *state of charge* limitations. Doing so will limit the schedules they receive to inject from the *day-ahead market calculation engine* and the *pre-dispatch calculation engine,* as otherwise the schedules produced from these engines may exceed the ability of the *resource* to provide *energy*. *Electricity storage participants* entering a *maximum daily energy limit* should use 'fuel availability' as a reason code.

Default submission – For the purposes of **MR Ch.7 s.3.5.25**, where no *maximum daily energy limit* is submitted, a null value will apply for the *dispatch day*.

Reason codes – When submitting the *maximum daily energy limit* pursuant to **MR Ch.7 s.3.5.25**, *registered market participants* must select one of the following reason codes from the MAX DEL reason code field to be submitted with the *maximum daily energy limit* value:

- safety of any person;
- damage to equipment;
- violation of any *applicable law*; or
- fuel availability.

[3] The *maximum daily energy limit* submitted on a hydroelectric *generation resource* registered to have a shared *forebay* represents the maximum amount of *energy* that can be scheduled in a *dispatch day* across all hydroelectric *generation resources* registered to the same shared *forebay* (i.e., the sum of the hourly schedules over a *dispatch day* on all *resources* registered to a shared *forebay* will not exceed the specified limit).

2.1.11 Minimum Daily Energy Limit

(MR Ch.7 s.3.5.26)

Forebays – For the purposes of **MR Ch.7 s.3.5.26**, for a *dispatchable* hydroelectric *generation resource* that is registered to a *forebay*, the *minimum daily energy limit* is submitted on the *forebay* rather than on the individual *resources* registered to the *forebay*.

Default submission – For the purposes of **MR Ch.7 s.3.5.26**, where no *minimum daily energy limit* is submitted, a null value will apply for the *dispatch day*.

Revisions to minimum daily energy limits – Following **MR Ch.7 s.3.5.26.2,** after the *dispatch day* has begun, revisions to the *minimum daily energy limit* must also take into account the total actual *energy* produced up to the last hour and the *real-time market* dispatch advisory for the current *dispatch hour*.

2.1.12 Maximum Number of Starts Per Day

(MR Ch.7 s.3.5.28)

Default submission – For the purposes of **MR Ch.7 s.3.5.28**, where no *maximum number of starts per day* is submitted on an eligible *resource*, a default value of null will apply.

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.28**, for a *pseudo-unit*, the *maximum number of starts per day* is submitted on the *resource* for the associated combustion turbine *generation unit* rather than on the *resource* associated with the steam turbine *generation unit* or the *pseudo-unit*.

Additional submission instructions – For the purposes of **MR Ch.7 s.3.5.28**, the *maximum number of starts per day*, if submitted, must be greater than or equal to 1.

2.1.13 Minimum Loading Point

(MR Ch.7 s.3.5.29)

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.29**, for a *pseudo-unit*, the *minimum loading point* is submitted on the *resources* for the associated combustion turbine and steam turbine *generation units* rather than on the *pseudo-unit*.

Resources for steam turbines – All steam turbine (ST) *generation resources* that are part of a *combined cycle plant* and are not physically aggregated (regardless of whether or not the *market participant* has elected to use the *pseudo-unit* model, or a *facility* using the *pseudo-unit* model and operating in *single cycle mode*) must provide each of their n-on-1 *minimum loading points* where applicable under **MR Ch.7 s.3.5.29**. The number of *minimum loading points* that must be submitted for an ST is dependent on the number of combustion turbines (CTs) in the *combined cycle plant*.

The additional n-on-1 *minimum loading points* is limited and equal to n, where n is equal to the number of CTs at the *combined cycle plant*. For example, a *combined cycle plant* with three CTs and one ST must provide a 2-on-1 and 3-on-1 *minimum loading point* but may not submit a 4-on-1 *minimum loading point*. A *registered market participant* may only submit CT-to-ST configuration values for the number of CTs in the *combined cycle plant*.

Resources for steam turbines in the pseudo-unit model – For the purposes of **MR Ch.7 s.3.5.29.1**, for a steam turbine *generation resource* that is using the *pseudo-unit* model, the 1-on-1 *minimum loading point* submitted on the *resources* must not exceed the maximum registered generation capacity minus the registered duct firing capacity, multiplied by the minimum of the registered steam turbine percentage shares from all associated *pseudo units*.

2.1.13.1 Minimum Loading Point after Day-Ahead Market Submission

(MR Ch.7 s.3.3.7)

Operating below the minimum loading point – To comply with **MR Ch.7 s.3.3.7**, after *day-ahead market expiration*, if a *resource* is required to operate below its *minimum loading point,* an *outage* request must be submitted to derate the *resource* to the desired output two hours prior to the derate.

Operating above the minimum loading point – If a *resource* is required to operate above its *minimum loading point* after *day-ahead market expiration,* the *market participant* must request a SEAL constraint[4] from the *IESO*.

Duration of outage or constraint – The *outage* or SEAL constraint start, and end times should correspond to the period of time the *resource* expects to operate below or above *minimum loading point*.

Additional submission instructions – A revision of *offer price-quantity pairs* to economically schedule the *resource* to the desired output is required in conjunction with and at the same time as the *outage* request submission. *Operating reserve* cannot be provided when the *resource* operates below its *minimum loading point*.

2.1.14 Minimum Generation Block Run-Time

(MR Ch.7 ss.3.3.7 and 3.5.30)

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.30**, for a *pseudo-unit*, the *minimum generation block run-time* is submitted on the *resource* for the associated combustion turbine *generation unit* rather than on the *resource* associated with the steam turbine *generation unit* or the *pseudo-unit*.

[4] A SEAL constraint is used to help prevent a situation that could potentially endanger the safety of any person, damage equipment or the environment, or violate any *applicable law*.

Revisions for minimum generation block run-time – **MR Ch.7 s.3.3.7** governs revisions to *minimum generation block run-time*.

2.1.15 Minimum Generation Block Down-Time

(MR Ch.7 s.3.5.31)

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.31**, for a *pseudo-unit*, the *minimum generation block down-time* is submitted on the *resource* for the associated combustion turbine *generation unit* rather than on the *resource* associated with the steam turbine *generation unit* or the *pseudo-unit*.

2.1.16 Single Cycle Mode

(MR Ch.7 ss.3.3.7 and 3.5.27)

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.27**, *single cycle mode* is submitted on the *resource* for the associated combustion turbine *generation unit* rather than on the *resource* associated with the steam turbine *generation unit* or the *pseudo-unit*. The *registered market participant* should ensure that *dispatch data* submitted on the *pseudo-unit* supports the *single cycle mode* selection to avoid unintended scheduling results.

Revisions to single cycle mode – **MR Ch.7 s.3.3.7** governs revisions to *single cycle mode*, and the *IESO* will manually review and approve any revisions to *single cycle mode* submitted with the appropriate reason code. Refer to section 7.3.3 and Appendix B for the process to submit revisions to the *single cycle mode*.

2.1.17 Lead Time

(MR Ch.7 s.3.5.32)

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.32**, for a *pseudo-unit*, the *lead time* is submitted on the *resource* for the associated combustion turbine *generation unit* rather than on the *resource* associated with the steam turbine *generation unit* or the *pseudo-unit*.

2.1.18 Ramp Up Energy to Minimum Loading Point

(MR Ch.7 s.3.5.33)

Additional submission instructions – For the purposes of **MR Ch.7 s.3.5.33**, the *ramp up energy to minimum loading point* is submitted by providing an average quantity of *energy* in MWh for each ramp up hour for each thermal state.

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.33**, for a *pseudo-unit*, the *ramp up energy to minimum loading point* is submitted on the *resources* for the associated combustion turbine and steam turbine *generation units* rather than on the *pseudo-unit*.

2.1.18.1 Energy per Ramp Hour

(MR Ch.7 s.3.5.33.3)

Additional submission instructions – For the purposes of **MR Ch.7 s.3.5.33.3**, the *energy per ramp hour* must be submitted for contiguous *ramp hours to minimum loading point* starting from the first ramp hour to the *minimum loading point. Energy per ramp hour* shall be submitted for all *ramp hours to minimum loading point* that a *resource* is expected to inject into the *IESO-controlled grid*.

2.1.18.2 Ramp Hours to Minimum Loading Point

(MR Ch.7 ss.3.5.33.1 and 3.5.33.2)

Additional submission instructions – For the purposes of **MR Ch.7 s.3.5.33**, *ramp hours to minimum loading point* is derived based on the number of submitted *energy per ramp hour* values.

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.33**, for *resources* that are a steam turbine *generation unit* associated to a *pseudo-unit,* the *ramp hours to minimum loading point* must be less than or equal to the minimum of all the submitted *lead times* for the corresponding *thermal state* on the associated[5] *resources* for the combustion turbine *generation units.*

For a *pseudo-unit*, the submission on the associated *resources* for the combustion turbine and steam turbine *generation units* with the larger number of ramp hours represents the *resource* that will be ramped up first. For example, if the number of *ramp hours to minimum loading point* submitted on the *resource* for the steam turbine *generation unit* is greater than the number of *ramp hours to minimum loading point* submitted on the *resources* for the combustion turbine *generation units*, it indicates the steam turbine *generation unit* is ramping up first.

2.1.19 Thermal State

(MR Ch.7 s.3.5.35)

Pseudo-units – For the purposes of **MR Ch.7 s.3.5.35**, for a *pseudo-unit*, the *thermal state* is submitted on the *pseudo-unit* rather than on the *resources* associated with the combustion and steam turbine *generation units* used to model the *pseudo-unit*.

2.2 Computed Pseudo-Unit Technical Parameters

(MR Ch.7 s.2.2.6I)

[5] Specifically pertaining to the submission of *ramp up energy to minimum loading point* on the steam turbine *generation unit*, the combustion turbine *generation unit* is considered to be associated to the steam turbine *generation unit* when the *single cycle mode* is set to **False**.

Computation process – The *IESO* will compute *pseudo-unit* technical parameters for *pseudo-units* pursuant to **MR Ch.7 s.2.2.6I** using the daily *dispatch data* parameters submitted on the *resources* for the corresponding combustion turbine and steam turbine *generation units*. The computed technical parameter values are inputs to the *day-ahead calculation engine*, *pre-dispatch calculation engine*, and *real-time calculation engine* to determine the *pseudo-unit* schedules, commitments, and *dispatch instructions*.

Rounding computed values – All computed technical parameters will be rounded to the nearest single decimal value, if applicable.

Onus on registered market participants – The *registered market participant* submitting *dispatch data* for its *pseudo-unit* is expected to understand the impact of each *dispatch data* parameter submitted on the *resources* for the corresponding combustion turbine and steam turbine *generation units* and its effect on the *pseudo-unit* schedules and commitments.

The following table lists the *dispatch data* parameters for *pseudo-units*, and whether it is submitted on the *pseudo-unit* or the *resources* for the associated combustion turbine *generation unit* or steam turbine *generation unit*.

Table 2-2: Submitted Pseudo-Unit Daily Dispatch Data

Dispatch Data Parameter	Pseudo-Unit	Combustion Turbine Generation Unit	Steam Turbine Generation Unit
Daily energy ramp rate	x		
Maximum daily energy limit	x		
Maximum number of starts per day		x	
Minimum loading point		x	x
Minimum generation block run-time		x	
Minimum generation block down-time		x	
Single cycle mode		x	
Lead time		x	
Ramp up energy to minimum loading point		x	x

Dispatch Data Parameter	Pseudo-Unit	Combustion Turbine Generation Unit	Steam Turbine Generation Unit
Thermal state	x		

This section provides additional information and formulae on how the IESO computes technical parameters pursuant to **MR Ch.7 s.2.2.6I.**

2.2.1 Single Cycle Mode for a Combustion Turbine of a Pseudo-Unit

Effect of single cycle mode selection – If the *registered market participant* submits its intent to operate in *single cycle mode* in accordance with **MR Ch.7 s.3.5.27**, the steam turbine *generation unit* contribution is removed for the *pseudo-unit*, and the computed technical parameters for the *pseudo-unit* will be equal to the parameters of the combustion turbine *generation unit*.

Availability of single cycle mode – The *single cycle mode* parameter is only available to a combustion turbine *generation unit* associated with a *pseudo-unit*, and will enable the *registered market participant* to continue submitting *offers* on the *pseudo-unit* when the steam turbine *generation unit* is derated or unavailable.

Computing single cycle mode – The *single cycle mode* is a single value applied to all hours of the *dispatch day*, or the remaining *dispatch hours* in the *dispatch day* if the *single cycle mode* selection is changed during the day due to an *outage* resulting in the *pseudo-unit resource* to only be available in *single cycle mode*.

IF
SingleCycleModeFlagPSU(n) = NO,

THEN
PSU operates in combined cycle mode (ST contribution enabled)

ELSE
SingleCycleModeFlagPSU(n) = YES,

THEN
PSU operates in *single cycle mode* (ST contribution disabled)

2.2.2 Computed Pseudo-Unit Technical Parameters

The following technical parameters are computed by the *IESO* based on the relevant daily *dispatch data* parameters submitted on the resource for the corresponding *generation unit*.

2.2.2.1 Pseudo-Unit Maximum Generator Capacity (PSU MGC)

PSU MGC is computed to be the sum of the MGC of the associated combustion turbine (CT) submitted during the facility registration process, plus the steam turbine (ST) contribution to PSU MGC (computed value).

$$MaxCapacity_{PSU(n)} = MaxCapacity_{CT(n)} + MaxCapacity_{ST_to_PSU(n)}$$

WHERE,
IF
$SingleCycleModeFlag_{PSU(n)} = NO$,
$MaxCapacity_{ST_to_PSU(n)} = Share\%_{PSU(n)} * MaxCapacity_{ST}$

ELSE
$MaxCapacity_{ST_to_PSU(n)} = 0.0$

2.2.2.2 Pseudo-Unit Minimum Loading Point (PSU MLP)

PSU MLP is computed to be the sum of the *minimum loading point* of the associated CT plus the 1-on-1 MLP of the ST submitted as *dispatch data*.

IF
$SingleCycleModeFlag_{PSU(n)} = NO$,
$MLP_{PSU(n)} = MLP_{CT(n)} + MLP_{ST}$

ELSE
$MLP_{PSU(n)} = MLP_{CT(n)}$

2.2.2.3 Pseudo-Unit Minimum Generation Block Run Time (PSU MGBRT)

PSU MGBRT is computed to be equal to the associated CT MGBRT submitted as *dispatch data*.

$$MGBRT_{PSU(n)} = MGBRT_{CT(n)}$$

2.2.2.4 Pseudo-Unit Minimum Generation Block Down Time (PSU MGBDT)

PSU MGBDT is computed to be equal to the associated CT MGBDT submitted as *dispatch data*.

$$Hot\ MGBDT_{PSU(n)} = Hot\ MGBDT_{CT(n)};$$

$$Warm\ MGBDT_{PSU(n)} = Warm\ MGBDT_{CT(n)};$$

$$Cold\ MGBDT_{PSU(n)} = Cold\ MGBDT_{CT(n)}$$

2.2.2.5 Pseudo-Unit Maximum Number of Starts (PSU MaxStarts)

PSU MaxStarts is computed to be equal to the associated CT *maximum number of starts per day* submitted as *dispatch data*.

$$MaxStarts_{PSU(n)} = MaxStarts_{CT(n)}$$

2.2.2.6 Pseudo-Unit Lower Operating Region Amount (PSU_OR_1)

PSU_OR_1, also known as the MLP Range, is defined as the capacity available from zero output to the MLP of the PSU. The PSU Lower Operating Region is computed to be equal to the computed value of the MLP of the PSU.

$$PSU_OR_1_{PSU(n)} = MLP_{PSU(n)}$$

2.2.2.7 Pseudo-Unit Upper Operating Region Amount (PSU_OR_3)

PSU_OR_3, also known as the Duct Firing Range, is defined as the capacity available from duct firing above the Middle Operating Region. The PSU Upper Operating Region is computed to be the product of ST percentage share per PSU and the ST duct firing capacity. Both input values are submitted during the facility registration process.

IF
$SingleCycleModeFlag_{PSU(n)} = NO$,
$PSU_OR_3_{PSU(n)} = Share\%_{PSU(n)} * DuctFiring_{ST}$

ELSE
$PSU_OR_3_{PSU(n)} = 0.0$

2.2.2.8 Pseudo-Unit Middle Operating Region Amount (PSU_OR_2)

PSU_OR_2, also known as the *Dispatchable* Range, is defined as the capacity available above the PSU MLP and below the start of duct firing. The PSU Middle Operating Region is computed as the difference of the PSU Maximum Generator Capacity, the Upper Operating Region and the Lower Operating Region.

$$PSU_OR_2_{PSU(n)} = MaxCapacity_{PSU(n)} - PSU_OR_3_{PSU(n)} - PSU_OR_1_{PSU(n)}$$

2.2.3 Computed Steam Turbine Portion of Pseudo-Unit Operating Regions

This subsection sets out computations for the steam turbine *generation unit* portion of *pseudo-unit* operating regions.

The following technical parameters are computed by the *IESO* based on the relevant daily *dispatch data* parameters submitted on the *resource* for the corresponding steam turbine *generation unit*.

The steam turbine (ST) portion of an operating region is the capacity the ST contributes to the *pseudo-unit* for a specified operating region. The *day-ahead calculation engine*, *pre-dispatch calculation engine* and *real-time calculation engine* require this input of the ST portions to be expressed as percentages.

2.2.3.1 Steam Turbine Portion of the Lower Operating Region Amount (ST_OR_1)

ST_OR_1 is equal to the 1-on-1 *minimum loading point* (MLP) of the ST.

IF
$SingleCycleModeFlag_{PSU(n)}$ = NO,
$ST_OR_1_{PSU(n)} = MLP_{ST}$

ELSE
$ST_OR_1_{PSU(n)}$ = 0.0

2.2.3.2 Steam Turbine Portion of the Upper Operating Region Amount (ST_OR_3)

ST_OR_3, expressed in MW, is computed as the product of steam turbine percentage share per *pseudo-unit* and the steam turbine duct firing capacity. Both input values are submitted during the *facility* registration process.

IF
$SingleCycleModeFlag_{PSU(n)}$ = NO,
$ST_OR_3_{PSU(n)} = Share\%_{PSU(n)} * DuctFiring_{ST}$

ELSE
$ST_OR_3_{PSU(n)}$ = 0.0

2.2.3.3 Steam Turbine Portion of the Middle Operating Region Amount (ST_OR_2)

ST_OR_2, expressed in MW, is computed as the difference of the steam turbine contribution to a PSU MGC, the ST Portion of the Upper Operating Region and the ST Portion of the Lower Operating Region. All three input values are computed.

$$ST_OR_2_{PSU(n)} = MaxCapacity_{ST_to_PSU(n)} - ST_OR_3_{PSU(n)} - ST_OR_1_{PSU(n)}$$

2.2.3.4 Steam Turbine (ST) Portions of Operating Regions

ST Portions of PSU Operating Regions, expressed as percentages, are computed as the share of the ST portion operating region divided by the corresponding PSU Operating Region. The percentages are denoted by K1, K2, and K3 to represent the ST portion of the PSU's MLP Range, Dispatchable Range, and Duct Firing Range, respectively. Both input values are computed.

$$K1 = ST_OR_1_{PSU(n)} / PSU_OR_1_{PSU(n)} * 100$$

$K2 = ST_OR_2_{PSU(n)} / PSU_OR_2_{PSU(n)} * 100$ where $PSU_OR_2_{PSU(n)} > 0$, ELSE K2 = 0

$K3 = ST_OR_3_{PSU(n)} / PSU_OR_3_{PSU(n)} * 100$ where $PSU_OR_3_{PSU(n)} > 0$, ELSE K3 = 0

2.3 Non-Dispatchable Generation

(MR Ch.7 ss.3.7 and 3.9)

Variable generation – A *registered market participant* for a *variable generation resource* that is a *self-scheduling generation resource* or *intermittent generation resource* must comply with **MR Ch.7 ss.3.7.1** or **3.9.1**, as applicable, by submitting the total installed capacity of the *variable generation,* net any derates or *outages* that have been submitted through the *outage* process.

Refer to Appendix A for content requirements of *dispatch data* for non-dispatchable generation.

2.4 Dispatchable Loads, Dispatchable Electricity Storage Resources and Hourly Demand Response Resources

This subsection pertains to the submission of *dispatch data* for *dispatchable loads, dispatchable electricity storage resources* proposing to withdraw, and *hourly demand response resources*.

2.4.1 Price-Quantity Pairs

(MR Ch.7 ss.3.5.3, 3.5.5 and 3.5.6)

This subsection includes additional information related to *price-quantity pairs* for *dispatchable loads*, *hourly demand response resources*, and *dispatchable electricity storage resources* proposing to withdraw.

Status of electricity storage resources – A *market participant* registered as an *electricity storage resource* is not entitled to change its load status as set out in **MR Ch.7 s.3.3.3.1**. *Electricity storage units* intending to withdraw must follow the *outage* requirements contained in **MM 7.3** to signal planned unavailability and the requirements listed in Appendix B.4 for *state of charge* changes.

Dispatchable load energy bids and operating reserve offers – For a *dispatchable load* that expects to be consuming *energy* for only part of the *dispatch hour,* the *bid* quantity under **MR Ch.7 s.3.5.5** shall reflect its average value at normal production when operating. To comply with **MR Ch.7 s.7.4.2**, its *operating reserve offer* shall reflect its minimum *dispatchable* consumption during the *dispatch hour,* or zero if the entire *bid* is at *MMCP*.

Operating as non-dispatchable load – A *dispatchable load* that intends to operate its load in whole as non-dispatchable can, pursuant to **MR Ch.7 ss.3.2.3** and **3.3.3.1**, refrain from submitting *bids* or remove all *bids* as necessary for the hours in which it intends to be non-dispatchable, in which case the *dispatchable load* will have no schedule and have "zero" *dispatchable* quantity.

In the *real-time market,* the *IESO* will automatically *dispatch* the load to 0 MW in the first interval (Interval 1) of the first hour that does not have *dispatch data.* The *dispatchable load* is required to disregard the 0 MW *dispatch instruction* to confirm its intention to becoming non-dispatchable. The *IESO* will consider the load as non-dispatchable until new *bids* are submitted, resulting in a new *dispatch instruction*.

Alternatively, the *dispatchable load* may identify all or a portion of its consumption as non-dispatchable by bidding the consumption at the *maximum market clearing price* in accordance with **MR Ch.7 s.3.5.5**.

Changing status after the day-ahead market submission window – If a *dispatchable load* requires a change to *dispatchable* status in the *real-time market* from non-*dispatchable* status in the *day-ahead market,* or an increase to its *dispatchable bid* quantity after the *day-ahead market submission window* the change or increase must meet the requirements for expanding the *availability declaration envelope* under **MR Ch.7 s.3.1.13**. Refer to section 7.5 for details.

Changing status during the real-time market mandatory window – If a *dispatchable load* requires a change to or from *dispatchable* status by submitting or removing *bids* during the *real-time market mandatory window* under **MR Ch.7 s.3.3.5**, the *registered market participant* is required to contact the *IESO* to indicate the reason for its status change.

The *dispatchable load* will automatically be dispatched to 0 MW in the first interval (Interval 1) of the first hour that does not have *dispatch data*. The *dispatchable load* is required to disregard the 0 MW *dispatch instruction* to confirm its intention to becoming non-dispatchable. The *IESO* will consider the *dispatchable load* as non-dispatchable until new *bids* are submitted, resulting in a new *dispatch instruction* (refer also to Appendix B.4: Hourly Dispatch Data Submissions or Revisions during the Real-Time Market Mandatory Window).

Demand response bid price threshold – For the purposes of **MR Ch.11 "demand response bid price threshold"**, the *demand response bid price threshold* is $100/MWh. A *capacity market participant* intending to meet its *capacity obligation* for a *demand response resource* must submit a *demand response energy bid* quantity equal to the *capacity obligation* for their *demand response resource* for all hours of the *availability window* of the *obligation period* (as specified in **MM 12**: Capacity Auctions).

2.4.2 Energy Ramp Rate

(MR Ch.7 s.3.5.7)

This subsection includes additional information related to submitting *energy* ramp rates for *hourly demand response resources*.

Energy ramp rates for hourly demand response resources – Pursuant to **MR Ch.7 s.3.5.7**, *capacity market participants* must submit ramp up rates and ramp down rates for each hourly demand response *resource* that is equal to the *demand response capacity* of the *hourly demand response resource*. For example, an hourly demand response *resource* with a *demand response capacity* of 10 MW would submit ramp up rates and ramp down rates of 10 MW/minute.

2.5 Price Responsive Loads and Self-Scheduling Electricity Storage Resources Intending to Withdraw

(MR Ch.7 ss.3.8 and 3.11)

Bids automatically excluded from real-time market – *Price responsive loads* and *self-scheduling electricity storage resources* intending to withdraw are evaluated in the *day-ahead market* only. After *day-ahead market expiration*, the *registered market participant* is not required to remove its *energy bid from* the *real-time market*. The *energy bids* are automatically excluded from the pre-dispatch scheduling process and real-time scheduling process.

– End of Section –

3 Dispatch Data to Supply Operating Reserve

(MR Ch.7 s.3.6)

Overview – Subject to eligibility requirements for applicable *resource* types (refer to MM 1.5), there are three classes of *operating reserve* that may be offered. The Register Equipment process establishes the classes of *operating reserve* that a *registered market participant* may submit for a given *resource.*

Standing dispatch data – *Standing dispatch data* may be submitted for *operating reserve*.

3.1 Dispatchable Resources

(MR Ch.7 s.3.6)

Pseudo-units – For the purposes of **MR Ch.7 s.3.6**, for a *pseudo-unit*, *operating reserve* offers are submitted on the *pseudo-unit* rather than on the *resources* associated with the combustion turbine and steam turbine *generation units* used to model the *pseudo-unit*.

3.1.1 Supply Operating Reserve Price-Quantity Pairs

(MR Ch.7 s.3.3.3.12)

Timing of operating reserve price revisions – After the *pre-dispatch calculation engine* has initialized at the top of each hour, in accordance with **MR Ch.7 s.3.3.3.14,** revisions to increase *operating reserve offer* prices for *GOG-eligible resources* by the *registered market participant* are prohibited until 30 minutes past the hour when a *binding pre-dispatch advisory schedule* would be issued. Revisions after 30 minutes past the hour are subject to **MR Ch.7 ss.3.3.3.12.** The *operating reserve offer* price revision restrictions are based on the latest *dispatch data* accepted and approved in the system at the top of each hour when the *pre-dispatch calculation engine* is initialized.

Offering additional operating reserve quantities previously not offered in hours subject to price restrictions – The *registered market participant* for *GOG-eligible resources* may *offer* additional MW quantities previously not offered for a *dispatch hour* that is subject to *operating reserve offer* price revision restrictions in **MR Ch.7 s.3.3.3.12**. The *offer* price for additional MW quantities previously not offered must not exceed the maximum *offer* price submitted for the *dispatch hour* (if a submission was made) at the time the revision restriction is applied, unless

circumstances exist whereby the *market participant* may increase the *operating reserve offer* price.

Conditions for operating reserve price increase after a commitment – **MR Ch.7 s.3.3.3.13** set out the conditions required for a *registered market participant* to increase its *operating reserve offer* price after a *day-ahead operational commitment*. All submissions are subject to the applicable restrictions in the *real-time market unrestricted window* and *real-time market mandatory window*.

Related provisions – Refer to Appendix A for content requirements of *dispatch data*.

3.1.2 Operating Reserve Class

(MR Ch.7 ss.3.6.0 and 3.6.1)

Classes of operating reserve – Pursuant to **MR Ch.7 ss.3.6.0** and **3.6.1**, the *registered market participant* must select one of the following *operating reserve* classes, to the extent it is eligible to provide it, with each *offer* to supply *operating reserve*:

- *ten-minute operating reserve* synchronized;
- *ten-minute operating reserve* non-synchronized; or
- *thirty-minute operating reserve*.

3.1.3 Operating Reserve Ramp Rate

(MR Ch.7 s.3.5.8)

Ramp rate submission – The *operating reserve* ramp rate is expressed in megawatts per minute (MW/min), up to one decimal place, must be greater than zero, and cannot exceed 999.9.

Electricity storage resources – The constraints for ramp up and ramp down rates required for energy market *offers* in accordance with **MR Ch.7 s.3.5.7.4A** are only applicable to the *energy* market. Ramp up and ramp down rates submitted for *operating reserve offers* need not adhere to these constraints.

3.1.4 Reserve Loading Point

(MR Ch.7 s.3.6.5)

Dispatchable loads and dispatchable electricity storage resources registered to withdraw – For *dispatchable loads* and *dispatchable electricity storage resources* registered to withdraw, the *reserve loading point* is not

applicable, and the value submitted for any class of *operating reserve offers* under **MR Ch.7 s.3.6.5** must equal zero.

Reserve loading point submission – The *reserve loading point* is to be expressed in MW, up to one decimal place, greater than or equal to zero and cannot exceed 9,999.9. The *reserve loading point* value submission for:

- synchronized *ten-minute operating reserve offers* must be greater than or equal to zero and less than or equal to the registered maximum *generation capacity* or *electricity storage capacity* of the *resource* registered to inject;
- non-synchronized *ten-minute operating reserve offers* must equal zero; and
- *thirty-minute operating reserve offers* must be greater than or equal to zero and less than or equal to the registered maximum *generation capacity* or *electricity storage capacity* of the *resource* registered to inject.

Effect of submission – The quantity of *operating reserve* scheduled will respect the *reserve loading point* for the *resource* based on the quantity of *energy* scheduled and is prorated[6] if the quantity of *energy* scheduled is below the *reserve loading point*.

3.2 Operating Reserve Offers for Electricity Storage Resources

(MR Ch.7 s.21.6)

Duration requirements for injecting component – When the *electricity storage resource* is *offering operating reserve* exclusively from the injecting component of an *electricity storage unit*, the *remaining duration of service* until the *resource* is depleted of *energy* must be greater than or equal to 130 minutes at the end of the *real-time market mandatory window* (i.e. minute 50) for the applicable *dispatch hour*.

Duration requirements for withdrawing components – When the *electricity storage resource* is offering to provide *operating reserve* exclusively from the withdrawing component of the *electricity storage unit*, the *remaining duration of service* to full *state of charge* is greater than or equal to 70 minutes at the end of the *real-time market mandatory window* (i.e. minute 50) for the applicable *dispatch hour*.

[6] For example, assuming a *reserve loading point* of 100 MW, an *energy* schedule of 60 MW, and a maximum *offered* quantity of 20 MW of *thirty-minute operating reserve*. The schedule of *thirty-minute operating reserve* will be limited to a maximum of (60/100) multiplied by 20 MW = 12 MW. Note that this example assumes that the submitted *operating reserve* ramp rate does not limit the amount of *operating reserve* that can be scheduled.

Related provisions – Refer to Appendix A.3 for further details, examples, and rationale for electricity storage *dispatch data* requirements.

– End of Section –