IESO Response to Feedback on MRP Draft Market Rules – Calculation Engines

IESO Response to Implementation Feedback

The following table the IESO's responses to stakeholder feedback on the Calculation Engines batch of market rules.

***Note**: Section references in the "Section" column are to the proposed market rule amendments (PDF) posted February 4, 2022, on the IESO's stakeholder engagement page. In these responses, "DAM" means "Day-Ahead Market", "PD" means "Pre-Dispatch", and "RT" means "Real-Time".*

ID	Stakeholder	Section or Manual	Feedback	IESO Response
1	OPG	Appendix 7.1A, section 4.2.2.11 Appendix 7.2A, section 4.2.2.11 Appendix 7.3A, section 4.2.2.15	Please clarify the definition of URRDGb in the Day-Ahead (DA) calculation engine, specifically contrasting the definition of URRDGb in DA calculation engine Section 4.2.2.11 versus Pre-Dispatch (PD) calculation engine Section 4.2.2.11 versus Real-Time (RT) calculation engine Section 4.2.2.15.	The DAM, PD, and RT calculation engines respect the ramping restrictions determined by the up to five offered MW quantity, ramp up rate and ramp down rate value sets. The definitions for URRDGb in the DAM and PD calculation engine appendices will be updated to clarify URRDGb reflects multiple ramp rate values as follows: For DAM section 4.2.2.11: URRDGh,b,w for w ∈ {1,..,NumRRDGh,b} designates the ramp rate in MW per minute at which the resource can increase the amount of energy it supplies in hour *h*∈{1,..,24} while operating in the range between RmpRngMaxDGh,b,w-1 and RmpRngMaxDGh,b,w, where RmpRngMaxDGh,b,0 shall be equal to zero. Definitions for NumRRDGh and RmpRngMaxDGh will also be added to align with the above definition as follows: • NumRRDGh,b designates the number of ramp rates provided for hour *h*∈{1,..,24}. • RmpRngMaxDGh,b,w for w ∈ {1,..,NumRRDGh,b} designates the wth ramp rate break point for hour *h*∈{1,..,24}. For PD section 4.2.2.11: URRDGt,b,w for w ∈ {1,..,NumRRDGt,b} designates the ramp rate in MW per minute at which the resource can increase the amount of energy it supplies in time-step t ∈ TS while operating in the range between RmpRngMaxDGt,b,w-1 and RmpRngMaxDGt,b,w, where RmpRngMaxDGt,b,0 shall be equal to zero. Definitions for NumRRDGh and RmpRngMaxDGh will also be added to align with the above definition as follows: • RmpRngMaxDGt,b,w for w ∈ {1,..,NumRRDGt,b} designates the wth ramp rate break point for time-step t ∈ TS. • NumRRDGt,b designates the number of ramp rates provided for time-step t ∈ TS. The definition for URRDG in the RT calculation engine appendix already reflects multiple ramp rate values and to avoid ambiguity will be updated

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				to exclude the 'maximum' descriptor for ramp rate. The ramp rate used is a function of the ramp rate specified for the operating range and not the maximum ramp rate across all specified operating ranges.
2A	OPG	Appendix 7.1A, section 6.3.2.2	The Price Responsive Load is excluded from the Pass 2 calculation. Why is this parameter included in Peak Forecasted Load in the Security Assessment function of Pass 2 of the DA calculation engine, stated in 6.3.2.2?	Section 6.3.2.2 reflects the IESO peak forecast for all loads considered to have non-dispatchable status in real-time. Price response loads are considered to have non-dispatchable status in real-time and are therefore part of the IESO peak forecast in Pass 2. It is the price responsive load **bids** that are excluded from Pass 2, not the IESO forecast for price responsive loads.
2B	OPG	Appendix 7.1A, section 6.3.2.2	OPG suggest to not italicize "each" in "each price responsive load".	Thank you, the IESO has implemented this change in response to your feedback.
3A	OPG	Appendix 7.1A, section 8.5.4.6	Please explain the functionality of the constraint in 8.5.4.6. Examples identifying situations in which it would restrict the scheduled synchronized ten-minute OR would be helpful.	The constraint in section 8.5.4.6 ensures that the amount of synchronized ten-minute operating reserve that a dispatchable generation resource is scheduled to provide is governed by its energy schedule in proportion to its synchronized 10-minute reserve loading point. See response to ID #3D for an example.
3B	OPG	Appendix 7.1A, section 8.5.4.6	The definition of reserve loading point (RLP) in Market Renewal Program: Energy Offers, Bids and Data Inputs Issue 2.0, Section 3.4.6.4 states: "Additionally, if the registered market participant anticipates that a generation unit will be operating below its reserve loading point for the entire duration of a given dispatch hour, an offer to supply operating reserve (OR) shall not be submitted for that dispatch hour." For a resource with (MinQDG*ODG + SDG) < RLP10S, how can a market participant anticipate the schedule would be below the reserve loading point when the PD schedule is not always equal to its RT schedule, e.g. the PD schedule for hydraulic resources?	Thank you for the feedback. The IESO will provide clarity for how these obligations are met in the future market as part of the market and system operations batch of proposed market rule and market manual amendments.
3C	OPG	Appendix 7.1A, section 8.5.4.6	Comparing 8.5.4.6 against the formula in 8.5.4.5 and 8.5.1.7, and assuming Q10SDG > 10*ORRDG: If a resource's (MinQDG*ODG + SDG) >= RLP10S, the right side of the equation in 8.5.4.6 is greater than 10*ORRDG. However S10SDG is capped by the equations in 8.5.4.5 and 8.5.1.7, meaning 8.5.4.6 does not provide any additional constraint.	Yes. The constraint in section 8.5.4.6 will only limit a resource's 10S OR schedule when its energy schedule is less than its reserve loading point. Otherwise, the resource's 10S operating reserve schedule will be limited by the constraints in sections 8.5.4.5 and 8.5.1.7.
3D	OPG	Appendix 7.1A, section 8.5.4.6	Furthermore, please provide an example for how 8.5.4.6 would reduce a resource's 10S OR schedule when its scheduled energy is below its reserve loading point.	Assuming a reserve loading point of 100 MW and an energy schedule of 50 MW, the 10S operating reserve schedule will be limited to a maximum of 0.5 (i.e. 50/100) multiplied by the minimum (maximum 10S reserve ramp rate, the maximum of the offered 10S reserve quantity).
3E	OPG	Appendix 7.1A, section 8.5.4.6	Finally, would forward economics drive the resource to its minimum load point (MLP) or above to respect the RLP, with the consideration that a resource cannot provide OR given the equation in 8.5.4.6 when it is below MLP?	Yes.

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4A	OPG	Appendix 7.1A, sections 8.6.1.6.2 and 4.2.2.11	Please clarify the definition of URRDGb in 8.6.1.6.2 with reference to the definition in Section 4.2.2.11.	The clarifications provided in the IESO's response to ID #1 and 14A provides clarification on URRDGb in section 8.6.1.6.2.
4B	OPG	Appendix 7.1A, sections 8.6.1.6.2 and 4.2.2.11	Please clarify if URRDGb represents the maximum value in the five sets of ramp rates submitted in the DAM for the dispatch day. If yes, this should be more explicit in the rules.	URRDGb does not represent the maximum value in the five sets of ramp rates. The definition changes in the IESO's response to ID #1 provides a revised definition for URRDGb that excludes the term 'maximum'.
4C	OPG	Appendix 7.1A, sections 8.6.1.6.2 and 4.2.2.11	Can URRDGb be any other number which is not within the five submitted sets of ramp rates?	No.
5A	OPG	Appendix 7.1A, section 8.6.4.1.2	NQS resources can be energy limited resources. Please clarify why the formula in 8.6.4.1.2 does not include the scheduled energy portion of a NQS resource during the time it is ramping. For example, consider a NQS resource with 1000 MWh Max DEL and which produces 100 MWh during both ramp up and ramp down. For this resource, realistically only 800 MWh of Max DEL is available above MLP. Using the formula in 8.6.4.1.2, the DA calculation engine could potentially schedule this resource for 1200 MWh or more, depending on the number of starts the resource is scheduled for in the DAM, and would be in excess of the resource's actual available Max DEL.	When looking at the issue of managing ramping energy in relation to the MaxDEL constraint, the IESO is proceeding with a design within the DAM and PD calculation engines that is consistent with the constraints used in today's day-ahead commitment process (DACP) engine, and does not introduce undue complexity in the calculations. The market participant is expected to manage Max DEL submissions based on their expected number of starts and expected impact of ramping energy on available Max DEL. For the example provided, the market participant would submit 800MWh as its MaxDEL if the resource is expected to be scheduled for one start in the DAM.
5B	OPG	Appendix 7.1A, section 8.6.4.1.2	Is it the responsibility of the market participant to reduce the submitted Max DEL to account for energy produced during ramp hours?	Yes. Further to the response in ID #5A, the future calculation is consistent with how participants manage the submitted MaxDEL in today's market.
6	OPG	Appendix 7.1A, sections 10.5.2.1 and 10.5.2.2.2	Do 10.5.2.1 and 10.5.2.2.2 refer to the same condition? If so, please confirm that 10.5.2.2.2 was intended to be removed. The status of 10.5.2.2.2 is ambiguous as presented	Yes, the intent was to include the contents of section 10.5.2.2.2 within Section 10.5.2.1. This change will be reflected in the next version of Appendix 7.1A.
7	OPG	Appendix 7.1A, section 10.7.2.1	Are there typos in 10.7.2.1, 10.7.2.2, and 10.7.2.3? OPG proposes "day-ahead calculation engine" be used in place of "pre-dispatch calculation engine".	Thank you, the IESO will implement this change in response to your feedback.
8	OPG	Appendix 7.1A, section 23.5.2	OPG requests that the IESO publish the node-level and facility-level substitution list as public reports to be available to Market Participants. If the lists will be published as public reports: 1. Will there be routine updates to the lists? 2. If so, what would be the update frequency? 3. What are the conditions (e.g. network structure changes) that would trigger an update of the lists, outside of any routine updates? If the lists cannot be published as public reports, please provide rationale as to why.	The substitution list will not be published due to confidentiality of the network model.

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9	OPG	Appendix 7.2A, section 2.1.1.1	The PD run at 00:00 EST is not included in 2.1.1.1. What is the rationale for this exclusion?	Thank you, 00:00 EST was excluded in error. The IESO will update section 2.1.1.1 to reflect 00:00 EST to 19:00 EST instead of 01:00 EST to 19:00 EST.
10A	OPG	Appendix 7.2A, section 4.2.2.11	Similar to the comment made to the DA Calculation Engine Market Rule Section 4.2.2.11, please clarify the definition of URRDGb in the PD calculation engine, specifically contrasting the definition of URRDGb in the DA calculation engine versus the PD calculation engine and the RT calculation engine. IESO mentioned that one daily ramp rate (for ramp up or ramp down) is used for DA and PD; this is in addition to the five ramp rates that can be submitted (for ramp up or ramp down). Is the URRDG in 4.2.2.11 referring to the daily ramp rate?	Yes, URRDGb is referring to the daily ramp rate which represents the up to five sets of ramp rates that apply to all hours of the PD look ahead period. The definitions for URRDGb in the DAM and PD calculation engine appendices will be updated as described in the IESO's response to ID #1.
10B	OPG	Appendix 7.2A, section 4.2.2.11	Is the daily ramp rate referring to the maximum or average ramp rate during the dispatch day? Market participants can submit up to five values for URRDG and DRRDG. These values align with different ramp capabilities at different resource outputs. The RT calculation engine respects a resource's output based on ramp capability whereas the DA and PD engines only consider one ramp rate for the resource's entire capability range.	Whether submitted as daily or hourly, the ramp rate is neither maximum nor average. Both daily and hourly ramp rate submissions can include up to five values for URRDG and DRRDG. The RT calculation engine will use hourly ramp rates (i.e. up to five ramp rates that can be different for each RT hour), while the DAM and PD calculation engines will use the daily ramp rate (i.e. up to five ramp rates that are the same for all hours of the DAM and PD look ahead periods). The daily ramp rate can be updated between DAM and subsequent runs of PD.
10C	OPG	Appendix 7.2A, section 4.2.2.11	Please explain how the DA and PD calculation engines will respect the resource's actual ramping capabilities at different loading points. For a resource with a ramp rate of 6 MW/min between 0 MW and 20 MW and 1 MW/min between 20 MW and 100 MW, please clarify which ramp rate(s) will be used in the DA/PD/RT engines for the different loading points.	The DAM, PD and RT calculation engines respect the ramping restrictions determined by the up to five offered MW quantity, ramp up rate and ramp down rate value sets. The ramp rate used is a function of the ramp rate specified for the operating range. For this example, all three engines will use a ramp rate of 6 MW/min between a loading point of 0 MW and 20 MW and 1 MW/min ramp rate between a loading point of 20 MW and 100 MW.
11A	OPG	Appendix 7.2A, section 8.6.1.6.1	8.6.1.6.1 uses a multiplier of 30 times the ramp rate in its formula. 8.6.1.6.2 uses a multiplier of 60 times the ramp rate in its formula. Please provide the rationale(s) for the different multipliers in 8.6.1.6.1 and 8.6.1.6.2.	A multiplier of 30 is used for the resource's first commitment hour instead of a multiplier of 60 for consecutive commitment hours because a resource is assumed to be at MLP at the start of the first commitment hour. Therefore, the maximum average schedule in the first commitment hour can only reflect half of the ramp capability the resource could achieve between consecutive commitment hours. The constraints used in sections 8.6.1.6.1 and 8.6.1.6.2 are consistent with those used in today's DACP calculation engine.

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11B	OPG	Appendix 7.2A, section 8.6.1.6.1	Please clarify how the PD calculation engine would address the following: a. Consider a NQS resource with a ramp rate of 1 MW/min, MLP of 60 MW and a capacity of 200 MW. In the previous hour, it is scheduled at 59 MW, which is below MLP. In the current hour, it is able to ramp up to 119 MW, however, based on 8.6.1.6.1 the resource's schedule would be suppressed to 30 MW.	In the example provided, if the resource is committed per section 8.5.2.5, it will be scheduled to at least 60MW in all the committed hours. Per Appendix 7.2A, section 8.6.1.6.1, in the resource's first commitment hour, its energy schedule should not exceed an additional 30MW (assuming 1 MW/min ramp rate) above its MLP. Therefore the resource can be scheduled between 60MW and 90MW in the first commitment hour. The IESO will add MinQDGCb to the definition of the SDG variable in section 8.3.1.10 to clarify that the SDG quantity refers to energy scheduled above a resource's minimum loading point as follows: SDGt,b,k , which designates the amount of energy that a dispatchable generation resource is scheduled to provide above MinQDGCb at bus b ∈ BDG in time-step t ∈ TS in association with lamination k ∈ Kt,b.
12	OPG	Appendix 7.3A, section 5.6.2.1.4	OPG proposes that the definition of EvalSD include a condition that would require a resource to be at or above MLP. This would reduce ambiguity.	The definition of EvalSD cannot include this condition because when EvalSD=1, the resource is evaluated for energy schedules below its MLP, but it can still be scheduled at or above its MLP. The IESO will add a clarification to the end of the definition of EvalSD as follows: EvalSDi,b ∈ {0,1}, which designates that the resource has been de-committed by the pre-dispatch calculation engine, such de-commitment has been confirmed by the IESO, and the resource can be evaluated for energy schedules below its minimum loading point but can still be scheduled at or above its minimum loading point.
13	OPG	Appendix 7.3A, section 8.5.3.5	OPG proposes to add in a general condition to 8.5.3.5 for the SDG parameter that includes the *EvalSD* parameter, similar to the OR scheduling equations in 8.5.1.3. i.e. Sum(SDG) >= (AtMLP + EvalSD) * MinQDG; with the current 8.5.3.5 allocated as a sub-bullet. This would give clarity in the following example: A resource has a ramp-down rate of 5 MW/min with MLP at 100 MW. In the previous interval, it was at 200 MW and the PD engine de-commits the resource (EvalSD = 1). In the RT calculation engine, to respect the ramp down rate, the resource must be scheduled above its MLP for several intervals before shutdown.	The constraint in section 8.5.3.5 is used to ensure that the NQS resource will be scheduled at or above its MLP when it is committed, but it does not prevent the resource from also being scheduled above its MLP when EvalSD = 1. If EvalSD were included in section 8.5.3.5 as suggested, it would preclude the resource from being dispatched below MLP when its decommitted by the PD engine. For the example provided, even without EvalSD = 1 in section 8.5.3.5, the resource would continue to be scheduled above MLP for several intervals because its ramp down rate will limit its schedules in accordance with the energy ramping constraint in section 8.6.1.

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14A	OPG	Appendix 7.3A, section 8.6.1.1	Section 4.2.2.15, with reference to Market Renewal Program: Energy Offers, Bids and Data Inputs Issue 2.0 Section 3.4.2.2 Hourly Dispatch Data – Energy Ramp Rate (page 29), indicates there can be up to five sets of ramp rates, $URRDG_{i,b,w}$, used in the RT calculation engine. Please explain why Section 8.6.1.1 states that a single ramp up rate ($URRDG_b$) and a single ramp down rate ($DRRDG_b$) will be used over the full operating range of a dispatchable generation resource. For a dispatchable generation resource with the following sets of ramp up rates: • 0-10 MW: 5 MW/min • 10-20 MW: 4 MW/min • 20-30 MW: 8 MW/min • 30-40 MW: 2 MW/min • 40-50 MW: 1 MW/min which ramp up rate is used if the resource is to ramp up across two break points, i.e. which ramp rate is selected as the $URRDG_b$ in Section 8.6.1.1?	Section 8.6.1.1 inaccurately describes URRDG and DRRDG as single ramp up and ramp down rates as the RT calculation engine is designed to evaluate multiple ramp rates. Section 8.6.1.1 will be revised as follows: For dispatchable generation resources, the ramping constraint in Section 8.6.1.5 uses URRDGb to represent a ramp up rate selected from URRDGi,b,w and uses DRRDGb to represent a ramp down rate selected from DRRDGi,b,w. Section 8.6.1.2 will also be updated in a similar manner to the reflect the use of multiple ramp rates for dispatchable loads. Since the DAM and PD calculation engines also evaluate multiple ramp rates, the equivalent sections in Appendix 7.1A and Appendix 7.2A will also be updated. For the example provided, a combination of multiple ramp rates will used to ramp a resource across multiple break points.
14B	OPG	Appendix 7.3A, section 8.6.1.5	With reference to the comment for Section 8.6.1.1, if there can be up to five sets of ramp rates used in the RT calculation engine for each ramping direction, why are only URRDGb and DRRDGb (the constant ramp up and ramp down rates from 8.6.1.1) referenced in the operational constraint calculation in Section 8.6.1.5? For a dispatchable generation resource with the following set of ramp up rates: • 0-10 MW: 5 MW/min • 10-20 MW: 4 MW/min • 20-30 MW: 8 MW/min • 30-40 MW: 2 MW/min • 40-50 MW: 1 MW/min if the resource is currently at 10 MW at the beginning of an interval, which ramp up rate (URRDGb) is used in the equation in Section 8.6.1.5?	Please see IESO response to ID #14A. For the example provided, ramp up rates 4, 8, and 2 could all be used to ramp up the resource within the next interval.

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15A	OPG	Offers, Bids and Data Inputs Detailed Design 2.0, section 3.4.6.4	Could the IESO elaborate on the intent of the statement quote above? OPG interprets the statement as "Market Participants shall not submit operating reserve offers if the resource is scheduled below its reserve loading point for entire duration of a given dispatch hour." Is this the correct interpretation? How would the MP know whether the resource is scheduled below its reserve loading point prior to operating reserve offer submission? How would the MP anticipate/infer a resource's schedule without having the scheduling output from the IESO for the dispatch hour?	Thank you for the feedback. The IESO will provide clarity for how these obligations are met in the future market as part of the market and system operations batch of proposed market rule and market manual amendments.
15B	OPG	Offers, Bids and Data Inputs Detailed Design 2.0, section 3.4.6.4	OPG requests clarification of the treatment of the MLP and the RLP parameters by the DA and PD calculation engines after Market Renewal. The current IESO Dispatch Scheduling and Optimization (DSO) tool does not consider a resource's MLP and RLP as the minimum operating limits for providing OR. This can result in dispatch instructions that removes the resource's ability to offer OR, resulting in OR cancellation; see example below: - In PD, a resource has MLP of 50 MW, RLP of 50 MW and has maximum OR offer at 20 MW; - Through the current joint-optimization process, the resource receives an OR dispatch of 20 MW and energy dispatch of 30 MW; -Resource is not able to provide OR at 30 MW, which is below both its MLP and RLP; -Resource cancels its OR offer as it cannot meet the OR activation due to resource being scheduled below its MLP and RLP.	For MRP, the DAM and PD calculation engines will consider minimum loading point (MLP) and reserve loading point (RLP) in the joint optimization of energy and OR. In this example, the DAM and PD calculation engines will ensure that the resource can be scheduled for OR only if its energy schedule is at or above MLP, and will consider the RLP constraint when scheduling OR.
15C	OPG	Offers, Bids and Data Inputs Detailed Design 2.0, section 3.4.6.4	Is there a difference in consideration of the MLP and RLP between the current DSO and the enhanced DA and PD calculation engines, i.e. do the enhanced calculation engines consider the MLP and RLP as binding parameters in OR scheduling?	Yes, there is a difference between today's DACP and PD engines and the MRP DAM and PD calculation engines. Today's DACP calculation engine does not consider RLP constraints, but does consider MLP when scheduling OR. The current PD calculation engine considers RLP constraints but does not consider MLP when scheduling OR. For MRP, the DAM and PD engines will consider both MLP and RLP constraints when scheduling energy and OR.

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15D	OPG	Offers, Bids and Data Inputs Detailed Design 2.0, section 3.4.6.4	Can the IESO outline differences (if any) in energy and OR scheduling from the current DSO tool and the enhanced DA and PD calculation engines for the example presented above.	In the example presented in ID #15B above, the current DACP engine does not respect RLP constraints, but respects the MLP constraint. Therefore, the resource will be scheduled for OR only when the energy schedule is at or above MLP (i.e., >= 50MW) without respecting the RLP constraints. In the current PD engine, RLP constraints are considered, but the MLP constraint is not considered. So, if the resource is scheduled for 30MW of energy, the resource can be scheduled up to 30MW*(20MW/50MW) = 12MW of operating reserve. For MRP, the DAM and PD calculation engines will not schedule OR for the resource unless the energy schedule is at or above its MLP = 50MW. Both engines will also consider the RLP = 50MW constraint when scheduling reserve for the resource.