Stakeholder Feedback and IESO Response

MR-00494-R00: Pseudo Unit Updates in the Calculation Engines – Comments and Questions from Vlad Urukov

Provision	Comment	IESO Response
22.2.2A The *day-ahead market calculation engine* shall prorate the derating submitted by a *market participant* on the steam turbine *resource* in hour $h \in \{1, .., 24\}$ to the associated *pseudo-units* when *pseudo-unit* $k \in \{1, .., K\}$ for hour h meets all the following conditions: 22.2.2A.1 *Pseudo-unit* k has submitted an *offer* in hour h; 22.2.2A.2 *Pseudo-unit* k has no *planned outage* or *forced outage* on the	As Market Participants submit offers, consider rewording 22.2.2A.1 as "an offer for pseudo-unit was submitted…" I think the h's in .1 to .5 need to be italicized as the k's are.	Thank you, the wording "pseudo-unit k has submitted an offer" has been replaced with "an offer for pseudo-unit k was submitted" as suggested. This change has been made throughout in the following sections: • Appendix 7.5, sections 22.2.2A, and 22.3.5.2A; • Appendix 7.5A, sections 15.2.2A, and 15.3.5.2A; • Appendix 7.6, sections 10.2.2A and 10.3.5.1A. Variable "h" has been italicized in the following sections:

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associated combustion turbine *resource* in hour h; 22.2.2A.3 *Pseudo-unit k* has no fixed or maximum constraint on the associated combustion turbine *resource* below the designated *minimum loading point* of combustion turbine *resource* in hour h; 22.2.2A.4 *Pseudo-unit k* has no fixed or maximum constraint below the *minimum loading point* of *pseudo-unit* k in hour h; and 22.2.2A.5 *Pseudo-unit k* is not operating in *single cycle mode* for the day.		• Appendix 7.5 sections 22.2.2A and 22.3.5.2A.
	Is this change related to the proposed amendment or addressing a separate issue?	This change was identified when reviewing the limitations inherent in the existing pseudo unit design. Non-Quick starts are (NQS) particularly affected by this logic due to their slower ramping abilities. The

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5.6.1.6 Where *dispatch instructions* are issued by the *IESO* due to a manual constraint, the *real-time calculation engine* shall determine the initial *energy* schedule using the most recent *dispatch instructions* in place of $SDLSch_{0,b}^{Prev}$ and $SDGSch_{0,b}^{Prev}$.		majority of NQS resources are pseudo-units. Once this issue was identified the change was extended to all resource types to improve the logic in the tool and ensure consistent treatment across all resource types. The inclusion of this provision is not expected to have a material impact on non-pseudo unit resources.
8.6.2.3 Where a *resource*'s minimum constraint, maximum constraint, or derating below *minimum loading point* overlaps with the calculated ramping trajectory of a *non-quick start* resource, the *real-time calculation engine* shall enforce the applicable constraint or derating for the duration of that overlap. Upon the expiry or	Can you provide more detail on what is a "ramping trajectory". The two can overlap but not be incongruent. An example for this case will be useful.	A ramping trajectory is the sequence of scheduled energy quantities for a resource over time as determined by the DSO, taking into account the resource's ramp rates. When one or more quantities on the calculated ramping trajectory fall outside the resource's permissible operating range, the constraint becomes binding on portions of the trajectory and requires the DSO to enforce the constrained quantity until the constraint or derating is removed. Please

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removal of the constraint or derating, the *real-time calculation engine* shall continue ramping the *non-quick start resource* from the most recently established quantity in the *real-time schedule*.		see the example provided in the Appendix to this document.
Description: The added section was introduced to capture the scenario where the PSU is operating in single cycle mode or the associated ST is offline. Modified sections: • 22.2.3.1.1 (Appendix 7.5), • 15.2.3.1.1 (Appendix 7.5A), • 10.2.3.1.1 (Appendix 7.6) 15.1.1.7 $CSCM_k \in \{0,1\}$ designates whether *pseudo-unit k* $\in \{1,..,K\}$ is flagged to operate in *single cycle mode*, subject to section 15.5. 22.2.3.1.1 Step 1: Calculate the amount of *offered energy* attributed to each combustion turbine *resource* ($CTAmt_{h,k}$) and steam turbine *resource* portion ($STAmt_{h,k}$):	Can you explain the impact of not having the added section in the existing rules. Was it ignoring altogether when the unit was in a single cycle mode? Which of the three issues does the addition of (1-CSCM) map back to?	There is no impact, it was added for clarity and consistency with the variable *STAmtDR*. This is not directly tied to any of the three enhancements but was identified while reviewing the rules.

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If $TotalQ_{h,k} < MMLP_k$ then: $CTAmt_{h,k} = 0$; and $STAmt_{h,k} = 0$. Otherwise: $CTAmtMLP = MMLP_k \cdot CTShareMLP_k$; and $STAmtMLP = (1 - CSCM_k) \cdot MMLP_k \cdot STShareMLP_k$. If $TotalQ_{h,k} > MMLP_k + MDR_k$, then:		

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22.2.3.1.2	Step 2: Allocate the steam turbine *resource* capacity to each steam turbine *resource* portion associated with *pseudo-unit* that meets the conditions in Section 22.2.2A: $PRSTCap_{h,k} = \left(\frac{STAmt_{h,k}}{\sum_{w \in \{1,..,K\}} STAmt_{h,w}}\right) \cdot STC$	1- Consider adding "…with pseudo unit k ∈ {1, . . ,K} …in hour h …that meets all the conditions …. " to align with next section. 2- Also what is the value of $STAmt_{h,k}$ which is set to zero if the conditions are not met. 3- What is $PRSTCap_{h,k}$? I don't see it defined in the Appendix at all.	1- Thank you, "all" has been added. 2- The value of $STAmt_{h,k}$ is calculated in step 1 which is outlined in section 22.2.3.1.1 3- $PRSTCap_{,h,k}$ represents the pro-rated steam turbine share in the pseudo-unit after the derates have been accounted for. It is not currently defined, an edit to section 22.2.3.1.2 has been made to define this variable, similar to how $CT\ Amt_{hk}$ and $ST\ Amt_{h,k}$ are defined in 22.2.3.1.1.

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22.3.5.3 The steam turbine *resource* maximum constraint shall be converted to a *pseudo-unit* constraint as follows: The steam turbine *resource* portion ($STAmt_{h,k}$) shall be calculated as per Section 22.2.4.1.1. Allocate the steam turbine *resource* maximum constraints to each *pseudo-unit* that met the conditions in Section 22.3.5.2A as follows:	1- Is there a closing bracket after STAmt that needs to be removed or an opening one added? 2- Also how is section 22.2.4.1.1 establishing the calculation of STAmt as per: 22.2.4.1.1 $QMLP_{h,k}$ designates the total quantity that may be scheduled in the *minimum loading point* region;	1- Thank you, we have removed the brackets around *STAmt.* 2- The correct cross-reference should be 22.2.3.1.1. We have corrected this in the proposal.
15.3.5.3.2 Allocate the steam turbine *resource* maximum constraints to each *pseudo-unit* that met the conditions in section 15.3.5.2A as follows: $PRSTMax_{t,k} = \left(\frac{STAmt_{t,k}}{\sum_{w\in\{1,..,K\}} STAmt_{t,w}}\right) \cdot STMax.$	Where is the section that specifies what happens if the conditions are not met as included in the other sections where such language was added?	Section 15.3.5.3.2 has been revised to add an 'if statement' if the conditions are not met as suggested.
~~If $CTCap_{t,k} < CMLP_k$, then the *pseudo-unit* is unavailable.~~	Explain the deletion of this two If…then statements. Why are they removed?	Previously, a PSU was deemed unavailable in RT when a CT or ST derate reduced its capability below the MLP. This requirement has been removed.

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~~If $PRSTCap_{i,k} < SMLP \cdot (1 - CSCM_k)$, then the *pseudo-unit* is unavailable.~~		Under the enhancements, the RT engine will calculate a *PSUMax* from the CT and ST high operating limits, permitting operation below the MLP.
10.2.3.1.5 Step 5: Apply the derating for the combustion turbine *resource* to the *dispatchable* and *minimum loading point* regions for *pseudo-units* not operating in *single cycle mode* where the associated steam turbine *resource* is online: If $CTCap_{i,k} < CMLP_k$, then Calculate $PRSTCapMLP_{i,k} = CTCap_{i,k} \cdot \left(\frac{STShareMLP_k}{CTShareMLP_k}\right)$ Update $MLP_{i,k} = CTCap_{i,k} + PRSTCapMLP_{i,k}$; $DR_{i,k} = 0$; and $DF_{i,k} = 0$. Otherwise: Calculate P so that $CMLP_k + P \cdot CTShareDR_k \cdot MDR_k = CTCap_{i,k}$; and ~~Set~~ Update $DR_{i,k} = min(DR_{i,k}, P \cdot MDR_k)$.	1- What is the difference between "Calculate" and "Update"? I also note the word "calculate" was deleted in previous sections. 2- The first part of this section updates MLP, DR and DF whereas the old section only updated DR. Confirm MLP and DF do not need to be updated. 3- Step 5 does not contain an "if". Consider rewording so that the "otherwise" is clear.	1- "Update" refers to a variable that is already calculated but needs to be updated based on the provision. "Calculate" refers to variables that are being calculated for the first time. 2- In the Otherwise condition, no adjustment to the MLP is required because the derate does not reduce capability below the MLP. The DF is then subsequently determined in Step 6. If the derate does reduce capability below the MLP as in the first condition, the pseudo-unit is inherently unavailable to operate within the DR and DF ranges. As a result, the corresponding values are set to zero. 3- The 'otherwise' catches all scenarios that are not covered under the "if $CTCap < CMLP$" statement. As such, the IESO believes it is fine as is.

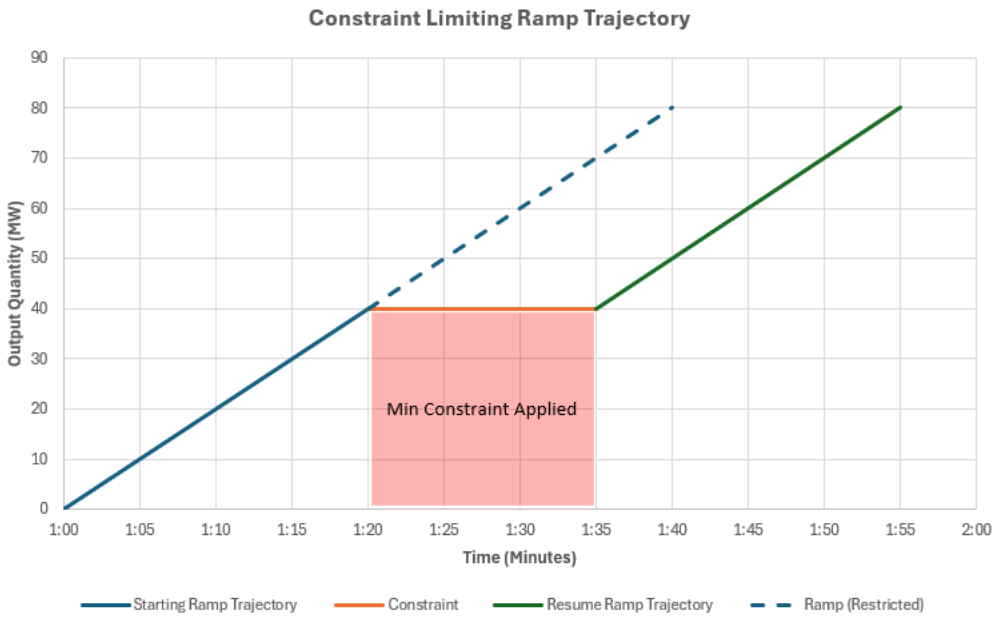
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The aggregate steam turbine maximum constraint shall equal the summation of the steam turbine *resource* portion maximum constraints across all applicable *pseudo-units*.	How is this condition incremental to the equation and why is it not itself represented by an equation? $CTMax_{i,k} = PSUMax_{i,k} * CTShareMLP_k$; and $PRSTMax_{i,k} = PSUMax_{i,k} - CTMax_{i,k}$.	The condition is incremental as the equation reflects a singular resource whereas the text reflects an aggregate of the resources across a facility. It was determined that this would be best explained in text.
10.3.3.2.3 Where the associated combustion turbine *resource* and/or steam turbine *resource* are not online and a future *start-up time* has been confirmed, the *real-time calculation engine* shall apply the calculated maximum constraints determined in Sections 10.3.3.2.1 and 10.3.3.2.2 to the advisory intervals, using the confirmed *start-up time* to determine when the associated *resource* is considered online.	Isn't the case where one or the other is not online (see "or" in "and/or") the same as in 10.3.3.2.1, assuming not online = offline.	Section 10.3.3.2.3 covers the scenario where either the CT and ST (or both) are off-line, however there is a confirmed future start-up time. In this case, in the advisory intervals leading up to that start-up time, the constraints on the combustion turbine and the steam turbine resource share are calculated according to sections 10.3.3.2.1 and 10.3.3.2.2.

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10.3.5.2.1 The steam turbine *resource* portion $STAmt_{i,k}$) shall be calculated as per section 10.2.4.1.1. 10.3.5.2.2 Allocate the steam turbine *resource* maximum constraints to each *pseudo-unit* that met the conditions in section 10.3.5.1A as follows:	1- Missing an opening bracket or need to delete closing bracket. 2- How is STAmt related to QMLP? 10.2.4.1.1 $QMLP_{i,k}$ designates the total quantity that may be scheduled in the *minimum loading point* region;	1- Thank you, we have removed the brackets around *STAmt.* 2- The correct cross-reference should be 10.2.3.1.1 and has been corrected in the proposal.
10.3.5.1A.3 *Pseudo-unit* k has no 0MW fixed or maximum constraint on the associated combustion turbine *resource* in interval i; 10.3.5.1A.4 *Pseudo-unit* k has no 0MW fixed or maximum constraint in interval i; and	Confirm that there can be a maximum constraint or fixed constraint as 0MW. I would expect a maximum constraint would be a non zero value. How is such a zero constraint different than being unavailable?	Effectively, a zero constraint is the same as being unavailable in the DSO. There may be some situations where there is a zero maximum constraint that is needed to correct erroneous scheduling resulting from incorrect data inputs.

Appendix

Ramp Trajectory

- A resource with a 2 MW/Min is ramping starting from 1:00 from zero to 80 MW
- A minimum constraint is applied from 1:20 to 1:35, the resource will be restricted to 40 MW
- After the constraint is lifted at 1:35, the resource will continue to ramp starting from 40 MW



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