Comments and Questions

ID	Statement (From TP presentation found here, the proposal found here, and the supplemental presentation found here)	IESO Response
From Vlad Urukov Make-Whole Payments are one of the more complex components of the payment structure(s) of the Renewed Market. As such, I believe caution is necessary when evaluating any changes to the existing formulae to avoid introducing new, unwarranted interactions or inappropriate settlement outcomes. Fundamentally, MWPs should reflect their design intent to "compensate dispatchable resources … for lost cost and lost opportunity cost in the real-time market when following IESO dispatch instructions."[1] I am also relying on the IESO's characterization of all three items in the proposed amendment as occurring only in "specific and limited circumstances,"[2] absent specific materiality analysis.		
1	As I highlighted in the December 2, 2025 Technical Panel meeting, forbidden regions and MWPs — including the notion of MWP reduction via a FROP term — were presented to participants in the August 25, 2022 presentation titled "Day-Ahead and Real-Time Make-Whole Payments for Hydroelectric Generation Facilities". In its August 25, 2022 presentation, the IESO stated: "Forbidden region restrictions can potentially result in a higher or lower schedule than would otherwise be determined by the calculation engine." In my opinion, the existing Energy FROP was introduced to address instances when the DSO produces a schedule that is different from the EOP as a result of a forbidden region. Fundamentally, the argument is that when a resource with a forbidden region is scheduled at the boundary or inside that region by the DSO, the DSO is either looking to be outside or to ramp through the region and, but for the presence of the forbidden region, would have instead produced a schedule matching the EOP (hence, MWPs are not warranted). While the IESO stated in its response to my question on Item 1 that "There could be situations where EOPs and schedules differ just as there are for resources without Forbidden Regions," the assumption remains that if the DSO schedules a resource with a forbidden region at the boundary or inside the forbidden region, it does so for no reason	The IESO undertook an analysis of forbidden regions and MWPs since MRP go-live, and the results show that the majority of instances are scheduled at the boundary of a forbidden region due to the presence of a forbidden region. We agree that there are edge-case instances that have occurred due to reasons other than to respect a forbidden region. These instances represent a very small percentage of scheduled intervals. Specific findings show that since MRP launch (May 2025) approximately 95% of occurrences are the result of the engine respecting the forbidden region of a hydro-electric resource, and therefore the removal of the make-whole payment would be appropriate. There are 3 main reasons why a hydro resource may be scheduled at the upper boundary of its submitted forbidden region, described below. The percentages are the result of the analysis. Of those intervals in which a RT LC FROP is triggered:

[1] Guide to Wholesale Electricity Charges www.ieso.ca
[2] Technical Panel Education: Adjustments to Real-Time Make-Whole Payments, December 2, 2025

<table>
<tr><th>ID</th><th>Statement

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<tr><td></td><td>other than the presence of the forbidden region. I can understand why that would be the case inside the region based on the statement that the DSO will schedule inside only in order to ramp through it. However when it comes to the question of “at the boundary”, my understanding from the discussion in the January 13, 2026 meeting is that the IESO does not know this with certainty but instead relies on a claim of high likelihood — a claim for which no supporting evidence was provided.
In Item 1 Additional Example 2 (Supplemental Presentation), the IESO states:
“RT MWP for the lost opportunity operating reserve will be clawed back because the RT energy schedule is at the upper boundary of the forbidden region,” which in my opinion can be extended to say: “…which is at this value for no other reason than the existence of forbidden regions for the resource in question.” Importantly, by comparison, a resource that does not have registered forbidden regions and receives this same 20 MW / 20 MW schedule will keep its MWPs because the schedule logically could not have been a result of the presence of forbidden region.
By way of an example, a hypothetical resource with a 0 – 40 MW forbidden region and a 100 MW “in the money” offered capacity can be sent (i.e., constrained) down to 0 for reasons unrelated to forbidden regions. Consider the following schedules as the resource ramps down:
<table><tr><td>Int</td><td>Schedule</td><td>EOP</td><td>Comments</td></tr><tr><td>1</td><td>100</td><td>100</td><td>No MWP required</td></tr><tr><td>2</td><td>50</td><td>100</td><td>MWP and no FROP</td></tr><tr><td>3</td><td>0</td><td>100</td><td>FROP takes MWP to zero</td></tr><tr><td>4</td><td>0</td><td>100</td><td>FROP takes MWP to zero</td></tr><tr><td>5</td><td>50</td><td>100</td><td>MWP and no FROP</td></tr><tr><td>6</td><td>100</td><td>100</td><td>No MWP required</td></tr></table>
The treatment in interval 3 and 4 is not related to forbidden regions and should be not be subject to the FROP clawback as is the case for interval 2 and 5. This example has been observed in market data and demonstrates that at times the existing methodology does</td><td>1. The DSO is respecting the forbidden region (approximately 95% of intervals)
2. There were pricing and scheduling discrepancies that led to the resource being scheduled at the boundary. This happens when the schedule from the scheduling pass is equal to the forbidden region upper limit (FR_UL) and the schedule from the pricing pass is less than or equal to the forbidden region lower limit (FR_LL). (approximately 4% of intervals)
3. The IESO has constrained the resource for reliability to the FR_UL (Approximately 1% of intervals)

In all 3 cases from the resource’s perspective, the outcome looks the same. The resource is scheduled at the FR_UL and the energy lost cost EOP is to a value less than the FR_UL.
How can reason #2 happen:
The real-time engine optimizing schedules over a time horizon of the next 12 intervals. There could be several possible constraints the RT engine is considering when coming to this scheduling pass outcome such as ramping up the resource to be available in a future interval at higher RT LMPs. These outcomes can be complicated and are separate from when the real-time engine adjusts a schedule to respect the forbidden region.
How can reason #3 happen:
This happens when the IESO constrains the resource for reliability to exactly the upper boundary of their forbidden region.

Response to the example:
In an example where the RT MWP is calculating for a range of MW that goes beyond the forbidden region, then the FROP calculation will only clawback the MWP from the forbidden region. Meaning in this example the FROP</td></tr>
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	not appropriately treat certain instances by ascribing binding significance to forbidden regions, where one does not exist. **Fundamentally, it is not clear to me how the IESO has ensured the validity of the claim that a schedule at the boundary of a forbidden region is the result of the forbidden region rather than another constraint that coincidentally aligns with it.** Further explanation is essential to justify both the existing and the proposed FROP terms. **I encourage the IESO to provide additional information in support of this underlying claim.** **For further clarity, I would like to know what percentage of instances relate to the DSO scheduling inside as opposed to at the boundary of a forbidden region. Also, what gives the IESO certainty that a schedule at a forbidden region boundary is not a coincident event rather than a causal one.** Ultimately, I believe the broadly applied market rules that include the boundary of forbidden region is not appropriate and requires further deliberation and discussion.	clawback would only be up to the FR_UL = 40MW. Any MWPs between 40MW and 100MW would continue to be paid to the resource. This is relevant to intervals 3 and 4, since the MWP would not go to zero. **Q: For further clarity, I would like to know what percentage of instances relate to the DSO scheduling inside as opposed to at the boundary of a forbidden region.** Of the instances observed since May, approximately 60% of these represented hydro resources which have been scheduled within their forbidden region, and 40% where hydro resources were scheduled at the boundary of a forbidden region. **Q. What gives the IESO certainty that a schedule at a forbidden region boundary is not a coincident event rather than a causal one.** The analysis above shows that 95% is a causal relationship with the remaining 5% a coincident relationship.
2	Additionally — and unrelated to the comments above — the current Charge Codes and Equations document contains an error (in the form of an inconsistency) when comparing the yellow-highlighted and red-underlined portions for the equal portion of the "≥" and "≤" terms.	The IESO will correct the error as shown below to coincide with the implementation of MR-00490-R00 market rule changes and Charge Types and Equations: The where clause underlined in red has incorrect language. Correct language is: $RT\_QSI_{k,h}^{m,t}$ is greater than or equal to $FR\_LL_{k}^{m,f}$ and $RT\_QSI_{k,h}^{m,t}$ is less than $FR\_UL_{k}^{m,f}$, • FR_UL – replace "RT_QSI < FR_UL" with "RT_QSI <= FR_UL"; • FR_LL - replace "RT_QSI >= FR_UL" with "RT_QSI > FR_UL".

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	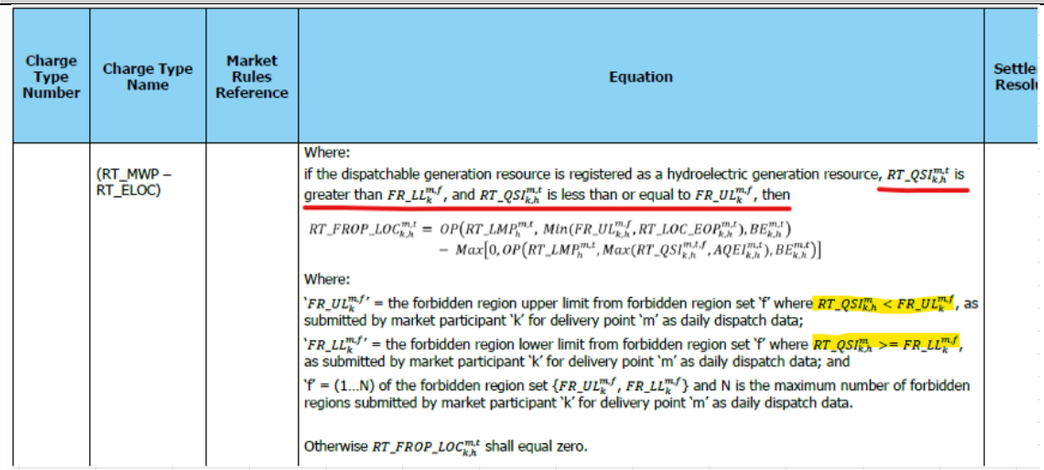 Charge Type Number / Charge Type Name: (RT_MWP – RT_ELOC) / Market Rules Reference / Equation / Settle Resol Where: if the dispatchable generation resource is registered as a hydroelectric generation resource, $RT\_QSI_{k,h}^{m,t}$ is greater than $FR\_LL_{k}^{m,f}$, and $RT\_QSI_{k,h}^{m,t}$ is less than or equal to $FR\_UL_{k}^{m,f}$, then $RT\_FROP\_LOC_{k,h}^{m,t} = OP(RT\_LMP_{h}^{m,t}, Min(FR\_UL_{k,h}^{m,f}, RT\_LOC\_EOP_{k,h}^{m,t}), BE_{k,h}^{m,t}) - Max[0, OP(RT\_LMP_{h}^{m,t}, Max(RT\_QSI_{k,h}^{m,t,f}, AQEI_{k,h}^{m,t}), BE_{k,h}^{m,t})]$ Where: '$FR\_UL_{k}^{m,f}$' = the forbidden region upper limit from forbidden region set 'f' where $RT\_QSI_{k,h}^{m} < FR\_UL_{k}^{m,f}$, as submitted by market participant 'k' for delivery point 'm' as daily dispatch data; '$FR\_LL_{k}^{m,f}$' = the forbidden region lower limit from forbidden region set 'f' where $RT\_QSI_{k,h}^{m} >= FR\_LL_{k}^{m,f}$, as submitted by market participant 'k' for delivery point 'm' as daily dispatch data; and 'f' = (1...N) of the forbidden region set {$FR\_UL_{k}^{m,f}$, $FR\_LL_{k}^{m,f}$} and N is the maximum number of forbidden regions submitted by market participant 'k' for delivery point 'm' as daily dispatch data. Otherwise $RT\_FROP\_LOC_{k,h}^{m,t}$ shall equal zero.	
3	Original language: 3.5.4.5 *resources* shall be ineligible for ELC when it is injecting or withdrawing energy below it's RT_LC_EOP; 3.5.4.6 *resources* shall be ineligible for ELOC when it is injecting or withdrawing energy above RT_LOC_EOP;	**Q: can a negative ELC/ELOC be calculated in instances when injections/withdrawals are below RT_LC_EOP or above RT_LOC_EOP, respectively?** Yes **Q: Can the IESO comment on conditions when the above would result in a negative ELC, ELOC, if any?** If injections/withdrawals are below RT_LC_EOP or above RT_LOC_EOP it will result in a negative ELC/ELOC. We have provided an example below to illustrate this. With ELOC this can happen if a resource is more economic in OR but, gets scheduled for more in energy (due to constraints or Constraint Violation Prices).

<table>
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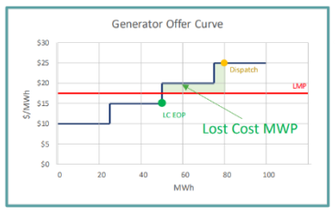
Lost Cost and Lost Opportunity Scenarios


Lost cost (LC) scenarios occur when the LMP implies the resource should have been scheduled lower.
Lost opportunity cost (LOC) scenarios occur when the LMP implies the resource should have been scheduled higher.


The original condition covers cases where MWPs are not warranted because the perceived LOC and LC have not materialized based on actual output.
The proposed change, when ignoring the added language for real-time schedules, changes this condition so that it only applies when ELC and ELOC are positive, which is the common case.
Can the IESO comment on conditions when the above would result in a negative ELC, ELOC, if any? Specifically, can a negative ELC/ELOC be calculated in instances when injections/withdrawals are below RT_LC_EOP or above RT_LOC_EOP, respectively? I expect that it is not the case but would like to confirm this as the amended language introduces a change to this condition.
</td><td>
The resource is injecting up to their scheduled amount in energy. When the EOP engine runs, it will put more MWs into OR than energy because the resource is more economic in OR. In this case the ELOC will result in a negative to offset against the positive OLOC, ensuring the resource is made whole to their optimal schedule and nothing more.
<table>
<tr><td>Energy Offer P & Q</td><td></td><td>Energy LMP</td><td>Energy RT injection</td><td>Energy EOP</td></tr>
<tr><td>$10.00</td><td>50</td><td>$500.00</td><td>50</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td>Market OP</td><td>Optimal OP</td></tr>
<tr><td>ELOC Result</td><td>-$2,041.67</td><td></td><td>$2,041.67</td><td>$0.00</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>10S Offer P & Q</td><td></td><td>10S LMP</td><td>10S RT Injection</td><td>10S EOP</td></tr>
<tr><td>$0.09</td><td>50</td><td>$700.00</td><td>0</td><td>50</td></tr>
<tr><td></td><td></td><td></td><td>Market OP</td><td>Optimal OP</td></tr>
<tr><td>OLOC Result</td><td>$2,916.29</td><td></td><td>$0.00</td><td>$2,916.29</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total Market OP</td><td>Total Optimal OP</td></tr>
<tr><td>Total LOC MWP</td><td>$874.63</td><td></td><td>$2,041.67</td><td>$2,916.29</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total Payments</td><td>$2,916.29</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td colspan="3">Received from Kristine Liao, OPG. January 26, 2026</td></tr>
<tr><td>4</td><td>OPG is supportive of this change as OPG recognizes that hydro market participants should not be eligible for Make Whole Payments (MWPs) for the portion of the schedule that is unachievable strictly due to physical limitation, i.e. forbidden regions. However, OPG strongly recommends the IESO to consider the edge cases where a hydro resource is scheduled to the upper bound or lower bound of the forbidden region due to markets economics and not due to physical limitation. In</td><td>See response to Vlad Urukov above.

The scope of this project has been to address Operating Reserve. Removing the '=' sign would be beyond the scope of the project by impact energy lost cost (ELC) and energy lost opportunity cost (ELOC). If the equal sign were removed from the FROP formulas then the calculations for ELC, ELOC would generate unwarranted RT MWP when the resource is</td></tr>
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	these instances, the proposed OR FROP unfairly penalizes hydro market participants. OPG proposes a revision to the FROP formula in the General Feedback section for the IESO to consider in the fair determination of MWP for schedules driven market economics as opposed to forbidden regions.	being scheduled at the boundary of its forbidden region due to the forbidden region. The change to apply the RT_OR_LOC_FROP calculation uses the same trigger as the RT_LC_FROP, meaning a change to the trigger would also impact when RT_OR_LOC_FROP.
5	OPG is supportive of this change and has no comments.	Thank you
6	OPG is supportive of this change and has no comments.	Thank you
7	Chapter 9, Section 3.5.6.3 There are potentially two errors in 3.5.6.3.c RT_OR_FROP_LOC formula: • (1) Can the IESO confirm if "RT_LC_EOP" in FR_QTY_AVAIL formula should be changed to "RT_LOC_EOP"? Since this formula is used in Lost Opportunity Cost MWP calculation, Lost Opportunity Cost EOP "RT_LOC_EOP" should be instead of Lost Cost EOP "RT_LC_EOP". • (2) The "where" condition under FR_QTY_AVAIL is inconsistent between proposed market rule amendments and "Item 1 Additional Example 1: Forbidden Region (con't)" from the January 13th Adjustments to Real-Time Make-Whole Payments – Supplemental Presentation, slide 13. The Supplemental Presentation shows FR_LL < RT_QSI <= FR_UL, but the proposed market rule amendments show FR_LL <= RT_QSI. There is misalignment between proposed market rule amendments and the material from the supplemental presentation: (1) the relationship between RT_QSI and FR_UL; and (2) the "=" sign is in a different place: one is associated with FR_LL and the other is associated with FR_UL.	1- IESO can confirm that the formula is correct as stated. The OR FROP for LOC applies to the same number of MW as does the existing energy FROP for RT LC. Because the LC energy FROP is dependent on the RT_LC_EOP, so too is the OR FROP. 2- Thank you for noting this discrepancy. The IESO has updated section 3.5.6.3 c. 3- The IESO agrees that including separators into sections 3.5.4.5 and 3.5.4.6 would minimize ambiguity and has revised the proposal accordingly. 4- Sections 3.5.4.5 through to 3.5.4.8 are all part of the ineligibility criteria outlined in section 3.5.4. Equations are applicable only for those resources that meet the eligibility criteria. In other words, eligibility is assessed first, then equations are applied.

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	Chapter 9, Section 3.5.4.5 This provision outlines the two conditions for ineligibility: "below its RT_LC_EOP" and "real-time schedule for energy is less than its RT_LC_EOP". OPG recommends that the IESO separate the conditions into bullet points to minimize ambiguity for interpretation and provide clarity to market participants. Secondly, can the IESO include reference to the settlement equations associated with the RT-MWP offset between Energy and Operating Reserve in this section for market participant review and understanding?	
8	Chapter 9, Section 3.5.4.6 Same comment as above, but applicable for RT_LOC_EOP.	See ID 7 above
9	OPG strongly recommends the IESO to remove instances where RT_QSI has "=" to both lower and upper limits from all FROP formulas, i.e. the FROP condition should be changed to FR_LL < RT_QSI < FR_UL, to exclude the forbidden region boundary limits in FROP calculation, in order to avoid unfairly penalizing a resource in cases where it is economically scheduled to the boundary limits. When RT_QSI = FR_UL or RT_QSI = FR_LL, it is hard to differentiate whether RT_QSI is scheduled based on forbidden region constraints (i.e. at upper or lower bounds) or is economically scheduled. The following example demonstrates the market participant is penalized unfairly for Real-Time Energy Lost Opportunity Cost MWP (RT_ELOC) when the resource's RT_QSI is scheduled economically by the DSO to the forbidden region lower bound. Resource A with the following market parameters: • Max Cap = 61 MW • Forbidden region = 0 to 25 MW • RT_LMP = $100	See response to ID 1 and ID 4.

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	• Energy Offer (BE) = {(10, 0); (10, 30); (45, 61);} • RT_LOC_EOP = 61 MW • RT_QSI = AQEI = 0 MW Calculation based on the formulas from Market Rule Chapter 9 Section 3.5.6.2 where: • OP(RT_LOC_EOP) = $4405 • OP(QSI, AQEI) = $0 • RT_FROP_LOC = $2250 • Thus RT_ELOC: = {Max[0, OP(RT_LMP, RT_LOC_EOP, BE)] – Max[0, OP(RT_LMP, Max[RT_QSI, AQEI], BE)] - RT_FROP_LOC} / 12 = {$4405 - $0 - $2250]} /12 = $179.58 In the above, Resource A is unfairly penalized by $2250/12 per interval when it is scheduled to 0 MW (i.e. lower bound of the forbidden region), even though the resource is scheduled economically by the DSO, and not due to the forbidden region. Economically scheduled resources should not be penalized, and it would be appropriate for the IESO to remove the boundary conditions in FROP calculation.	