



OCTOBER 14, 2026

Make-Whole Payments for Energy-Limited Resources

Independent Electricity System Operator (IESO)

Territory Acknowledgement

The IESO acknowledges the land from where we are delivering today's webinar is the traditional territory of many nations including the Mississaugas of the Credit, the Anishinaabeg, the Chippewa, the Haudenosaunee and the Wendat peoples, and is now home to many diverse First Nations, Inuit and Métis peoples. We also acknowledge that Toronto is covered by Treaty 13 with the Mississaugas of the Credit First Nation.

As we have attendees from across Ontario, the IESO would also like to acknowledge all the traditional territories across the province, which include those of the Algonquin, Anishinaabeg, Ojibwe, Cree, Oji-Cree, Huron-Wendat, Haudenosaunee, Métis, and Inuit peoples.

Engagement Principles

This engagement is conducted in accordance with the IESO's [External Engagement Framework](#), which includes the following principles:

- **Purposeful** – Initiate meaningful conversations that move the sector forward
- **Inclusive** – Invite many voices and diverse perspectives to the table
- **Timely** – Seek input and insight when it can have the most impact
- **Accessible** – Ensure we meet people where they are on their energy journey
- **Traceable** – Allow everyone to follow the path that is being taken
- **Transparent** – Show how engagement helped shape the final outcome

Shared Commitment to Respectful Participation

To support a focused and constructive discussion:

- We will take questions one at a time; please use the raise-hand feature to enter the speaking queue
- We encourage concise and focused comments to allow time for multiple perspectives
- Participants are encouraged to raise relevant points during the discussion and provide more detailed feedback through the written submission process
- We ask that all participants maintain a respectful and professional tone throughout the session
- Facilitators will guide the discussion and manage participation to stay aligned with today's focus and agenda
- Where necessary, we may disable a participant's microphone to manage participation



Agenda

Agenda

- Introduction
- Principles For Determining Day-Ahead Make-Whole Payments
- Operating Profits and Calculation of Make-Whole Payments
- Make-Whole Payments for Energy-Limited Resources
- Next steps and timelines



Introduction

Context

- Per the Market Rules, Energy-Limited Resources (ELRs) are those that submit a maximum daily amount of energy that can be allocated throughout the dispatch day.
- More broadly, a resource is energy-limited when there is a limitation on how the energy can be scheduled. This limitation is not only with respect to the volume of energy.
- ELRs include resources using the Single Model Storage Resource (SMSR) design that are optimized over multiple hours while respecting their energy limits and specific operational constraints.
- The Day-Ahead Market (DAM) optimization produces schedules for ELRs such that they achieve the greatest operating profits over the hours for which they are scheduled subject to resource and system constraints.
- When there is a misalignment between schedules and locational marginal prices, appropriate Day-Ahead Lost Cost Make-Whole Payments (DA LC MWP) should be determined for the scheduled hours.

Make Whole Payment Principles

- **Cost Recovery:** Appropriate compensation for unrecovered negative operating profits and foregone positive operating profits.
- **Make Whole, Not More Than Whole:** The calculation of make-whole payments should not result in compensation for revenues that the resource would otherwise be unable to realize.
- **Recognition of Inter-Temporal Relationships:** Appropriate consideration of any operational constraints and dispatch decisions that create dependencies between multiple hours.

DA MWP Calculation Approach

- The day-ahead market calculation engine schedules result from an optimization over a 24-hour horizon rather than a series of independent hourly decisions.
- Operational characteristics may create dependencies between hours and are inter-temporal constraints that affect a dispatchable resource's overall operating profit.
- When such inter-temporal constraints exist, assessing DA LC MWP on an hourly basis or a full 24-hour basis can result in over- or under-compensation.
- The relevant assessment period should align with the duration that is linked by when the constraint is binding.
- Within a day there can be more than one assessment period.

DA MWP for Energy-Limited Resources (ELRs)

- Based on the broader definition, ELRs have a constraint on how it can be feasibly scheduled throughout the dispatch day.
- In the DAM, resources, including ELRs, are optimized to respect their specific inter-temporal constraints over the day.
- For existing resource types, these constraints include the maximum daily energy limit (MaxDEL) and maximum number of starts (MaxStarts).
- With the ERP design, Single Model Storage Resources have State of Charge (SoC) constraints as an ELR.
- DA MWP calculations will be based on the operating profits accrued over the period when ELR specific temporal constraints are binding.



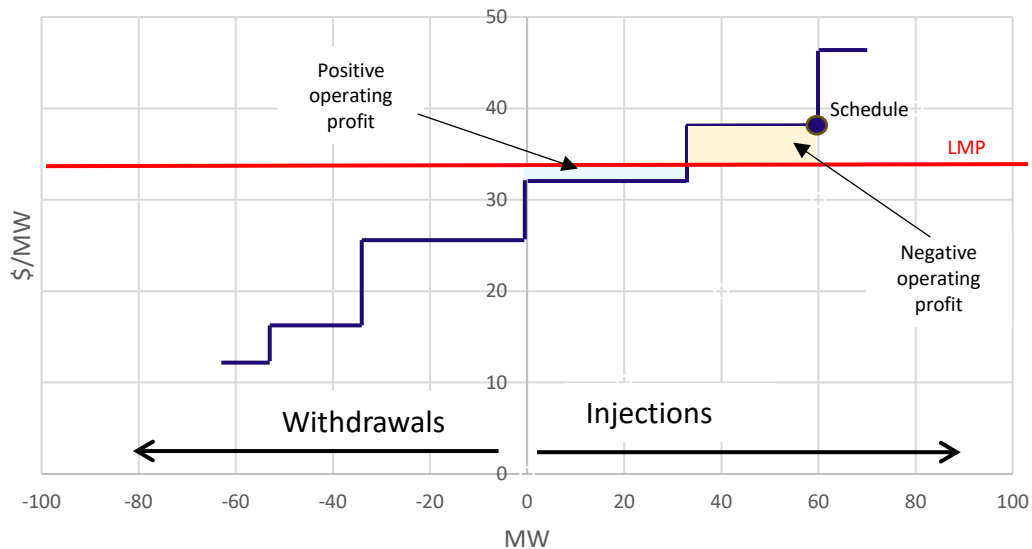
Operating Profits and Calculation of Day-Ahead Make-Whole Payments

Recap on Operating Profits

- Operating profit (OP) is calculated as the difference between the price offered/bid and the cleared locational marginal price times the MW schedule.
- Dispatchable generation resources have OPs based on offers.
- Dispatchable load resources have OPs based on bids.
- Single Model Storage Resources have OPs based on bi-directional offers (i.e., offers to withdraw are negative quantities).

Example of Operating Profits for a SMSR

Single-Model Storage Resource Bi-Directional Offer Curve



Operating Profits and Make-Whole Payments

- An operating profit can be positive, zero, or negative.
- A positive operating profit means that the resource is making money relative to its offered costs.
- A zero operating profit means that the resource is neither making nor losing money relative to its offered costs.
- A negative OP means that the resource is losing money relative to offered costs.
- DA Lost Cost MWP are intended to appropriately compensate resources for negative OPs.

Operating Profits from the Calculation Engines

- The Dispatch Scheduling Optimization (DSO) and Economic Operating Point (EOP) calculation engines both optimize consistent to the best OP outcomes based on resource bids and offers, subject to resource and system constraints.
- They differ in that the DSO considers system needs over a 24-h horizon, whereas the EOPs are calculated one hour at a time and with only resource constraints.

Economic Operating Points

- The calculation of make-whole payments requires an assessment of how a resource would be operated in a time-period based on economics alone, subject to a resource's physical limitations.
- For DA LC MWP, this operation is given by the DA LC economic operating points (EOP) and the application of settlement rules.
- DA LC EOPs for each offered energy and OR product are calculated by performing an optimization that maximizes the OP of a resource given its locational marginal price (LMP), offer/bid curve, and constraints related to its physical characteristics.

See the [May 22, 2026 engagement webinar](#) for examples of the calculation of EOPs.

Day-Ahead Lost Cost Make-Whole Payments (DA LC MWP)

- DA LC MWP are calculated by a comparison of the OP of the DSO schedule with that for the DA LC EOP.
- When the OP for the EOP is greater than the OP for the DSO schedule, a DA LC MWP, subject to settlement rules, is paid.



Applying the Make-Whole Payment Principles to Different Constraints

Applying MWP Principles Across Constraints

- The MWP principles outlined previously are applied consistently to the different types of constraints that limit how energy is scheduled.
- The following sections illustrate how these principles are applied to:
 - Maximum daily energy limit constraints (MaxDEL)
 - Maximum number of starts (MaxStarts)
 - State of Charge (SoC)

Resources Limited by MaxDEL

- Resources can specify a MaxDEL expressed in MWh.
- Over the course of the day, the DSO can only produce hourly schedules in which the energy summed over the day does not exceed MaxDEL.
- In determining the hourly schedules, the DSO considers tradeoffs across all 24 hours and, subject to constraints, schedules the energy in the hours that maximize the gains from trade.
- When MaxDEL is not binding, the schedules in each hour are effectively independent of one another.

Resources Limited by MaxDEL

- When the MaxDEL constraint is submitted, any scheduled energy in an hour reduces the amount that can be scheduled in other hours.
- When the MaxDEL constraint is binding, the DSO has optimally scheduled the resource such that any schedule changes among different hours would reduce the daily operating profit for the resource.
- In this instance the hours are intertemporally-linked and it is appropriate that the DA LC MWP properly reflect this dependency.
- Assessment over 24 hours, the hours in which there is a non-zero schedule, or hourly will result in the same DA LC MWP.

Application to Resources Limited by Max Starts

- MWPs for resources specifying a maximum number of starts considers the temporal nature of how their energy can be scheduled.
- For example, when a resource is limited by the maximum number of starts, the 24-hour optimization horizon can result in the resource incurring an OP loss in one or more hour to capture a larger positive OP in subsequent hour(s) instead of incurring another start.
- This dependency is captured by existing market rules for the calculation of DA LC MWP with negative and positive hourly OPs being assessed over each start.

Max Starts Limited Resource: MaxStarts is Binding and No DA LC MWP Paid

- A MaxStart-limited resource submits an offer curve of \$30/MWh for 100 MW and specifies a maximum of two starts per day.
- The DSO will determine how best to schedule the resource while taking the constraint on MaxStarts into consideration.
- The MaxStarts constraint can either be binding or not.
- In this example it is binding.

Parameter	Value
Offer	\$30/MWh for 100 MW
Maximum starts	2/day

MaxStarts is Binding and No DA LC MWP Paid

- The optimal schedule produced by the DSO uses one start in HE1 and the second in HE11.
- For the first start, all hours have a positive OP.
- The OP for HE14 – HE16 is negative.
- The DSO could avoid the negative OP hours and schedule the resource only for HE17 – HE21 with a total OP of \$61,000.
- Alternatively, the DSO could additionally schedule the resource for HE11 – HE16 to obtain the OP in HE11 – HE13 of \$4,500 and the OP of -\$4,000 in HE14 – HE16.

HE	LMP	Offer	DSO Energy Schedule MW	Operating profit	EOP MW
1	\$70	\$30	100	+\$4,000	100
2	\$65	\$30	100	+\$3,500	100
3	\$60	\$30	100	+\$3,000	100
4	\$55	\$30	100	+\$2,500	100
5	\$50	\$30	100	+\$2,000	100
6	\$45	\$30	100	+\$1,500	100
7	\$20	\$30	0	\$0	0
8	\$15	\$30	0	\$0	0
9	\$10	\$30	0	\$0	0
10	\$20	\$30	0	\$0	0
11	\$45	\$30	100	+\$1,500	100
12	\$50	\$30	100	+\$2,000	100
13	\$40	\$30	100	+\$1,000	100
14	\$20	\$30	100	-\$1,000	0
15	\$10	\$30	100	-\$2,000	0
16	\$20	\$30	100	-\$1,000	0
17	\$100	\$30	100	+\$7,000	100
18	\$150	\$30	100	+\$12,000	100
19	\$200	\$30	100	+\$17,000	100
20	\$250	\$30	100	+\$22,000	100
21	\$60	\$30	100	+\$3,000	100
22	\$25	\$30	0	\$0	0
23	\$20	\$30	0	\$0	0
24	\$15	\$30	0	\$0	0

MaxStarts is Binding and No DA LC MWP Paid

- The net of adding schedules for HE11 – HE16 is a positive OP of \$500.
- The resource is better off being scheduled for HE11 – HE21 with a total OP of \$61,500 as compared to the \$61,000 for only for HE17 – HE21.
- The DSO produces the HE11 – HE21 schedule.
- The OP for the entire HE11 – HE21 is considered when calculating the DA LC MWP. Even though there is a negative OP in HE14 – H16 a MWP is not appropriate for these hours and is not paid.

HE	LMP	Offer	DSO Energy Schedule MW	Operating profit	EOP MW
1	\$70	\$30	100	+\$4,000	100
2	\$65	\$30	100	+\$3,500	100
3	\$60	\$30	100	+\$3,000	100
4	\$55	\$30	100	+\$2,500	100
5	\$50	\$30	100	+\$2,000	100
6	\$45	\$30	100	+\$1,500	100
7	\$20	\$30	0	\$0	0
8	\$15	\$30	0	\$0	0
9	\$10	\$30	0	\$0	0
10	\$20	\$30	0	\$0	0
11	\$45	\$30	100	+\$1,500	100
12	\$50	\$30	100	+\$2,000	100
13	\$40	\$30	100	+\$1,000	100
14	\$20	\$30	100	-\$1,000	0
15	\$10	\$30	100	-\$2,000	0
16	\$20	\$30	100	-\$1,000	0
17	\$100	\$30	100	+\$7,000	100
18	\$150	\$30	100	+\$12,000	100
19	\$200	\$30	100	+\$17,000	100
20	\$250	\$30	100	+\$22,000	100
21	\$60	\$30	100	+\$3,000	100
22	\$25	\$30	0	\$0	0
23	\$20	\$30	0	\$0	0
24	\$15	\$30	0	\$0	0

Application to Resources with SoC

- When DA LC MWP are assessed on an hourly basis for resources with SoC, the fact that the energy schedule in one hour can create the opportunity to obtain a positive OP in another hour(s), is ignored.
- These opportunities arise from the DAM optimization such that the best OP outcomes result, and the SoC is within its minimum and maximum limits.
- The SoC at the end of one hour depends upon where it began the hour and the energy schedule during that hour – this is a fundamentally inter-temporal relationship.
- Considering SoC and other constraints, the DSO schedules the resource so that it should do no better in terms of OP.

SoC Resource Example: Opportunity to Inject at a Profit is Created by Withdrawing at a Loss

Parameter	Value
Max SoC	400 MWh
Min SoC	0 MWh
Initial SoC	0 MWh
Max charge / discharge	100 MW
Cycle efficiency	95%
Charge bid	\$20/MWh
Discharge offer	\$100/MWh

- An initial state of charge (ISoC) of 0 MWh has been submitted for a resource.
- The market participant has submitted a simple bi-directional offer curve to inject at prices at or above \$100/MWh and to withdraw at prices equal to or below \$20/MWh.

Opportunity to Inject at a Profit is Created by Withdrawing at a Loss

- Locational marginal prices in the evening peak are very high and significantly exceed the offer to inject.
- The only hour in which it is economical to withdraw is HE1. The DSO schedules a withdrawal of 100 MW.
- Prices in HE2 – HE5 are above the offer to withdraw, but by less than the amount by which the HE20 – HE23 prices are above the offer to inject.

HE	LMP	DSO Energy Schedule MW	End of Hour DSO SoC MWh	Energy EOP MW	End of Hour EOP SoC MWh
1	\$10	-100	95	-100	95
2	\$25	-100	190	0	95
3	\$30	-100	285	0	95
4	\$40	-100	380	0	95
5	\$60	-21	400	0	95
6	\$65	0	400	0	95
7	\$70	0	400	0	95
8	\$75	0	400	0	95
9	\$80	0	400	0	95
10	\$70	0	400	0	95
11	\$70	0	400	0	95
12	\$70	0	400	0	95
13	\$70	0	400	0	95
14	\$70	0	400	0	95
15	\$75	0	400	0	95
16	\$75	0	400	0	95
17	\$80	0	400	0	95
18	\$85	0	400	0	95
19	\$95	0	400	0	95
20	\$300	100	300	95	0
21	\$250	100	200	0	0
22	\$200	100	100	0	0
23	\$150	100	0	0	0
24	\$80	0	0	0	0

Opportunity to Inject at a Profit is Created by Withdrawing at a Loss

- The DSO schedules the resource to withdraw at a negative OP in HE2 – HE5 in order to capture a larger magnitude OP in HE20 – HE23.
- The EOP calculation engine is looking at one hour at a time. It schedules a withdrawal of 100 MW in HE1 resulting in a SoC of 95 MWh at the end of HE1.
- For HE2 – HE19, the economically optimal action is an energy EOP of 0 MW.

HE	LMP	DSO Energy Schedule MW	End of Hour DSO SoC MWh	Energy EOP MW	End of Hour EOP SoC MWh
1	\$10	-100	95	-100	95
2	\$25	-100	190	0	95
3	\$30	-100	285	0	95
4	\$40	-100	380	0	95
5	\$60	-21	400	0	95
6	\$65	0	400	0	95
7	\$70	0	400	0	95
8	\$75	0	400	0	95
9	\$80	0	400	0	95
10	\$70	0	400	0	95
11	\$70	0	400	0	95
12	\$70	0	400	0	95
13	\$70	0	400	0	95
14	\$70	0	400	0	95
15	\$75	0	400	0	95
16	\$75	0	400	0	95
17	\$80	0	400	0	95
18	\$85	0	400	0	95
19	\$95	0	400	0	95
20	\$300	100	300	95	0
21	\$250	100	200	0	0
22	\$200	100	100	0	0
23	\$150	100	0	0	0
24	\$80	0	0	0	0

Opportunity to Inject at a Profit is Created by Withdrawing at a Loss

- In HE20, the LMP is above the resource's offer, and it is economic to inject 95 MW. At the end of HE20, the EOP SoC is 0 MWh.
- Although LMP's are above the offer price for injections in HE21 – HE23, no SoC is available, so the energy EOP is 0 MW.
- Based on the LMP, the energy EOP in HE24 is also 0 MW.

HE	LMP	DSO Energy Schedule MW	End of Hour DSO SoC MWh	Energy EOP MW	End of Hour EOP SoC MWh
1	\$10	-100	95	-100	95
2	\$25	-100	190	0	95
3	\$30	-100	285	0	95
4	\$40	-100	380	0	95
5	\$60	-21	400	0	95
6	\$65	0	400	0	95
7	\$70	0	400	0	95
8	\$75	0	400	0	95
9	\$80	0	400	0	95
10	\$70	0	400	0	95
11	\$70	0	400	0	95
12	\$70	0	400	0	95
13	\$70	0	400	0	95
14	\$70	0	400	0	95
15	\$75	0	400	0	95
16	\$75	0	400	0	95
17	\$80	0	400	0	95
18	\$85	0	400	0	95
19	\$95	0	400	0	95
20	\$300	100	300	95	0
21	\$250	100	200	0	0
22	\$200	100	100	0	0
23	\$150	100	0	0	0
24	\$80	0	0	0	0

Opportunity to Inject at a Profit is Created by Withdrawing at a Loss

- Over HE2 – HE5, the resource has a -\$4,340 negative OP on withdrawal of 400 MWh. These 400 MWh are injected over HE20 – HE23 at an OP of \$31,000.
- Combined, these linked hours result in a positive operating profit of \$26,660, thus a MWP of \$4,340 would not be appropriate. The MWP is \$0.
- The resource earns an OP of \$1,000 through the HE1 withdrawal of 100 MWh and an additional \$19,000 by injecting this energy in HE20. There is no offset of this \$20,000.

HE	LMP	Charge bid	MW	Operating profit
2	\$25	\$20	100	-\$500
3	\$30	\$20	100	-\$1,000
4	\$40	\$20	100	-\$2,000
5	\$60	\$20	21	-\$840

HE	LMP	Offer	MW	Operating profit
20	\$300	\$100	5*	+\$1,000
21	\$250	\$100	100	+\$15,000
22	\$200	\$100	100	+\$10,000
23	\$150	\$100	100	+\$5,000

Item	Amount
HE2-5 OP on uneconomic withdrawals	-\$4,340
HE20-23 OP on injections created by the HE2-5 uneconomic withdrawals	+\$31,000
Net linked benefit	+\$26,660

*The schedule in HE20 is an injection of injected in HE20, of which 95 MW is attributable to the economic in HE1. The total OP in HE20 is \$20,000 of \$19,000 is attributable to the economic withdrawal in HE1. The remaining 5 MW schedule and \$1,000 OP are linked to the uneconomic withdrawal in HE2.



Next Steps and Timelines

Next Steps and Timelines

- To provide feedback on today's session, please use the feedback form on the engagement page and submit to engagement@ieso.ca by **October 28**.
- An updated SMSR settlement design memo, with revised equations, will be posted by **October 16**.
- These revised equations will reflect the fact that the assessment is over the full 24 hours and will outline which hours should be excluded from the 24-hour DA LC MWP netting.
- To support stakeholder review and feedback on that memo, an additional ERP Phase 1 engagement session will be held in early November on these revised equations.
- Redline Market Rules for changes to DA LC MWP will be brought forward with those for ERP Phase 1.

Thank You

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