

Adjustment for Loads on the Margin Stakeholder Engagement Session

April 13, 2021

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- All attendees join the webinar in listen-only mode and the host will have attendee cameras disabled and microphones muted
- When asking or typing in a question, please state
 - **The organization you work for and your first and last name**
- Two ways to ask questions if you are accessing the webinar using your computer or smartphone
 - If you would like to ask a question during the Q&A portion, click the icon to raise your hand and the host will see that you have raised your hand. The host will unmute your microphone, you in turn will need to unmute your microphone and then you can ask your question. Your name will appear on the screen but your camera will remain turned off.
 - You can also ask questions by typing them into the Q&A window. Click the “Q&A” button next to “Raise Hand.” You’re able to up-vote questions that have been already asked.

- Using a 2-in-1/PC/MAC Computer
 - Hover your cursor over the bottom area of the Zoom app and the Controls will appear.
 - Click “Raise Hand” and the host will be notified that you would like to ask a question.
 - Click “Lower Hand” to lower it if needed.
 - You can also ask questions by tapping the “Q&A” button and typing them in. You’re able to up-vote questions that have been already asked.
- Using a Smartphone
 - Tap “Raise Hand.” The host will be notified that you’ve raised your hand.
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 - You can also ask questions by tapping the “Q&A” button and typing them in. You’re able to up-vote questions that have been already asked.

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 - If you would like to ask a question during the Q&A portion, on your phone's dial pad, hit *9 and the host will see that you have raised your hand. The host will unmute your microphone, you in turn will need to unmute your microphone by hitting *6 and then you can ask your question. Your number will appear on the screen.
- Phone controls for attendees
 - To raise your hand, on your phone's dial pad, hit *9. The host will be notified that you've raised your hand.
 - To toggle between mute and unmute, on your phone's dial pad, hit *6.

- The participation of everyone here is critical to the engagement process. To ensure everyone has the opportunity to participate, we ask you to:
 - Listen to understand others' perspectives
 - Disagree respectfully
 - Balance airtime fairly
 - Keep an open mind

Welcome & Introductions

Items	Time	Presenter
Welcome and introductions	13:00 – 13:15	Ruppa Louissaint
Stakeholder feedback review	13:15 – 13:30	Thanh Nguyen
ALM: eligibility, price level, determination <i>- Questions will be taken throughout</i>	13:30 – 14:30	Thanh Nguyen
Potential changes <i>- Questions will be taken throughout</i>	14:30 – 14:45	Ruppa Louissaint
Discussion	14:45 – 15:15	All
Closing remarks & next steps	15:15 – 15:30	Ruppa Louissaint

Review of Sub-hourly Settlement Session 3 and Stakeholder Feedback

- Determine if there is value in moving towards a shorter interval and if yes, what interval?
- Through the sub-hourly settlement stakeholder engagement the AESO was looking to better understand
 - The expected enhancement in price fidelity and flexibility
 - The expected financial impact on loads and generators
 - Implementation costs for AESO and market participants
 - Timing required to transition to a sub-hourly settlement interval

	Total Benefit \$M	Total Cost Low \$M	Net Impact \$M
One time cost or benefit	0	-31.1	-31.1
Ongoing cost or benefit	0.5	-6.2	- 5.7
Total	0.5	-37.3	-36.8

- While the AESO believes SHS incents flexibility and promotes price fidelity, it seems unlikely the costs associated with implementation would be outweighed by identifiable static benefits at this time
- The AESO expects that SHS will promote improved competition as assets that can ramp quickly / change demand quickly will be able to counter price extremes
 - However, the costs associated with the change to SHS will largely be borne by the load customers that can't currently participate in the market.
- There will be longer term dynamic efficiency benefits but the timing and magnitude of these benefits is highly uncertain

Do not proceed with the SHS initiative at this time

- The AESO believes sub-hourly settlement is a superior market design to the current hourly settlement interval as it allows for better price fidelity, incents flexibility, and reduces uplift payments. However, the costs to implement currently far outweigh the benefits
 - Now is not the time to assign additional costs to industry
 - Benefits are not aligned with costs
 - Little ability for LSA customer base (commercial and retail consumers) to currently benefit from initiative. Benefits are enjoyed by a few large industrial loads
- This initiative could be aligned with other future initiatives that require IT system changes to allow for cost efficiencies
- Planning ahead
 - While adoption at this time is not recommended, the market design maybe pursued in the future
 - Market participants should incorporate the ability to settle sub-hourly when making future upgrades to their systems

- Exploring adjustment for load on the margin
 - Pros
 - Allows for dynamic benefits of sub-hourly settlement to be realized with much lower implementation cost
 - *Would incent load to bid into the market*
 - *Load pays energy prices more reflective of price during consumption*
 - *Fair as it is comparable to payment for suppliers on the margin*
 - Increase system controller certainty as a demand curve could be created and used for dispatch
 - Cons
 - Increases uplift as an additional out of market payment is applied
 - Some loads indicated that ALM would not incent them to bid in, as the compliance burden would outweigh the benefits

- Sub-hourly Settlement
 - Majority of stakeholders agreed with the AESO's decision to conclude the consultation as the analysis showed that the costs far outweighed the benefits
- Payment for Load on the Margin now changed to Adjustment for Load on the Margin
 - Better reflect the adjustments that load may receive
- Adjustment for Load on the Margin
 - All stakeholders who responded found merit in exploring adjustment for load on the margin

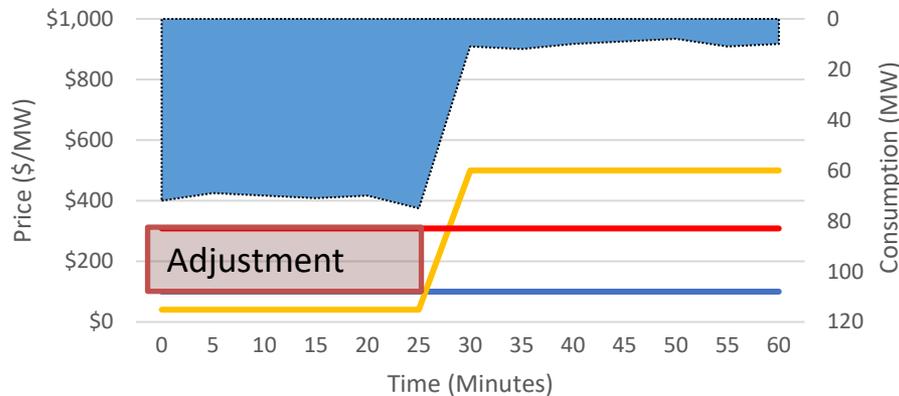
ALM

Adjustment for load on the margin

True-up to bid

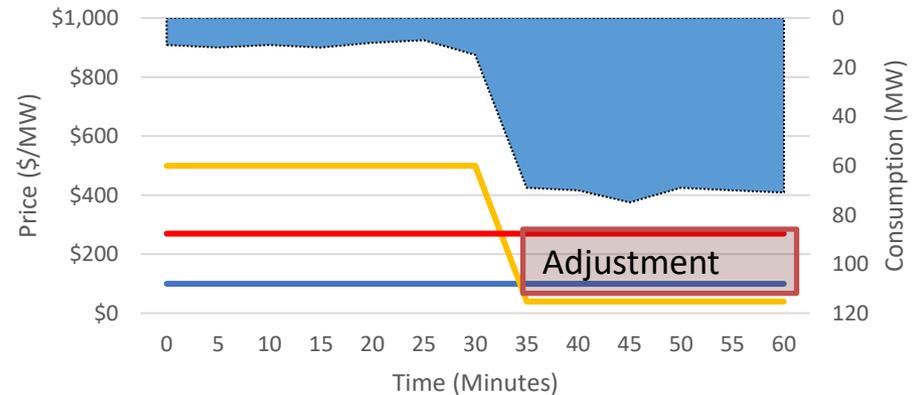
- True-up to bid approach is analogous to payment for suppliers on the margin (PSM)
- Adjustment equals the difference between pool price and bid price multiplied by volume of energy consumed in the dispatched bid block

ALM with SMP increasing



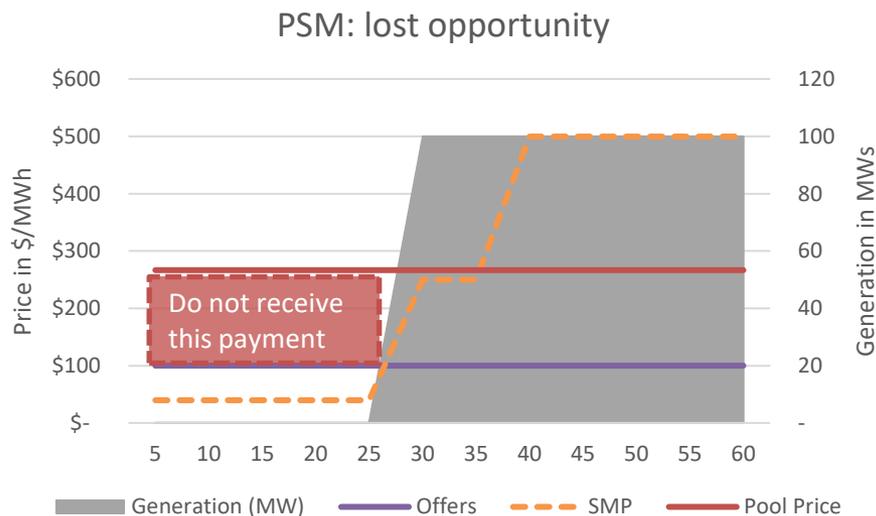
Load Consumption (RHS) Bid (\$) SMP (\$) Pool Price (\$)

ALM with SMP decreasing



Load Consumption (RHS) Bid (\$) SMP (\$) Pool Price (\$)

- PSM compensation is not for lost opportunity but to keep the generator whole to their offers when they generate
 - Generators do not receive an uplift payment when system marginal price (SMP) is low, they have not been dispatched, and pool price settles above offer price



The AESO will not contemplate changes where it will compensate for lost opportunity for either load or supply

Review of potential past ALM payouts

- ALM would have resulted in approximately \$50k - \$950k in annual uplifts
 - Assumes price responsive loads bid, based on the price and volume contained in load bid curve presented in sub-hourly settlement stakeholder session 3
- ALM payout is very small compared to energy payments
 - Approach does not account for more than 0.05% of energy payments

Year	Energy Payments (\$)	ALM True-up to Bid (\$)
2015	\$1,753,333,420	\$566,008
2016	\$1,059,156,351	\$47,393
2017	\$1,422,568,073	\$157,674
2018	\$3,294,946,721	\$545,122
2019	\$3,498,828,088	\$931,418

- **Fairness**
 - Participating load dispatch requirements and payments are analogous to generator treatment
- **Efficiency**
 - Provides the right settlement signal to incent load participation and flexible consumption
 - Participating loads will not pay more than bid price for energy
 - The least cost option available to enable flexible load consumption
- **Competition**
 - Demand curve from load bids would provide a better price signal for both market and AESO system controller
 - While long term integration is still being developed – this approach could be applied to energy storage assets

- Promote fairness - ALM comparable to PSM
 - Follow process and rules from PSM as closely as possible while accounting for differences in sink vs source
 - Formulas and calculation are comparable to PSM
 - Settlement principles remain the same:
 - Auditable
 - Measurements must be revenue quality
 - Implement ALM rules without changes to PSM rules

Questions

ALM Eligibility

- Only sink assets are eligible for ALM
 - Source assets are eligible for PSM
- To be eligible for ALM, sink assets must bid into the energy market
 - Bidding in the energy market remains voluntary
 - If sink assets choose not to bid, they will not be eligible to collect ALM
- If sink assets bid, they must comply to dispatches and directives
 - This obligation is the same as those of source assets that offer
- Metering
 - Measurements must be revenue quality
 - Interval meters
 - SCADA requirements

ALM Adjustment Options

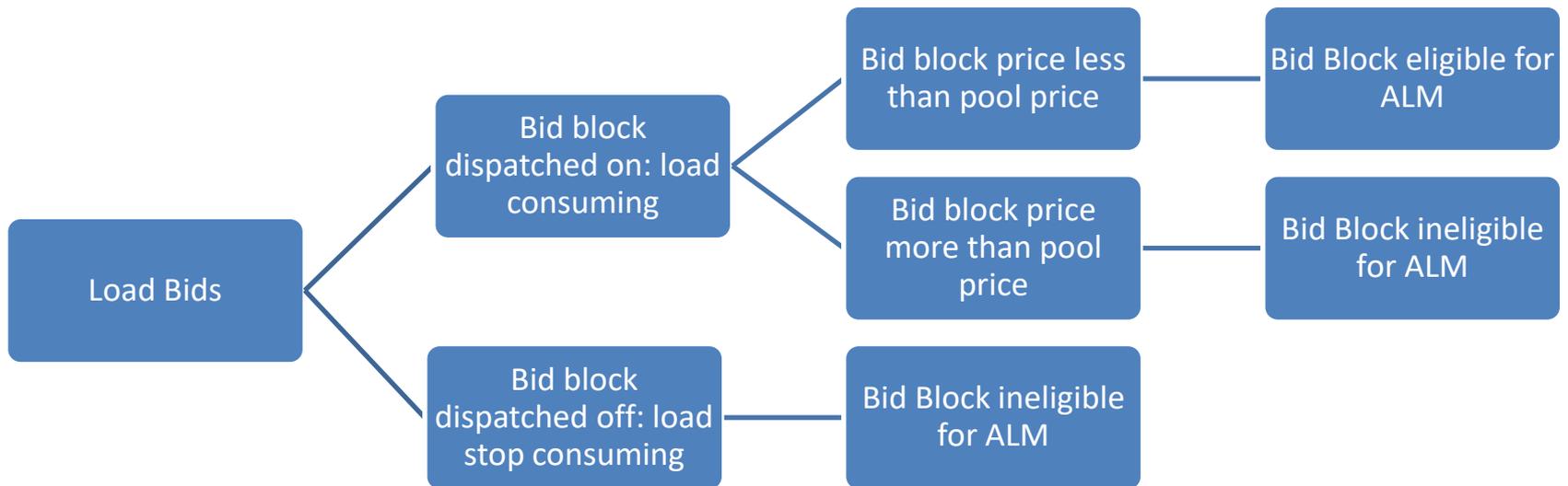
- We looked at 2 options for adjustments
 - Adjustment based on bids
 - Calculate adjustment price based on bid price that market participant submits
 - Adjustment price = difference between pool price and bid
 - Adjustment based on SMP
 - Calculate adjustment price based on SMP
 - Adjustment price = difference between pool price and SMP

- Adjustment based on bid
 - Fairness: Equivalent treatment of sink and source assets. True up to bid similar to true up to offer for PSM
 - Efficiency: Incentivizes loads to follow dispatch, as ALM ensures load does not pay any more than the bid price for energy consumed
 - Competition: Demand curve from load bids would provide a better price signal for both market and AESO system controller
 - Competition: Allows energy storage to participate

- Settlement to SMP
 - Fairness: Does not promote fairness as it is different from PSM adjustment. Creates different adjustment price levels for source vs sink.
 - Efficiency: May be inefficient as settling to SMP incent loads to over consume instead of following dispatch. The intent of ALM/PSM is to ensure that participants do not incur a loss by following dispatches.
 - SMP is not used for settlement.
 - Competition: May not create an accurate bid/demand curve if market participants response not linked to bid.

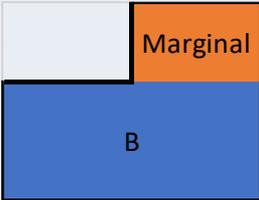
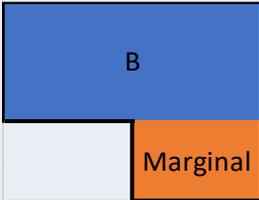
- We recommend adjustment to be made based on bid
 - Meets ALM principles:
 - Fairness
 - Efficiency
 - Competition
 - Meets design objective:
 - Follows process and rules from PSM as closely as possible
 - Formulas and calculation are comparable to PSM

Adjustment Determination



- Dispatched on: load to start consuming – SMP is below bid price
- Dispatched off: load to stop consuming – SMP above bid price

ALM and PSM formula comparison

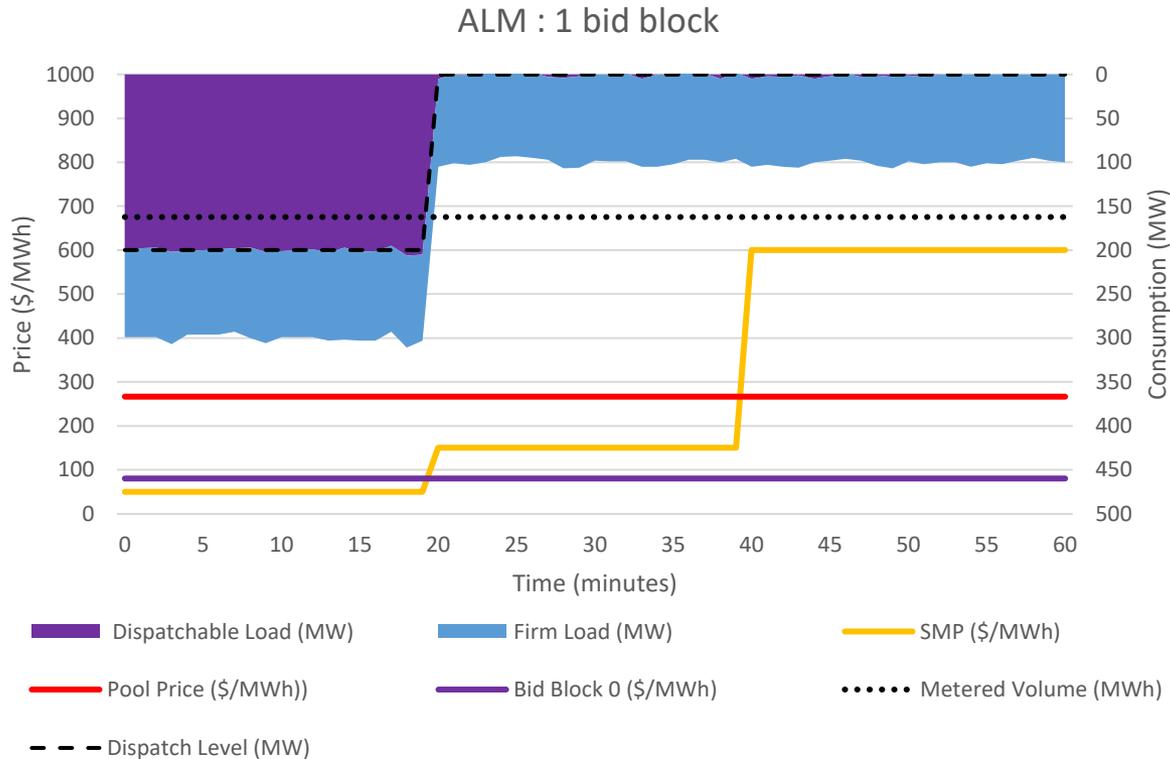
PSM	ALM	Changes
<p>If $(A-B) \leq (C-B)$ Use $(A-B) * (D - PP)$</p>	<p>If $(A-B) \leq (C-B)$ Use $(A-B) * (PP - D)$</p>	<ul style="list-style-type: none"> Changed order of subtraction for prices to account for bid
<p>If $(A-B) > (C-B)$ Use $(C-B) * (D - PP)$</p>	<p>If $(A-B) > (C-B)$ Use $(C-B) * (PP - D)$</p>	<ul style="list-style-type: none"> Changed order of subtraction for prices to account for bid
<p>A: Metered volume B: Dispatched blocks below marginal block C: All dispatched blocks (marginal block + B) D: Block offer price PP: Pool Price</p>	<p>A: Metered volume B: Dispatched blocks above marginal block C: All dispatched blocks (marginal block + B) D: Block bid price PP: Pool Price</p>	<ul style="list-style-type: none"> Substituted bid for offer price Substituted above for below to account for order of dispatch
		

Example 1: single bid block, SMP increasing



Bid	Block Price (\$)	Block Size (MW)	Block MW (MW)
Block 0	80	200	200

- At \$80, you will reduce your load down by 200MW
- Firm load is load not bid into the market



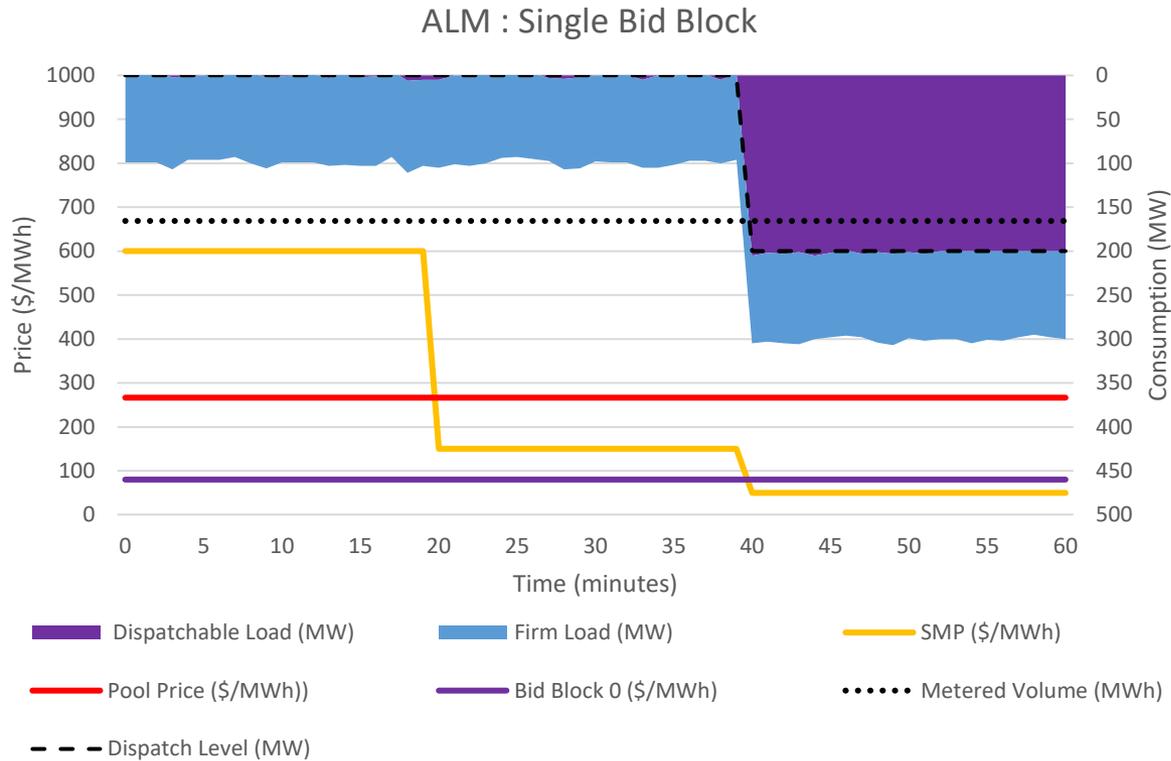
Example 1: single bid block, SMP increasing continued

- Determine blocks eligible for ALM
 - Firm load ineligible as it does not bid
 - Block 0 eligible as it was dispatched, consuming and the bid price < pool price
- Metered Volume (MWh) = data from revenue meters
 - A: 162 MWh
- Total Dispatched Volume (MWh) = dispatched blocks + marginal block
 - B: No blocks above marginal block = 0 MWh
 - Marginal: Block 0: $200 \text{ MW} * (20 \text{ minutes} / 60 \text{ minutes}) = 67 \text{ MWh}$
 - C: $B + \text{Marginal} = 0 \text{ MWh} + 67 \text{ MWh} = 67 \text{ MWh}$
- Determine which formula to use by comparing (A-B) with (C-B)
 - $(A-B) = 162 \text{ MWh} - 0 \text{ MWh} = 162 \text{ MWh}$
 - $(C-B) = 67 \text{ MWh} - 0 \text{ MWh} = 67 \text{ MWh}$
 - If $(A-B) > (C-B)$: use $(C-B) * (\text{PP} - \text{block bid price})$
- ALM adjustment = Volume * (Pool Price – Block 0 Price)
 - $67 \text{ MWh} * (\$266.67/\text{MWh} - \$80/\text{MWh}) = \$12,506.89$

Example 2: single bid block, SMP decreasing



Bid	Block Price (\$)	Block Size (MW)	Block MW (MW)
Block 0	80	200	200



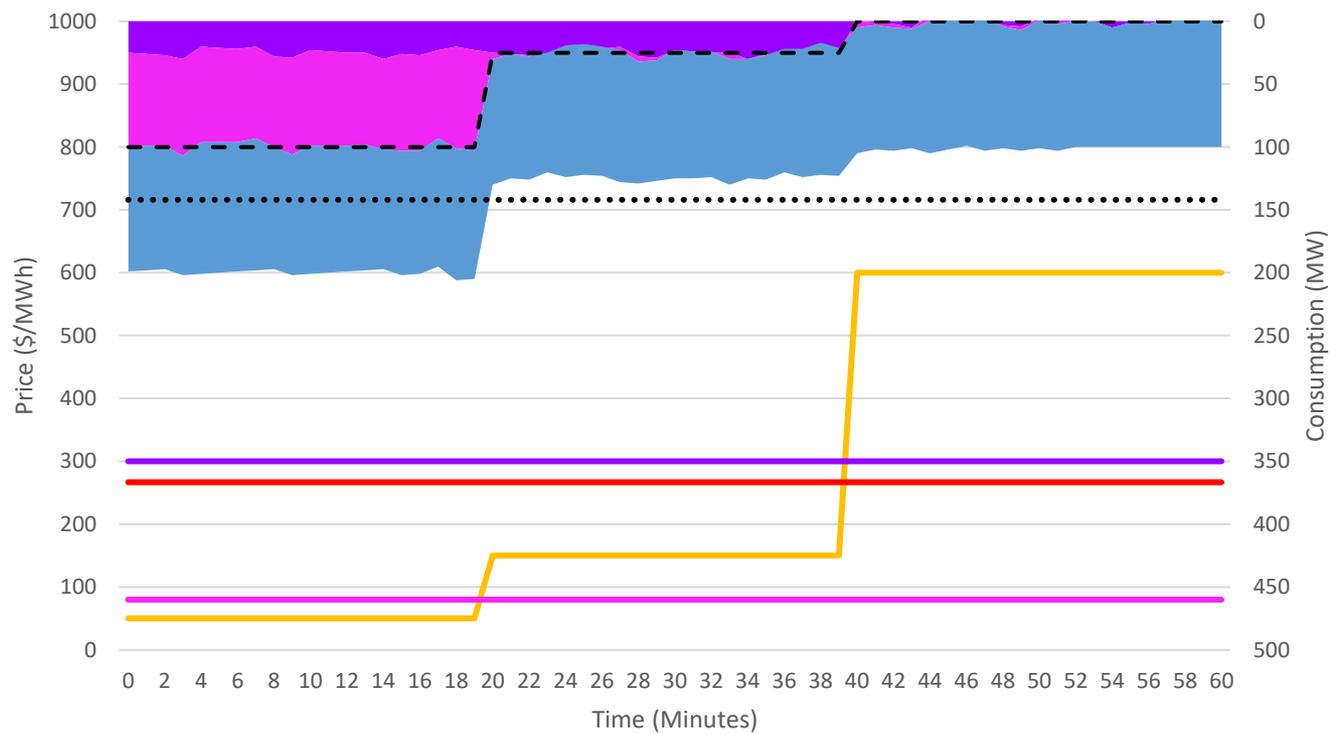
Example 2: single bid block, SMP decreasing continued

- Determine blocks eligible for ALM
 - Firm load ineligible as it does not bid
 - Block 0 eligible as it was dispatched, consuming and the bid price < pool price
- Metered Volume (MWh) = data from revenue meters
 - A: 162 MWh
- Total Dispatched Volume (MWh) = dispatched blocks + marginal block
 - B: No blocks above marginal block = 0 MWh
 - Marginal: Block 0: $200 \text{ MW} * (20 \text{ minutes} / 60 \text{ minutes}) = 67 \text{ MWh}$
 - C: $B + \text{Marginal} = 0 \text{ MWh} + 67 \text{ MWh} = 67 \text{ MWh}$
- Determine which formula to use by comparing (A-B) with (C-B)
 - $(A-B) = 162 \text{ MWh} - 0 \text{ MWh} = 162 \text{ MWh}$
 - $(C-B) = 67 \text{ MWh} - 0 \text{ MWh} = 67 \text{ MWh}$
 - $(A-B) > (C-B)$: use $(C-B) * (PP - \text{block bid price})$
- ALM adjustment = Volume * (Pool Price – Block 0 Price)
 - $67 \text{ MWh} * (\$266.67/\text{MWh} - \$80/\text{MWh}) = \$12,506.89$

Example 3: multi-bid blocks

Bid Stack	Block Price (\$)	Block Size (MW)	Block MW (MW)
Block 0	300	25	25
Block 1	80	75	100

ALM : Multi-Bid Block



- Dispatchable Load Block 0 (MW)
- Dispatchable Load Block 1 (MW)
- Firm Load (MW)
- SMP (\$/MWh)
- Pool Price (\$/MWh)
- Bid Block 0 (\$/MWh)
- Bid Block 1 (\$/MWh)
- Dispatch Level (MW)
- Metered Volume (MWh)

Example 3: multi-bid blocks continued

- Determine blocks eligible for ALM
 - Firm load ineligible as it does not bid
 - Block 0 (@ \$300) ineligible as it was dispatched, consuming but bid price > pool price
 - Block 1 (@ \$80) eligible as it was dispatched, consuming and bid price < pool price
- Metered Volume (MWh) = data from revenue meters
 - A: 142 MWh
- Total Dispatched Volume (MWh) = dispatched blocks + marginal block
 - For Block 1:
 - B: Block 0: $25 \text{ MW} * (40 \text{ minutes} / 60 \text{ minutes}) = 17 \text{ MWh}$
 - Marginal: Block 1: $75 \text{ MW} * (20 \text{ minutes} / 60 \text{ minutes}) = 25 \text{ MWh}$
 - C: B + Marginal = $17 \text{ MWh} + 25 \text{ MWh} = 42 \text{ MWh}$

Example 3: multi-bid blocks continued

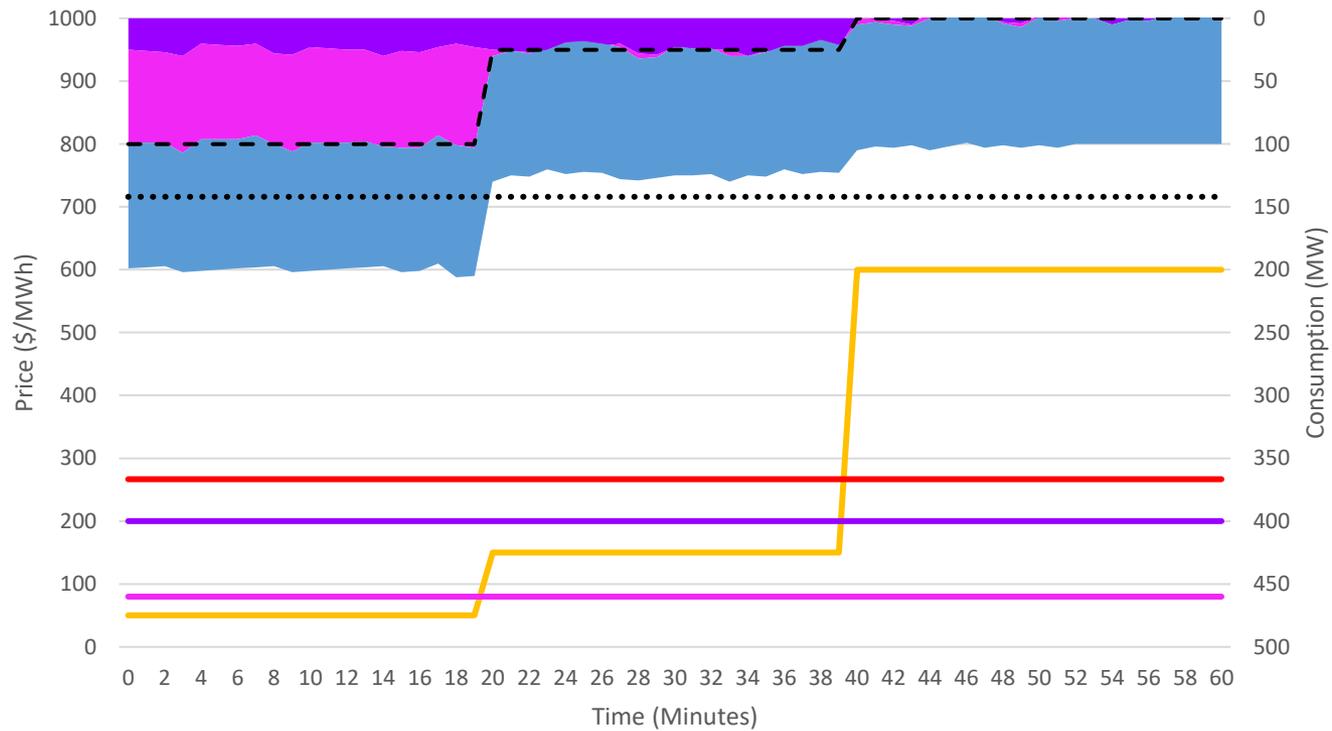
- Determine which formula to use by comparing (A-B) with (C-B)
 - For Block 1:
 - $(A-B) = 142 \text{ MWh} - 17 \text{ MWh} = 125 \text{ MWh}$
 - $(C-B) = 42 \text{ MWh} - 17 \text{ MWh} = 25 \text{ MWh}$
 - $(A-B) > (C-B)$: use $(C-B) * (PP - \text{block bid price})$
- ALM adjustment = Volume * (Pool Price – Block 1 Price)
 - Block 1: $25 \text{ MWh} * (\$266.67/\text{MWh} - \$80/\text{MWh}) = \$4,666.75$

Example 4: multi-bid blocks (2 blocks eligible for ALM)



Bid Stack	Block Price (\$)	Block Size (MW)	Block MW (MW)
Block 0	200	25	25
Block 1	80	75	100

ALM : Multi-Bid Block



- Dispatchable Load Block 0 (MW)
- Dispatchable Load Block 1 (MW)
- Firm Load (MW)
- SMP (\$/MWh)
- Pool Price (\$/MWh)
- Bid Block 0 (\$/MWh)
- Bid Block 1 (\$/MWh)
- Dispatch Level (MW)
- Metered Volume (MWh)

Example 4: multi-bid blocks continued

- Determine blocks eligible for ALM
 - Firm load ineligible as it does not bid
 - Block 0 (@ \$200) eligible as it was dispatched, consuming and bid price < pool price
 - Block 1 (@ \$80) eligible as it was dispatched, consuming and bid price < pool price
- Metered Volume (MWh) = data from revenue meters
 - A: 142 MWh
- Total Dispatched Volume (MWh) = Dispatched blocks + marginal block
 - For Block 0:
 - B: No blocks above marginal block = 0 MWh
 - Marginal: Block 0: $25 \text{ MW} * (40 \text{ minutes} / 60 \text{ minutes}) = 17 \text{ MWh}$
 - C: B + Marginal = 0 MWh + 17 MWh = 17 MWh
 - For Block 1:
 - B: Block 0: $25 \text{ MW} * (40 \text{ minutes} / 60 \text{ minutes}) = 17 \text{ MWh}$
 - Marginal: Block 1: $75 \text{ MW} * (20 \text{ minutes} / 60 \text{ minutes}) = 25 \text{ MWh}$
 - C: B + Marginal = 17 MWh + 25 MWh = 42 MWh

Example 4: multi-bid blocks continued

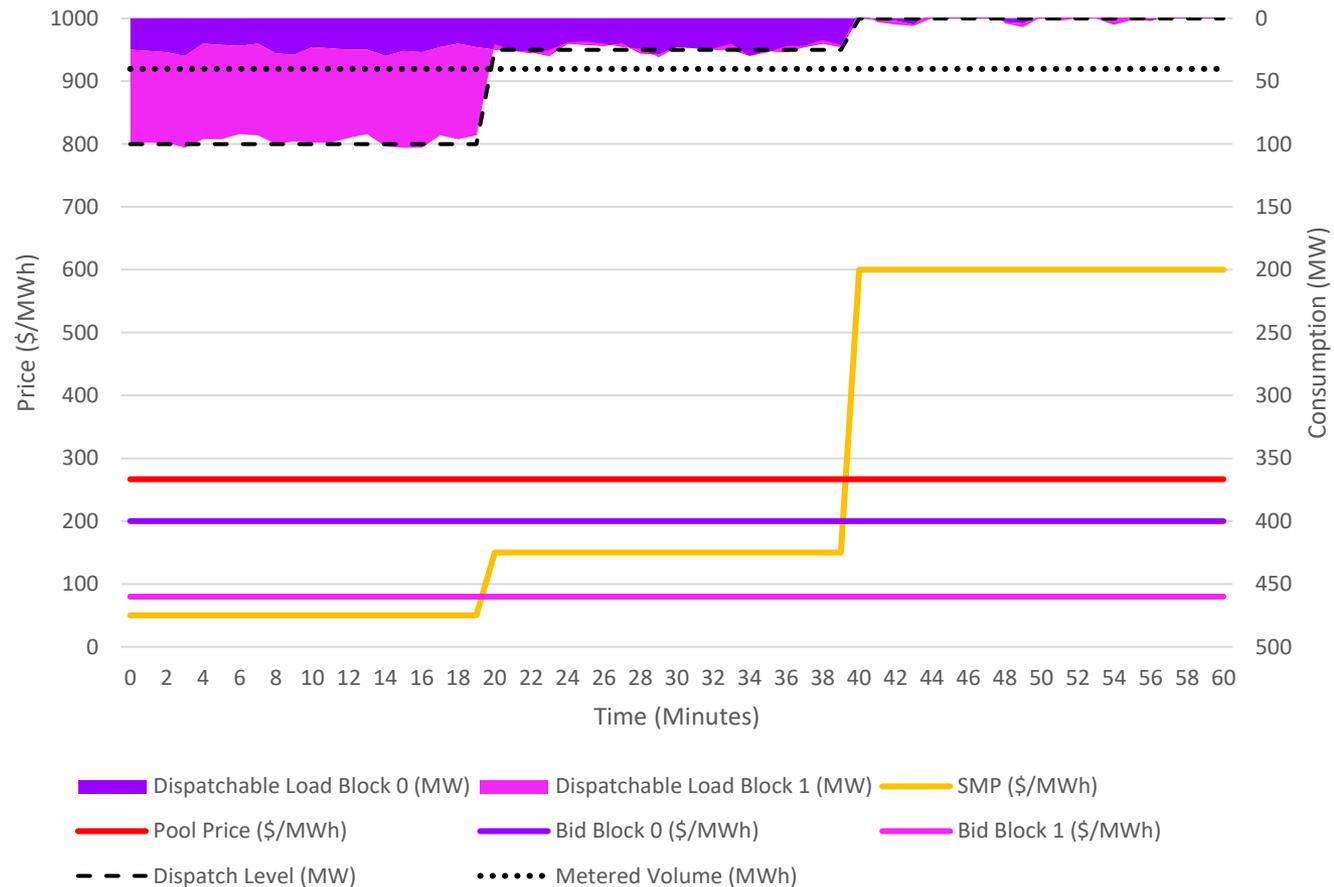
- Determine which formula to use by comparing (A-B) with (C-B)
 - For Block 0:
 - $(A-B) = 142 \text{ MWh} - 0 \text{ MWh} = 142 \text{ MWh}$
 - $(C-B) = 17 \text{ MWh} - 0 \text{ MWh} = 17 \text{ MWh}$
 - $(A-B) > (C-B)$: use $(C-B) * (\text{PP} - \text{block bid price})$
 - For Block 1:
 - $(A-B) = 142 \text{ MWh} - 17 \text{ MWh} = 125 \text{ MWh}$
 - $(C-B) = 42 \text{ MWh} - 17 \text{ MWh} = 25 \text{ MWh}$
 - $(A-B) > (C-B)$: use $(C-B) * (\text{PP} - \text{block bid price})$
- ALM adjustment = Volume * (Pool Price – Block X Price)
 - Block 0: $17 \text{ MWh} * (\$266.67/\text{MWh} - \$200/\text{MWh}) = \$1133.39$
 - Block 1: $25 \text{ MWh} * (\$266.67/\text{MWh} - \$80/\text{MWh}) = \$4,666.75$
 - Total: \$5800.14

Example 5: multi-bid blocks (no firm load)



Bid Stack	Block Price (\$)	Block Size (MW)	Block MW (MW)
Block 0	200	25	25
Block 1	80	75	100

ALM : Multi-Bid Block



Example 5: multi-bid blocks continued

- Determine blocks eligible for ALM
 - No firm load
 - Block 0 (@ \$200) eligible as it was dispatched, consuming and bid price < pool price
 - Block 1 (@ \$80) eligible as it was dispatched, consuming and bid price < pool price
- Metered Volume (MWh) = data from revenue meters
 - A: 40 MWh
- Total Dispatched Volume (MWh) = Dispatched blocks + marginal block
 - For Block 0:
 - B: No blocks above marginal block = 0 MWh
 - Marginal: Block 0: $25 \text{ MW} * (40 \text{ minutes} / 60 \text{ minutes}) = 17 \text{ MWh}$
 - C: B + Marginal = $0 \text{ MWh} + 17 \text{ MWh} = 17 \text{ MWh}$
 - For Block 1:
 - B: Block 0: $25 \text{ MW} * (40 \text{ minutes} / 60 \text{ minutes}) = 17 \text{ MWh}$
 - Marginal: Block 1: $75 \text{ MW} * (20 \text{ minutes} / 60 \text{ minutes}) = 25 \text{ MWh}$
 - C: B + Marginal = $17 \text{ MWh} + 25 \text{ MWh} = 42 \text{ MWh}$

Example 5: multi-bid blocks continued

- Determine which formula to use by comparing (A-B) with (C-B)
 - For Block 0:
 - $(A-B) = 40 \text{ MWh} - 0 \text{ MWh} = 40 \text{ MWh}$
 - $(C-B) = 17 \text{ MWh} - 0 \text{ MWh} = 17 \text{ MWh}$
 - $(A-B) > (C-B)$: use $(C-B) * (\text{PP} - \text{block bid price})$
 - For Block 1:
 - $(A-B) = 40 \text{ MWh} - 17 \text{ MWh} = 23 \text{ MWh}$
 - $(C-B) = 42 \text{ MWh} - 17 \text{ MWh} = 25 \text{ MWh}$
 - $(A-B) \leq (C-B)$: use $(A-B) * (\text{PP} - \text{block bid price})$
- ALM adjustment = Volume * (Pool Price – Block X Price)
 - Block 0: $17 \text{ MWh} * (\$266.67/\text{MWh} - \$200/\text{MWh}) = \$1133.39$
 - Block 1: $23 \text{ MWh} * (\$266.67/\text{MWh} - \$80/\text{MWh}) = \$4,293.41$
 - Total: \$5,426.80

Questions

Allocation of Cost

Settlement: Who should pay?

Possible Options	Description	Evaluation
All sink assets	All sink assets consuming in the hour that ALM is paid	Fairness: Equivalent to PSM Efficiency: Least cost option as IT changes are minimal
Partial sink assets	Sink assets consuming and not receiving ALM	Fairness: Unfair as non-dispatchable portion of sink asset also avoids ALM payments Efficiency: Costly and complex IT option for minimal allocation improvement
All source assets	All source assets producing in the hour ALM is paid	Efficiency: Cost would be incorporated into offers and in turn may increase pool price - more efficient to charge sink assets directly
All pool participants	All sink assets consuming and source producing in the hour ALM is paid	Efficiency: Cost would be incorporated into offers and in turn may increase pool price - more efficient to charge sink assets directly

Potential changes

- AESO IT changes
 - Several IT systems will need to be changed to accommodate ALM
 - Can utilize some of the processes used in PSM which saves time and money
- ISO rules and definitions that may be impacted
 - Key Terms & Definitions
 - Financial settlement
 - Offers & Bids

Questions

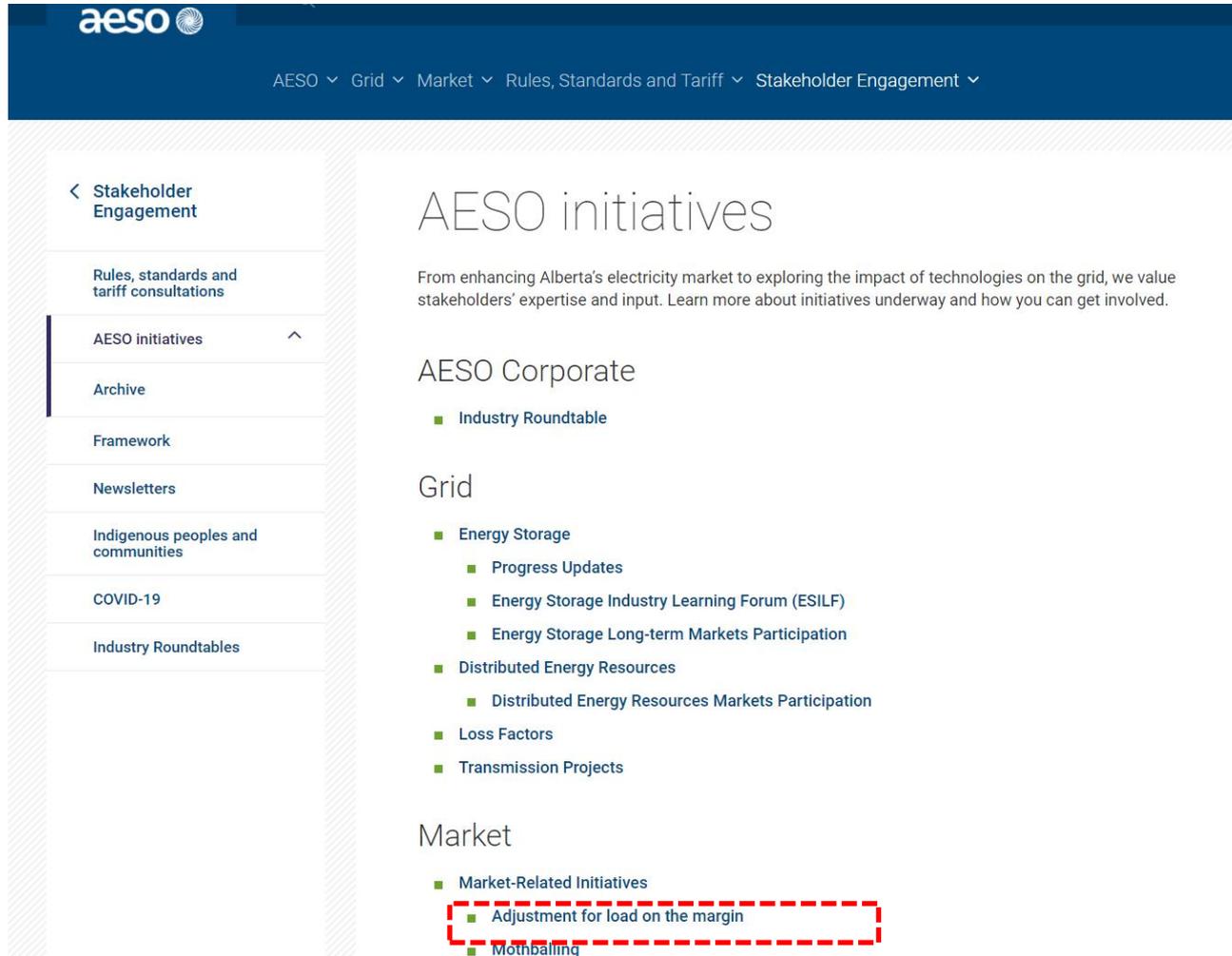
Conclusion and Next Steps

Next steps

- Stakeholders to provide feedback through comment matrix by April 30, 2021. Comment matrix posted on website and through stakeholder newsletter.
- The AESO will consider stakeholder feedback and determine further consultation steps in alignment with the other initiatives the AESO is currently engaging on.
 - The AESO anticipates that any ISO rule changes resulting from this consultation will likely be conducted as part of the Energy Storage Long-Term Markets Participation initiative given the synergies with the AESO's optional full range energy storage participation recommendation
 - For questions regarding the development of energy storage rule amendments, please email the AESO at: rules_comments@aeso.ca

Sub-hourly settlement and Adjustment for Load on the Margin engagement materials

Information on SHS and ALM



aeso

AESO ▾ Grid ▾ Market ▾ Rules, Standards and Tariff ▾ Stakeholder Engagement ▾

< Stakeholder Engagement

Rules, standards and tariff consultations

AESO initiatives ^

Archive

Framework

Newsletters

Indigenous peoples and communities

COVID-19

Industry Roundtables

AESO initiatives

From enhancing Alberta's electricity market to exploring the impact of technologies on the grid, we value stakeholders' expertise and input. Learn more about initiatives underway and how you can get involved.

AESO Corporate

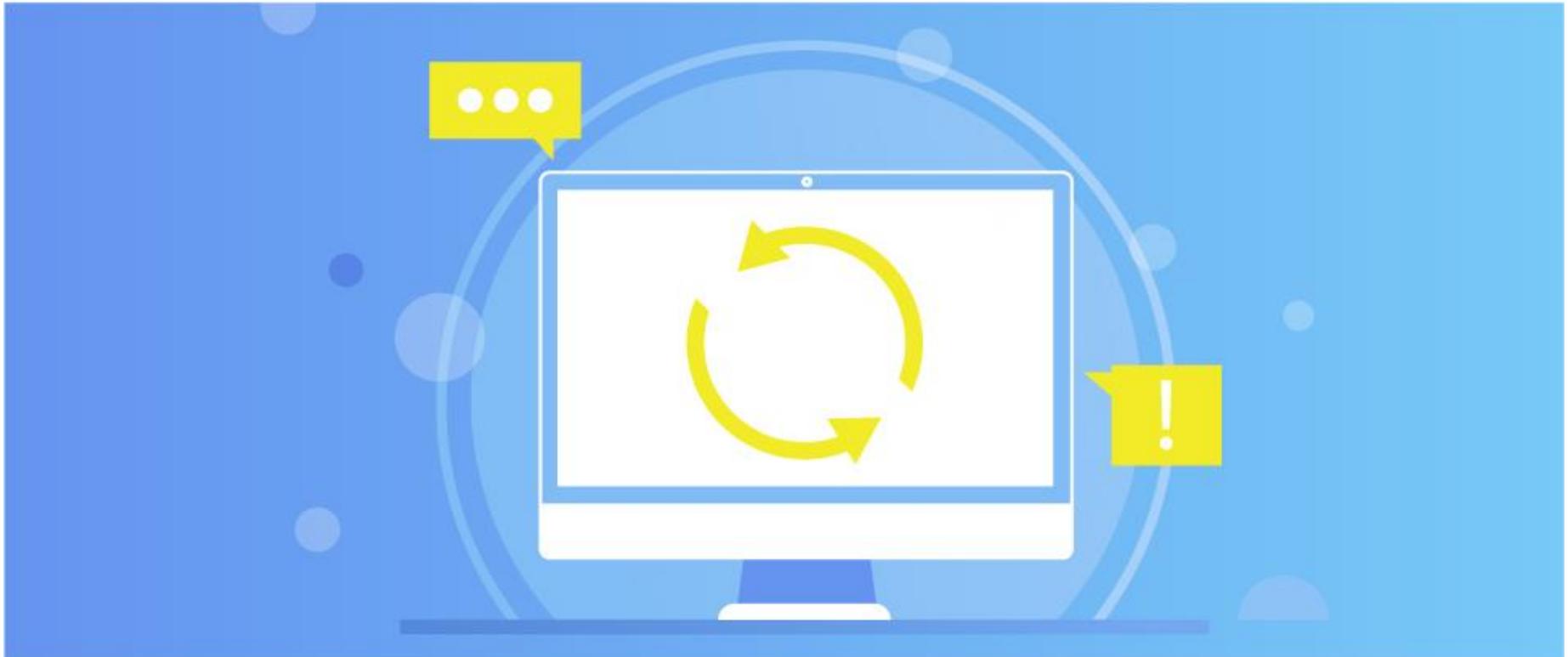
- Industry Roundtable

Grid

- Energy Storage
 - Progress Updates
 - Energy Storage Industry Learning Forum (ESILF)
 - Energy Storage Long-term Markets Participation
- Distributed Energy Resources
 - Distributed Energy Resources Markets Participation
- Loss Factors
- Transmission Projects

Market

- Market-Related Initiatives
 - Adjustment for load on the margin
 - Mothballing



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Thank you