Operating Reserves Market Review Session #1

November 30, 2021

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- When asking or typing in a question, **please state your first and last name and the organization you work for** to ensure your comments are attributed to your company**.**

- Two ways to ask questions during the Q&A portion if you are accessing the webinar using your computer or smartphone.
  - Raise your “hand”: The host will be notified that you have raised your hand and will open up your microphone when there is an opportunity to do so. Wait until the host opens up your microphone.
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Using Zoom – where to access controls

- Using a 2-in-1/PC/MAC Computer
  - Hover your cursor over the bottom area of the Zoom app and the Controls will appear.
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  - Click “Lower Hand” to lower it if needed.
  - Click the ”Q&A” button and typing them in.

- Using Smartphone.
  - Tap “Raise Hand”.
  - When the host opens your mic, your name will appear on the screen but your camera will remain turned off.
  - Tap “Lower Hand” to lower it if needed.
  - You can also ask questions by tapping the “Q&A” button and typing them in.

Using Zoom – where to access controls

- If you are accessing the webinar via conference call
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  - Unmute your microphone by pressing *6 and then you can ask your question.

- Phone controls for attendees
  - Press *9 Click phone's dial pad. The host will be notified that you've raised your hand.
  - To toggle between mute and unmute, on your phone's dial pad, press *6.

Introductions & Session Overview

Agenda

Topic	Presenter(s)	Time	Duration
Welcome, introductions, session overview	Nicole LeBlanc	9:00 am	10 min
Rule development process overview	Melissa Mitchell-Moisson	9:10 am	10 min
Background & analysis of existing OR market	Brendan Jewitt	9:20 am	20 min
Purpose and scope of OR market review	Brendan Jewitt	9:40 am	20 min
Discussion and Q&A	Open discussion	10:00 am	20 min
Break	N/A	10:20 am	10 min
Proposed in-scope items – group 1	Brendan Jewitt	10:30 am	20 min
Discussion and Q&A	Open discussion	10:50 am	20 min
Proposed in-scope items – group 2	Brendan Jewitt	11:10 am	20 min
Next steps	Ruppa Louissaint	11:30 am	10 min
Discussion and Q&A	Open discussion	11:40 am	20 min

Introductions

- Market Design
  - Nicole LeBlanc, Director Markets & Tariff
  - Ruppa Louissaint, Manager Market Implementation
  - Shezana Mills, Manager Market Design
  - Brendan Jewitt, Economist
- Legal and Regulatory Affairs
  - Melissa Mitchell-Moisson, Regulatory Analyst
  - Valerie Anasco, Regulatory Coordinator

Initiative summary

- Purpose of this initiative:

> Assess opportunities to enhance competition and price fidelity in the existing OR markets to improve efficiency.

- At the highest level the market is functioning, but there are several design elements that are not performing in a way that promotes efficiency
- Incremental change should be sufficient to address the concerns
  - Ensuring an efficient market design is essential, especially given the importance of OR both economically and operationally as the system and fleet evolve

Initiative process

Session 1	Nov 30, 2021	• Background • Purpose and scope • Initial discussion of alternatives and considerations for group 1 design elements • Introduction of group 2 design elements
Session 2	Mar 2022	• Continued analysis of group 1 design elements, including stakeholder feedback • Initial discussion of alternatives and considerations for group 2 design elements
Session 3	May 2022	• Continued analysis of group 2 design elements, including stakeholder feedback • Formation of final recommendation
Rule drafting	Q2/Q3 2022	Subject to change as initiative progresses
Application filing with AUC	Q3 2022	
Implementation	2022/2023	

*Dates and content subject to change

Session summary

- Our objectives in this session are to:
  - Ensure a common baseline understanding of how the OR markets function today
  - Set the purpose and scope for this engagement
  - Share analysis that has identified potential opportunities to improve the current market design
  - Begin exploring alternatives for market design elements we have classified as ‘group 1’
  - Introduce ‘group 2’ design elements that have been identified for discussion at future sessions
  - Establish the timing and format for the remainder of the engagement

Rule Development Legislation & Consultation Process

Meeting Minutes

- Meeting minutes will be prepared by AESO employees with the help of a minute-taking software program.
- Organization names will be used to identify contributions.
- Draft meeting minutes will be circulated to attendees for review and ultimately posted to the AESO website.

AESO Stakeholder Engagement Framework

Stakeholder Participation

- The participation of everyone 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

ISO Rules Development Requirements

ISO Rules Development

- Section 20 of the *Electric Utilities Act* grants authority to the AESO to develop ISO rules.

ISO Rules Development Requirements

- AUC Rule 017, *Procedures and Process for Development of ISO Rules and Filing of ISO Rules with the Alberta Utilities Commission*, sets out the requirements for the development of ISO rules, including:
  - Stakeholder engagement requirements; and
  - AUC application requirements

ISO Rules Process

Stakeholder engagement group formed

The AESO engages with stakeholders on the development of the proposed new ISO rules

The AESO develops the proposed new ISO rules considering input from the group

The AESO posts the proposed new rules on the AESO website and solicits stakeholder comments

Stakeholders provide written comments

The AESO posts stakeholder comments and AESO replies

The AESO may amend the proposed new rules considering stakeholder comments

The AESO files an application with the AUC requesting approval of the final proposed rules.

AUC process begins

Background

Introduction

- The following sections share some information that was used by the AESO to inform the proposed purpose and scope
- Background
  - Operating reserve fundamentals
  - Market power mitigation advice
- Analysis summary
  - Economic objectives
  - Liquidity
  - Participant surveys
  - Pricing observations
  - Hydro PPA expiry

Operating reserve fundamentals

- Operating reserves (OR) are ancillary services (AS) procured to support reliability
  - These include regulating reserves and contingency reserves
- Regulating reserves (RR) are used to correct for instantaneous imbalances between supply and demand
- Contingency reserves (CR) are used to balance supply and demand when an unexpected system event occurs
  - Spinning reserves (SR) are synchronized to the grid and provide primary frequency response
  - Supplemental reserves (SUP) are not synchronized
    - Can be supplied by generators (SUPG) or loads (SUPL)
- The AESO procures both active reserves and standby reserves, which are activated when the active portfolio is insufficient

Operating reserve fundamentals

- OR is procured day-ahead in a series of auctions through the WattEx platform
  - OR is procured for multi-hour time blocks
  - Products are procured sequentially, starting with active RR, SR, SUP and then standby RR, SR, SUP
- The AESO is the sole buyer
  - The AESO buys reserves to meet forecasted system needs
  - The AESO submits a volume and a bid price for each active product and time block
  - Procurement volumes come from reliability standards and technical studies

Energy and OR market structure

- The OR market is separate from the energy market and cleared independently on a day ahead basis
- Indexed pricing links the active market to the energy market
  - Active reserves use a uniform price model
  - Standby reserves use a pay-as-bid model
- Participation in the OR markets is voluntary
  - ‘May-offer’ as opposed to ‘must-offer’ for energy

Pricing in the active market

- Sellers submit offers and AESO clears the market based on offer price

Offer	Price	Volume	Sum-Volume
G	$20	20 MW	140 MW
F	$15	20 MW	120 MW
E	$10	5 MW	100 MW
D	$5	20 MW	95 MW
C	-$10	15 MW	75 MW
B	-$40	40 MW	60 MW
A	-$50	20 MW	20 MW

- **Dispatch Payment** is calculated using equilibrium price formula:
- Equilibrium Price = Average (Clearing Price + AESO Bid)
- Equilibrium Price = ($10 + $50)/2 = $30 premium to pool price (discount if negative)
- Seller is paid the premium/discount to pool price
- **Directive payment:** Seller is paid the pool price for MW delivered

Pricing in the standby market

- Sellers submit offers with premium and activation price
- AESO clears the market using a **blended price formula**:
  - Blended Price = Premium + (Activation % x Activation Price)
- Activation % is based on historical activation rates:

Activation %	Regulating	Spinning	Supplemental
On Peak	1%	10%	10%
Off Peak	3%	10%	10%

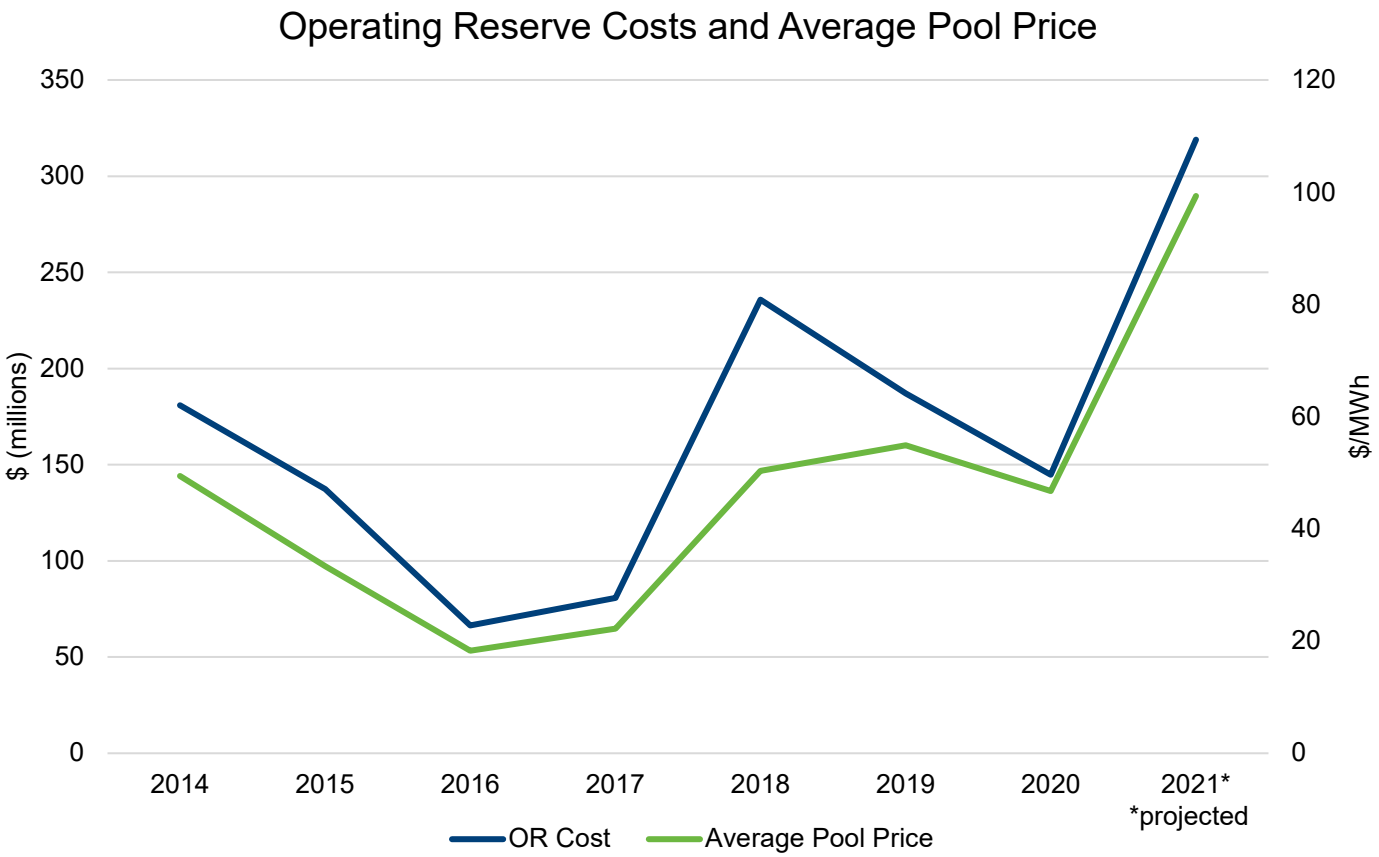
- **Premium Price:** availability payment
- **Activation Price:** price paid to seller if reserve is dispatched
- **Directive Payment:** seller is paid the pool price for MW delivered

Pricing in the standby market

- *Example: Total On Peak REG required = 40 MW*

Product	Premium	Activation	Volume	Blended Price
On Peak REG	$10.00	$73.10	10	$10.73
On Peak REG	$9.75	$59.00	20	$10.34
On Peak REG	$9.00	$88.10	10	$9.88
On Peak REG	$9.00	$75.25	10	$9.75

Operating reserve costs



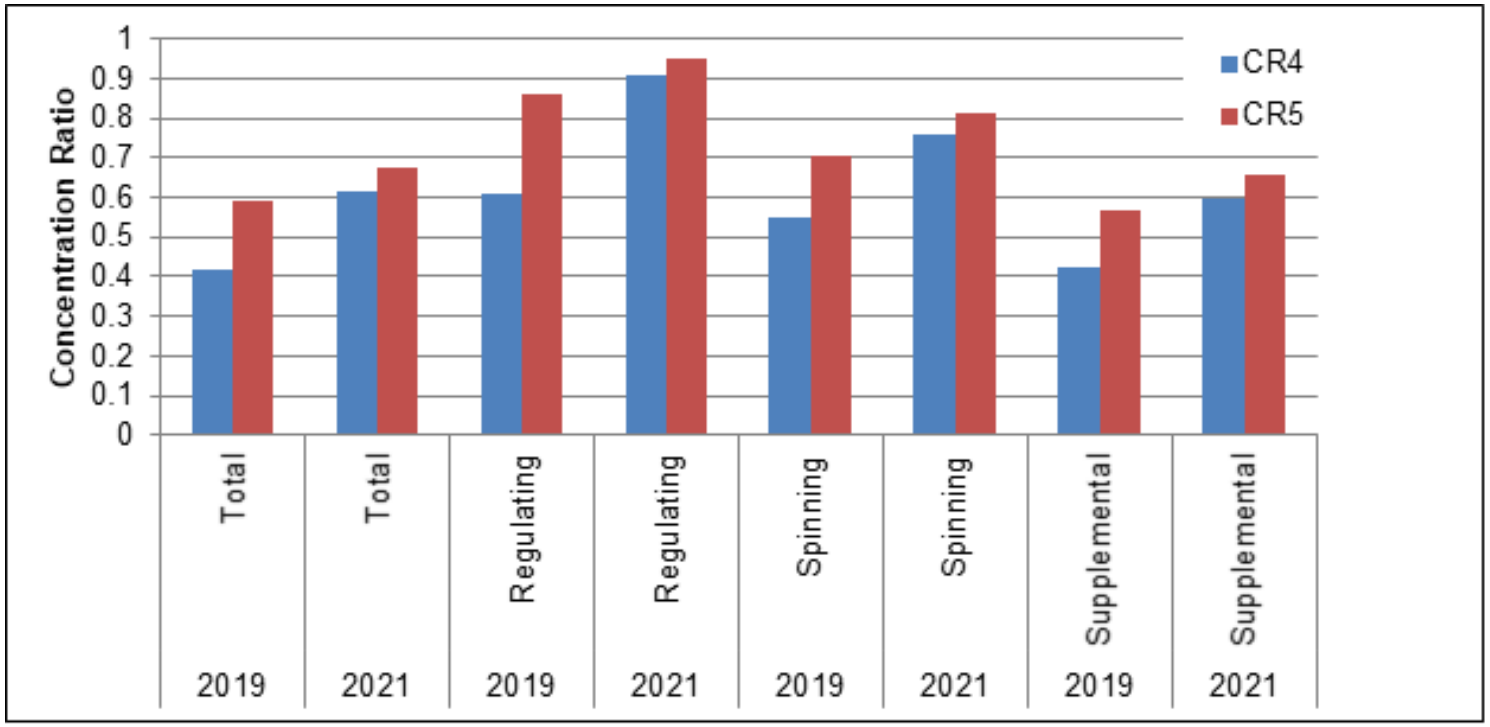
- Annual OR costs have ranged from ~$65M to $320M
  - Due to indexed pricing, OR costs closely follow the energy price

Market power mitigation advice

- In 2019, the AESO provided its market power mitigation advice to the minister of energy
- Conclusions for OR were made in 3 broad areas:
  - Concentration
    - The OR market is substantially concentrated, particularly in the RR market
  - Offer behaviour
    - There are instances where the structure, conduct and performance of the OR market has not delivered competitive outcomes
    - The expiry of the Hydro PPA may increase the incentive to exercise market power
  - Efficiency
    - Incremental exercise of market power in the OR markets may not correspond to long-run efficiency benefits

Market concentration

- The following figure from the market power mitigation advice shows the concentration ratio (CR) of qualified OR capacity
  - The concentration ratio shows the highest combined market share held by a given number of market participants



Analysis of Existing OR Market

Initial objectives

- Develop a set of economic objectives that define the key drivers of efficiency in the OR markets
- Summarize and augment the previous OR market analysis to isolate the key issues
- Analyze the impact of the Hydro PPA expiry

Economic considerations

- Efficiency is not quantified easily in the OR markets compared to the energy market
  - Complex opportunity cost instead of explicit marginal cost
  - Exogenous operational and environmental constraints
  - AESO as the sole buyer
- Measuring the extent of competition is challenging, as OR does not have a must-offer requirement
  - Qualified volumes that do not actively participate will still restrict the extent to which market power can be exercised
- Comparisons to other jurisdictions must consider that Alberta does not have separate mechanisms for recovery of commitment and capital costs

Economic principles & objectives

- The following objectives provide context to the AESO economic principles

Economic Principle	Objectives
Competition	• Competition across the energy and operating reserve markets should be maximized • Barriers to entry should be minimized • The market design should not enable anti-competitive practices
Effective Operations & Pricing	• Price signals should guide efficient capacity allocation across energy and operating reserve markets • Price signals should incent efficient investment in reserve-capable capacity • The framework should enable participation by assets that are well-suited to providing reserves • The operating reserve markets should be designed and operated in alignment with technical standards and product definitions
Cost	• The opportunity for cost recovery should exist across the energy and operating reserve markets • The cost of administering the operating reserve markets should be minimized
Public Interest	• Changes to the operating reserve market design should only be made with a clear justification to avoid unnecessary disruption to market stability

Liquidity

- An analysis conducted in 2020 found that liquidity for RR was limited, while SR and SUP experience much more active participation
- The following table shows the average volume offered for each product in excess of the traded volume
  - Includes observations from May 2019 – April 2020
  - Percentages indicate average excess offers as a percentage of average procurement volume

Product	On peak volume (MW)	Off peak volume (MW)
Active RR	44 MW (29%)	52 MW (41%)
Active SR	171 MW (65%)	132 MW (60%)
Active SUP	227 MW (86%)	238 MW (108%)

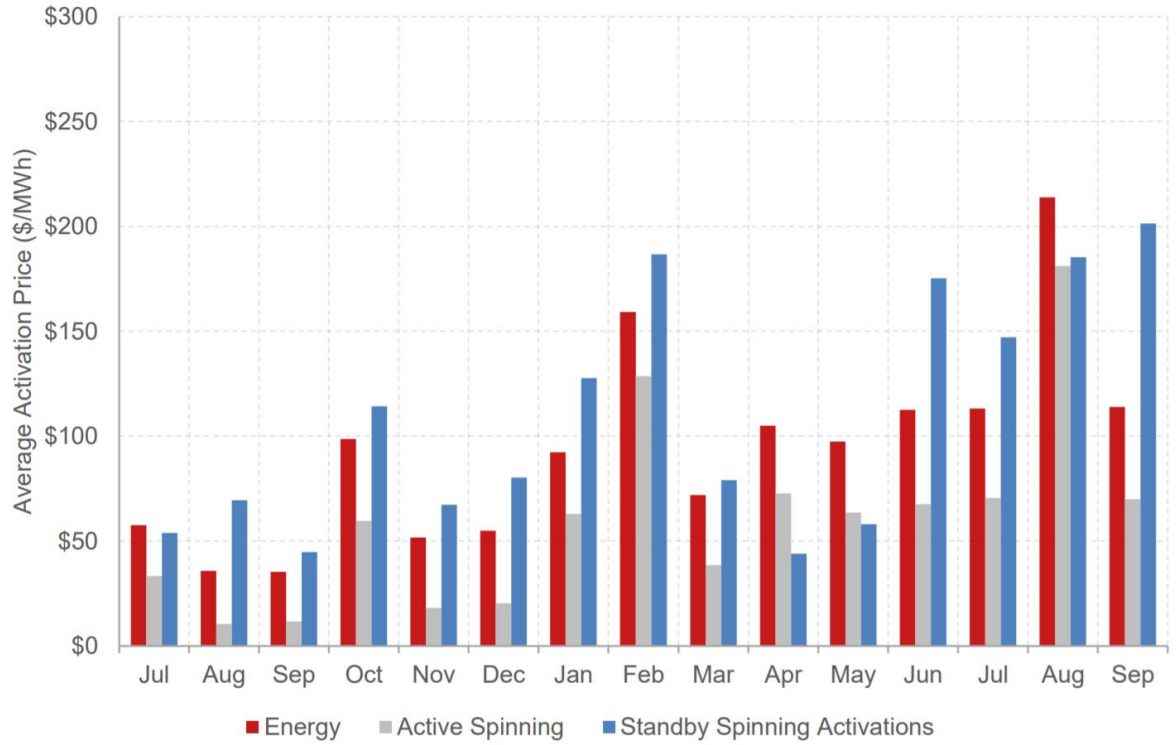
Participant surveys

- In 2020, two participant surveys were conducted regarding limited OR participation
  - Directed at market participants with OR qualified assets
  - One focused on RR, while the other included all OR products
- The following response themes were heard from participants
  - Technical and operational restrictions
    - e.g. 5 MW offer size threshold
  - Prohibitive complexity
  - Offers are priced out of the market
  - Other products and services are priced more attractively
- The AESO's view is that there are potential barriers to further explore, but that responding to price signals is part of efficient market dynamics

Standby activation price observations

- The MSA Q3 2021 report shows that standby SR activation prices are often higher than energy and active SR prices
  - This should not be occurring frequently, as reserve providers do not incur their full marginal cost of producing energy

Figure 19: Standby spinning activation prices compared to the prevailing price of energy and active spinning reserves (July 2020 to September 2021)[16]



Historical analysis summary

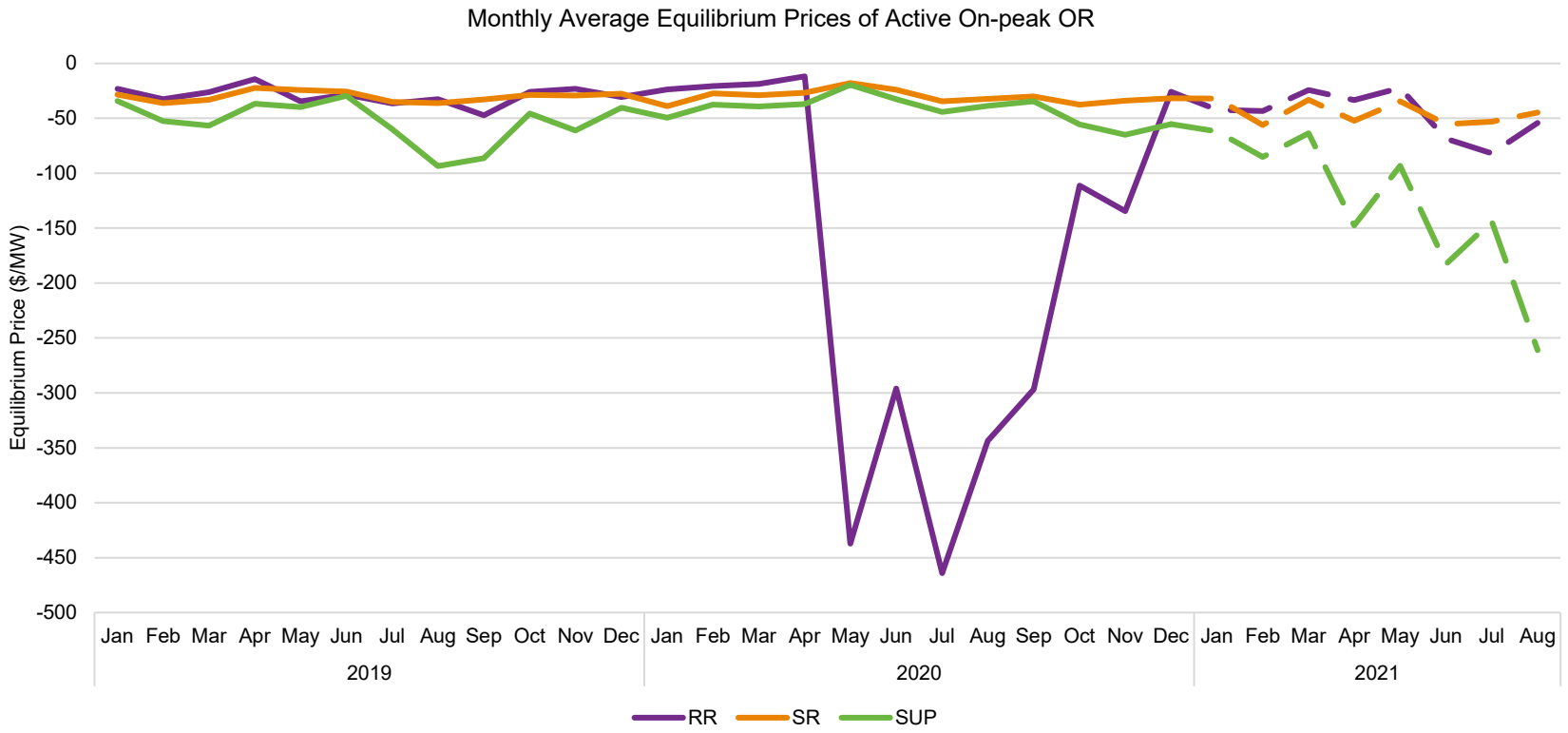
- Market liquidity and participant surveys indicate that competition is not being maximized
- Unclear whether historical outcomes are driven by the market design, or the incentives created by the Hydro PPA
- The following pricing outcomes do not appear to be efficient
  - Price inversions when products with more rigorous technical requirements are priced below those with lower requirements
    - The price for SUP historically exceeds the SR price in approximately 20-80 days per year despite having lower requirements
  - Standby activation prices consistently above the price of energy

Hydro PPA expiry

- The Hydro PPA was a contract that was formed during deregulation and expired at the end of 2020
  - Hydro PPA provided strong financial incentives to ensure that a significant portion of hydro capability was scheduled to provide OR
- The AESO has analyzed the market before and after the PPA expiry and we do not believe the state of the market has materially changed
  - Conclusions drawn from observations before the expiry should still be applicable to the current market
- OR prices have generally remained constant or declined through 2021
  - This indicates that any change in incentives is not leading to increased prices at this time
- The AESO continues to assess the market to ensure that the market design is promoting efficiency
  - The Market Surveillance Administrator (MSA) monitors for anti-competitive behaviour

Active OR prices through 2020 and 2021

- Since the Hydro PPA expiry, OR prices have not increased
  - SUP prices have declined through 2021



- In 2020, RR prices were abnormal, with historical prices typically between $0 and -$50

Purpose and scope

Purpose and scope of OR market review

- The findings of the historical analysis have informed the following purpose statement for this initiative

Assess opportunities to enhance competition and price fidelity in the existing OR markets to improve efficiency.

Scope – enhanced competition

- Remove barriers to entry
  - Enable new entry from assets that are technically capable of providing OR
- Support competitive outcomes
  - Ensure that the market design and parameters are not restricting competitive behaviour
- Facilitate appropriate transparency
  - Foster an information-rich environment while preventing anti-competitive behaviour

Scope – enhanced price fidelity

- Remove unnecessary complexity
  - Simplify pricing where possible to encourage clear price signals
- Improve offer strategy incentives
  - Strengthen incentives for market participants to offer in a manner that promotes efficiency
- Align pricing with cost and value
  - Ensure that pricing mechanisms are reflective of the underlying cost and value of each product

Scope – existing OR markets

- Existing suite of products
  - Any potential need for new OR products is not part of the scope of this existing market-focused assessment
- Day-ahead format
  - The day-ahead procurement format using the WattEx platform can accommodate the proposed scope of changes
- Change limited to OR markets
  - Broader changes to the structure of the energy and AS markets are not necessary to address the currently identified issues

Comparison of market frameworks

- Market restructuring is not necessary to address the currently identified issues with competition and price fidelity

	Alberta Model	FERC Model
Market structure	- Separate energy, OR	- Co-optimized energy, AS
Offers	- Voluntary participation - Single OR buyer - Single-part - Economic withholding	- Must offer (implied) - LSE obligations - Multi-part - Cost-based mitigation
Commitment and dispatch	- Markets dispatched separately - OR volumes removed from energy market - Self-commitment	- Markets jointly dispatched - Capacity for AS taken from energy offers - Central unit commitment
Security Optimization	- Market incentives for flexible assets and OR participation - Infrequent congestion	- SCED, SCUC to address security concerns - Frequent congestion
Pricing	- Market-driven OR pricing - Index to pool price	- Dispatch-derived OR pricing - Administrative price adders

Scope summary

- At the highest level the market is functioning, but there are several design elements that are not performing in a way that promotes efficiency
- Incremental change should be sufficient to address the concerns
  - Ensuring an efficient market design is essential, especially given the importance of OR both economically and operationally as the system and fleet evolve
- Future considerations
  - The AESO may consider a broader market change like co-optimization in the future if the need is identified
  - The market design may need to adapt to accommodate new OR products if a need is identified

Discussion and Q&A

Discussion and Q&A

- Economic objectives
- Historical analysis
- Purpose and scope

- Should there be any additions or modifications to the economic objectives?
- Are there relevant historical market outcomes that have not been analyzed?
- Is the defined scope clear and appropriate?

Break

Proposed in-scope items – group 1

Proposed in-scope items

- Used economic objectives and historical findings to identify market design elements with opportunities for improvements
- These design elements have been categorized based on their relative complexity and impact

Design elements under review – group 1

- It is the AESO's view that the case for change is clearer for these design elements
  - Clearly identifiable alternatives
  - Broad benefits
  - Low cost
- The considerations and alternatives for these changes can be discussed in this session
- These are not final recommendations and stakeholder feedback is welcome and appreciated

Equilibrium pricing & AESO bid price

Current practice

- The equilibrium price in the active OR markets is determined by averaging the marginal offer and the AESO bid price
  - AESO bid prices are not visible to parties outside the WattEx platform
- Dispatched active reserve providers are paid the energy pool price + the equilibrium price

Considerations

- A competitive market participant would be expected to account for equilibrium pricing in their offer strategy
  - While sophisticated market participants can account for this, it creates an added complication to offer incentives
- The AESO bid price is a direct input in price setting

Equilibrium pricing & AESO bid price

AESO proposed alternative

- Remove equilibrium pricing and clear the market at the marginal offer
  - The index to the energy pool price would remain
- Replace the AESO bid price with a publicly disclosed price cap

Standing offers

Current practice

- Market participants must submit new offers to the WattEx platform each time they wish to participate

Considerations

- Increased burden may reduce willingness to actively participate
  - This is especially true for participants whose assets would only rarely clear the market

AESO proposed alternative

- Allow for market participants to submit standing offers that would carry forward and be automatically included in future trading intervals
  - These offers would remain until changed by the participant or if the trader is deactivated

Offer transparency

Current practice

- Offers to the WattEx platform are visible to all participants as soon as they have been submitted
  - Participants typically submit offers in the final moments of each procurement
- 60 day lagged offer information is available with price and participant attribution for cleared volumes only

Considerations

- Fully transparent offer information may create the opportunity for anti-competitive practices
  - Offers timed precisely at the end of the auction also create vulnerability to latency issues
- Offers that are not accepted are not currently reported

Offer transparency

AESO proposed alternative

- Move to a sealed-bid format
- Align OR offer disclosure with the energy offer disclosure stipulated by the FEOC regulation
  - These changes should align the OR market with the energy market by reducing real-time transparency and increasing ex-post transparency

Minimum qualification & offer size

Current practice

- The minimum qualification size for RR is 15 MW, SR is 10 MW and SUP is 5 MW
- The minimum offer size for all OR is 5 MW
- Dispatch tolerance is currently 1 MW for assets <= 20 MW and 5% for assets > 20 MW

Considerations

- A reduction in minimum qualification and offer size would allow for participation from more types and sizes of resources
- Providing uniform treatment across different asset sizes would simplify requirements

AESO proposed alternative

- Reduce minimum qualification and offer size to 1 MW for all products
- Change dispatch tolerance to 5% for all assets

Discussion and Q&A

Discussion and Q&A

- Proposed in-scope items – group 1
  - Equilibrium pricing & AESO bid price
  - Standing offers
  - Offer transparency
  - Minimum qualification & offer size

- Are there considerations that have not been mentioned?
- Are there additional alternatives that should be considered?
- Are there opportunities for further quantitative and/or qualitative analysis?

Proposed in-scope items – group 2

Design elements under review – group 2

- It is the AESO's view that these design elements require more complex and substantial analysis to assess alternatives
- These topics are being introduced to give insight into the content of subsequent sessions and to receive initial feedback
  - We recognize stakeholders will likely require more information from future sessions before they provide fulsome feedback
- More detailed alternatives and considerations will be explored in session 2, with stakeholder feedback and updated analysis shared in session 3

Block procurement

Current practice

- The AESO procures reserves in four time blocks, as follows:
  - On peak means the period from 07:00 to 22:59:59
  - Off peak means the period from 00:00 to 06:59:59 and from 23:00 to 23:59:59
  - AM super peak means the period from 05:00 to 07:59:59
  - PM super peak means the period from 16:00 to 23:59:59 in November, December, and January and from 17:00 to 23:59:59 in all other months
- Only active RR are purchased for super peak blocks, while all reserves are procured for on peak and off peak blocks

AESO proposed scope

- Assess whether the current block definitions facilitate competition and efficient operations

Contingency reserve procurement

Current practice

- SR and SUP are procured through separate sequential auctions
- BAL-002-WECC requires that the AESO hold a minimum of 50% of total CR as SR

AESO proposed scope

- Assess whether an alternative procurement mechanism can reflect the interrelated function of these products by clearing the lowest cost offers

OR curtailment priority

Current practice

- The AESO currently prioritizes energy over AS when resolving transmission constraints
  - Section 203.6 prioritizes energy when determining allocation of joint and system available transfer capability (ATC) on the interties
  - Section 302.1 prioritizes energy when issuing curtailments to generators and loads to mitigate real-time transmission constraints

AESO proposed scope

- Assess whether the AESO should continue with its current practice of prioritizing energy over AS
- Assess whether an alternative curtailment priority may improve competition, efficient operations, and/or cost

Standby reserves

Current practice

- Standby reserves are procured to meet reserve requirements when the active portfolio is insufficient
- Market participants submit a premium and an activation price to WattEx
- These prices are combined using the following blended price formula to determine which offers clear the market

  Blended Price = Premium + (Activation % x Activation Price)
- The activation % is determined by the AESO
- Participants that clear the market are paid the premium and, if activated, the activation price on a pay-as-bid basis

AESO proposed scope

- Assess the operational and economic purposes of standby reserves
- Assess whether adjustments to the pricing mechanism can reduce complexity, improve incentives, and align with cost

Next Steps

Path forward

Session 1	Nov 30, 2021	• Background • Purpose and scope • Initial discussion of alternatives and considerations for group 1 design elements • Introduction of group 2 design elements
Session 2	Mar 2022	• Continued analysis of group 1 design elements, including stakeholder feedback • Initial discussion of alternatives and considerations for group 2 design elements
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Discussion and Q&A

Discussion and Q&A

- Proposed in-scope items – group 2
  - Block procurement
  - Contingency reserve procurement
  - OR curtailment priority
  - Standby reserves

- Are there other design elements that should be considered in-scope?
- Should there be any adjustments to the timing and/or content of the future engagement sessions?

Thank you