# Stakeholder Comment Matrix – October 8, 2019
## Request for input on market power mitigation

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| Period of Comment: | October 8, 2019 through October 29, 2019 | **Contact:** | [redacted] |
| **Comments From:** | TransAlta Corporation | **Phone:** | [redacted] |
| **Date:** | 2019/10/29 | **Email**: | [redacted] |

***The AESO is seeking comments from stakeholders on market power and market power mitigation in Alberta's energy and ancillary services markets.***

| | Questions | Stakeholder Comments |
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| 1. | What has been effective in Alberta's historical approach to market power mitigation in the energy-only market, and what could be improved? | ***Alberta's approach covers all bases and allows the market to decide outcomes***<br><br>The regulatory framework in Alberta is comprehensive and effective. It includes a structural component (market share offer control restriction), clear conduct restrictions, prohibitions from physical withholding, "must offer, must comply" requirements and a low offer cap, effective ex-post investigation and enforcement through an independent market watchdog, and an obligation for market participants to support a competitive market.<br><br>1. **Requirements to support fair, efficient and open competition** – Section 6 of the *Electric Utilities Act* contains a broad requirement for all participants to conduct themselves in a manner that supports fair, efficient and open competition.<br><br>2. **Ex-post investigation and enforcement** – The MSA has a broad mandate under the *Alberta Utilities Commission Act* to investigate and undertake activities including enforcement to address conduct that does not support the fair, efficient and openly competitive operation of the electricity market and any other matters that relate to or affect the structure and performance of the electricity market.<br><br>3. **30% restriction on market share offer control** – Market participants are restricted from holding offer control in excess of 30% of the total maximum capability of generating units in Alberta under subsection 5(5) of the *Fair, Efficient and Open Competition Regulation* (FEOC Reg). This bright-line restriction explicitly defines the level of market share offer control that could be a structural impediment to effective competition in the market.<br><br>4. **Restriction from physically withholding capacity** – Subsection 2(f) requires market participants to offer all electrical energy from a generating unit that is capable of operating. This requirement is codified in the ISO Rules as a "must offer, must comply" requirement (a requirement to submit offers that equals the available capability of the source asset) in Section 203.1 of the ISO Rules. The available capacity must equal the maximum capability of an asset unless the |

pool participant has submitted an acceptable operational reason.

5. **Offers cannot exceed the offer cap of $999.99/MWh** – Energy market offers cannot exceed $999.99/MWh. This offer cap has been in place since the formation of the power pool and has not been changed since that time. As noted by the MSA, "the comparatively low price cap in Alberta is accompanied by an acceptance that generators may exercise market power."[1]

6. **Prohibitions from conduct that restricts competition or a competitive response** – Section 2 of the FEOC Reg prohibits collusion, misrepresentations to the market, restricting or preventing competition or a competitive response, and manipulating market prices away from a competitive market outcome.

7. **Single zonal pricing** – The Alberta market maximizes competition between market participants by operating a market with no transmission constraints and minimal congestion. Locational pricing, which exists in a number of other markets, increases the ability for certain market participants within transmission constrained areas to exercise market power.

8. **Hourly settlement model** – Longer settlement periods such as Alberta's hourly settlement period increase the ability for market participants (load and supply) to respond to price signals thereby enhancing the opportunity for competitive response and reducing the ability to exercise market power. Shorter settlement periods enhance the ability for a market participant to exercise market power.

9. **Availability of information** – the availability of forecasts of future pool price and load, visible information about supply and outages, as well as historical information on offers enhance the ability for a competitive response from load and supply.

***Alberta's market power mitigation approach works***

Alberta's historical approach to market power mitigation has a proven track-record of supporting the development of a competitive energy-only market. It has delivered on achieving "effective competition", which is defined by the MSA as:

> A level of competition (and related outcomes) that (i) achieves efficient

[1] Pages 38-39, MSA State of the Market Report: An Assessment of Structure, Conduct and Performance of Alberta's Wholesale Electricity Market, December 10, 2012.

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| | | investment with the lowest possible short run inefficiency, (ii) does so over a reasonable timeframe, and (iii) where open competition ensures neither collusion, abuse or anti-competitive practices.<br><br>This definition explicitly recognizes that getting an efficient outcome over time is the goal and in achieving it is acceptable to have some efficiency loss in the short run.[2]<br><br>In the MSA's State of the Market Report 2012, it analyzed the efficiency losses for the period from 2008-2011 and determined that the productive efficiency losses were estimated to be less than 1% and its preliminary estimate of allocative efficiency losses was an even smaller fraction. The MSA noted that the static efficiency losses as a proportion of the average pool price was small, close to the required benchmark, and small enough that the dynamic efficiency benefits over time do not have to be particularly large. Most importantly, in assessing dynamic efficiency, the MSA noted that "prices over the last ten years have not seen sustained periods of high prices and there has been considerable generation investment in different technologies".[3]<br><br>More recently, the MSA engaged Charles River Associates (CRA) to assess whether offer behavior guidelines should be put in place during the transition to the capacity market. CRA's paper was titled *Offer Behaviour Guidelines Prior to the Implementation of a Capacity Market* (dated December 10, 2018) and included an analysis of the current and expected state of the Alberta market during the transition period (2018 to 2021). The scope of the analysis included a review of historical and recent market conditions, supply cushion and reserve margin levels, market shares, and the forward market. The conclusions at that time were that there is no evidence of insufficient competitive discipline and no significant concerns that realized supply cushions would shrink to levels that would increase concerns about market vulnerability to anti-competitive behavior.<br><br>***Regulatory stability and certainty enhance operator and investor confidence***<br><br>Regulatory uncertainty erodes investor confidence and negatively impacts the market. In the past three years, we have experienced a significant level of regulatory change including the revocation of the *Offer Behaviour Enforcement* |

[2] *Ibid,* Page 51.
[3] *Ibid,* Page 68.

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| | | *Guidelines*, pursuit of a new capacity market design, and then cancellation of the implementation of the capacity market design. Rather than stabilize and steer the market, the level of potential change and the response from the regulatory agencies has shaken investor confidence and has left market participants confused and uncertain about the future of the market.<br><br>We have also experienced concerning misalignments within and between the regulatory agencies including with the MSA, AESO and AUC.<br><br>While it is reasonable and appropriate to review the market and periodically consider the need for change to ensure that it is functioning properly, the current level of regulatory churn is unhealthy and harmful to the market and market participants seeking the stability to make investment decisions. The stakes are too high with significant investment in coal-to-gas planned in the next few years to pursue other market design changes to address unsubstantiated, possible concerns. It is imperative that the regulatory agencies work to reduce the currently high level of instability and uncertainty. |

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| 2. | Do you expect the historical approach to market power mitigation in the energy-only market (e.g. OBEG, ex-post monitoring, must offer, 30% offer control limit, FEOC Regulation) will be effective on a go-forward basis?<br>If yes, please explain your rationale. If no, please explain your rationale and changes required. | ***The historical approach to market power mitigation will be effective going forward***<br>Yes, TransAlta expects the historical approach to market power mitigation in the energy-only market will be effective on a go-forward basis.<br>The MSA's *State of the Market Report 2012* provided an assessment of key features and aspects of the Alberta wholesale market that led to its conclusion that the market is effectively competitive. We believe that the following observations, findings, and conclusions in the report apply on a go-forward basis and support a conclusion that the historical approach will be effective:<br>• Alberta's electricity market most closely resembles a tight oligopoly, where the leading 4 firms have 60-100% of the market.[4] We note that the tight oligopoly structure observed today where the top 4 suppliers hold a market share offer control of 57.7% is expected to be roughly the same at approximately 61% after the expiry of the PPAs.<br>• "Our findings are that the ability of market participants to influence market prices is variable. In many hours the ability of the larger generators to move the pool price is limited by market fundamentals and by competitive forces. In a smaller number of hours the larger generators were shown to be in a position to meaningfully influence market outcomes. However, establishing that these generators could influence market outcomes is not the same as establishing that they do. Whether a generator chooses to exercise market power is primarily determined by the expected profitability of exercising market power for the firm."[5]<br>• "In the short-term, the ability of a generator to raise the pool price through economic withholding is limited to instances where they have structural market power and by the responses of other market participants. For example, during periods of weak demand or high wind generation even large generators may be unable to influence prices."[6]<br>• "Price Responsive loads limit the ability of generators to exercise market power…. Many of the price responsive loads in Alberta reduce their consumption within a matter of minutes in response to pool price spikes. Consequently, these |

[4] Page 6, State of the Market Report 2012: An Assessment of Structure, Conduct, and Performance of Alberta's wholesale electricity market, MSA, December 10, 2012.
[5] *Ibid,* Page 37.
[6] *Ibid,* Page 42.

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| | | loads can be important and very timely constraint on the market power of generators" [7]<br><br>• "the incentive a generator has to engage in economic withholding is linked closely to its overall portfolio position. Exercise of market power is likely to impact future forward prices, for example loads may purchase more forward contracts to avoid pool price volatility pushing the price for those contracts higher. This may in turn reduce the incentives for economic withholding by the party selling the forward contract leading to lower volatility and perhaps yet more changes in the incentives for load to contract forward." [8]<br><br>• "Economic withholding mostly benefits those generators not withholding – Generators who regularly engage in economic withholding incur a cost. The conduct may still be profitable overall but some available capacity is left un-dispatched and therefore earns no revenue. A smaller generator, even one highly exposed to pool price, can reason that a larger generator will withhold and raise price. In this case the smaller generator can simply act as a price taker and gain from the higher price caused by the larger generator. In the long term this is important to encourage the entry and growth of smaller firms which in turn reduces the ability of larger firms to influence market outcomes." [9]<br><br>• "we noted that small participants can act as price takers and still benefit from the economic withholding of larger market participants. This also applies to larger market participants in that they might choose to act as price takers with the expectation that another large participant has sufficient length such that the rival firm will economically withhold even in their absence. In instances when larger participants are simultaneously exercising market power, there is often still an incentive to undercut rivals in order to increase dispatch in order to raise overall profitability." [10]<br><br>***The energy-only market design has been successful in Alberta because it doesn't mitigate unilateral market participant offer behaviour***<br><br>The MSA aptly described the following key observations of the energy-only market compared to other market designs:<br><br>• "Some other markets, adopting a different design, restrict prices in the energy |

[7] *Ibid*.
[8] *Ibid,* Page 43.
[9] *Ibid*.
[10] *Ibid,* Page 45.

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| | | market and provide generators with additional revenue in the form of capacity payments, essentially these are payments for making units available whether they are used or not. No matter what design is chosen, the total revenue to generators needs to be sufficient, over time, to pay for the total cost of prudent investments in generating capacity and sufficient profit that they would not be better off investing their money elsewhere. Different designs do differ in the amount of risk different groups bear. In an energy-only design, risk is borne by investors and returns need to be somewhat higher to compensate."[11]<br><br>• "In the absence of generator market power, the majority of generators would be heavily reliant on scarcity rents in order to recover fixed costs. There are two possibilities: either that scarcity becomes quite common or that prices would need to be very high when scarcity occurs. The former option is not desirable in that common scarcity would likely imply there would be some hours where generation was not only scarce but insufficient to cover demand. In the second option, scarcity would be uncommon but prices would in these circumstances need to very high. Infrequent scarcity events may also cause problems for investors in that the high prices associated with them may not occur for many years and that if those prices did result there is a risk of political intervention."[12]<br><br>• "The comparatively low price cap in Alberta is accompanied by an acceptance that generators may exercise market power. If no market power was exercised it is likely that generation investment would fall, scarcity events increase and generation would be inadequate from the perspective of reliability."[13]<br><br>• "Vigorous generator on generator competition is key to the competitive market structure chosen in Alberta." [14]<br><br>Under the energy-only market design, the MSA clarified in its Offer Behaviour Enforcement Guideline (OBEG) that: "market participants are free to pursue individually profit maximizing behavior that does not impact on rivals' conduct."[15]<br><br>It is because the energy-only market design relies on competitive market forces to determine price outcomes and the government and agencies have support the design with very limited intervention that it has been successful. This is further |

[11] Page 7, State of the Market Report 2012: An Assessment of Structure, Conduct, and Performance of Alberta's wholesale electricity market, MSA, December 10, 2012.
[12] *Ibid,* Page 38.
[13] *Ibid,* Page 39.
[14] *Ibid,* Page 42.
[15] Page 9, Offer Behaviour Enforcement Guidelines, MSA, January 14, 2011.

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| | | supported by the Government's decision to return to the existing energy-only market and reject a capacity market design. We note that parties including the MSA, generators and load groups were concerned about the administrative complexity of the capacity market and its design elements including the ex-ante market power mitigation schemes. They favoured the continuation of the existing energy-only market, not a different, unproven energy-only market design with new mitigation measures. In fact, the Government's own conclusion was also that the existing energy-only market will continue to provide Albertans with a reliable supply of electricity at affordable prices.<br><br>***Ex-ante mitigation is unnecessary and will contribute to future missing money issues***<br><br>The AESO report, *Alberta's Wholesale Electricity Market Transition Recommendation*, dated October 3, 2016 made a number of relevant reasons for recommending a transition to a capacity market design:<br><br>• "Adding even higher volumes of wind can erode the economics of generating electricity in Alberta. All generators will have an increasingly difficult time earning the revenues they need to be economic. The resulting low pool price, if expected to stay low and perhaps drop further, together with increasing amounts of renewables added through the REP, will also deter investors."[16]<br><br>• "Quantitative modeling indicates that under anticipated future market conditions, the AESO expected there to be insufficient investment in new firm generation due to reduced revenues available in the energy market."[17]<br><br>• "While enhancements to the energy-only market may theoretically address the problem of insufficient revenue, and could lead to a high enough reserve margin, this is not viewed as a practical or viable solution due to high risks of market interference, volatile prices for consumers, and failure to address fundamental concerns of generation investors regarding revenue certainty."[18]<br><br>The government's decision to cancel the Renewable Electricity Program (REP) in addition to the increased likelihood that coal generation will be converted to gas may have reduced the imminent risk to energy-only market. However, the supply mix in the energy market will almost double the amount of intermittent resources in the near future as REP generation comes on line in the next couple of years. Furthermore, |

[16] Page 7, Alberta's Wholesale Electricity Market Transition Recommendation, October 3, 2016.
[17] *Ibid,* Page 17.
[18] *Ibid*.

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| | | we expect to see continued development of intermittent solar and wind generation (several large developments have made announcements that they have secured long term commercial contracts). As such, revenue sufficiency and certainty for the firm generation required to maintain resource adequacy could still present a "missing money" risk.<br><br>More importantly, an energy-only market with ex-ante market power mitigation is a fundamentally different design than the existing energy-only market design, increases "missing money" concerns, and could contribute to future resource adequacy issues. It is not the existing energy-only market that the government and stakeholders chose over the capacity market design.<br><br>***Alberta's approach is consistent with other non-US markets***<br><br>Alberta's approach, which relies more on competitive market forces disciplining the exercise of market power and ex-post approaches than administrative ex-ante mitigation mechanisms, is common in energy-only market designs and jurisdictions outside of the US. The energy-only market designs in Australia and New Zealand also share this approach. The UK market also uses ex-post rather than ex-ante approaches.<br><br>***The most prevalent market design in the US is a capacity market structure***<br><br>The large markets in the US include PJM, ISO-NE, NYISO, and CAISO, which are all capacity market designs. MISO operates a voluntary wholesale market but is dominated by regulated entities that serve the constituent states. These markets are fundamentally different than an energy-only market and offer very few, if any, true comparisons to Alberta's design.<br><br>***Ex-ante mitigation approaches are most common in capacity market designs***<br><br>Capacity market designs provide two key revenue sources: capacity payments and energy and ancillary service revenues. Capacity procurements and payments ensure an adequate level of investment to meet future resource adequacy requirements and the combination of both revenue streams provide for revenue sufficiency and certainty for resource owners.<br><br>The two-revenue stream structure of a capacity market exposes customers to a risk of having to pay twice: once to buy the capacity and then again when energy is delivered. Given this risk, it is reasonable to expect stringent mitigation to cost-based (short run marginal cost) offers in the energy market since the resources already earn revenues to cover their fixed costs through the capacity market payments. |

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| | | In contrast, the energy-only market only provides energy and ancillary services revenues and only charges customers on delivered energy (not capacity). The underlying rationale for ex-ante mitigation offers to cost-based does not apply. As noted by the MSA, mitigation that reduces the exercise of market power increases a reliance on scarcity pricing, which can have significant and negative impacts on generation investment and resource adequacy.<br><br>***ERCOT is only energy-only market design in the US***<br><br>The only energy-only market design in the US is ERCOT and, amongst energy-only markets, is an exception because it does apply ex-ante mitigation. ERCOT has many fundamental features that contribute to a higher risk of abuse of market power including: a locational pricing model, an offer cap of US$9,000/MWh, and a short (15-minute) settlement window.<br><br>***ERCOT is an example of a market that cannot attract sufficient firm generation to maintain its reserve margin target***<br><br>ERCOT is not a market that should be emulated. In fact, it is a prime example of the market design the MSA has described as heavily reliant on scarcity rents due to its mitigation approach and one that suffers from an inability to attract sufficient firm generation to maintain a healthy level of reliability.<br><br>ERCOT's planning reserve margin was forecast at 8.1% over the summer, far below its current minimum target reserve margin of 13.75%. In fact, its reserve margin is projected to be less than 12.5% over the next few years – a demonstration that it cannot achieve sufficient resource adequacy. Furthermore, it experienced several emergency energy alert events over this summer and saw real-time prices hit the offer cap of US$9,000/MWh. Its prices were so high that a single week in August provided more than a full year's energy margin for a peaker. A market that relies on a very small number of extremely high-priced events does not provide revenue certainty for investment and exposes customers to significant price volatility. It also creates a fundamental flaw in the design because it makes suppliers reliant on poor resource adequacy to earn their returns which is exactly the least desirable outcome for consumers and the system operator.<br><br>***Active hedging and contracting provides stability of cashflows for suppliers and reduces the incentive to exercise market power***<br><br>Alberta's wholesale energy market has substantially evolved from its early beginnings. At its outset, the market was dominated by vertically integrated utilities, there were limited opportunities to contract, and there was a nascent forward market. The market power that existed at that time was addressed with PPAs. Since that |

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| | | time, the competitive retail market has grown with more suppliers and more competitive product types, the forward market has developed into an active market traded on exchanges and through brokers, and there are more long-term contracting opportunities.<br><br>Suppliers actively hedge and enter into contract to provide cashflow stability to support their investments. Suppliers desire to reduce the positions that they carry into the real-time market. The limitation on the amount of hedging and contracting that suppliers engage in has more to do with having enough buyers willing to hedge their exposure to the real time market. In this respect, additional mechanisms that mitigate price outcomes away from outcomes that would otherwise be set by competitive market forces would disincentivize contracting and forward hedging.<br><br>Increasing forward contracting by loads reduces the incentive for suppliers to exercise market power in real time and should be encouraged. We note that there is very limited liquidity two or more years out and even within the delivery year where market liquidity improves substantially, large suppliers are still limited in their ability to hedge their full portfolio length. New elements could be introduced that require or incent load consumers to contract ahead of the real-time market which would support more hedging, reduce merchant risks for suppliers, lower the cost of capital, and reduce the incentive to exercise market power. |
| 3. | If deemed that additional mitigation measures are required in the energy-only market, please indicate whether they should be applied ex-ante (mitigation occurs prior to prices being set) or ex-post (mitigation occurs following market prices being set). | ***No additional mitigation measures are required***<br><br>TransAlta does not agree that additional mitigation measures are required. The existing market design has features that sufficiently mitigate the exercise of market power on an ex-ante basis. No additional ex-ante mitigation measures should be applied. Additionally, the market design already has ex-post monitoring, investigation and enforcement mechanisms that help to ensure that any abuse of market power or anti-competitive conduct can be effectively addressed should it ever arise.<br><br>***Clarify the requirement for long lead time assets to commit to the market on an individual asset basis versus a portfolio basis.***<br><br>We note that during the capacity market proceeding the AUC (through its questions) appeared to misapprehend the parameters for committing a long lead time asset to the market. The concerns raised by the MSA's consultants also appeared to assume that generation assets could be physically withheld based upon a portfolio benefit. We disagree that such an interpretation is reasonable.<br><br>As a point of reference, a unit that is mothballed requires a corporate officer to attest that the forecast market prices and market conditions are insufficient to recover |

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| | | avoidable costs for the source asset for the duration of the mothball outage. Such an assessment is not based upon what is most profitable for the asset owner's portfolio but rather on whether the individual asset can recover its avoidable costs. Our view, and practice, is that a physical commitment decision including a mothball outage and long lead time asset must be made on an individual asset basis or to meet portfolio obligations and commitments not to physically withhold capacity for a portfolio benefit.<br><br>We would suggest that if this is unclear to the regulatory agencies or any market participants that further clarification is warranted. |
| 4. | What has been effective in Alberta's historical approach to market power mitigation in the operating reserves market, and what could be improved? | The OR market is a small, highly competitive subcomponent of the overall energy market. The market has a surplus of providers, low barriers to entry, and is procured in a manner that maximizes competition to effectively mitigate the need for other forms of administrative market power mitigation approaches.<br><br>***There is ample competition in the OR market to mitigate the exercise of market power***<br><br>All of the system needs required to meet energy needs and OR and other ancillary services are met from the same pool of resources. In this respect, the resources that supply OR are the same resources that participate in the energy market. More relevant is that the number of suppliers that can provide OR is significantly greater than Alberta's OR needs. There is no lack of competition in the OR market.<br><br>London Economics International LLC. (LEI) conducted an analysis of the OR market dated April 4, 2019, in which they made the following observations and findings:<br><br>• From 2014 to 2018, the average quantity offered in active OR markets was 67% to 332% higher than the quantity procured by the AESO.[19]<br><br>• From 2014 to 2018, the combined MWs offered in each OR product by all market participants (excluding the largest market participant) are sufficient to meet the highest level of OR products demanded. This means the largest participant is not pivotal in the active OR markets.[20]<br><br>Attachment 1 to this letter is a copy of LEI's evidence as submitted in AUC proceeding 23757. |

[19] Page 16, "Does Alberta require additional mitigation protocols for non-thermal storage resources and separate market power mitigation frameworks for operating reserves and the energy market?", London Economics International LLC, April 4, 2019.
[20] *Ibid,* Pages 16-17.

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| | | ***The OR market is not a separate market; it is a small part of the energy market***<br><br>OR are a suite of complementary products that are procured by the AESO to ensure real-time balancing in the electric system. The amount of OR that is needed is significantly smaller than the amount of energy required to meet system needs and should be considered a very small subcomponent of the energy market.<br><br>While we use the term "OR market" to differentiate the manner in which OR products are procured versus the manner in which energy is priced through the centralized power pool, it is inaccurate and misleading to consider the OR market a separate market from the energy market. The danger in doing so is to misapprehend the close interlinkages between the products (OR and energy) and to mis-state or ignore the important competitive constraints that mitigate the possibility of an abuse of market power or anti-competitive behavior.<br><br>OR and energy are substitutes for one another. OR products that are procured ahead of time are capacity obligations to provide energy in real-time at the system operator's discretion. OR procurement obviates the need for the system operator to procure extra energy in real-time to meet the system's balancing requirements. However, procuring OR products ahead of time is less costly to Alberta consumers than purchasing back-up extra energy for balancing and ensures that the balancing requirements are available in real time.<br><br>***The OR market is open to a wide range of resources including generation and load***<br><br>The barriers to entry are low to enter into the OR market and offer different products. For example, the thermal generating units on the system can easily qualify to provide OR with minimal levels of incremental investment. The AESO has endeavored to ensure that the technical requirements to qualify resources is technology agnostic thus ensuring the OR market is open to as many resources as possible. Many resources that currently participate in the energy market but do not participate in the OR market can install additional equipment at relatively low investment cost and supply OR products. Furthermore, supplemental OR products can be provided by both load and supply resources.<br><br>***Limits on maximum qualified capacity reduce reliability risk and ensures that OR is procured from a large number of resources***<br><br>The AESO caps the total amount of combined OR offers for any qualified OR resources. The cap is typically 80 MW for non-hydroelectric units. This practice reduces the reliability risk by limiting the system's reliance on any individual OR resource but also serves to increase competition. In the past five years, there have |

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| | | been at least 72 assets that have actively sold OR products. The overall level of qualified OR supply is several times the amount of OR demand in the market and reduces the ability to exercise market power.<br><br>***Procurement of OR ahead of time maximizes participation***<br><br>OR is procured at least one day-ahead of the real-time energy market. The OR is the only forward market that the AESO participates in. OR procurements are run a simple and quick auction processes that are easy to participate in and enable suppliers to sell their capacity and secure revenues ahead of delivery. Suppliers are able to make OR offers that reflect their future expectations about energy market prices and the opportunity cost of supplying OR. The OR procurement process reduces revenue risk for suppliers, encourages forward selling, and facilitates planning and operations, all of which enhances competition.<br><br>***AESO acts as sole buyer and its bid price caps the market***<br><br>Unlike the energy market, the AESO acts as the buyer in the OR market and submits a bid price to which suppliers respond to with their lower offer prices. The bid price is not set by an ISO Rule. The AESO applies its own discretion to set a bid price at a discount or premium to pool price but at a level that it deems is high enough that it expects the market will clear. As such, the bid price that is determined by the AESO acts as an upper bound to cap the OR market and safeguards the market from abuses of market power. |
| 5. | Do you expect the historical approach to market power mitigation in the operating reserves market (e.g. FEOC regulation, indexed to pool price) will be effective on a go-forward basis?<br>If yes, please explain your rationale. If no, please explain your rationale and changes required. | Yes, we expect the historical approach in the OR market will be effective on a go-forward basis.<br><br>***The OR market will continue to have a surplus of providers***<br><br>As stated above, there is an abundance of qualified OR assets and suppliers relative to the small size of the OR market. We expect the number of assets in the market to increase going forward as new resources continue to enter to meet future growing demand. We anticipate that many of these assets will elect to become OR suppliers given the potential opportunity to earn additional revenues on capacity in addition to earning energy produced.<br><br>***The emergence of new technologies such as batteries will increase competition***<br><br>In addition to an increase in generation resources, we expect that new types of technologies will increase OR competition. For example, we are seeing an increasing trend towards the use of battery technology in other markets. Battery |

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| | | technologies are well suited to supply OR due to their high capacity value and limited energy storage. We see many technologies with fast response times and characteristics that rival hydroelectric resources in providing OR. Furthermore, these technologies are coming down quickly in cost and have the benefit of modular design, scalable size, and are easy to install and maintain.<br><br>***TransAlta's future participation in the OR market does not change due to the expiry of the PPAs***<br><br>The expiry of the PPAs will not change TransAlta's future participation in the OR market. For thermal units, the OR market offers an alternative opportunity to the energy market. The PPA for TransAlta's hydro units was financial in nature and provided TransAlta the same offer discretion over the hydro assets that TransAlta will have post-PPA. In this regard, the expiry of the PPA is not a significant change from the perspective of competition in the OR market.<br><br>***Hydro is energy-limited, environmentally constrained and most suitable for OR***<br><br>TransAlta filed rebuttal evidence in AUC proceeding 23757, included as Attachment 2, that explained the various energy limitations and environmental considerations that affect hydro operations. The following are key excerpts from that evidence:<br><br>• TransAlta states that its primary objective in operating the hydro system is water management, with 98% of water used for water management or to supply reserves. [21]<br><br>• TransAlta has historically operated the hydro assets to first provide regulated water flow for downstream users, second for ancillary services (system support or reserves) to the AIES and lastly to provide energy when it is most valuable to the system. These objectives remain the best use of its hydro system going forward. TransAlta also participates in the energy market with its hydro assets, but historical data shows that it has very little flexibility in its energy offers over the course of the year.[22]<br><br>• TransAlta conserves the scarce supply of water from its hydro facilities by flowing water in higher price hours when the energy market is signaling a need to dispatch this type of resource, typically during periods where supply and demand are tight. Other water flows are used to meet water license requirements and to support the provision of regulating reserves. High hydro |

[21] Para. 11, Page 5, TransAlta Corporate Rebuttal Evidence AUC Proceeding 23757: ISO Rules to Implement the Capacity Market, April 4, 2019.
[22] *Ibid,* Para.13, Page 5.

energy offers are a reflection of scarcity and the value of water and the need to conserve water to meet future requirements and are not indicative of an intention to extend market power. [23]

- TransAlta manages its available hydro capacity to supply regulating and contingency reserves and to supply energy to the grid. Based on the last thirty-four years of actual data (1985-2018), a median water year yields approximately 180MW/h of energy production. Approximately 130MW/h is offered at $0/MWh to ensure dispatch and that water flows are managed. Approximately 100 MW/h is offered in as regulating reserves, with a small portion used to meet energy demands during peak periods. This typically produces about 50MW/h of energy, for a total of 180 MW/h. In addition to energy and regulating reserves, TransAlta typically supplies 220 MW/h of contingency reserves (spinning and supplemental reserves). Finally, it is common for more than 200 MW/h to be offered at high prices out of merit to avoid over consumption in most periods and ensure generation capacity remains available for high value periods. [24]

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| **130 MW/h** | Zero Block Energy Offers (safety, environmental compliance, etc.) |
| **100 MW/h** | Supply of Regulating Reserves to AESO (~50MW/h energy generated) |
| **220 MW/h** | Supply of Spinning and Supplemental Reserves to the AESO |
| **210 MW/h** | Out-of-Merit Energy Offers (water conservation for future requirements) |
| **660 MW/h** | Total Available Capability |

- For the period 2012-18, TransAlta's hydro assets rarely set price when the supply cushion was greater than 1,000MW but more frequently when the supply cushion was less than 250MW. Almost 89% of hours during this timeframe had a supply cushion greater than 1,000MW and TransAlta's hydro offers set price during just ~2% of those hours. In contrast, when the supply cushion was less than 250MW, which usually comprises less than 1% of the hours in any year, TransAlta's hydro offers set price in ~66% of hours.[25] As stated in the AESO's

[23] *Ibid,* Para. 14, Page 5.
[24] *Ibid,* Para. 19, Pages 6-7.
[25] *Ibid,* Para. 28, Pages 9-10.

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| | | evidence in the capacity market proceeding: "many of the high prices noted in tight supply hours are established by non-mitigated firms, many of them small firms or hydro. Historically, hydro offers have been mainly set in response to environmental or regulatory incentives. Such prices therefore, are not set via an abuse of market power."[26]<br>• Also, in reviewing actual prices when the supply cushion was greater than 1,000MW, the data shows that market prices generally reflect short-run economics of conventionally-fueled generation sources. Prices in these periods were less than ~$30/MWh on average (2012-18). Any of TransAlta's hydro offers would therefore not be exerting an undue influence on price because the market has sufficient low-cost supply. Forcing fuel-limited generation into the supply by constricting offer flexibility would therefore have no social benefit and, in fact, would be contrary to the exact physical performance the AESO explicitly values for energy reliability. [27]<br>• Lastly, attempting to use offer strategies in operating reserves markets to shift capacity out of those markets and to increase exposure to the electricity merit order is not economically rational. As the data mentioned above indicates, almost 90% of the time this would be of no consequence to energy prices because the market is well supplied, and would lead to economic loss to TransAlta, having exited the operating reserves markets. During the remaining top 10% of hours in the year, TransAlta's hydro assets will be providing physical energy and have energy in-storage to provide any contingency reserves the AESO may require, again, consistent with the objective of overall energy/system reliability.[28] |
| 6. | If deemed that additional mitigation measures are required in the operating reserves market, please indicate whether they should be applied ex-ante (mitigation occurs prior to prices being set) or ex-post (mitigation occurs following market prices being set). | ***No additional mitigation is required.***<br>As discussed above, the OR market is a small subcomponent of the overall energy market and has features including time-ahead forward procurement, AESO acting as sole procurer, indexing to pool prices, a low limit on maximum qualified capacity, and a surplus of suppliers that mitigate market power and make it an attractive and highly competitive market. We see several factors driving more competition in the OR market including more supply resources being added to the system in the future and adoption of new technologies well-suited to provide OR. With regard to all of these |

[26] Page 6, Exhibit 347, Proceeding 23757, Efficiency Assessment of the AESO's Proposed Energy Market Mitigation Framework, AESO, January 29, 2019.
[27] Para. 29, Page 10, TransAlta Corporate Rebuttal Evidence AUC Proceeding 23757: ISO Rules to Implement the Capacity Market, April 4, 2019.
[28] *Ibid,* Para. 30, Page 10.

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| | | competitive considerations, we see no need to adopt additional mitigation measures in the OR market.<br><br>While we disagree that additional mitigation measures are required, we note that the backstop of ex-post investigation and enforcement is already in place and sufficient to handle any future issues of market power and anti-competitive conduct that could arise. |
| 7. | What criteria should be considered in evaluating Alberta's mitigation framework? Would you rank one or some of these criteria more highly than others? | ***Criteria: Does the energy market provide proper investment signals?***<br><br>***Evaluate whether the prices are consistent with Long Run Marginal Cost (LRMC)***<br><br>The most important criterion for evaluating Alberta's mitigation framework and more generally the success or failure of energy-only market design is measuring whether prices outcomes support dynamic efficiency and provide clear investment signals for the firm generation required to ensure reliability. It is important to measure how the market responds to the investment signal provided through price outcomes. This allows for an evaluation of whether the market is functioning properly, and whether there may be an issue with the mitigation framework.<br><br>More specifically, we believe that the most relevant standard to measure dynamic efficiency is to evaluate price outcomes over the medium and long term against the LRMC of firm generation technologies required to meet resource adequacy that are most likely to be developed in Alberta. LRMC should include all costs including short-run marginal costs, fixed costs, capital costs, and return on investment for the technologies and calculated on a present-value basis. The focus of the evaluating dynamic efficiency is whether sustained price outcomes (over the course of a year or more) are being responded to appropriately by market participants either through new investment or cancelling new investment. As a point of reference, the MSA routinely conducts a Net Revenue Analysis in its quarterly reports to examine the potential profitability of a hypothetical gas peaking plant in the OR market. An assessment of LRMC should also be conducted on a periodic basis.<br><br>***Criteria: Are price trends consistent with market fundamentals?***<br><br>***Evaluate whether price patterns are consistent with supply-demand fundamentals***<br><br>A secondary criterion is whether the price trends are consistent with supply and demand fundamentals. We note that the MSA has routinely monitored and presented their observations in its quarterly reports. We have typically seen this as an assessment of historical price outcomes and supply cushion levels where we |

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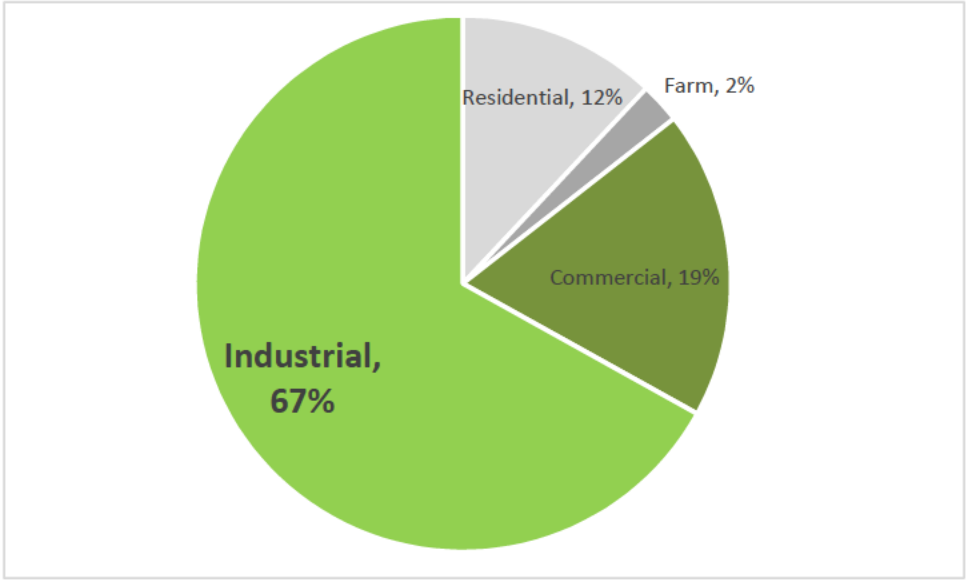
| | | expect to see a general pattern of higher prices when levels of supply are lower relative to demand.<br><br>We do not rank this higher because we expect to see a range of price outcomes that reflect various factors that impact participants offer behavior (e.g. portfolio positions, different perspectives on market fundamentals) and real-time prices, which make it difficult to interpret this type of analysis. Furthermore, the energy-only market design is premised on a principal objective of achieving efficient outcomes over time and an acceptance that there may be some degree of efficiency loss in the short-run to achieve that outcome.<br><br>***Criteria: Does the market encourage or discourage forward contracting by suppliers and customers?***<br><br>***Evaluate whether forward market liquidity, activity by participants, and market prices over time are indicative of a healthy and competitive market***<br><br>A tertiary criterion is to evaluate the activity and liquidity of the forward market to determine if it supports a healthy and reasonable level of forward contracting by suppliers and customers. Unexpected changes such as a marked reduction in market liquidity, significant changes in trading activity by types of market participants or unpredictable changes in market prices can all be early warning signs of deterioration of market conditions. An active forward market mitigates the incentive for suppliers to exercise market power in real time and should be monitored to ensure that its activity shows robust and active participation. Reductions in activity should be investigated to further understand if they represent a breakdown in fundamentals that may become a persistent issue in the market. |
| 8. | Are there unique characteristics of Alberta's electricity market that may impact whether the market power mitigation approaches used in other jurisdictions are suitable for Alberta? If so, please describe them. | ***Energy-only market design***<br><br>The key unique characteristic of Alberta's electricity market is the energy-only market design. As elaborated above, there are only a few jurisdictions with energy-only market designs and Alberta's approach is comparable to the market power mitigation approach used in those jurisdictions. We disagree that the market power mitigation approaches used in other market designs such as capacity markets are reasonable or suitable to employ in Alberta. Our market model is premised on an acceptance of market power and a tolerance for the exercise of market power provided that it creates an efficient outcome over time. It is a successful design that is widely endorsed by the Government and market participants.<br><br>***High percentage of the market are sophisticated commercial and industrial customers*** |

Alberta's electricity market is unique in its high proportion of large commercial and industrial customers. Figure 1 below provides the percentage share of Alberta's internal load by load customer type in 2018.

**Figure 1: Percentage Shares by Load Customer Type in 2018**




Sources: AUC Sales History Data and AESO 2019 Long Term Outlook Data File

These are savvy and sophisticated customers that manage their electricity costs through a range of options including entering into bilateral contracts, forward transactions through brokers and exchanges, self-supplying through on-site generation, or purchasing through the power pool. These customers have a high incentive to manage their electricity costs by reducing their exposure to real-time wholesale electricity prices.

***Residential and small commercial customers are insulated from exposure to the real-time energy market***

Residential customers do not purchase from the power pool and have limited direct exposure to the real time wholesale electricity prices. These consumers have their electricity provided through either the regulated rate option or competitive retail contracts. There are various types of competitive retail offerings including fixed or

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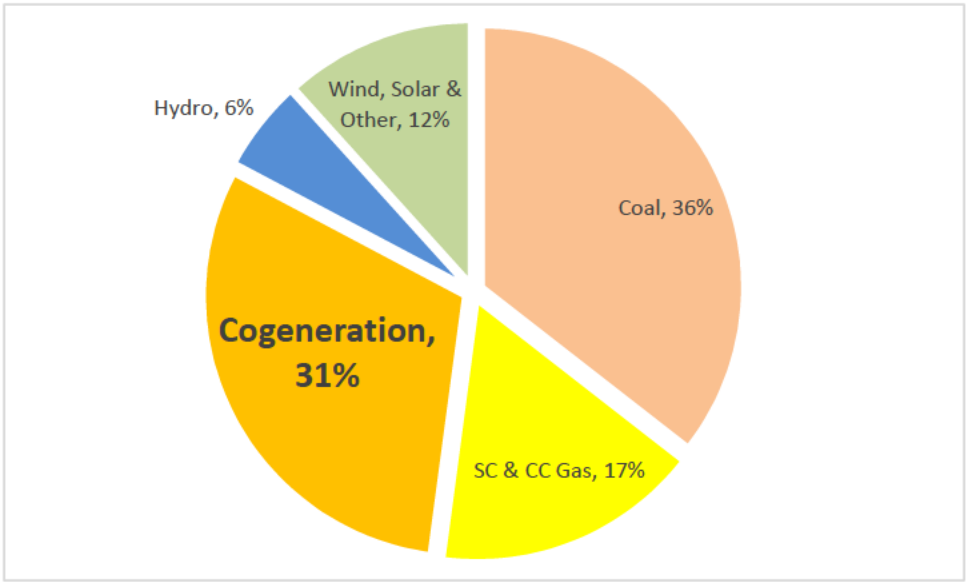
| | | variable rates of various term lengths.<br>***Strong participation of self-supply and opportunities to develop cogeneration***<br>Cogeneration represents more than 30% of the installed generation capacity in the Alberta. Figure 2 below provides the supply mix of installed capacity by generation type in 2018.<br>**Figure 2: Installed Capacity Supply Mix in 2018**<br>  <br><br>Historically, generation self-supply has been a strong and competitive alternative to grid supply given the high steam and electricity requirements of the oil and gas sector. However, going forward we see greater interest in self-supply from other industries and small customers including residential customers as small-scale generation technologies such as solar continue to decline in cost and gain in popularity. |
| 9. | What do you think the appropriate role for the AESO is in Alberta's mitigation framework? | TransAlta views the AESO's role as ex-ante and should be limited to designing a market that maintains a level playing field, encourages competition, and is efficiently administered in a fair manner. We believe that the role the AESO currently plays is appropriate and includes the following: |

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| | | • ***Market rule developer*** – The AESO is responsible for consulting on and developing ISO Rules that generally govern the energy and ancillary services markets including the operation of the electric system.<br>• ***Power pool administrator and operator*** – The AESO administrates and operates the real-time wholesale electricity market. In this role, the AESO is responsible for managing the efficient operation of the power pool and monitors its day-to-day operations.<br>• ***Technical standard and requirement developer*** – The AESO also dictates the technical requirements for participating in the OR and electricity markets. The AESO has rationalized the requirements to expanded participation and competition in the markets by enabling load and imports to participate in the OR market as well as allow loads to bid into the energy market.<br>• ***OR procurement agent*** – The AESO acts as the sole buyer in the OR market. As described above, it plays an integral role in mitigating market power. |
| 10. | What do you think the appropriate role for the MSA is in Alberta's mitigation framework? | ***MSA is the independent monitor for the wholesale electricity market***<br>The MSA is responsible for monitoring the market on an ex-post basis including its structure and performance to ensure that it is operating in a fair, efficient and openly competitive manner.<br>***The MSA role is responsible for investigation and enforcement***<br>The MSA is also responsible for investigating the conduct of market participants, AESO and the Balancing Pool and enforcing the ISO Rules, Alberta Reliability Standards and the *Fair, Efficient and Open Competition Regulation*.<br>***The MSA is not the market designer***<br>The MSA is not an alternative market designer to the AESO. When it acts as a market designer and takes a position on how the market should be structured, it removes its ability to act impartially in its true role as the surveillance, investigation and enforcement agency.<br>It should be noted that while market monitors in other jurisdictions often take positions on how a market should be designed and participate in proceeding related to market design, those market monitors are not also enforcement agencies. This is an important difference in role. A perception of bias in an enforcement agency undermines confidence that it can act in a fair manner in an investigation or enforcement action it undertakes. |

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| 11. | Please describe your role in the Alberta electricity market. | |
| | a. Are you a load, a generator, both, neither (e.g. developer, storage, interested party) | TransAlta is primarily a generator and developer that operates a diversified portfolio of assets that includes coal, hydro and wind assets. TransAlta is actively developing new coal-to-gas conversions, repowered gas, cogeneration and energy storage projects. |
| | b. What is the approximate size of your load and/or generation? | TransAlta owns approximately 4,430 MW of generation in Alberta of which we only have market share offer control of 3,270 MW. We consume power as a load consumer for the station service that we require to operate our generating facilities. We also actively contract with commercial and industrial load consumers as a competitive supplier. |
| | c. Do you participate in the energy market, AS market, both? | TransAlta actively participates in the energy and AS markets. |
| | d. Do you forward hedge? If so, is it physically, financially, both? What percentage of your portfolio is hedged? | Yes, TransAlta forward hedges. We actively manage risk by financially hedging through exchanges, brokers and customer contract arrangements. The percentage of the portfolio that is hedged varies over time according to market conditions and the opportunities to forward sell and/or contract with load customers as well as our internal risk management program. As such, we cannot provide a set percentage of our portfolio that is hedged. We attempt to hedge a significant percentage of our merchant length but we are limited by the overall liquidity, loads' interest in the forward and contract markets, and the composition of our portfolio - which includes a significant amount of intermittent generation that is difficult to hedge. We support a more robust and liquid forward market and would welcome changes that increase load participation, which minimizes their exposure to price volatility and mitigates market power. |

Thank you for your input. Please email your comments to: stakeholder.relations@aeso.ca.

# Does Alberta require additional mitigation protocols for non-thermal storage resources and separate market power mitigation frameworks for operating reserves and the energy market?

*prepared for the Alberta Utilities Commission Proceeding 23757*

April 4, 2019


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*London Economics International LLC ("LEI") was retained by Osler, Hoskin & Harcourt LLP, legal counsel to TransAlta Corp. ("TransAlta") to conduct an independent assessment of AESO's Final Comprehensive Market Design and evaluation of the proposed ISO rules. The opinions and recommendations presented in this report are that of the author and may not reflect the views of TransAlta or other LEI clients.*

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# 1 Executive summary

London Economics International ("LEI") reviewed intervenor evidence submitted on February 28, 2019 to the Alberta Utility Commission ("AUC") Proceeding 23757.[1] The submission by the Market Surveillance Administrator's ("MSA") consultants, Charles River Associates and Potomac Economics (hereafter referred to as "MSA's Consultants")[2] raises concerns around the Alberta Electric System Operator's ("AESO") proposed Independent System Operator ("ISO") Rules for energy market mitigation of non-thermal resources with storage fuel.[3] In addition, the MSA's prior comments on the AESO's Comprehensive Market Design ("CMD") also implied they had concerns about market power in Alberta's ancillary services ("AS") or operating reserve ("OR") market. [4]

LEI examined the MSA's and MSA's Consultants' concerns and conducted analysis of the AESO's proposed ISO Rules related to the energy market mitigation scheme for storage hydro, a type of non-thermal resource with fuel storage. LEI also examined the relevant market definition and assessed the level of structural competition in the OR market. LEI concluded that additional rules are not required to ensure competitive offers in the energy market by non-thermal storage resources. Additional mitigation rules for the OR market are also unnecessary, given the evidence on the relevant market definition, empirical findings about competition in the OR market, and the existing ISO rules and business practices. These conclusions are based on the following key findings from LEI's analysis:

**Energy and OR are part of the same economic market.** The potential for market power must be examined methodically. The first step in competition analysis is to appropriately define the market. Operating reserves and real-time energy are procured on separate platforms and in different periods of time in Alberta. However, energy and OR are essentially substitutes from the system operator's perspective once OR resources are activated. In addition, energy and OR products are substitutes from the perspective of providers (suppliers). LEI applied industry standard empirical techniques to determine the relevant market definition and concluded that given this ability to substitute for one another, energy and OR products in Alberta are part of the same economic market for purposes of competition analysis and design of market power-related rules.

**With a robust energy market mitigation framework for thermal resources, the AESO's proposed additional rules around offers from non-thermal resources with storage capability will be sufficient.** When energy market mitigation protocols safeguard the market from

[1] LEI was retained by Osler, Hoskin & Harcourt LLP ("Osler") on behalf of TransAlta Corp. ("TransAlta") to perform an independent assessment of 1) the Comprehensive Market Design ("Final CMD") issued by the Alberta Electric System Operator ("AESO") in June 2018 and 2) the AESO Application for Approval of the Final Set of ISO Rules to Establish and Operate the Capacity Market submitted to the AUC on January 31, 2019 (the "Application").

[2] Alberta Market Surveillance Administrator, Market Design Issues in the Alberta Capacity and Energy Markets, February 28, 2019.

[3] Ibid. Page 52.

[4] MSA. "Notice to Participants and Stakeholders – Re: MSA Response to the AESO's Final CMD Proposal" August 23, 2018. <https://albertamsa.ca/uploads/pdf/Archive/000000-2018/2018-08-23%20MSA%20response%20to%20AESO%20CMD.pdf>

economic withholding by thermal resources, this will also significantly lessen the risk of economic withholding by non-thermal resources with storage. Competitive energy offers from thermal resources will discipline non-thermal resources with storage fuel because the offers by a resource with storage fuel is a function of the opportunity cost of storing energy and selling it in future periods. Moreover, the AESO's specific rules under Section 203.5 for non-thermal energy storage units essentially eliminates the possibility of physical withholding by a non-thermal energy storage resource, as it must offer all available capacity between the energy and OR markets. **Finally, attempts to manipulate market prices in the energy markets, as suggested by the MSA's Consultants, is not economically rational on a repeated, day after day basis, given the operational priorities of a storage hydroelectric resource, as discussed further in TransAlta's rebuttal evidence.**[5]

**Additional rules are not necessary to ensure competitive OR market dynamics**. OR product markets are part of the energy market. Therefore, the implementation of a robust energy market mitigation framework for thermal resources would also protect the OR markets. The AESO has a number of safeguards for procurement of OR products. Those will continue into the future. In addition, the AESO's proposed energy mitigation rule which applies specifically to designated non-thermal storage units eliminates the possibility of physical withholding. [6] This further reduces the need for mitigation measures in the active OR markets.

**Over-mitigation can be harmful to system reliability and dampen the investment signal for storage resources that could provide needed OR supply.** Over-mitigation can be harmful to both existing resource providers and new investments. For example, LEI's analysis of the historical dispatch of a large hydro storage unit in Alberta using an energy offer cap that is 300% of the 30-day rolling average pool price ("3xRAPP") shows that such mitigation results in over-dispatch of energy in the calendar year, leading to insufficient water available to be dispatched during high priced hours later in the calendar year. This is because the backward-looking 3xRAPP approach does not properly capture the opportunity cost of water. This leads to insufficient ancillary services supply and therefore negatively impacts overall system reliability in Alberta. Lower market prices will occur when the 3xRAPP forces over-dispatch. This may also harm competition in the OR markets by reducing the incentive for existing resources to participate in the OR markets and dampening the investment economics for new resources with storage. Such unintended consequences are counter to the government's goal of fair, efficient and open competition in the Alberta electricity market.

[5] TransAlta Corporate Rebuttal Evidence, AUC Proceeding 23757, ISO Rules to Implement the Capacity Market, April 4, 2019.

[6] That storage units are exempted from the formula-based energy market power mitigation rule if and only if they offer their full capacity into the active OR markets.

# 2 Summary of AESO's energy market mitigation proposal for storage units and MSA's response

## 2.1 AESO's proposed market power mitigation rule for non-thermal storage resources

Under the capacity and energy market's "must-offer" requirement,[7] physical withholding of resources with capacity commitments is not allowed. Therefore, any potential for the exercise of energy market power would be in the form of economic withholding. Under the proposed Section 203.5 of the ISO Rules in Alberta, ex-ante energy market mitigation will be governed through offer caps on formulaic short-run marginal costs ("SRMCs") for generation units owned by entities that fail the energy mitigation screen.[8]

The AESO has proposed an exception for non-thermal resources, because the lack of physical fuel makes it challenging to calculate the SRMC of such a resource. Under the AESO proposal, a non-thermal resource with storage will be subject to a 3x or 6x multiplier on a 30 day rolling average pool price ("RAPP") unless it offers all its available capacity into the active OR markets.[9] In other words, if a storage unit offers all of its available capacity into the active OR markets, the energy market offers from the storage unit would only be subject to the "maximum permissible price for an offer made under Section 203.1 of the ISO rules,"[10] which is currently set at $999/MWh.

The AESO's logic behind this market power mitigation framework is mainly driven by its recognition of the high value of foregone opportunity costs (in both energy and ancillary services markets) of storage units, and the inability to forecast when high energy price hours could happen. The AESO has noted that such foregone opportunity costs could be as high as $999/MWh,[11] while also recognizing the negative consequences to the system if the energy market mitigation framework undercuts this opportunity cost. The validation of the AESO's rationale is simple: if a resource has offered all its available capacity to the ancillary services and energy markets, it is already providing its value to system reliability. And if the system requires it, that capacity can be converted (at the direction of the system operator) from active OR product to energy.[12]

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[7] AESO Market Rule Section 203.1.3(1).

[8] AESO Market Rule Section 203.5.9.

[9] AESO Market Rule Section 203.5.5.

[10] AESO Market Rule Section 203.5.5(4).

[11] AESO Consolidated Rationale. Page 119. "Since there is significant uncertainty about future energy and ancillary services prices, and uncertainty about whether ancillary services are going to be used, the opportunity cost of energy-limited assets may be as high as the energy market price cap in some hours."

[12] AESO Consolidated Rationale. Page 118.

### 2.2 MSA had raised concerns about market power in Alberta's OR markets

On August 23, 2018, the MSA issued its response[13] to the AESO's Final CMD proposal.[14] In its comments, the MSA questioned whether the Final CMD sufficiently dealt with market power, and whether additional ex-ante mitigation rules would be needed for ancillary services. Specifically, the MSA stated that "the operating reserves market may be subject to the exercise of market power and that there may be seams between the ancillary services and energy markets that could be exploited by market participants."[15] At the same time, the MSA recognized "that practical options [to change the OR market framework and associated ISO rules] may be limited in the short term."[16]

### 2.3 MSA's direct testimony with the AUC reiterated concerns around AESO's proposed management of energy market mitigation for non-thermal resources with storage

MSA's Consultants claim that a non-thermal resource with storage (e.g., a hydro asset with a storage reservoir) can "skirt energy market power mitigation" by:

- offering into the ancillary services market at a high price so that it is confident that it will not clear; and
- following that, proceed to offer into the energy market using any offer strategy it wishes, which may include the exercise of market power.[17]

In our comparative review of MSA's Consultant's submission and the AESO's rationale of the Final CMD, there appear to be two main differences that drive these distinctive perspectives.

First, MSA's Consultants and the AESO appear to have varying views on the opportunity cost of stored energy from hydroelectric operations. The AESO's view is that "the opportunity cost of energy-limited assets may be as high as the energy market price cap in some hours" and that "there is significant uncertainty about future energy and ancillary services prices," meaning that it is not practical to set a separate offer price cap when it is generally close to the energy offer price cap. In contrast, the MSA's Consultants believe that the AESO can "develop an approach to calculating the SRMC for such resources" that is "a reasonable proxy for the opportunity cost of stored energy", and with this SRMC developed, "such resources should be mitigated similarly to all other resources in the energy market."[18] In LEI's opinion, the arguments suggest that the

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[13] MSA. "Notice to Participants and Stakeholders – Re: MSA Response to the AESO's Final CMD Proposal" August 23, 2018. <https://albertamsa.ca/uploads/pdf/Archive/000000-2018/2018-08-23%20MSA%20response%20to%20AESO%20CMD.pdf>

[14] AESO. Comprehensive Market Design Final Proposal. June 29, 2018.

[15] MSA. "Notice to Participants and Stakeholders – Re: MSA Response to the AESO's Final CMD Proposal" August 23, 2018. <https://albertamsa.ca/uploads/pdf/Archive/000000-2018/2018-08-23%20MSA%20response%20to%20AESO%20CMD.pdf>

[16] Ibid.

[17] Alberta Market Surveillance Administrator, Market Design Issues in the Alberta Capacity and Energy Markets, February 28, 2019. Page 47.

[18] Ibid. Page 53.

MSA's Consultants believe that the value of stored energy for energy-limited assets could be materially lower than the energy market offer price cap and therefore it is worth developing a separate price cap for storage units.

A second area of disagreement between the MSA's Consultants and the AESO relates to the operational priorities of the storage hydroelectric resources. In the AESO's view, withholding energy (to then provide OR capacity or future sales of energy) is a core feature of hydroelectric operations (where storage allows for this). Specifically, the AESO states that it "recognizes the importance of water management to the operation of hydro assets and that opportunity cost is a critical element of determining when the available water is best used to produce energy."[19] Meanwhile, the MSA's Consultants' comments suggested that they view withholding (offering at a high price) as an indicator of the exercise of market power.

# 3 Market power testing and mitigation in energy and operating reserve markets

The first step in testing for market power and devising market power mitigation schemes is to define the relevant market. Are ancillary services distinct markets that require their own set of market mitigation rules? Or are they part and parcel of the energy market? LEI demonstrates below that in Alberta, the active OR markets are a subset of the wholesale energy market. This then implies that proper mitigation in the energy market would also safeguard competitive outcomes in the active OR markets.

## 3.1 What defines a relevant market for competition analysis?

When analyzing market power and developing a market power mitigation framework, it is first important to define the market.[20] The relevant market is defined by reference to all suppliers and all consumers. As such, the market definition takes into account both demand and supply considerations. There are four dimensions of a market definition:

(i) the product market (which products to group together),
(ii) the geographic market(which geographic areas to group together),
(iii) the functional characteristic (whether wholesale or retail), and
(iv) the time dimension (over what period of time are consumers and buyers engaged in making commercial decisions).

For example, for the product dimension, on the demand side, the consumer must view the products as substitutes if they are part of the same market. On the supply side, all producers (providers) that can produce the qualified products or could easily switch production to those products must be included in the defined market. In other words, all products that are substitutes

[19] AESO Consolidated Rationale. Page 119.

[20] As has been observed, "throughout the history of U.S. antitrust litigation, the outcome of more cases has surely turned on market definition than on any other substantive issue. Market definition is often the most critical step in evaluating market power and determining whether business conduct has or likely will have anticompetitive effects." *See* Baker, Jonathan (2007) "Market Definition: An Analytical Overview" *74 Antitrust L.J. 129 2007*, Page 129.

(or close substitutes) from the consumers' and suppliers' perspectives must be considered as part of the same relevant market for competition analysis.

### 3.1.1 Quantitative tests for market definition

There are multiple established quantitative methods to test whether two products can be considered as part of a single market. These quantitative methods include the **S**mall **b**ut **S**ignificant and **N**on-transitory **I**ncrease in **P**rice ("SSNIP") test[21] (or otherwise known as the Hypothetical Monopolist test), Cross Price Elasticity ("CPE") of Demand,[22] Granger Causality analysis, and price correlation analysis. Such tests have been accepted by courts, competition authorities, and market regulators as part of market power/competition analyses.[23]

The basic foundation for the price correlation and Granger Causality tests is derived from Marshallian economic theory, which states that in open markets, prices encapsulate and characterize all supply and demand dynamics. On that basis, prices for two products which are perfect substitutes should be identical, assuming no transaction costs (such as transportation and distribution costs). In markets which have transportation costs, examination of how prices move together (correlation analysis[24]) and whether prices in one geographical area or for one product help explain the behavior of another price series (using the Granger Causality test[25]) are used.

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[21] The SSNIP test defines the market space by looking at the substitution potential from the perspective of the consumer if, hypothetically, a monopolist owned all supply in a specific area. If the hypothetical monopolist's attempts to increase prices by a small but significant amount are frustrated by consumers switching products, then the chosen market dimension is not a distinct market and therefore the "market" needs to be expanded. This process continues until the hypothetical monopolist cannot successfully increase prices, and therefore profits, without losing a sufficient number of customers such that it is disciplined by the market.

[22] Elasticity metrics allow us to measure the relationship between quantities and price: the elasticity of demand documents the change in the quantity of demand expected as a result of a change in price, while the elasticity of supply represents the change in quantity of supply as a result of a change in price. For the purposes of defining markets, we are specifically interested in the inter-relationship between price and quantity of many goods and services. This inter-relationship is known as cross-price elasticity. Cross-price elasticity measures the change in the quantity demanded (or supplied) of one good or service in response to a change in price of another good or service.

[23] For example, the Granger Causality test and correlation test been used in Australian Gas Light Company v Australian Competition & Consumer Commission (No. 3), price analysis for airlines in Australia Competition & Consumer Commission (2006), merger analysis in Ireland (Heineken/Scottish & Newcastle, 2008) and in Turkey, on whether Coca-Cola was enjoying a dominant position in the cola market (23 January 2004, 04-07/75-18).

[24] In correlation analysis, if price movements are similar, we can hypothesize that the products are responding to common demand or supply changes and so, by extension, are part of a single market.

[25] The fundamental premise behind the Granger Causality analysis is simple. Suppose you have a regression model that explains the current price of a product (for example, spinning reserves) by fitting a curve to the historical prices of that product. Clive Granger's idea explores whether you could significantly increase the explanatory power of this regression analysis for the price of spinning reserves by including the price of another product, for example spot electricity, as an additional independent variable. If including real-time energy prices improves your ability to explain the price of spinning reserves, this means prices observed in the spot electricity market "Granger causes" those observed in the spinning reserve market. This, in turn, suggests that price setting in (or for) spinning reserves does not occur independently of price setting in the energy market, implying they are part of the same economic market.

### 3.2 Tests for incentives to exercise market power

Once the market is properly defined, then the extent of market power exercise can be analyzed and mitigation measures can be considered. Market power potential is, by itself, not a concern for competitive markets. Rather, the focus of market power testing should be on the economic motivations to exercise market power and conditions that may discipline the exercise of market power. Therefore, the determination of whether a firm has the potential to exercise market power (that needs to then be controlled through ex ante mitigation) should consider the economic incentives to raise market prices and whether a firm's competitors within the defined market (and new entry) are sufficient to discipline the potential of market power. According to the Competition Bureau Canada, "the size of a business, even one that dominates a particular market, is not, of itself, a cause for concern."[26] It is when a firm abuses its market power that a violation of the Competition Act is triggered.[27] Therefore, even if a firm has a large market share, the competitive constraints of its operations and threat of new entry may be sufficient to prevent anti-competitive behavior.

## 4 Are changes to mitigation rules for non-thermal storage resources required?

LEI empirically analyzed the proper market definition of energy and ancillary services in Alberta. LEI also examined the extent of competition in Alberta's OR markets and energy markets, especially as it relates to the AESO's proposed non-thermal resource exemption. The key findings of LEI's analysis include the following:

- OR products are part of the energy market for competitive analysis purposes;
- Mitigating the energy market already mitigates the active OR markets;
- AESO's proposed energy mitigation of non-thermal resources with storage is effective;
- Alberta's active OR markets are competitive; and,
- Over mitigating hydro storage resources leads to inefficiencies, which could negatively affect system reliability and future investment.

Based on these findings, LEI does not believe that additional mitigation measures are required for the Alberta OR markets or for non-thermal resources with storage capability.

### 4.1 OR is part of broader economic market for energy

In Alberta, there are three types of active OR products: regulating reserve ("RR"), spinning reserve ("SR"), and supplemental reserve ("SUP"). This set of three ORs are viewed by the supply side, the demand side, the system operator, and the regulator as substitutes (to varying degrees):

- On the supply side, the active OR market is served by the same resources that supply the energy market. Any resources that can supply the active OR market can supply the energy

[26] Competition Bureau Canada website. < https://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/04258.html> Accessed 26 March 2019.

[27] Ibid.

market. Generating units that are already supplying energy and synchronized with the grid can, in theory, also provide many ancillary services from their spare capacity.[28]If a unit is supplying the active OR market, it cannot simultaneously supply energy from the same megawatt of capacity, and vice versa. When considering whether to supply in the energy or active OR market, the main consideration of a supplier is the lost opportunity cost of selling into the other market. On the demand side, active OR products function as various forms of backup to energy. Active OR products, especially spinning and supplemental reserves, are procured to serve energy market demand when real-time energy market supply is insufficient relative to demand. Back up supply in the form of OR resources is a core feature of a well-functioning electricity markets, as electricity demand and supply must be balanced in real-time. Without OR markets, consumers would have to buy more energy to ensure that they have enough to meet demand in the real-time. In practice, system operators typically procure spinning and supplemental reserves instead of purchasing extra energy as back up, because reserves can be procured at a lower cost.[29] Therefore, OR and energy are substitutes from the perspective of consumers.

- OR and energy are treated as substitutes by the system operator. AESO procures operating reserves one business day in advance,[30] and procures real-time energy hours in advance of actual delivery. The OR capacity is converted to energy (at AESO's direction) during the real-time energy market. This means that, though the clearing of the energy and active OR markets is not co-optimized, the expected price of energy heavily influences the price offers of AS providers. At the same time, since capacity sold in the active OR market will not be able to sell in the energy market for the same time period, OR market results also influence the energy market outcome.
- The MSA has acknowledged that the active OR markets and energy market are inter-linked, and that suppliers can choose between which market to participate in: "[t]he operating reserves market and Dispatch Down Service market are directly connected to the wholesale Power Pool since they 'compete' for supply from the existing generating fleet. At any moment, all the needs of the energy market, operating reserves market and Dispatch Down Service market must be met from the available resources, basically in-province generation that is not on maintenance ... Load participates in the supplemental reserve market to a moderate extent, and the BC intertie provides some spinning and supplemental reserves to Alberta. However, the bulk of these services are met by the

[28] While not all resources supplying the energy market have the technical capability to supply the active OR markets, most newer gas-fired technologies can be upgraded to enable them to participate in the active OR markets with minimal capex investment and ongoing operational expenditures. Based on estimations from TransAlta's engineers conducted in 2016 (and confirmed again in 2019), the cost to install AGC equipment onto a CCGT is about $100,000 to $500,000, as most CCGTs would already have the capability but would require programming to enable that capability. There is also a requirement for a secured communication line which is quite small relative to other fixed operating costs.

[29] In theory, the procurement of spinning and supplemental reserve can be substituted by over-procuring energy in the real-time energy market (e.g. creating artificial load and reducing such load when real-time energy supply falls short). However, this is less cost efficient because extra demand in energy raise prices for all load served.

[30] AESO Website. <https://www.aeso.ca/market/market-and-system-reporting/>

generating fleet in Alberta. Participants rationally make choices among these markets to maximize value and accordingly prices are linked."[31]

Thus, it is evident that participants in Alberta's energy market and active operating reserve markets view OR and energy as part of a single market. The next sections present LEI's quantitative analyses demonstrating that Alberta's active OR markets and energy markets should be considered as a single market for the purpose of competition analysis.[32]

### 4.1.1 Price correlation analysis

The traded contracts in Alberta's active OR markets are priced based on a premium/discount to time blocks of real-time energy market prices (i.e., Pool Prices), and they are traded one day before the real-time energy market. To analyze the price correlation between the active OR markets and the energy market, LEI converted the two sets of price data for 2012 to 2018 (active OR contracted prices and energy prices) into comparable formats, using two steps:

1) **LEI converted hourly data to time-block data.** Active OR products are traded in four time-blocks per day (on-peak, off-peak, AM superpeak and PM superpeak), but the energy market is settled hourly. Therefore, LEI grouped the hourly energy pool prices into time-blocks that matched the active OR products' definitions. Prices for each energy time-block were defined as the average energy price during the time-block.

2) LEI c**onverted day-ahead discount/premium data to payment data**. LEI converted the traded active OR prices into actual payments made to resources that cleared the market, based on the following formula:

***Active OR payments = Active OR traded discount/premium + average real-time pool prices during the relevant time block***

LEI then ran correlation tests on the converted time series. The price correlation is very strong correlation (greater than 0.9) between movements in Pool Prices and active OR prices across all active OR products (regulating, supplemental and spinning) for on peak periods (see Figure 1). The correlation is weaker but still positive for off-peak periods (and regulating reserve during AM superpeak).

The correlation between the real time energy time-block-based prices and the active OR payments can then be calculated.

[31] MSA. Alberta Wholesale Electricity Market. 2010. Page 6.

[32] We only conducted price correlation analysis and Granger Causality analysis here due to time constraints required in setting up the SSNIP and cross price elasticity tests.

**Figure 1. Price correlation of Alberta's energy and active OR markets (2012-2018)**

| | | Active OR payments | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | RR On | RR Off | RR AM | RR PM | SR ON | SR Off | SUP ON | SUP Off |
| Real Time Pool prices | On peak | 0.93 | 0.22 | 0.35 | 0.81 | 0.99 | 0.45 | 0.99 | 0.51 |
| | Off peak | 0.46 | 0.39 | 0.44 | 0.48 | 0.49 | 0.73 | 0.48 | 0.80 |
| | AM Super peak | 0.42 | 0.34 | 0.68 | 0.41 | 0.46 | 0.62 | 0.46 | 0.73 |
| | PM Super peak | 0.78 | 0.20 | 0.28 | 0.94 | 0.84 | 0.45 | 0.83 | 0.52 |

Source: AESO for OR prices and day-ahead energy price forecasts; LEI analysis

RR stands for Regulating Reserve, SR stands for Spinning Reserve, SUP standards for Supplemental Reserve. "On" and "Off" refers to on-peak and off-peak time blocks, and "AM" and "PM" refers to AM Superpeak and PM Superpeak time blocks.

When the price correlation is calculated against time blocks that are not directly relevant to the active OR product (for example, on-peak regulating reserve vs off-peak energy prices), the correlation levels are weaker - but that is as it should be. For market definition purposes, the focus is on the price correlations between products in the same time blocks (which are the values highlighted in green in Figure 1). The combination of high price correlation between energy prices and active OR payments during relevant time blocks supports the hypothesis that the active OR markets and the energy market are part of the same market.

### 4.1.2 Granger Causality analysis

The correlation test above does not consider the order of the information—in other words, it does not matter if OR payments are known ahead of real time energy market prices, or vice versa. In contrast, the Granger causality test allows the user to test whether one data series is reacting to data that occurs beforehand. For the purpose of defining a market, the test is whether the active OR payments react to the energy market.

LEI developed a Granger Causality test using the market price data from 2012-2018. LEI lagged the energy prices by one day, and tested the reaction of active OR payments for each of the OR products.[33] In all cases, results indicated that the active OR product payment reacted to the lagged energy price for the same time block. Details of the test results are summarized in the Appendix. This further demonstrates the relevant market includes both OR products and energy.

[33] The correlation analysis uses real-time energy prices while the Granger Causality analysis uses one day lagged energy prices because to test for Granger Causality, the sequence of information known to market participants is important. Since active OR markets are traded one day before the real-time energy market, only the lagged energy price is known when active OR products are traded. Therefore, we have to use lagged energy prices as inputs to the Granger Causality test. For correlation test, we are testing whether the market outcome (i.e. energy price vs active OR payments) are correlated, and the sequence of events are not important.

### 4.1.3 Mitigating the energy market is sufficient to ensure competitive active OR markets

Now that we established that Alberta's active OR markets and energy markets are a single market for the purpose of competition analysis, we can assess whether there are any competitive concerns in the OR product markets that require additional mitigation.

LEI's analysis indicated that mitigating the energy market would simultaneously protect the active OR markets because:

- **Suppliers in the active OR markets make offer decisions based on expectations about energy market prices**, as the opportunity cost of participating in the active OR market is based on the profits that would have otherwise been earned from the energy market if that capacity was offered into the energy market instead of the OR market. At the same time, the offer of supply into the OR market means that that capacity is not available for the energy market. Therefore, the reservation of operable capacity for the OR market in lieu of the energy market also indirectly affects energy prices. Mitigation in the energy market therefore also mitigates opportunity cost in supplying the active OR markets, and therefore OR offers.

- **Many types of suppliers in the energy market can easily enter the active OR markets (and for specific products requiring additional equipment, the barriers to entry are relatively small).** If mitigation in the energy market results in low economic returns in the energy market and participating in active OR markets is relatively more attractive, suppliers can readily switch to offering in the active OR markets. AESO rules are generally flexible in qualifying OR providers so long as they can respond effectively to AESO directives. Some telemetry and equipment are required for participation in the regulating reserve markets, but the costs of adding such equipment are typically modest for utility-scale units, as discussed in Section 4.1. Moreover, the size of the OR markets combined is a fraction of the energy market,[34] which means relatively minor amount of supply in energy market switching to participate in the OR market would result in abundant competition in the OR market. Furthermore, currently, no single market participant is needed to supply the active OR markets, as presented in Section 4.3.1. As mentioned in Section 3.2, the threat of new entry may be sufficient to prevent anti-competitive behavior. The relative size of potential active OR market participants switching from the energy market pool would ensure market power in the active OR market would be kept in check by the threat of new supply.

- **Hydro plant operators are economically motivated to use stored water efficiently.** As the AESO has pointed out, the opportunity cost of production from storage units is geared toward allowing these storage units to "use their limited energy in the future".[35] If energy market prices are reflective of the competitive costs of producing energy, then the opportunity cost of water would also reflect that competitive cost. In an extreme scenario,

[34] Based on LEI analysis using data from AESO Annual Market Statistics 2018 and AESO ETS – Offer Control – Operating Reserve. In 2018, Alberta has over 16 GW of installed capacity, while average active OR market supply was only 1,388 MW, and the average active OR demand was less than 700 MW.

[35] AESO Consolidated Rationale. Page 118.

stored water would be spilled if it is not used within a hydrological cycle. In this case, there is little incentive for storage units to economically withhold their capacity in both the energy and operating OR market as this would lead to foregone value for the hydro in revenue losses that cannot be recouped. Therefore, sufficient mitigation in the energy market would force rational hydro operators to price their offers competitively in both the energy and active OR markets.

- **AESO can substitute the procurement of active OR products by over-procuring energy.** This means energy is a substitute of active OR, and therefore mitigation in the energy market implies mitigation in the active OR markets. In other words, the mitigation of market power concerns in the energy market also disciplines active OR offers.

In summary, additional market power mitigation of the active OR markets is not required to ensure competitive market outcomes.

### 4.2 AESO's proposed energy mitigation of non-thermal resources with storage is effective

Hydro units with storage need to bid high in the energy market to reserve energy for future use (in the energy market, at a future date) or to set aside water for the OR market. Although this may appear to be a "withholding" strategy, it is not a manifestation of market power. Rather, it is a reasonable (and competitive) commercial strategy in light of the current structure of the active OR markets and real-time energy market. If storage resources were not allowed to price in this way, then that would lead to suboptimal use of water and uneconomic outcomes consisting of too low prices when water is plentiful (e.g., in the springtime during freshet) and very high prices when demand peaks later in the year (exacerbated by the lack of stored energy). In summary, with respect to storage hydro that participates in the OR markets, the "withholding" dynamic is a manifestation of optimizing the value of water rather than the exercise of market power.

Although in theory a market participant in the energy and active OR markets with a hydro storage unit could try to increase its overall portfolio's profit by economically withholding the storage unit in the active OR market and the energy market, under the AESO's proposed rule, it is in practice difficult to execute, because the opportunity cost and operating risk of executing such a strategy on a repetitive basis is high. A simple example illustrates this:

1. A hydro storage unit would first need to offer its entire available capability into the OR markets in order to qualify to bid higher than 3xRAPP.[36]
2. It would offer this OR capacity day-ahead at a relatively high price so as not be awarded any OR obligations.[37] It would thus forego earning active OR revenues on that capacity. It would then be free to offer all this capacity into the real-time energy market at any price.
3. In order to successfully raise energy prices, sufficient capacity has to be priced at a very high price (e.g., economically withheld). The capacity that is economically withheld will need to be larger than the potential spare capacity from competitors. The hydro storage

[36] AESO proposed Market Rule Section 203.5.5(2) and 203.5 Appendix 1.

[37] This is a simplified example and other variations on this strategy exist. In all cases, however, the opportunity for economic withholding is highly constrained and transitory.

unit owner would therefore need to willingly take on the possibility that most (if not all) of its capacity will not be accepted in the energy market and therefore not be dispatched and no earn energy revenue.

4. In addition to being willing to give up its energy market revenue (for the portion of its high-priced offer that does not clear the energy market), the unit will also need to accept certain operational and financial risks. For example,
    a. If there is no further room in the reservoir, then that would mean that water would need to be spilled, foregoing future market revenues;
    b. The unit would also be at risk of a performance penalty under its capacity obligation.[38]

The logic for economic withholding is based on premise that the supplier has the ability and incentive to raise prices:

- The owner of the hydroelectric capacity may in theory have this capability – but in practice, it will be significantly limited. For the designated assets stipulated in Information Document related to Section 203.5 of the ISO rules,[39] the discretionary capacity covers only a small portion of their available energy given various water management and operational constraints, as described in TransAlta's rebuttal evidence;[40]
- The incentive only exists if the hydroelectric unit can withhold sufficient MWh so as to raise the price (for the dispatched volumes) by more than the loss in revenues from the volumes that were withheld (energy and AS) and the potential costs (capacity performance penalties). However, given the size of the discretionary capacity, the extent of spare capacity available from competitors, the increased risk of costs associated with hydro facility management and the other risks involved, the practical opportunity for hydro storage units to withhold sufficient capacity to raise energy prices day after day is low and very transitory.

In summary, AESO's proposed rule for storage units eliminates physical withholding and aligns competitive market outcomes with inherent commercial incentives for hydro – which is to sell stored energy in the form of OR capacity and offer the energy it does not want to store into the energy market (e.g. water flow that the hydro unit must flow due to operational, contractual, or environmental reasons).

### 4.3 No need for additional OR mitigation

Apart from the analysis above, additional ex-ante market power mitigation rules in the Alberta's OR market are unnecessary because:

- the Alberta OR markets are competitive;

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[38] *See* TransAlta Corporate Rebuttal Evidence, AUC Proceeding 23757, ISO Rules to Implement the Capacity Market, April 4, 2019.

[39] AESO. Information Document - Mitigation of Prescribed Assets. https://www.aeso.ca/assets/Uploads/203.5-Mitigation-of-Prescribed-Assets.pdf> The document designated the units with asset ID BRA, BOW, and BIG as prescribed assets.

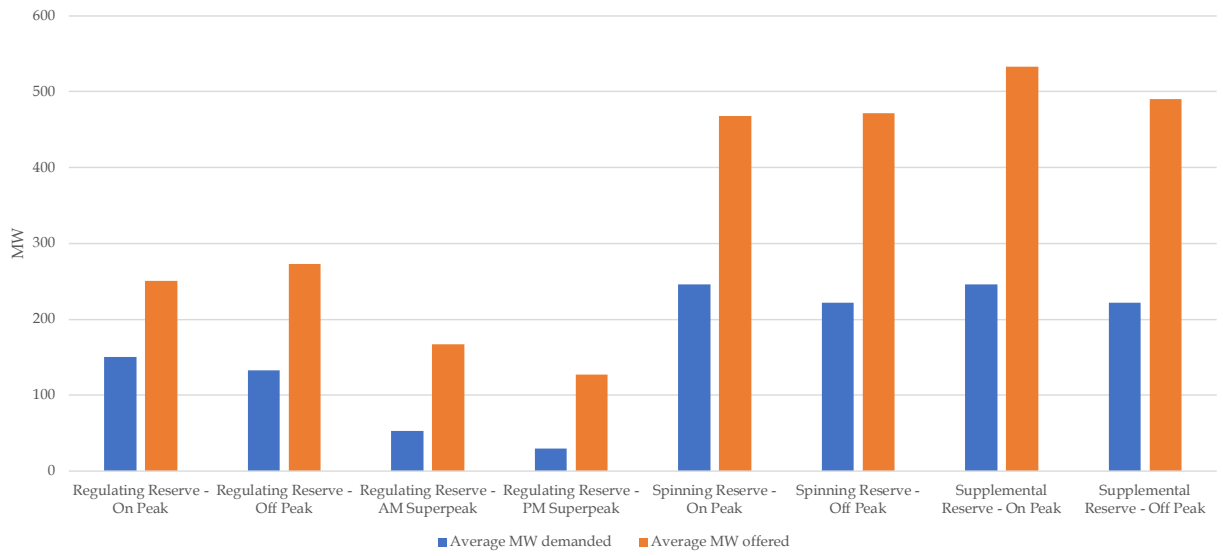
[40] *See* TransAlta Corporate Rebuttal Evidence, AUC Proceeding 23757, ISO Rules to Implement the Capacity Market, April 4, 2019.

- there are already measures in the OR market to enhance competition (see further Section 4.3.2); and
- over-mitigation of OR providers can have negative consequences.

### 4.3.1 Alberta's active OR market is competitive

The Alberta active OR market is very competitive. The active OR market is flush with supply, which provides a competitive environment for generators. The total MWs offered to each product over time block far exceeds the amount of product procured daily by AESO, as presented in Figure 2.

**Figure 2. Average quantity of active operating reserve demanded (procured) and offered (2014-2018)**




Source: AESO ETS – Offer Control – Operating Reserve, LEI Analysis

From 2014 through 2018, the average quantity offered in active OR markets were 67% to 332% higher than the quantity procured by the AESO. In comparison, the average supply cushion in the Alberta energy market from 2014 to 2018 equated to an average offer surplus over demand of only 23%.[41] This indicates that the Alberta active OR markets are significantly oversupplied and therefore a strategy of economic (or physical) withholding would not be successful in the Alberta active OR markets as compared to the energy market.

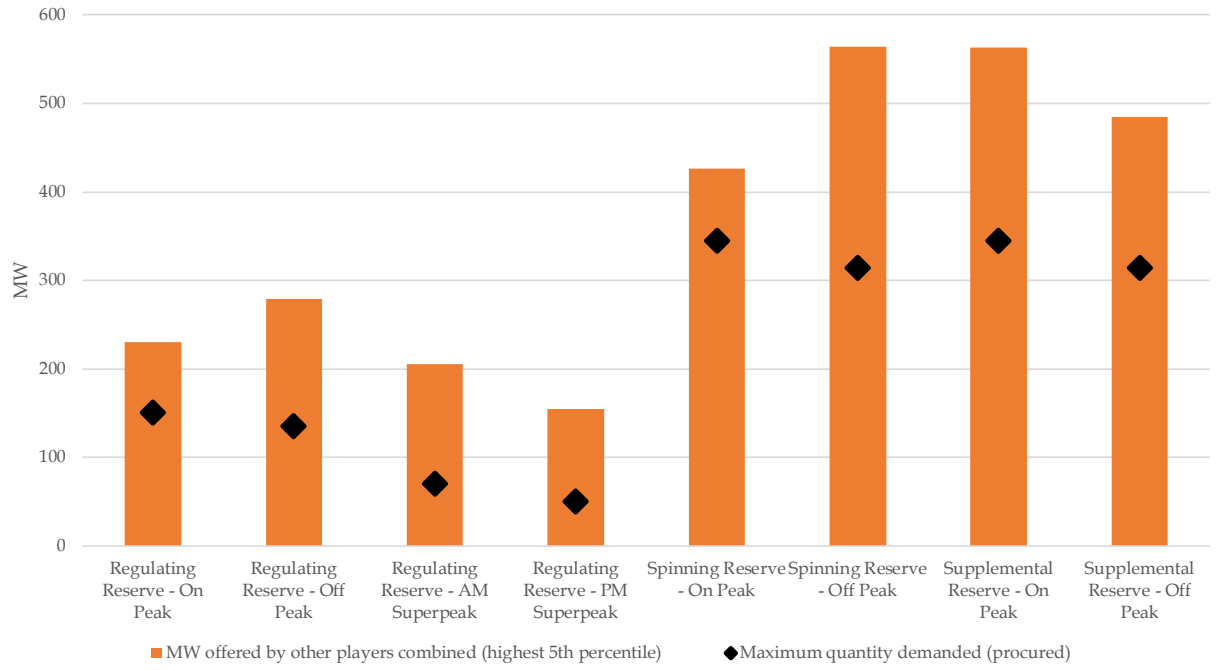
We also analyzed whether the largest market participant is pivotal in the active OR markets. From 2014 to 2018, the combined MWs offered in each OR product by all market participants (excluding the largest market participant)[42] are sufficient to meet the highest level of OR products demanded,

[41] Source: AESO 2018 Annual Market Statistics. This assumes all available capacity has to offer into the energy market according to the market rule.

[42] We use the 5th percentile of total MW offered by all participants (excluding the largest participant), because someone certain days LEI observed a very large quantity offered by these participants which appears to be a data error.

as presented in Figure 3. This means the largest participant is not pivotal in the active OR markets.[43]

**Figure 3. Maximum quantity of active operating reserve demanded (procured) vs offered by all market participants except largest one (2014-2018)**




Source: AESO ETS – Offer Control – Operating Reserve, LEI Analysis

### 4.3.2 Existing measures are in place to enhance competition in the active OR markets

There are currently a number of measures in place in Alberta's active OR markets design that enhances the level of competition:

- the maximum size of combined OR offers from each non-hydroelectric unit is capped (typically at 80 MW); [44]
- the clearing price in the active OR market is capped by the bid price of the AESO;[45] which has historically been set at less than or equal to $100/MWh premium over the energy price.[46] Although the bid price of the AESO is not a fixed number set in the market rule, the AESO has stated that "For each ancillary service product, the ISO will follow the

[43] "A supplier is said to be 'pivotal' in a given hour if by withdrawing supply under its control there would be insufficient remaining supply to satisfy demand." MSA "Market Concentration Metrics". November 1, 2006.

[44] Hydroelectric units have a higher limit in recognition of their flexibility and OR capability. Source: AESO. Ancillary Services Participation Manual. Edition 3. Page 19. January 2012.

[45] AESO Market Rule 205.1.3(2).

[46] Although not explicitly stated in the market rule or AESO's operating procedures, this has been a long standing business practice in Alberta's active OR markets.

practice of bidding at a price sufficiently high such that it expects the market to clear at a strictly lower price level."[47]

The ISO rules related to the ancillary services market and business practices will not change with the introduction of the capacity market. As such, these safeguards will continue to promote competitive market outcomes for OR in Alberta.

#### 4.3.3 Over-mitigation can lead to negative unintended consequences

Economic rules have real consequences in the physical world. The discussion of market power mitigation not only affects the economic profit of market participants, but also the physical operation of generating units and the security of the electric system. In this section, we discuss how over-mitigating hydro storage units would limit their physical operations and negatively impact system reliability.

##### 4.3.3.1 Over mitigating hydro storage units causes inefficient use of water

Unlike other storage units like batteries, hydroelectric units with storage capability (reservoirs) cannot restore their fuel (water) on demand because they are subject to hydrological conditions.[48] This is illustrated by analysis conducted by LEI of the AESO rules applying 3xRAPP to Alberta's hydro complex with storage. Using actual market data from 2013 to 2017, LEI performed a simulation analysis that shows the consequences of a large hydro unit being forced to offer into the energy market at a price cap of 3xRAPP.[49] The figure below contains an excerpt of the results for 2013. It shows that under 3xRAP, the hydro asset would use up its energy faster than the average water replenish rate,[50] because offering at a price cap of 3xRAPP forces the hydro unit to dispatch in hours that it otherwise would not have dispatched in. As a result, as indicated in the blue area in Figure 4 below, the hydro asset would have significantly less energy generation potential (and ancillary services capacity) during periods later in the year, as compared to the baseline energy budget (green area). This would result in price spikes and may lead to unserved load events in those periods later in the year.

On top of losing energy and OR revenues in the future days due to insufficient water, the unit would also face capacity performance penalties because its availability would fall significantly below the uniform capacity it would have sold (and the lack of hydroelectric energy would increase the likelihood of a supply shortfall event due to tighter supply cushions and/or limited OR supply.

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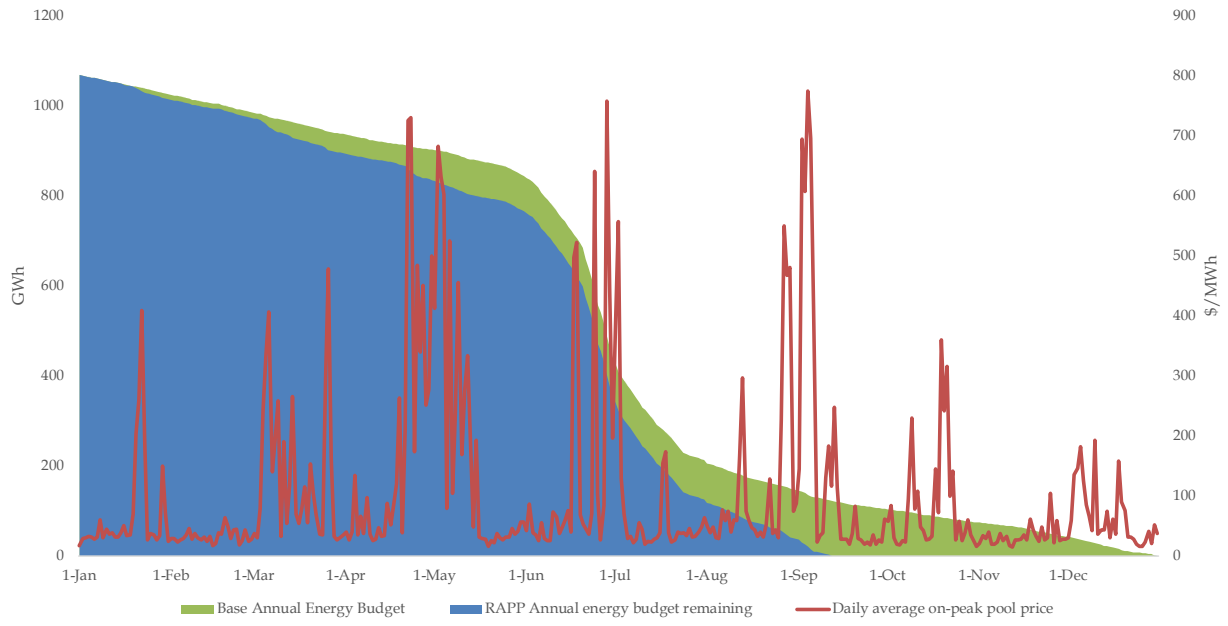
[47] AESO. Market Rule 203.5 - Information document – Mitigation of prescribed assets.

[48] Closed-loop pumped storage hydroelectric facilities are somewhat different as they can choose to run their pumps to fill the upper reservoir from their lower reservoir.

[49] The backcast is done by simulating the quantity of water the unit would have used, as compared to the baseline, if its bid were capped at 3xRAPP instead of the historical offers. The simulation redispatches the unit based on the adjusted price-quantity pairs relative to the historical pool price.

[50] Assuming the historical operation of the unit on average balances water inflow and outflow in the long run.

**Figure 4. Example of water usage under AESO's 3xRAPP energy mitigation proposal for a large hydroelectric plant with storage capability (using actual data for 2013)**




Source: LEI analysis

#### 4.3.3.2 Over mitigating OR markets would negatively impact system reliability

Hydro has historically been a competitive, low cost OR resource in Alberta. OR sales are a key source of revenue for energy-limited storage hydro assets, and therefore economic withholding of OR volumes are not in the best economic interest of the hydro-based OR provider – an idea recognized by the AESO.[51]

Over-dispatching hydro storage units earlier in the year due to low energy offer caps (such as 3xRAPP) would ultimately lead to lower availability of energy and ancillary services in later periods of the hydrological cycle, leading to system reliability concerns - a point the AESO also acknowledges.[52]

Furthermore, over-mitigation in the active OR market could result in depressed OR prices, which would lead to inefficient business decisions:

- some OR providers may leave the market due to low prices and low profitability (and even when prices start to rise, their "return" to the OR markets may take some time); and

[51] Application by the Alberta Electric System Operator for Approval of the First Set of ISO Rules to Establish and Operate the Capacity Market, Proceeding 23757, Application 23757-A001 - "These assets have unique energy limitations or environmental considerations that affect their operations and they are also unique with respect to how opportunity costs are determined."

[52] AESO Consolidated Rationale Page 119: "The high opportunity cost may come in significant part from the value of providing ancillary services and the potential inability to provide some of these services if the energy is immediately used."

- other OR providers may defer capital investment needed to maintain the operational flexibility of such resources.

Therefore, when considering the level of market power mitigation framework for the active OR market, a regulator has to consider carefully the framework's long-run implications for market efficiency and reliability.

One possible alternative to the historical RAPP-based formula is a legitimate opportunity-cost based price cap. ISOs in other jurisdictions have used opportunity-cost based methodologies to develop market power mitigation regimes for storage resources. For example, in PJM's regulation services market, hydro resources have an opportunity cost calculation depending on hydrological conditions, commitment of the unit in the day-ahead market, and the relative difference between day-ahead and real-time energy prices.[53] However, such calculations are complex and commercially sensitive. Notably, PJM market rules do not codify publicly a specific "opportunity cost" number.

# 5 Conclusion

LEI's analysis outlined in the subsections above refutes the MSA's Consultants' hypothesis that owners of hydro storage units have the opportunity and incentive to economically withhold capacity in energy markets. While owners of hydroelectric units do in theory have the ability to withhold, in practice the opportunity to withhold sufficient capacity to raise energy prices day after day is low and transitory. It would not be economically rational for hydro owners to attempt to manipulate energy market prices because they are more likely to lose money from such a strategy.

Alberta's active OR market is competitive, with on average significantly more MW offered into the market than demanded. Based on examination of actual data for recent years, the largest single supplier in all OR markets is not pivotal. LEI expects that this condition holds in the future as well, as OR-qualified supply and AESO's procurement targets for OR are not expected to change meaningfully in the next five to ten years.

Statistical analyses demonstrate that the energy and active OR markets can be considered a single market for competitive analysis purposes. Therefore, to the extent that energy market mitigation is adequate, the OR markets will also continue to be competitive. Moreover, the existing safeguards in the OR markets will continue to exist.

LEI disagrees with the MSA's suggestion that there should be additional market power mitigation rules in the active OR markets. Over-mitigation of hydro storage units would result in the inefficient use of water and would negatively impact the reliability of the system.

[53] PJM's Manual 11: Energy & Ancillary Services Market Operations.

# 6 Appendix A: Details of Alberta's active OR market

In Alberta, ancillary services can be split into operating reserves and other ancillary services (such as black start and transmission-must-run). Within operating reserves, there are active operating reserves and standby operating reserves. LEI's focus is related to active operating reserves, as standby operating reserves and other ancillary services (such as black start) are a relatively small part of the ancillary services market and are not covered by Market Rule Section 203.5.

Section 205 of the ISO rules governs the ancillary services market in Alberta. This section of the ISO Rules was not revised in the capacity market design process, and therefore it is expected that the current ancillary services market design, including the types of products, product definitions, offer limitations, and market timeline, would remain unchanged.

There are three types of active OR products: regulating reserve ("RR"), spinning reserve ("SR"), and supplemental reserve ("SUP"). All three products are settled based on time-blocks, where spinning reserve and supplemental reserve have on-peak and off-peak blocks per day, and regulating reserve has on-peak, off-peak, and super-peak blocks.

Unlike the energy market, which is cleared on AESO's trading platform, active OR products are traded on the Watt-Ex online exchange.[54] The amount of active OR AESO procures each day is determined by reliability standards set by the Western Electricity Coordinating Council ("WECC") of which the AESO is a member.[55]

Regulating, spinning and supplemental reserve each have different technical requirements. The quantity a unit can offer into each product's market is governed by (1) its technical capability based on the unit's ramp rate, dispatch accuracy, and response time; and (2) minimum size (15 MW for regulating reserve,[56] 10 MW of spinning reserve,[57] and 5 MW for supplemental reserve).[58] Furthermore, eligible units have a maximum MW they can offer into each OR product market (80 MW).

[54] AESO Website. "Every day, the AESO procures OR from generators and loads through Watt-Ex, an online exchange. Prices for OR vary daily by each product type procured." <https://www.aeso.ca/market/ancillary-services/operating-reserve/>

[55] AESO Website. <https://www.aeso.ca/market/ancillary-services/operating-reserve/>

[56] AESO Market Rule Section 205.4.3(1)(a)(i).

[57] AESO Market Rule Section 205.5.3(1)(a)(i).

[58] AESO Market Rule Section 206.4.3(1)(a)(i).

# 7 Appendix B: Granger Causality test results

LEI used the 2012-2018 lagged real-time pool price and performed Granger Causality tests using active OR payments (including regulating reserve for on-peak, off-peak and AM/PM super peak periods, and spinning and supplemental reserve for on-peak and off-peak periods).

The Granger Causality tests are conducted for prices related to the same time period (i.e. on-peak energy prices against on-peak active OR prices).

The level of statistical significance required to reject the null hypothesis that the additional variable does not improve the predictiveness of the regression is set at 95%, consistent with standard statistical approaches.

The table below show the Granger Causality analysis result. If the probability > chi2 is larger than 0.05, then at a 95% confidence we cannot reject the null hypothesis that dropping the independent variable does not improve the predictive power of the regression model that tries to predict the dependent variable.

If we can reject the null hypothesis, then we can claim that the dependent variable (OR payment) reacts to the independent variable (real-time energy price). In other words, the independent variable Granger Causes the dependent variable. As presented in the table, the lagged real-time energy price (variables starting with "RT") Granger Causes the OR prices (labeled as RR, SR and SUP for regulating reserve, spinning reserve and supplemental reserve) for all time-blocks.

| Dependent variable | Independent variable | chi2 | df | Prob > chi2 | Null Hypothesis rejected at 5% level of significance? | Granger Causality |
|---|---|---|---|---|---|---|
| RRON | RTOP1 | 17.037 | 2 | 0.000 | Rejected | RTOP1 Causes RRON |
| RTOP1 | RRON | 12784 | 2 | 0.000 | Rejected | RRON Causes RTOP1 |
| RROFF | RTOFF1 | 28.36 | 2 | 0.000 | Rejected | RTOFF1 Causes RROFF |
| RTOFF1 | RROFF | 1146.3 | 2 | 0.000 | Rejected | RROFF Causes RTOFF1 |
| RRAM | RTAM1 | 21.722 | 2 | 0.000 | Rejected | RTAM1 Causes RRAM |
| RTAM1 | RRAM | 3915.7 | 2 | 0.000 | Rejected | RRAM Causes RTAM1 |
| RRPM | RTPM1 | 28.674 | 2 | 0.000 | Rejected | RTPM1 Causes RRPM |
| RTPM1 | RRPM | 19721 | 2 | 0.000 | Rejected | RRPM Causes RTPM1 |
| SRON | RTOP1 | 15.022 | 2 | 0.001 | Rejected | RTOP1 Causes SRON |
| RTOP1 | SRON | 180000 | 2 | 0.000 | Rejected | SRON Causes RTOP1 |
| SROFF | RTOFF1 | 27.223 | 2 | 0.000 | Rejected | RTOFF1 Causes SROFF |
| RTOFF1 | SROFF | 4925.3 | 2 | 0.000 | Rejected | SROFF Causes RTOFF1 |
| SUPON | RTOP1 | 15.89 | 2 | 0.000 | Rejected | RTOP1 Causes SUPON |
| RTOP1 | SUPON | 83168 | 2 | 0.000 | Rejected | SUPON Causes RTOP1 |
| SUPOFF | RTOFF1 | 11.158 | 2 | 0.004 | Rejected | RTOFF1 Causes SUPOFF |

| Dependent variable | Independent variable | chi2 | df | Prob > chi2 | Null Hypothesis rejected at 5% level of significance? | Granger Causality |
|---|---|---|---|---|---|---|
| RTOFF1 | SUPOFF | 11398 | 2 | 0.000 | Rejected | SUPOFF Causes RTOFF1 |

# TransAlta Corporate Rebuttal Evidence
# AUC Proceeding 23757

# ISO Rules to Implement the Capacity Market

April 4, 2019

# 1. Summary of TransAlta Rebuttal Evidence

1. TransAlta Corporation ("TransAlta") has reviewed the evidence filed by other parties in this proceeding on February 28, 2019. It has developed rebuttal evidence in response to some issues that it views as critical to the AUC's examination of the AESO's proposed rules to establish and implement the capacity market. The decision not to comment on certain evidence filed by others should not be construed as agreement with such evidence.

2. TransAlta's rebuttal evidence is comprised of the following reports by experts:

    a. Rebuttal Evidence of Julia Frayer of London Economics ("LEI") related to the Capacity Market Demand Curve;
    b. Rebuttal evidence of LEI on Market Mitigation in the Alberta Energy and Capacity Market;
    c. Rebuttal Evidence of LEI related to Cost to Consumers Measures;
    d. Rebuttal Evidence of LEI on Additional Mitigation for Energy Ancillary-Services because of Hydro;
    e. Rebuttal Evidence of Dr. John MacCormack related to Gross Procurement Volumes; and
    f. Rebuttal Evidence of Dr. Arman Kiani related to Penalties.

3. TransAlta also provides Corporate Rebuttal Evidence on Energy Market Mitigation of Storage Assets, and the issue of the Ex-Post Energy and Ancillary Services ("EAS") Offset in the sections that follow.

# 2. Rebuttal Regarding Energy Market Mitigation of Storage Assets

## 2.1. Summary

4. TransAlta has developed this rebuttal evidence in response to the February 28, 2019 intervener evidence of the Market Surveillance Administrator (MSA) relating to proposed ISO Rule Section 203.5(6) in respect of energy market mitigation of storage assets.[1]

[1]Exhibit 23757_X0390 Market Design Issues in the Alberta Capacity and Energy Markets, by Messrs. Russo and Kwok of Charles River Associates, and Dr. Patton of Potomac Economics; see the section "Treatment of Storage Resources" at pages 52 – 53.

5. The AESO developed the proposed rule[2] recognizing that hydro[3] and other non-thermal storage assets have unique energy limitations or environmental considerations that affect their operations and therefore require offer flexibility to manage these constraints. TransAlta supports the rule as proposed by the AESO and has stated so in its intervener evidence.[4]

6. The AESO has structured the energy market mitigation framework such that a hydro asset, if the market participant for that asset is mitigated (as TransAlta would be), will have the ability to manage its limited water and will not be required to flow water at specific times simply because the participant must offer at mitigated prices. TransAlta agrees with the AESO's assessment regarding hydro assets. From a power system perspective, it is not efficient for a hydro asset to be operated and to use water when its capacity is not needed, because doing so means water would no longer be available when the system does need it.[5] In the Alberta market setting, TransAlta must control and manage variability in water resources for its hydro systems through flexibility in pricing. If a hydro unit or system has constrained fuel, the offer price must be high enough that the offer is not taken, and the water can be conserved.

7. In its evidence, the MSA's experts have argued the proposed rule is "inconsistent with the intent of market power mitigation objectives." They maintain that all a hydro asset must do to avoid market power mitigation is to offer into the ancillary services market, and fully skirt energy market power mitigation simply by placing a very high offer into the ancillary services market. If the offer does not clear in the ancillary services market, the market participant may use any offer strategy it likes in the energy market, including exercising market power.[6]

8. TransAlta does not believe AESO needs to provide more clarity on ISO Rule Section 203.5(6) and believes the rule provides enough mitigation. Additionally, TransAlta believe an alternative approach in Alberta, such as opportunity costs, would lead to an increased

[2] Exhibit 23757_X0288.01 Appendix D New and Amended Energy Market and Ancillary Services Market Rules, Section 203.5 Energy Market Mitigation; particularly subsection 203.5(6) Asset-Specific Reference Price for a Designated Non-Thermal Generating Source Asset Capable of Storing Fuel, at pages 53 and 54. See also AESO Replies to Market Participant Comments: November 29, 2018, Pages 12-15; Public Proposed New Section 203.5 of the ISO Rules, Energy Market Mitigation, https://www.aeso.ca/assets/Uploads/AR-MX-EM-203.5-Energy-Market-Mitigation-AESO-Reply-2018-11-29.pdf
[3] AESO designated three hydro assets – Bow, Bighorn and Brazeau – as prescribed assets for purposes of section 203.5(6) of the proposed market rules. https://www.aeso.ca/assets/Uploads/203.5-Mitigation-of-Prescribed-Assets.pdf
[4] Exhibit 23757_X0379, 1. TransAlta Corporate Evidence, pages 17 – 19.
[5] Exhibit 23757-X0284, AESO Application for Capacity Market Rules, para 579
[6] MSA evidence, supra, footnote 1.

administrative burden without providing a net benefit to the system. The MSA will continue to have effective tools for surveillance and investigation that will ensure hydro compliance and support the fair, efficient and openly competitive (FEOC) operation of the electricity market.

9. As neither the hydrological cycle nor the need for flexible water management will change, hydro's past behavior will not change in the future. This past behavior has been of benefit to the system and has not harmed the market. As described in greater detail below, hydro will continue to have very limited ability to flexibly price its energy.[7]

## 2.2 Water Management Issues

10. What the MSA experts have not recognized is that, without the ability to offer at high prices in the ancillary services and energy markets, the operation of subsection 203.5(6)(3) of the ISO Rules, wherein the prices for TransAlta's hydro assets would typically be mitigated to 3 or 6 times the 30-day rolling average pool price (RAPP)[8], would cause TransAlta to waste valuable water, by being dispatched and running water through the units at prices that are too low to conserve it. There is a very real possibility that TransAlta would end up with insufficient water to use for system support services or to meet water flow requirements throughout an entire year. TransAlta must have the flexibility to manage a scarce water supply through ancillary services offers and energy offers that are higher than 3- or 6-times RAPP, in order to provide similar levels of system support to the AIES that these units have provided for decades.

11. With respect to market power, the AESO specifically noted the appropriateness of its rule for hydro in its Efficiency Assessment[9] when it stated, "Historically, hydro offers have been mainly set in response to environment or regulatory incentives. Such prices therefore, are not set via an abuse of market power." TransAlta supports this analysis by the AESO.

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[7] TransAlta refers to the conclusions of London Economics Inc. in their rebuttal evidence entitled "Does Alberta require additional mitigation protocols for non-thermal storage resources and separate market power mitigation frameworks for operating reserves and the energy market" dated April 4, 2019 and filed in this proceeding. They opine that the AESO's proposed energy mitigation of non-thermal resources with storage is effective, and that high bids in the energy market from hydro to reserve energy for future use or to reserve it for the OR market, are reasonable commercial strategies and optimize the use of water economically. They are not manifestations of market power.

[8] Only where the expected supply cushion is less than 250MW, the offer cap is the maximum of $1000 / MWh.

[9] Exhibit 23757_X0347, Appendix R Efficiency Assessment of the AESO's Proposed Energy Market Mitigation Framework, Pages 6-7, January 29, 2019

TransAlta further states that its primary objective in operating the hydro systems is water management, with 98% of water used for water management or to supply reserves.

12. Under the proposed rule, TransAlta cannot physically withhold using hydro assets as it has ancillary services and energy market "must offer" requirements. When the objective is to optimize water use, economic withholding is not a relevant consideration as water must be offered and dispatched in a way that ensures prudent conservation and management of water over the entire hydrological cycle.

13. TransAlta has historically operated the hydro assets to first provide regulated water flow for downstream users, second for ancillary services (system support or reserves) to the AIES and lastly to provide energy when it is most valuable to the system. These objectives remain the best use of its hydro system going forward. TransAlta also participates in the energy market with its hydro assets, but historical data shows that it has very little flexibility in its energy offers over the course of a year. Hydro operational constraints are described later in this document.

14. TransAlta conserves the scarce supply of water from its hydro facilities by flowing water in higher priced hours when the energy market is signaling a need to dispatch this type of resource, typically during periods where supply and demand are tight. Other water flows are used to meet water license requirements and to support the provision of regulating reserves. High hydro energy offers are a reflection of scarcity and the value of the water and the need to conserve water to meet future requirements and are not indicative of an intention to extend market power.

15. The introduction of the capacity market with its availability and delivery performance penalties will add a new risk for hydro assets that clear the capacity auction and receive a capacity obligation. For fuel constrained assets like hydro, where system emergency events could last longer than one or two hours, the burden of water management through scarcity pricing becomes more acute, in order to avoid facing large penalties.

## 2.3 Hydro Operations Require Offer Price Flexibility

16. TransAlta supports ISO Rule Section 203.5(6), as it provides the necessary flexibility for the company to offer at high prices to manage a limited water resource for the following objectives:
    a. Safely, and practically, manage competing physical and inter-temporal constraints given uncertainty about future fuel resources; i.e., stored water and/or precipitation-based inflows;
    b. Contribute to productive efficiency of the overall market; i.e., consistently compete over the course of a year in the supply of ancillary services products, and allocate scarce water resources to periods of highest system value;
    c. Comply with "must offer" requirements;
    d. Physically perform during *Availability* and *Delivery Events* to avoid penalties and the loss of future capacity revenues due to reduced UCAP level.

17. TransAlta's hydro system cannot operate at full output indefinitely. Uncertain future weather and water flow requirements complicate decisions to use fuel today or conserve it for the future.

18. Overall, the various safety, environmental and other requirements of hydro operations result in two operational impacts: the need to flow a certain amount of water in a given hour, and the need to conserve water to meet future requirements. The first need is managed by offering the energy at a price of zero which ensures the generation is dispatched and the water flows. The second need is managed by offering the energy at sufficiently high or out-of-merit prices that the generation will not be dispatched, thus conserving water.

19. TransAlta manages its available hydro capacity to supply regulating and contingency reserves and to supply energy to the grid. Based on the last thirty-four years of actual data (1985-2018), a median water year yields approximately 180MW/h of energy production. Approximately 130 MW/h is offered at $0/MWh, to ensure dispatch and that water flows are managed. Approximately 100 MW/h is offered in as regulating reserves, with a small portion used to meet energy demands during peak periods. This typically produces about

50 MW/h of energy,[10] for a total of 180 MW/h. In addition to energy and regulating reserves, TransAlta typically supplies 220MW/h of contingency reserves (spinning and supplemental reserves). Finally, it is common for more than 200MW/h to be offered at high prices out of merit to avoid over consumption in most periods and ensure generation capacity remains available for high value periods.

| | |
|---|---|
| **130 MW/h** | Zero Block Energy Offers (safety, environmental compliance, etc.) |
| **100 MW/h** | Supply of Regulating Reserves to AESO (**~50MW/h** energy generated) |
| **220 MW/h** | Supply of Spinning and Supplemental Reserves to the AESO |
| **210 MW/h** | Out-of-Merit Energy Offers (water conservation for future requirements) |
| **660 /h** | Total Available Capability |

20. The above example is an approximation for how the capacity of the system would be allocated in a median water year and is based on an Available Capability (AC) for the three hydro systems of ~660MW.

21. This example generally holds for most water years with some slight variations due to seasonality and market fundamentals. This is because the hydro systems reset each spring and due to limited inter-year storage. In high water years this means more generation and more zero priced base energy. It follows then that less volume is offered out of merit because there is more water that must flow. The opposite is true for lower water years.

22. Based on the last thirty-four years of history, the table below contains actual data (volumes are MW/h) from three analog years selected to show the amount of variability between a high, average, and low water year; illustrating how the major difference in water and energy volumes are concentrated between June and August and attributable to zero block energy.

23. In summary, of total generated electricity, 98% is either offered at zero ("ZERO Blocks") to support water use requirements or used to supply regulating reserves. The reference to "Non-ZERO Blocks in Merit" in table 1 below represents the energy offers that are dispatched in the merit order to meet demand during peak periods. The remaining

[10] Over and above the base energy volumes TransAlta's hydro systems will generate ~50MW/h to supply ~100MW/h regulating reserves to the AESO. When TransAlta supplies ~100MW/h of regulating reserves to the AESO it will result in ~50MW/h of generation on average and permit the AESO to ramp the units up or down within the 100MW band to meet system needs, balancing variations in demand and supply.

potential generation is priced out of merit to be stored and available to meet future safety, environmental and other requirements, to provide other ancillary services and to meet supply requirements during tight system events.

**Table 1: MW/h Based on Annual High, Average, and Low Hydrological Conditions**

| | ZERO Blocks | | | Regulating Reserves & NON-ZERO Blocks in Merit | | | OUT OF MERIT Blocks | | |
|---|---|---|---|---|---|---|---|---|---|
| | HIGH | AVG | LOW | HIGH | AVG | LOW | HIGH | AVG | LOW |
| Month | 2012 | 2014 | 2015 | 2012 | 2014 | 2015 | 2012 | 2014 | 2015 |
| 1 | 119 | 123 | 113 | 51 | 39 | 44 | 132 | 163 | 167 |
| 2 | 109 | 127 | 125 | 51 | 43 | 50 | 150 | 168 | 204 |
| 3 | 116 | 118 | 125 | 49 | 35 | 43 | 163 | 201 | 197 |
| 4 | 122 | 119 | 109 | 47 | 34 | 44 | 155 | 206 | 211 |
| 5 | 151 | 141 | 136 | 45 | 47 | 52 | 148 | 205 | 207 |
| 6 | 339 | 223 | 155 | 51 | 45 | 52 | 106 | 128 | 181 |
| 7 | 429 | 213 | 107 | 52 | 50 | 39 | 75 | 166 | 277 |
| 8 | 307 | 140 | 81 | 51 | 38 | 44 | 107 | 234 | 309 |
| 9 | 117 | 96 | 80 | 53 | 38 | 40 | 108 | 163 | 213 |
| 10 | 89 | 101 | 77 | 49 | 41 | 43 | 127 | 155 | 280 |
| 11 | 99 | 101 | 96 | 50 | 45 | 52 | 194 | 184 | 229 |
| 12 | 108 | 116 | 109 | 54 | 47 | 54 | 198 | 199 | 284 |
| | 175 | 135 | 109 | 50 | 42 | 47 | 139 | 181 | 230 |

24. While historic offer data reflects how hydro was managed during the PPA period and prior, future offers will need to reflect additional risks under the capacity market. Under the proposed market design, two performance events – Availability and Delivery – have been created whereby non-performance results in a loss of capacity payment revenue. Non-performance would also lead to a long-term effect of lowering of hydro's UCAP resulting in lower future capacity revenues. Business risk can only be managed through physical action; i.e., having sufficiently large resources available for use when market conditions are tight, or when approaching, or in, system emergency status. This added business risk increases the requirement to conserve stored water and use high offer prices to ensure electricity is available only for meeting capacity obligations and for use in highest value hours.

25. The table below shows the per unit impact of non-performance. For example, if the capacity market clears at $10/kw-month, each MWh below UCAP during an availability event costs $250/MWh. Recall, under the currently proposed ISO Rules, there is no portfolio substitution to de-risk this potential outcome. Each MWh below UCAP during a delivery event is worth $4,680/MWh (assumes Balancing Ratio equals 1).

**Table 2: Estimates of Capacity Market Availability and Performance Penalties**[11]

| Capacity Payment | Availability Penalty | Delivery Penalty |
|---|---|---|
| $/kw-month | $/MWh | $/MWh |
| 7 | 175 | 3276 |
| 10 | 250 | 4680 |
| 14 | 349 | 6552 |

26. Offer price flexibility remains necessary under the capacity market so that TransAlta can comply with market rules, meet its various obligations for the hydro systems, and to ensure scarce water resources are available for use in the operating reserve markets and for future use in the energy markets. In addition, offer price flexibility is required because the per unit cost of being short relative to UCAP will significantly exceed the per unit value of water in any other period of the year, when market participants are competing in the merit order up to 3x or 6x of their short-run marginal costs. The storage value of a finite resource will not just be the opportunity cost of energy but also the added capacity penalty risk. This new penalty risk can only be met through a further impetus toward conservation of the scarce water resource.

27. The AESO, through its calculation of UCAP, has explicitly made performance during the very tightest hours in the system the benchmark for energy reliability value. Historically, hydro assets have demonstrated high capacity performance under these market conditions, which is why hydro assets are expected to have high UCAP percentages in relation to annual average energy capacity factors.

28. For the period 2012-18, TransAlta's hydro assets rarely set price when the supply cushion was greater than 1,000MW but more frequently when the supply cushion was less than 250MW. Almost 89% of hours during this timeframe had a supply cushion greater than

[11] For details on calculations refer to TransAlta's Rebuttal Evidence on Obligation Period Performance Assessment by Dr. Kiani.

1,000MW and TransAlta's hydro offers set price during just ~2% of those hours. In contrast, when the supply cushion was less than 250MW, which usually comprises less than 1% of the hours in any year, TransAlta's hydro offers set price in ~66% of hours.

29. Also, in reviewing actual prices when the supply cushion was greater than 1,000MW, the data shows that market prices generally reflect short-run economics of conventionally-fueled generation sources. Prices in these periods were less than ~$30/MWh on average (2012-18). Any of TransAlta's hydro offers would therefore not be exerting an undue influence on price because the market has sufficient low-cost supply, and unintentionally forcing fuel-limited generation into the supply by constricting offer flexibility would have no social benefit and, in fact, would be contrary to the exact physical performance the AESO explicitly values for energy reliability.

30. Lastly, attempting to use offer strategies in the operating reserves markets to shift capacity out of those markets and to increase exposure to the electricity merit order is not economically rational. As the data mentioned above indicates, almost 90% of the time this would be of no consequence to energy prices because the market is well supplied, and would lead to economic loss to TransAlta, having exited the operating reserves markets. During the remaining top 10% of hours in the year TransAlta's hydro assets will be providing physical energy and have energy in-storage to provide any contingency reserves the AESO may require, again, consistent with the objective of overall energy/system reliability.

## 2.4 Response to MSA Recommendations

31. The MSA experts recommended, in respect of the AESO's treatment of storage resources, that "the AESO be required to provide more clarity on its proposal. In the alternative, we recommend that the AESO develop an approach to calculating the SRMC for such resources. This approach should be designed to be a reasonable proxy for the opportunity cost of stored energy…." Once this type of SRMC is calculated, they recommended that the storage resources should be mitigated similarly to all other resources in the energy market.[12] They stated that Potomac Economics has established opportunity cost type reference prices in markets it monitors.

[12] MSA, supra footnote 1, at page 53.

32. For the reasons outlined above, TransAlta does not believe it is necessary for the AESO to provide more clarity on ISO Rule Section 203.5(6) or to develop an alternative approach to mitigate hydro assets to an SRMC equivalent to opportunity costs. TransAlta considers that it has behaved consistently in its water management and hydro offers over the years, and the MSA already has effective tools for surveillance and investigation at its disposal to address any problems with offer behavior or the FEOC operation of the market.

33. However, with respect to opportunity cost mitigation, TransAlta understands that it is used in several jurisdictions in respect of hydro assets. Although TransAlta does not object in principle to properly calculated opportunity cost reference prices for its hydro assets, it does not believe that this added administrative process would provide any substantive benefit given the operational characteristics of TransAlta's hydro fleet and the AESO's proposed construct for the capacity market.

34. Opportunity cost reference prices for TransAlta's hydro would have to consider the seasonal water cycle, TransAlta's physical and regulatory operating constraints and any capacity market obligation performance risks. TransAlta does not have any information as to the process Potomac Economics or the MSA would propose to develop those prices within the present proceeding and, again, suggests that there is no compelling reason to add this administrative burden and process.

35. If the Commission considers that a process is required to determine opportunity costs for hydro price mitigation, TransAlta considers a proper process must be defined by the Commission and must include TransAlta as the affected asset owner. Such a process would be focused on proper opportunity cost reference prices by season, taking into account the unique nature of TransAlta's hydro assets in Alberta and would be confidential due to sensitive proprietary and cost information, and concerns for FEOC. Opportunity cost calculations should be completed by an independent third party with extensive hydroelectric system experience that has not been associated with the capacity market development to avoid any inherent bias.

## 2.5 Hydro Operational Constraints

36. As TransAlta has stated in its intervener evidence[13], its Alberta hydro assets are highly constrained, energy limited resources. This rebuttal evidence adds greater detail related to the system constraints and considerations outlined in TransAlta's intervener evidence. TransAlta submits that offer behavior for its hydro assets is dictated by prudent water conservation and management considerations, and not the extension or abuse of market power as suggested in the MSA's intervener evidence.

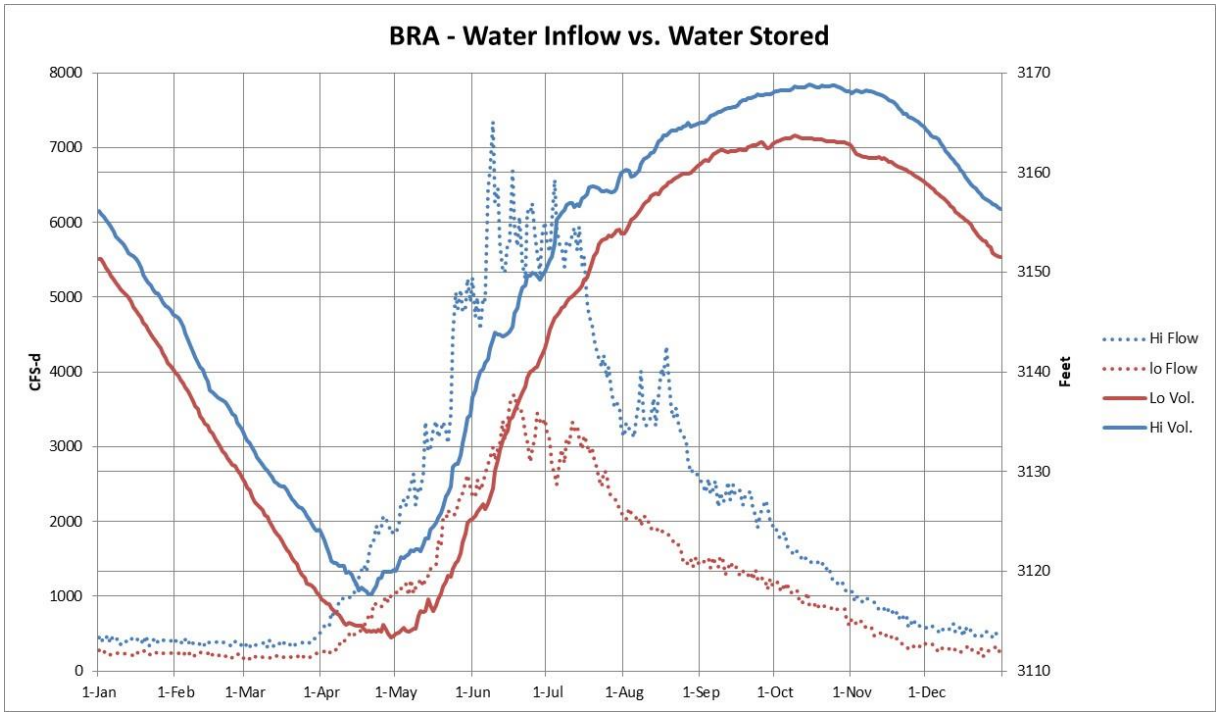
37. From a physical perspective, hydrological and weather patterns, together with reservoir refill and draw-down requirements, dictate available water for electricity generation. Figure 1 provides Brazeau's typical annual water flow and reservoir pattern. Bighorn and Bow experience a very similar water pattern.

38. This figure shows a typical annual reservoir cycle and historical inflows, demonstrating the management considerations with respect to a limited annual amount of water supply.

39. During reservoir fill and drawdown, water needs to flow to maintain the integrity of the hydro facility's infrastructure. Once the reservoirs are refilled, the system must ensure a controlled draw down occurs to reach the seasonal operating reservoir supply levels in anticipation of spring melt. Continual control is required to mitigate ice jams, meet water license requirements and maintain integrity of the civil infrastructure. Water management considerations restrict flexibility with respect to flow releases in TransAlta's hydroelectric systems.

[13] Exhibit 23757_X0379, 1. TransAlta Corporate Evidence, pages 17 - 19.

**Figure 1: Brazeau Annual Maximum & Minimum Waterflows and Reservoir Levels**




40. Details about the numerous operational and regulatory constraints and other relevant considerations affecting the Bow hydro system, and the North Saskatchewan hydro system (Bighorn and Brazeau hydro facilities) are provided below.

## Detailed Operational & Regulatory Constraints and Considerations

**Figure 2: Bow System with Constraints and Considerations**
Issues outlined Figure 2 below are explained are referenced Tables 3.1 and 3.2

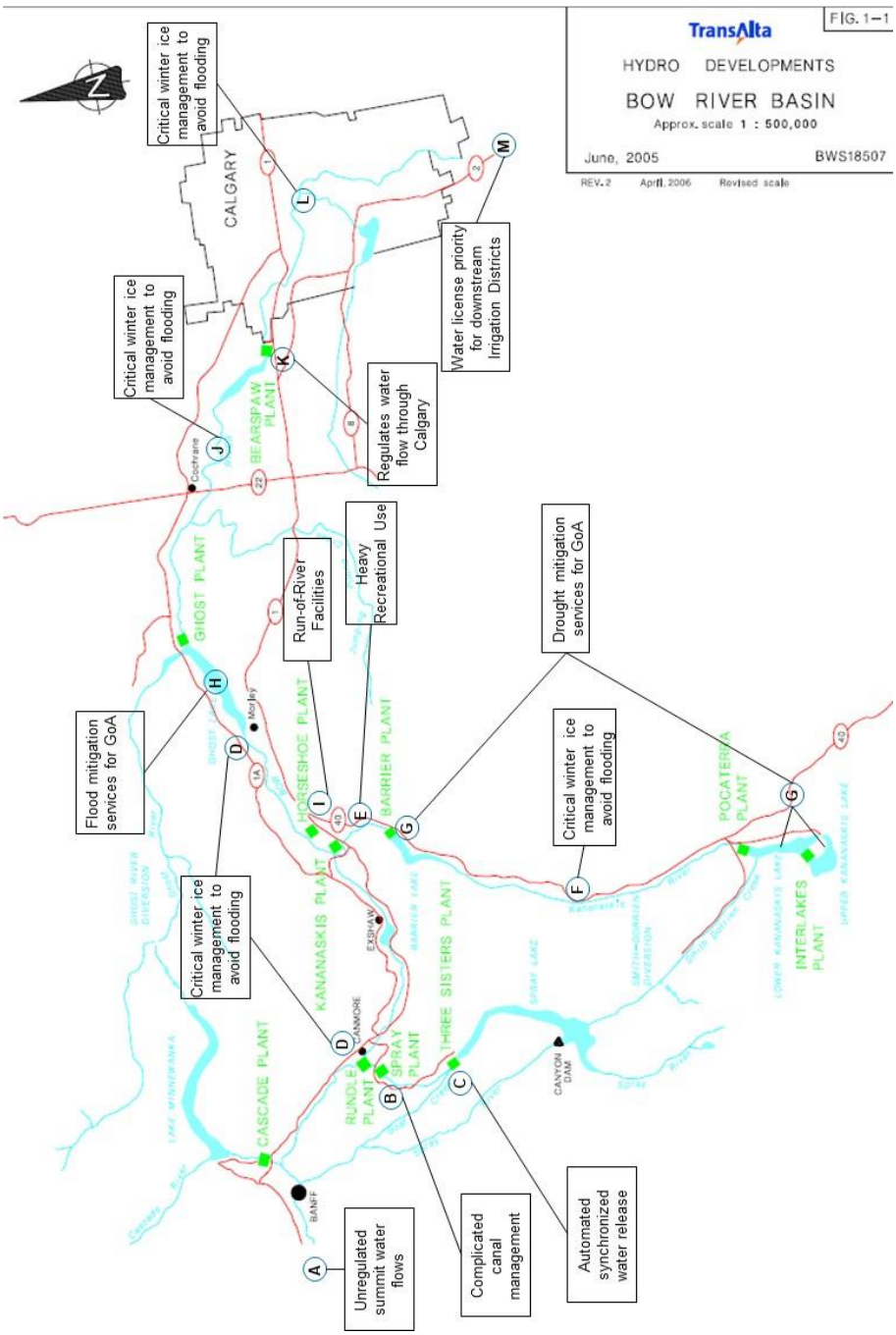


**Table 3.1: Bow System Constraints –**The constraints for various facilities on the Bow system are complex to manage due to the cascading nature of the water flows.

| | |
|---|---|
| **Cascade** | • Min and max reservoir elevation limits dictate safe operating range to ensure infrastructure integrity, safe operation and public safety<br>• Controls water flow and elevations for Lake Minnewanka to ensure safe aquatic environment conditions, as well as Two Jack Lake level management<br>• Helps maintain flows in the Bow River during winter for ice management through Canmore **(D)** |
| **Three Sisters/ Spray/ Rundle** | • Min and max reservoir elevation limits dictate safe operating range to ensure infrastructure integrity, safe operation and public safety<br>• Controls yearly water patterns for Spray Lake<br>• Complex canal management system and operations are synchronized **(B,C)**<br>• Maintains Bow flows during winter for ice management through Canmore **(D)** |
| **Interlakes/ Pocaterra/ Barrier** | • Min and max reservoir elevation limits dictate safe operating range to ensure infrastructure integrity, safe operation and public safety<br>• Controls annual water flows for Upper, Lower Kananaskis, and Barrier Lakes<br>• Controls releases to avoid flooding of low lands around the Evan-Thomas golf course area **(F)**<br>• Help regulate flows for run-of-the-river plants downstream<br>• Help mitigate impact of frazil ice in winter at Kananaskis and Horseshoe **(I)** |
| **Kananaskis/ Horseshoe** | • Min and max reservoir elevation limits dictate safe operating range to ensure infrastructure integrity, safe operation and public safety<br>• Run-of-the-river plants. Generation varies and is a function of the water upstream water flows (Bow River natural flow upstream of Banff, Cascade plant, Rundle plant, Barrier plant) at different times during the day **(I)** |
| **Ghost** | • Min and max reservoir elevation limits dictate safe operating range to ensure infrastructure integrity, safe operation and public safety<br>• Regulates releases to Bearspaw plant **(K)**<br>• Controls Bow River winter flow for ice management through Cochrane **(G)** |
| **Bearspaw** | • Min and max reservoir elevation limits dictate safe operating range to ensure infrastructure integrity, safe operation and public safety<br>• Regulates releases through Calgary to ensure safe aquatic environment conditions, irrigation requirements and recreational use **(K)**<br>• Controls Bow River winter flows for ice management through Calgary **(L)** |

**Table 3.2: Bow System Additional Considerations**

| | |
|---|---|
| **Cascade** | • Only source of power to Banff and area in case of transmission isolation |
| **Three Sisters/ Spray/ Rundle** | • Provides drinking water to Canmore |
| **Interlakes/ Pocaterra/ Barrier** | • Provides drought mitigation services for Alberta Environment and Parks **(G)**<br>• Provide regulated flows for recreational use downstream of the plant to whitewater kayaking, river surfing, and rafting users |
| **Kananaskis/ Horseshoe** | • When plants' generating capacity is capped, excess water must be spilled as there is minimum storage capacity **(I)** |
| **Ghost** | • Provides flood mitigation services for Alberta Environment and Parks **(H)** |
| **Bearspaw** | • Generation level is driven by the need of steady flows through Calgary **(K)**<br>• Municipal, industrial and irrigation flow at Bearspaw from upstream storage reservoir releases is coordinated to ensure sufficient water |

**Figure 3: North Saskatchewan system (Bighorn and Brazeau)**
Issues outlined Figure 3 below are explained are referenced Tables 4.1 and 4.2

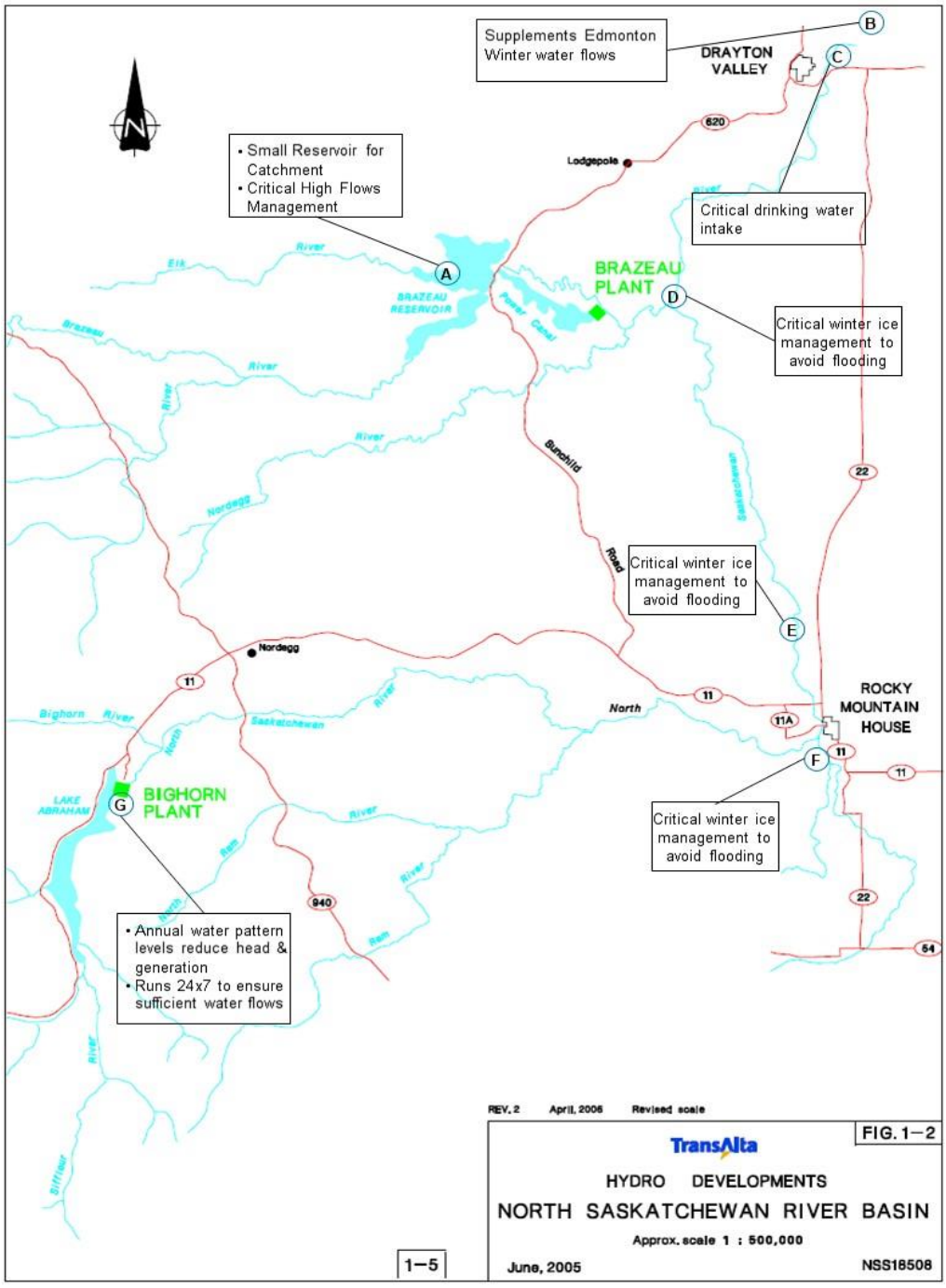


**Table 4.1: North Saskatchewan System Constraints**

| | |
|---|---|
| **Bighorn** | • Min and max reservoir elevation limits dictate safe operating range to ensure infrastructure integrity, safe operation and public safety<br>• Restricted flows during winter season due to ice management in the river **(G,E,F)**<br>• Reservoir drawdown imposing generation limitations due to head reduction **(G)** |
| **Brazeau** | • Min and max reservoir elevation limits dictate safe operating range to ensure infrastructure integrity, safe operation and public safety<br>• Small reservoir fed from a big watershed, must carefully manage high inflow events **(A)**<br>• Restricted flows during winter season due to ice management in the river **(D)** |

**Table 4.2: North Saskatchewan System Considerations**

| | |
|---|---|
| **Bighorn** | • Required water releases into North Saskatchewan River to ensure safe aquatic environment and regulate flows through Rocky Mountain House, Drayton Valley, and Edmonton **(B,G)** |
| **Brazeau** | • Complement Bighorn flow releases for Drayton Valley **(C)** and Edmonton **(B)** |

# 3. Rebuttal Evidence on the Ex-Post EAS Offset

## 3.1 The ex-post EAS Offset proposal is not workable within the overall proposed design of the capacity market.

41. LEI provided its response to the alternative ex-post EAS offset (Questions 15 and 16) of the AUC's Additional Application Requirements submission[14] on pages 55-57 of its evidence.[15] TransAlta provides the following additional evidence on why the ex-post EAS Offset proposal is not workable:

***The ex-post EAS Offset formula is a poor indicator of pool price***

42. The ex-post EAS Offset offers no real alternative to address the concerns raised about the forward market methodology for the EAS Offset. Those concerns include whether that methodology is appropriate or reliable for forecasting energy prices in setting Net CONE, which is the benchmark investment signal used in the demand curve and capacity market mitigation. The ex-post EAS Offset fails to provide any guidance on how to better estimate energy prices that are necessary for setting the demand curve and capacity market mitigation offer caps.

43. The ex-post formula provided by the AUC implies that it can be assumed that future energy prices should assumed to be a heat rate of 12GJ/MWh + $10/MWh and does not even attempt to address the gas price assumption that is key to a forecast approach.

[14] Ex. 23757-182, p. 7, Additional Application Requirements, AUC, November 30, 2018.
[15] Ex. 23757-380, pp. 55-57, Deficiencies in Proposed ISO Rule Related to Energy Market Mitigation and Setting of Net-CONE, and Responses to AUC Questions, LEI, February 28, 2019.

44. Table 5 below shows a comparison to actual average pool price and backcasting using the ex-post formula and actual average gas price data. As shown in the table, this approach overestimates realized actual prices in 11 out of 15 years. This result likely understates the how much the approach would overestimate realized actual prices because it uses historic actual gas prices and does not take into account any forecast error in gas prices if the approach was used to determine EAS Offset.

**Table 5: Comparison of Actual Average Hourly Pool Price and Backcast Energy Prices Using Ex-Post Formula**

| Year | Average Hourly Pool Price ($/MWh) | Average Daily gas Price ($/GJ) | Backcast Energy Prices Using 12 GJ/MWh + $10/MWh | Variance to Actual |
|---|---|---|---|---|
| 2004 | $54.59 | $6.21 | $84.56 | 55% |
| 2005 | $70.36 | $8.29 | $109.46 | 56% |
| 2006 | $80.79 | $6.21 | $84.51 | 5% |
| 2007 | $67.04 | $6.12 | $83.49 | 25% |
| 2008 | $89.95 | $7.74 | $102.88 | 14% |
| 2009 | $47.81 | $3.77 | $55.19 | 15% |
| 2010 | $50.88 | $3.80 | $55.60 | 9% |
| 2011 | $76.22 | $3.44 | $51.26 | -33% |
| 2012 | $64.32 | $2.27 | $37.20 | -42% |
| 2013 | $80.19 | $3.01 | $46.13 | -42% |
| 2014 | $49.42 | $4.24 | $60.84 | 23% |
| 2015 | $33.34 | $2.56 | $40.74 | 22% |
| 2016 | $18.28 | $2.06 | $34.70 | 90% |
| 2017 | $22.19 | $2.05 | $34.56 | 56% |
| 2018 | $50.35 | $1.44 | $27.26 | -46% |

***The ex-post EAS Offset approach increases investment risk and distorts market signals***

45. The ex-post EAS Offset approach may mitigate any incentive to raise energy prices but does so at the expense distorting investment, capacity and energy market signals.

46. The investment and capacity market signals will be negatively impacted due to bias in the ex-post formula to overestimate future energy prices. This will result in a poor estimate of Net CONE, which will impact both the demand curve and capacity mitigation through the default offer cap. Distortions to Net CONE, which is an anchor and key indicator for investment, will necessarily impact business decisions including new investment, spending on maintenance, delisting and retirement. Furthermore, it would significantly increase investment risk because of its asymmetric design which claws back capacity revenues when actual monthly prices are higher than the offset price but provides no true up if actual monthly prices are lower than offset price.

47. It is at best a crude approach to indirectly mitigate the potential for high energy prices, which are better achieved through directly applying a well-designed energy market mitigation framework. The energy market framework should allow for appropriate recovery of variable costs and price signals for generation and load response while minimizing unnecessary and inefficient economic withholding offer behaviour. The ex-post EAS Offset approach incentivizes capacity resources to suppress energy price signals by creating clawbacks if prices rise irrespective if those price signals are related to scarcity conditions. This will result in energy market inefficiencies through price signal distortions that could reduce system reliability rather than support it.

***The ex-post formula underestimates EAS Offset and is unworkable in the capacity market mitigation framework***

48. The default offer and asset specific offer cap which are the primary mechanism for mitigating suppliers that fail the capacity market screen could require those suppliers to offer at levels that have no reasonable opportunity to recover going forward costs. As shown above, the ex-post formula tends to over-estimate energy prices and as such the EAS Offset would be set too high and Net CONE would be set too low. This directly impacts the level of the default offer cap, which is set at 80% of Net CONE.

49. A mitigated supplier with going forward costs greater than the default cap could apply for an asset-specific offer cap, however, the use of the ex-post formula for determining the EAS Offset would also impact the determination of the asset-specific offer cap. Even if the supplier did avail itself of that process and demonstrated going forward costs greater than the default offer cap, the supplier would receive an asset-specific offer cap that is based on a forecast pool price that is likely higher than it would earn in the obligation period. This would cause the capacity resource to under-earn its going forward cost and operate uneconomically. Faced with this risk it is more likely that the supplier would elect to prematurely delist or retire the capacity resource.

50. TransAlta fully agrees with the AESO's view that "Pursuing this design option would be a fundamental change from what is currently proposed for the capacity market technical design."[16] It cannot be overstated that consideration of an ex-post EAS offset would

[16] Ex. 23757-339, p. 29, AESO Application, July 31, 2019.

necessitate an entirely new design of the proposed capacity market construct. There is insufficient time to analyze the full scope of this proposed change and if further pursued by the AUC this could require an entirely new consultation and full regulatory proceeding.

51. At a minimum, the scope of further consideration of the ex-post EAS Offset approach would include changes to the capacity and energy market mitigation framework, the shape of the demand curve, additional Resource Adequacy Modeling that accounts for the behavioural shifts under the new design, and additional review of the cost of capital in light of the higher risk of the market design.

## 3.2 A 3-year historical rolling class average should only be considered as a temporary methodology, if at all

52. TransAlta agrees with the MSA that "historical prices, at least for the first several years of the capacity market, would necessarily be based on market outcomes from a distinct market paradigm"[17] and the AESO's view that historical prices include "elements that are not expected to be aligned with the future of the Alberta market".

53. TransAlta disagrees that historical prices should be considered as a feasible long-term alternative to set EAS Offset. More specifically, a 3-year rolling average pool price would reflect past offer behaviour and emissions costs and cannot be relied upon to capture future changes in greenhouse gas emissions costs[18] that will significantly impact future energy prices.

## 3.3 A simulation-based methodology can and should be implemented for the base auction for 2023/2024.

54. TransAlta's view on the simulation modeling approach for EAS Offset determination are well documented in comments in the consultation record.[19] TransAlta provides the following rebuttal evidence as to the timing and manner in which a simulation-based approach could be implemented.

[17] Ex. 23757-390, p. 57, Market Design Issues in the Alberta Capacity and Energy Markets, MSA Intervenor Evidence, February 28, 2019.
[18] Carbon prices are expected to increase from $30/tonne to $40/tonne in 2021 and $50/tonne in 2022. The output based allocation standard will also decrease from 0.37 tonne $CO_2e$/MW in 2019 to 0.3626 tonne $CO_2e$/MW in 2021 and 0.3589 tonne $CO_2e$/MW in 2022.
[19] Ex. 23757-304, PDF page 978-380, TransAlta's Comprehensive Market Design 2 Comment Matrix, May 11, 2018.

55. TransAlta has reviewed the proposed pre-qualification and auction schedule and observes that the pre-qualification for 2023/2024 is planned to occur in August 2020. TransAlta submits that one-year from the date of the provisional rule decision is ample time to vet simulation model inputs, perform a simulation model, review the forecast, and file the forecast for Commission approval. Furthermore, additional Commission staff engagement during this process could be used to further expedite the process.

56. As previously stated in TransAlta comments: "administration of a simulation modeling approach is not an insurmountable challenge… there are many consulting firms that could competently perform this work."[20] The AESO should consider the use of several experts (at least three) to independently perform simulation models using a common set of inputs and average the forecasts of these experts. Such a process would help to guide the review process, ensure that results are verified and tested, and reduce any potential for modeling bias. Furthermore, this would reduce the potential for any perceived conflicts of interest related to the AESO's role in procuring capacity and performing a simulation forecast that sets the price of capacity.

57. While TransAlta acknowledges that there is some complexity in simulation modeling, it notes that all business decisions in generation and electricity system investment are based on forecasts and models and the resources (e.g. independent consulting firms) to perform this are readily available to the Alberta market.

[20] *Ibid*.