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AESO Public Response to the Primary Frequency Response Report

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Executive Summary

The Market Surveillance Administrator (**MSA**) published a preliminary investigative report on August 28, 2026 that makes claims about generator and Alberta Electric System Operator (**AESO**) compliance with primary frequency response (**PFR**) ISO rules, specifically section 503.6 of the ISO rules “Frequency and Speed Governing” (the **MSA Report**) and the AESO’s compliance monitoring under sections 503.6 and 103.12 of the ISO rules.

The AESO has reviewed the MSA Report and disagrees with its facts, interpretations and conclusions. The AESO provides its corrections in the enclosed **AESO Fact Report**.

The AESO’s major forward-looking concern has been the potential for market participants to interpret the MSA Report as requiring generators to maintain headroom to ensure compliance with section 503.6 during underfrequency events, potentially impacting the market, system reliability, and removing supply. The AESO has delayed publishing the **AESO Fact Report** pending discussions with MSA about clarifying its views relative to headroom and PFR.

In response, the MSA assured the AESO that:

- The MSA Report does not impose a requirement that generators reserve headroom and that the MSA does not interpret section 503.6 as requiring generators to maintain headroom;
- The MSA Report did not make any findings that electricity market participants contravened the PFR rules; and
- The MSA does not take issue with the AESO’s existing suspected contravention criteria.

This clarity is important. As such, market participants should: (1) **not** perceive new participation obligations arising from the MSA Report relative to section 503.6, (2) **expect** the AESO to continue its current practices of monitoring generators’ responses to system frequency and making inquiries of market participants to inform assessments under section 103.12, and (3) **watch** for consultation concerning section 503.6 in the coming months, in alignment with the 2030 target in the AESO’s 2025 Reliability Requirements Roadmap (the **2025 R3 Report**).

The enclosed **AESO Fact Report** provides context for the foregoing concerns, corrects technical issues with the MSA Report, and confirms that the AESO will continue to adhere to its longstanding, published Compliance Monitoring Program under section 103.12.

As the investigated party, the AESO was the primary source of information for the MSA. The AESO cooperated fully with the MSA and offered multiple times to have technical experts assist the MSA in distilling and comprehending the information provided. These offers were consistently rejected.

Again, the MSA’s subsequent confirmation of no market participant misconduct findings is important. It would be inappropriate to reimagine section 503.6 obligations through an interim report. It remains inappropriate to allege the AESO has failed in its surveillance, monitoring and referral duties when those “failures” stem from the AESO adhering to its published approach to implementing section 103.12.

I. Generator Responses to Low Frequency Events

A. Headroom is not Required and Baseload Mode is not a PFR Contravention

MSA Allegation: Generating units “were operated in a generating mode that would not provide a response to low frequency excursions primarily for [undefined] commercial reasons” during the June 7, 2020 load shed event and fall afoul of section 503.6 of the ISO rules.

In March 2021 the AESO publicly presented how operating in baseload mode limited the extent of some thermal and cogeneration units’ June 7, 2020 PFR response. Temperature restrictions prevented, for example, metallurgical damage from increased output. The AESO also presented how increased output from manually activated duct firing was neither immediately available nor a practical option for other units in response to the low frequency event. Baseload mode and/or operating absent duct firing is the apparent target of the MSA’s “commercial” criticism of generators’ June 7, 2020 PFR responses.

AESO Information Document #2020-018 confirms to market participants that “the AESO does not expect generating units that are base loaded, i.e., operating at full load, to respond to low frequency excursions”. This remains the case. The AESO understands from the MSA that despite its commercial criticism, such operating modes do not immediately fall afoul of section 503.6.

Alberta and other jurisdictions have considered frequency response services or rule changes to require generators to maintain some available headroom. Notably, the Federal Energy Regulatory Commission considered headroom obligations for some new generators in 2018. It only did so after notice, a full record and a fully argued proceeding, and rejected the option. The AESO expects the incoming R30 product (for which generators will be compensated) will increase the number of generators positioned to provide balancing capability, and plans to consult about revising section 503.6 in this context, per the 2025 R3 Report.

B. The PFR Rules do not Prescribe a Performance Standard

MSA Allegation: While the PFR rules do not contain a performance standard, limited PFR responses imply noncompliance with the obligation for governor systems to be free to respond to frequency changes, and the AESO has incorrectly not made referrals based on suspected ISO rule non-compliance.

There are numerous instances where a generator may not increase real power output in response to a frequency event that does not implicate governor settings, or control systems that interact with a governor. For example, physical limitations in adjusting real power output (such as where steam or fuel flow is already maximized), time lag between increased fuel input and electrical output, and the effect of controls or operating modes even though the governor is free to operate.

Lack of an observed response is not sufficient evidence of non-compliance with the ISO rules by itself, because there are many reasons why a governor that is configured, operated and free to respond in accordance with the ISO rules might not result in a generator providing real power in a frequency event. Among other things:

- Cogeneration plants tend to operate in baseload configuration unless participating in the operating reserves market. At baseload, these units cannot be responsive to frequency events.

- Combined cycle power plants' gas turbines tend to operate in baseload configuration unless participating in the operating reserves market. For these units, duct firing capability does not provide additional headroom to be responsive to frequency events.
- Some hydro units were slow in providing a response to frequency events due to a conflict between the AESO automatic generation control signals passed by a particular transmission facility operator system (subsequently addressed).
- To prevent metallurgical damage, among other things, some gas turbines only ramp generation up slowly in response to underfrequency events, delaying frequency response.

Conducting performance monitoring on the basis of this interpretation would amount to an ISO rule change without complying with the legislated requirements to amend ISO rules. The AESO raised its concerns with the MSA both before and after its publication of the MSA Report. The MSA has since confirmed to the AESO that the MSA does not interpret ISO Rule 503.6 as requiring generators to maintain headroom and that the MSA Report did not make any findings that electricity market participants contravened the PFR rules.

II. The Referral Threshold and Documentary Practices

A. The AESO's Referral Threshold Reflects the ISO rules

MSA Allegation: The AESO's referral threshold in the AESO's external compliance monitoring program (**CMP**), which operates in conjunction with section 103.12 of the ISO rules, is inconsistent with the AESO's role under the *Electric Utilities Act*.

The CMP describes how the AESO applies section 103.12. Section 103.12 requires the AESO to use its processes to determine whether it suspects contraventions. Processes include information requests to market participants and market participant representations to the AESO. These steps inform AESO "assessments" of whether it suspects non-compliance. The AESO's threshold for suspicion under the CMP is whether it "believes that the evidence supports" a contravention. The MSA's threshold to issue penalties or other enforcement action is when it is "satisfied" there has been a contravention.

The MSA Report attacks the AESO for applying a threshold of "satisfied" before making referrals. This is not accurate, does not reflect the AESO's practices, and ignores the specific "assessment" language under section 103.12. The AESO "conduct[s] assessment[s] in order to determine whether it suspects that a market participant may have contravened ISO rules" (s. 8(1)). Instead, the MSA Report effectively states that the AESO should refer cases to it even when the AESO knows there is relevant material that it has not reviewed and may, or is likely to, counter potential suspicion. That is outside the text of section 103.12, risks role duplication and, via confusion, unfairness to market participants, ultimately wasting resources from unnecessary adjudication. Investigations are expensive and inappropriate mechanisms to seek ISO rule changes.

The AESO raised its concerns with the MSA both before and after its publication of the MSA Report. The MSA has confirmed that it does not take issue with the AESO's existing per unit primary frequency response (**PUPFR**) based suspected contravention criteria.

B. The AESO Has Appropriate Record-Keeping Practices

MSA Allegation:

Where the AESO did not provide documents, it means that actions or investigations did not occur and an adverse inference should be made. Where AESO documents tangentially contradict one another, no matter the stage of the investigation or monitoring, it means the AESO is suppressing noncompliance.

The MSA makes several conclusions in the MSA Report that are solely tied to the non-provision of specific documents by the AESO to the MSA. This is despite the AESO's voluminous information request responses detailing its actions, monitoring program and compliance actions. The AESO does have a PFR monitoring compliance program in place. That program has changed over time. Not every meeting, phone call, discussion, etc. has been recorded. That does not change the facts as they exist. That does not make a program nonexistent.

The AESO approaches document production in response to information requests in a standard, efficient and common-sense way. This permits and encourages follow-up from the requesting authority to fill and clarify any gaps based on their objectives and review, and/or focus on the requesting authority's areas of interest. The AESO relies on its rights to be provided an opportunity to provide a full answer and defence and to know the case it must meet.

For example, the MSA continues to classify discussions between AESO personnel in 2020 on the PFR ISO rules as evidence of PFR non-compliances that were suppressed internally at the AESO. With respect, this is an unfounded conclusion that does not test this conclusion with the AESO participants allegedly at the heart of this suppression (as has been repeatedly offered by the AESO) and ignores AESO information provided to the MSA.

The facts show that the discussions the MSA cites between AESO personnel were of a preliminary nature and that AESO personnel stressed the requirement for further information gathering and engagement before any conclusions could be drawn. When the AESO publicly presented the Root Cause Analysis Report on March 9, 2021 to industry, including MSA attendees, no instances of non-compliance were noted. The Root Cause Analysis Report documents and represents the final application of the AESO's engineering judgment to the June 7, 2020 underfrequency load shedding event, signed by AESO engineers.

III. The AESO's Monitoring of Generator PFR Compliance

A. The AESO Monitors Generator Frequency Response

MSA Allegation:

The AESO did not monitor frequency response on a regular basis. When it did monitor, it only did so for a small number of individual assets and on an ad hoc basis. Once PUPFR was implemented, the AESO failed to meet its own standards.

Regular Monitoring. The AESO has designed and executed a compliance monitoring program for generator frequency response compliance that includes (i) periodic monitoring including through use of modelling reports, and (ii) targeted monitoring after impactful events. This program has identified frequency events and, for a subset of those events, assessed the specific balancing area's overall performance. The AESO's work was consistent with other North American jurisdictions. Specific results include:

- The AESO investigation of frequency events on October 16, 2020, February 21 and 22, 2021 and June 3, 2021.
- The AESO's referral of a generating station to the MSA in August 2021.
- The self-reporting of a generating station to the MSA in November 2022 after generator discussions with the AESO.
- The development and adoption of a new monitoring screening metric (PUPFR) based on methods developed by ERCOT and NERC BAL-001 standard, in 2022.
- The AESO investigation of multiple excursion events from 2021 to 2023, and the monitoring of generators using the PUPFR screening tool, in 2023.

Monitoring is Not Restricted to Certain Assets. The AESO consistently applies its periodic and per-event monitoring program to all generators subject to PFR compliance rules. The AESO does not restrict its monitoring to assets known to have frequency response issues nor does it restrict monitoring to a small number of individual assets or for any other reason. The fact that in 2023 the AESO evaluated a subset of assets following frequency events does not imply that it did not monitor other assets.

For example, the MSA alleges that by May 2023, of action items for generators with poor PFR response arising from the June 7, 2020 event, "most were still outstanding". That is incorrect. Of the 5 generators the MSA alludes to, only one generator had outstanding work, which was expected to be a work in progress and was never a violation.

Further, in 2023, the AESO's execution of its monitoring program led the AESO to evaluate a subset of assets following frequency events that occurred that year (i.e., targeted monitoring after impactful events). That the AESO evaluated these assets in 2023 specifically, does not negate that it monitored other assets. Equally, the AESO used the results of its 2023 assessment of those assets to review and evaluate the performance of over 25 individual generating units (i.e., those the MSA alleges were known to have frequency response issues).

PUPFR Referrals are Appropriate. The AESO did not "ignore" its own "Suspected Contravention Criteria" by not referring 64 "non-compliances" from the 2022/2023 frequency events. PUPFR is a screening tool. It is not a finding of noncompliance, nor does it ground a "suspicion" of noncompliance. When a low PUPFR score is observed, the AESO operations team undertakes a technical review of the governor response to determine if a governor has been incorrectly configured. Some investigations of generating units conclude on their own, whereas other investigations of generating units are referred to the AESO's external compliance group and ultimately to the MSA. Requesting information following the use of a screening tool is consistent with section 103.12 and not AESO non-compliance.

B. The AESO Monitors and Investigates Regardless of Generator Cost Concerns

MSA Allegation:

The AESO decided not to pursue market participant PFR noncompliance to protect industry. Specifically, following the June 7, 2020 under frequency load shed event, the AESO chose not to investigate or refer generator noncompliance for cost concerns.

The AESO investigated the June 7, 2020 load shedding event. An internal confidential report written, reviewed and approved by AESO professional engineers following inquiries into specific generators' responses, did not identify noncompliance with ISO rules concerning governor systems on June 7, 2020. The MSA attended the AESO's public presentation of these findings and no-noncompliance conclusions in March 2021.

The MSA's reference to "cost concerns" related to an interim step in the investigation assessing an original equipment manufacturer ramp rate limitation. When the AESO inquired about voluntary action to improve PFR response by a generator, despite the generator's compliance with the PFR ISO rules, cost was raised as a concern relative to potential new performance-based ISO rules.

C. The AESO and Generators Use and Update Accurate Models

MSA Allegation:

The MSA states that the AESO does not review model validation reports and that, even if the AESO did review model validation reports, it used inaccurate modelling and wrongly ignored non-material deviations from ISO rule requirements. The MSA also appears to conclude that some generators changed their governor or related control settings after submitting their initial model validation report.

Modelling is Consistent with Generator Characteristics. The AESO uses model validation reports and does not use modelling inconsistent with physical generator characteristics. The AESO undertakes model assessment reviews, assesses model performance against expected frequency response settings outlined in the ISO rules, and flags inconsistencies and material deviations. As models vary by generator type, site-specific characteristics and field test circumstances, the AESO's focus on material deviations when determining compliance is industry standard.

The Models are not Outdated. The use of model validation reports after their 5-year renewal deadline is reasonable when the unit's equipment has not changed. Generating units are required to perform model validation and reporting to the AESO when: (i) changes are made to certain systems, including governors; (ii) stator and rotor rewinds are performed; (iii) turbines are replaced; or (iv) modifications are made that change modelled behaviour with respect to the transmission system. Use of models by the AESO in the absence of changes and pending receipt of renewed modelling is not a compliance issue.

Modelling Validation Compliance. More generally, operating mode and plant system interactions that become evident during commercial operations do not necessarily mean modelling validation non-compliance. For instance, changes may be made throughout the year, or across years, to baseload temperature settings to account for changes in ambient temperature. Several generators have also encountered plant systems that responded in an unintended fashion. None of these situations reflect model validation report issues or that generators changed their governor or related control settings after submitting their initial models. The AESO confirmed that neither model validation report issues nor changed generator settings were at issue in the June 7, 2020 load shedding event.

IV. The Use of Deadbands

A. Identifying the Correct Deadband

MSA Allegation:

The Prescribed Deadband should be used to identify "frequency events".

The Alberta interconnected electric system (**AIES**) is the northeast extremity of the Western Interconnection and a relatively small system compared to the maximum capacity of its interties and largest generators. In consequence frequency excursions are not uncommon.

The ISO rules require that a generating unit has a governor system with a deadband but allow generating units to continually operate between 59.4-60.6 Hz. Underfrequency deviations where system frequency remains

above 59.5 Hz have no immediate negative impact on the AIES. As such, the AESO uses the following frequency ranges in the following ways:

- The section 503.6 deadband (the MSA's "Prescribed Deadband") is the technical setting for a generator. By definition, no frequency response is required from individual generators inside the deadband. The AESO accordingly utilizes larger system frequency ranges to monitor and analyze generators' frequency performance.
- A range of 60 +/- 0.1 Hz is used by the AESO to log "frequency deviations". Frequency deviations outside of this range are recorded in the AIES event log and the data is made publicly available.
- A range of 60 +/- 0.2 Hz is used in the AESO's analysis of compiled frequency data to identify and quantify what may be a frequency regulation issue. This range is a default value and is meant to be adjusted as required for proper analysis.
- A range of 60 +/- 0.6 Hz covers generator performance. Generators' frequency-based protections may be activated outside this range, and the AIES may be exposed to load shedding.

The frequency ranges used by the AESO are set, and may be adjusted, considering industry best practices and standards, engineering judgment, stakeholder consultation, the characteristics of the potential frequency event being evaluated and the goals of an investigation undertaken by the AESO.

B. The Prescribed Deadband is Not a Trigger

MSA Allegation: The Prescribed Deadband should be used to identify "frequency events".

The MSA incorrectly uses frequency excursions outside of the Prescribed Deadband as a brightline test to identify "frequency events". As a result, the number of "frequency events" are inflated and some captured as a "frequency event" are unsuitable for investigation.

Governors help to manage frequency excursions and do not operate within the deadband and, as such, mere evidence of governors having to operate does not show a system problem. The deadband should not be used as the sole basis for determining when a specific investigation into individual generators should occur, nor when a larger investigation regarding system frequency regulation performance should occur. Deadband excursions may be indicative but are not determinative of performance.

The majority of frequency events identified by the MSA would be unsuitable for investigating generator frequency response because they are small and often brief frequency deviations caused by random fluctuations in net demand, to which generators with compliant governors are not required to respond with measurable and persistent frequency responses outside the margin of error for measurement.

The MSA also describes a "subset" of 19 system-wide frequency events using the wider 60 +/- 0.2 Hz deadband, where the system wide frequency of the AIES went outside of the deadband for at least 30 seconds, as "more significant system frequency deviations" that the AESO failed to investigate. But this claim is also in error. Dispatching reserves or shedding load can overshoot, causing frequency oscillation and interrelated event clusters. Of the 19 "events" only 12 reflect actual events or clusters.

Instead, technical judgement is required to assess potential physical constraints (e.g., temperature-based), slow responses, control system interactions despite the governor being free to respond, waivers and/or mitigating factors. Confirming that an individual governor shows a response to its settings is different than identifying system-wide frequency excursions appropriate for broader assessments. More generally, frequency variation is an inevitable consequence of Alberta system features and geography and, as such, the AESO uses multiple frequency ranges to assess responses – not one.