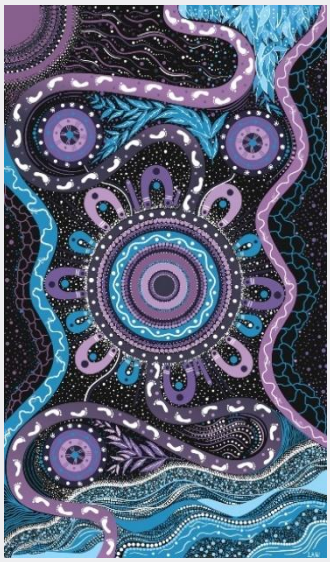
AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

2026 ESM Tolerance Range Review

May 2026

Review into the Tolerance Range and Facility Tolerance Ranges under Clauses 2.13.16 & 2.13.17 of the Electricity System and Market Rules.



We acknowledge the Traditional Custodians of the land, seas and waters across Australia. We honour the wisdom of Aboriginal and Torres Strait Islander Elders past and present and embrace future generations.

We acknowledge that, wherever we work, we do so on Aboriginal and Torres Strait Islander lands. We pay respect to the world's oldest continuing culture and First Nations peoples' deep and continuing connection to Country; and hope that our work can benefit both people and Country.

'Journey of unity: AEMO's Reconciliation Path' by Lani Balzan

AEMO Group is proud to have launched its first Reconciliation Action Plan in May 2024. 'Journey of unity: AEMO's Reconciliation Path' was created by Wiradjuri artist Lani Balzan to visually narrate our ongoing journey towards reconciliation - a collaborative endeavour that honours First Nations cultures, fosters mutual understanding, and paves the way for a brighter, more inclusive future.

Important notice

Purpose

The purpose of this publication is to document the process conducted by the Australian Energy Market Operator (AEMO) to review the current Tolerance Range and any Facility Tolerance Ranges under the *Electricity System and Market Rules (ESM Rules)* for 2026.

AEMO publishes this 2026 Tolerance Range Review Paper in accordance with Clauses 2.13.21 of the *Electricity System and Market (ESM) Rules*, and Clause 2.4.2(b) of the *WEM Procedure: Dispatch Compliance*. This publication is generally based on information available to AEMO as at 1 July 2025. More recent information may have been included where practical.

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Document Version Control

Version	Release Date	Changes
1.1	20/05/2026	Final version after Consultation

Document Approval

Name	Position	Date
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Executive Summary

The publication of this review paper completes the process conducted by AEMO to review the existing Tolerance Ranges under the *ESM Rules*. This is AEMO's first review of the Tolerance Ranges since 2022 and was commenced under paragraph 2.4.2(a) of the *WEM Procedure: Dispatch Compliance*.

This is also the first Tolerance Range review since the commencement of the new WEM in October 2023. Therefore, in addition to considering general factors impacting the effectiveness of the Tolerance Ranges, AEMO has specifically considered the impact of these market changes.

As a result of the assessments described in Sections 6 and 7, AEMO has determined:

1. **The current Tolerance Ranges will remain unchanged for Scheduled and Semi-Scheduled Facilities.**
   AEMO's analysis indicates that there is no immediate need to tighten or relax the existing Tolerance Ranges. Changes in market design have not resulted in a material change in typical non-compliance rates or magnitudes, and an analysis of fleet-wide aggregated dispatch deviations indicates that total deviations do not materially impact Power System Security, Power System Reliability, or market costs.
2. **Demand Side Programmes and Interruptible Loads will not have an applicable Tolerance Range.**
   The provisions of Clause 7.10.1 and section 3.21 of the ESM Rules are not applicable to Interruptible Loads or Demand Side Programmes, and therefore Tolerance Ranges are not applicable to these Facility types.
3. **No Facility Tolerance Ranges will be applied.**
   AEMO did not identify any Facilities requiring relaxed Facility Tolerance Ranges due to Facility-specific characteristics. AEMO observed some instances of Facility behaviours with the potential to impact Power System Security and Power System Reliability, but determined that tighter Facility Tolerance Ranges are not likely to be an effective measure for detecting or disincentivising these behaviours, partly due to current issues with the DCM.

Additionally, AEMO has identified the following next steps to improve dispatch compliance monitoring:

4. **AEMO will investigate resolving issues within the Dispatch Compliance Monitor (DCM).**
   A large number of DCM notifications are false positives driven by limitations in the DCM, rather than genuine compliance issues, which limit the value of DCM notifications and would only be exacerbated if Tolerance Ranges were to be tightened. Resolving these issues will improve the effectiveness of the DCM regardless of Tolerance Range settings.
5. **AEMO will develop enhanced monitoring processes to complement the DCM.**
   AEMO has identified several non-compliant behaviours with the potential to impact market effectiveness, Power System Security, or Power System Reliability, for which the DCM is not an effective monitoring tool, even if tighter Tolerance Ranges were implemented. New processes to monitor for such

behaviours will strengthen AEMO's ability to identify breaches of Clauses 7.10.1 and 7.10.3 of the ESM Rules.

6. **AEMO will monitor the need for Facility Tolerance Ranges.**
   In the next Tolerance Range review, AEMO will consider the need for tighter Facility Tolerance Ranges for specific Facilities based on ongoing observations of potential non-compliances, operational experience with enhanced monitoring processes, and improved DCM capabilities.

AEMO will report on progress in the next Tolerance Range review.

Contents

1 Purpose

1.1 Purpose of the Tolerance Range Review

The objective of this report is to outline the process and outcomes adopted for the 2026 review of the Tolerance Ranges in the Wholesale Electricity Market (WEM), undertaken by the Australian Energy Market Operator (AEMO) under the *Electricity System and Market (ESM) Rules*.

Section 2 sets out the relevant ESM Rule requirements, including AEMO's and Market Participants' obligations.

Section 3 summarises the basis for and requirements of the review, under the *ESM Rules*.

Section 4 describes Tolerance Range and Facility Tolerance Ranges which existed prior to the review.

Section 5 describes the Dispatch Compliance Monitor.

Section 6 describes the assessments and analyses undertaken by AEMO to evaluate the effectiveness of the existing Tolerance Range and the need for any changes.

Section 7 evaluates the technical effectiveness of the Dispatch Compliance Monitor.

Section 8 summarises the outcome of the review and the final determination made by AEMO.

Section 9 summarises the consultation feedback received from Market Participants.

2 ESM Rule Requirements

This section outlines the key requirements under the *ESM Rules* that govern Market Participants' obligations for dispatch compliance, and AEMO's obligations for the monitoring of dispatch compliance including the determination of Tolerance Ranges.

2.1 Dispatch Compliance

Clause 7.10.1 of the *ESM Rules* requires Market Participants to adhere to AEMO's Dispatch Instructions, stating:

> *Unless otherwise directed by AEMO, a Market Participant must comply with the following in the most recently issued Dispatch Instruction applicable to its Scheduled Facility, Semi-Scheduled Facility or Interruptible Load for the Dispatch Interval:*
>
> *(a) the Dispatch Target or Dispatch Cap as applicable;*
>
> *(b) Essential System Service Enablement Quantities; and*
>
> *(c) ramp rate.*

Clause 7.10.1 establishes a clear obligation for Market Participants to follow AEMO's Dispatch Instructions. In practice, however, minor deviations from these instructions are inevitable due to the physical and operational limitations of a Facility. The Tolerance Range framework therefore exists to accommodate these unavoidable variances and to provide a practical threshold for identifying material deviations and reporting potential non-compliances.

2.2 Setting Tolerance Ranges

The *ESM Rules* provide AEMO with the authority to establish Tolerance Ranges for the purposes of monitoring compliance with Clause 7.10.1. It also applies to provisions of Section 3.21 relating to Forced Outages.

The requirements for setting both general and Facility-specific Tolerance Ranges are outlined in Clauses 2.13.16 and 2.13.17 of the *ESM Rules*. Essentially, these Clauses allow AEMO to determine the Tolerance Range or Facility Tolerance Ranges, with the requirement that:

- AEMO consult with Rule Participants on the Tolerance Range and Facility Tolerance Ranges, and;
- AEMO publish them on the WEM Website at least 14 Business Days before they take effect, along with their effective date, any submissions from Rule Participants, and (for Facility Tolerance Ranges) the reasons for AEMO's decision.

2.3 Application of the Tolerance Range

Under Clause 2.13.11 of the *ESM Rules*, a Facility operating within its applicable Tolerance Range is not considered to be non-compliant by reason of deviation from its Dispatch Instruction alone.

As such, the Tolerance Range generally functions as a threshold for AEMO to report alleged breaches of Clauses 7.10.1 or Section 3.21 of the *ESM Rules*. However, it also follows that a Facility operating within its applicable Tolerance Range may still be non-compliant with Clause 7.10.1 due to some other factor, action, or inaction: for example:

- synchronising or desynchronising a Facility without a Dispatch Instruction to that effect;
- failing to synchronise or desynchronise when issued a Dispatch Instruction to that effect; or
- intentionally operating in a manner that is inconsistent with the Dispatch Instruction, for example:
  - Consistently operating at the extremes of its Tolerance Range (which is explicitly prohibited by Clause 7.10.3); or
  - Enabling an incorrect quantity of ESS.

Therefore, adherence to the Tolerance Range does not in itself imply that a Market Participant has met its obligations under Clause 7.10.1 of the *ESM Rules*.

Similarly, it is important to recognise that deviations beyond the Tolerance Range are not automatically considered non-compliances. Certain deviations may arise from legitimate and expected operational behaviour, such as frequency-based droop response or actions taken in response to an AEMO direction. In these circumstances, a Facility's deviation may reflect appropriate system support rather than a failure to follow Dispatch Instructions.

Any assessment of non-compliance must therefore consider the operational context and the nature of the response.

3 Basis for the Review

3.1 Trigger for the Review

AEMO must review the Tolerance Range if requested to by the ERA under Clause 2.13.21 of the *ESM Rules*, and otherwise may do so under paragraph 2.4.2 of the *WEM Procedure: Dispatch Compliance* if:

- factors that impact the effectiveness of the Tolerance Range, as listed in paragraph 2.1.1 of the *WEM Procedure: Dispatch Compliance*, have changed since the last review (2.4.2(b));
- requested by a Rule Participant (2.4.2(c)), or;
- a new Facility is registered for which the existing Tolerance Range is not appropriate (2.4.2(d));

and AEMO considers that a review of the existing Tolerance Range and Facility Tolerance Ranges is appropriate or required. In any case, AEMO may review the Tolerance Range annually if AEMO considers it appropriate (sub-paragraph (a)).

AEMO has commenced this review under paragraph 2.4.2(a) as a regular review, noting that the previous review was completed in December 2022. However, AEMO also notes the following significant changes in the WEM since the previous review, which may have affected the effectiveness or appropriateness of the Tolerance Range for one or more Facilities:

- the introduction of a new market design with changes including but not limited to:
  - a change from 30-minute dispatch to 5-minute dispatch;
  - a change in ramping requirements for Facilities, with Dispatch Instructions previously requiring ramping at maximum ramp rate, but now requiring a linear ramp rate to meet the end-of-interval Dispatch Target, for Scheduled Facilities, and;
- the introduction of over 1 GW of grid-scale batteries in the WEM: a new Facility technology which did not exist in the WEM at the time of the previous review, and which typically has a very high maximum ramp rate.

3.2 Requirements of the Review

In accordance with paragraph 2.1.1 of the *WEM Procedure: Dispatch Compliance*, AEMO may consider the following factors when determining a Tolerance Range:

- the degree of compliance with Dispatch Instructions that is required to maintain Power System Security and Power System Reliability;
- the degree of costs imposed on Market Participants as a result of AEMO's monitoring of compliance with Dispatch Instructions;

- the provision of Essential System Services, and;
- any other circumstances or information that AEMO considers relevant.

In particular, AEMO considers the following "other circumstances or information" to be relevant for determining the effectiveness of a Tolerance Range or Facility Tolerance Range in identifying material non-compliances (i.e. those which have or may have a significant impact on the effectiveness of the market or on Power System Security or Power System Reliability):

- the frequency of false positives, i.e. DCM notifications not related to material non-compliances;
- the frequency of false negatives, i.e. material non-compliances which are not identified by the DCM, and;
- operational or IT limitations of the DCM, and their impact on the effectiveness of the Tolerance Range.

AEMO may also determine Facility Tolerance Ranges to apply to individual Facilities in accordance with paragraph 3.1.1.

4 Current Tolerance Range

4.1 Current Tolerance Range

The Tolerance Range currently in effect, as determined by AEMO in July 2018 and most recently reviewed in December 2022, is illustrated in Figure 1, taken from AEMO's website.

Figure 1 Current Tolerance Range Calculation

(a) For **Scheduled Facilities**, the Tolerance Range is:

TR (MW) = (+/-) MAX (6, MIN [5% NPC, 4*RR])

Where:

- NPC is the nameplate capacity of the Scheduled Generator, expressed in MW, using the value set in Standing Data **[Appendix 1(b)(ii)]**; and
- RR is the ramp rate of the Scheduled Generator, expressed in MW/min, using the value set in Standing Data **[Appendix 1(b)(v)]**.

(b) For **Semi-Scheduled Facilities**, the Tolerance Range is:

TR (MW) = (+) 6

(c) For **Demand Side Programmes**, the Tolerance Range is:

TR (MW) = (+) MAX (6, 5% MCL)

Where:

- MCL is the maximum amount of load that can be curtailed by the Demand Side Programme, expressed in MW, using the value set in Standing Data [Appendix 1(h)(iii)].

(d) **For all other Facilities**:

TR (MW) = 0

Considering these Tolerance Ranges, it may be observed that:

- Scheduled Facilities whose nameplate capacity (NPC) is relatively large (above 120 MW) and whose ramp rate (RR) is relatively high, are assigned a Tolerance Range equal to 5% of their NPC;
- Smaller Scheduled Facilities (NPC below 120 MW) have their Tolerance Range floored at 6 MW, and therefore have a proportionally larger Tolerance Range than larger Facilities, regardless of their RR; and
- Larger Scheduled Facilities with a low RR (below 1.5 MW/min) have their Tolerance Range capped at 6 MW, and therefore have a proportionally smaller Tolerance Range than those with a similar NPC but a higher RR.

The formula reflects the fact that:

- Regulation can generally absorb small deviations between target and actual generation values, and therefore it is not necessary to place extremely tight tolerance bands on small Facilities; and
- Larger Facilities with smaller Ramp Rates may pose a greater risk to Power System Security, as they take longer to return to their setpoint after a deviation, and Regulation may not be able to absorb large, sustained deviations.

4.2 Current Facility Tolerance Ranges

Under Clause 2.13.17 of the *ESM Rules*, AEMO may determine a Facility Tolerance Range to apply to a specific Facility instead of the general Tolerance Range, which is applicable to all Facilities.

There are no existing Facility Tolerance Ranges.

4.3 Treatment of Demand Side Programmes

In accordance with Clauses 2.13.16 and 2.13.17, Tolerance Ranges and Facility Tolerance Ranges are applicable only for the purposes of reporting alleged breaches of Clause 7.10.1 or a provision of Section 3.21.

These clauses and provisions do not apply to Demand Side Programmes (DSPs), and therefore, AEMO considers a Tolerance Range may not be determined for Demand Side Programmes. Accordingly, component (c) of the existing Tolerance Range calculation will be removed, and no further consideration has been given to DSPs in this review.

5 The Dispatch Compliance Monitor

The Dispatch Compliance Monitor (DCM) is a tool developed by AEMO to support reporting of alleged breaches of Clause 7.10.1 of the *ESM Rules*, or a provision of Clause 3.21 (relating to Market Participants affected by a Forced Outage). The DCM automatically monitors Facility output, assesses compliance with Dispatch Instructions against the applicable Tolerance Range, identifies deviations that may constitute breaches, and notifies AEMO and Market Participants.

Clause 7.10.2(b) of the *ESM Rules* provides an exemption from compliance with Clause 7.10.1 under certain conditions. Specifically, it states:

> *A Market Participant is not required to comply with Clause 7.10.1 if:*
>
> *…*
>
> *(b) the actual Injection or Withdrawal of the Registered Facility does not, at any time the Dispatch Instruction applies:*
>
> *i. vary, by more than the applicable Tolerance Range or Facility Tolerance Range, from a linear profile between the Injection or Withdrawal of the Facility at the start of the Dispatch Interval and the Dispatch Target at:*
>
> *1. the time at which the Dispatch Target would be reached by ramping at the ramp rate specified in the Dispatch Instruction; or*
>
> *2. if no ramp rate is specified in the Dispatch Instruction, the end of the Dispatch Interval;*
>
> *ii. exceed by more than the applicable Tolerance Range or Facility Tolerance Range a linear profile between the Injection or Withdrawal of the Facility at the start of the Dispatch Interval and the Dispatch Cap at:*
>
> *1. the time at which the Dispatch Cap would be reached by ramping at the ramp rate specified in the Dispatch Instruction; or*
>
> *2. if no ramp rate is specified in the Dispatch Instruction, the end of the Dispatch Interval.*

In practice, the DCM calculates a Facility's expected output based on its current and previous Dispatch Targets or Dispatch Caps (as appropriate) and any enabled Regulation quantities, assuming a linear ramping profile, and compares this with the Facility's actual sent-out megawatt (MW) value once per minute (a "DCM check"). Where the actual output deviates from the expected profile by more than the applicable Tolerance Range or Facility Tolerance Range, as applicable, the DCM triggers a dispatch non-compliance notification, which is emailed to the relevant Market Participant.

6 Tolerance Range Review

6.1 Market Participant Submissions

Paragraph 2.4.2(c) of the *WEM Procedure: Dispatch Compliance* allows Rule Participants to submit requests regarding the Tolerance Range at any time, and Paragraph 2.4.3(a) requires AEMO to consider all such submissions when reviewing the Tolerance Range.

No such submissions have been received since the previous review.

6.2 Inter-Jurisdictional Review

AEMO has compared the WEM's Tolerance Range against those in other energy markets, including the National Electricity Market (NEM), summarised in Table 1.

The WEM's Tolerance Range is largely aligned with the NEM's Large Error Trigger. Both are floored at 6 MW an d capped at a variable value based on ramp rate (RR, referred to as Rate-of-Change or ROC for the NEM), and Facility size or output. In the WEM, a Facility's NPC is used for the latter, whereas the NEM uses the real-time megawatt output (MWO).

As such, for a given Facility, the NEM's Tolerance Range is dynamic, increasing and decreasing according to output, whereas the WEM's is static. A dynamic Tolerance Range may be more appropriate for Facilities capable of large ranges of outputs, but would require material resources to implement, so AEMO would only consider it if justified by other observations.

Other jurisdictions studied as part of the review (California, Alberta, and Ontario) used static values like the WEM, in some cases linked to Facility size, with Tolerance Ranges for Facilities up to 300 MW ranging between 5 MW and 15 MW.

Table 1 Jurisdictional Review

Market	Description	Tolerance	Approx. Installed Capacity
WEM	Scheduled Facilities	± Max(6 MW, MIN [5% NPC, 4* RR])	6 GW
	Semi-Scheduled Facilities	+ 6MW, N/A for negative deviation	
NEM	Small Error Trigger	Max(6 MW, MIN [3% MWO, 2*ROC])	68 GW
	Large Error Trigger	Max(6 MW, MIN [5% MWO, 4*ROC])	
USA CAISO California	All Facilities	± 5 MW	54 GW
Canada AESO Alberta	Facilities <200 MW	± 5 MW	18 GW
	Facilities >200 MW	± 10 MW	
Canada IESO Ontario	Facilities <30 MW	± 10 MW	38 GW
	Facilities >30 MW	Min of ± 15 MW or 2% of Facility NPC	

Overall, the WEM's Tolerance Range is generally aligned with most jurisdictions, except for Ontario, which applies a higher Tolerance Range, especially for smaller Facilities. However, it is also noted the WEM is a substantially smaller system than the other jurisdictions considered, as well as the only non-interconnected system, and therefore may be more sensitive to smaller dispatch non-compliances. However, AEMO considers that this is not in itself sufficient reason to justify a tighter Tolerance Range, and the increased burden of compliance and monitoring associated with it, unless it is further justified by considerations of cost or Power System Security and Power System Reliability.

6.3 Changes from the Balancing Market to Real Time Market

The introduction of a new market in October 2023 changed the frequency and nature of Dispatch Instructions and associated ramping requirements. However, the compliance monitoring framework (including the Tolerance Range, DCM functionality, and frequency of DCM checks) remains unchanged. Table 2 provides a comparison of key aspects of the old and new market, including Dispatch Compliance arrangements.

This section assesses the operational differences between the old Balancing Market, and the new Real Time Market, to determine whether market design changes necessitate a change in Tolerance Ranges.

Table 2 Market Comparison

Description	Balancing Market	Real Time Market
Dispatch Interval Length	30-minute Trading Intervals Marginal units re-dispatched every 10 minutes	5-minute Dispatch Intervals
Ramping	Max Ramp until Target, then maintain	Linear Ramp to Target
Early-Interval Compliance	High difficulty due to fast ramp	Medium difficulty due to gentle ramp
Mid/Late Interval Compliance	Easier due to flat output	Medium difficulty due to gentle ramp
DCM Check	Every 1 minute	Every 1 minute

6.3.1 Effect of Changes to Ramping Requirements

In the Balancing Market, Facilities were required to respond to new Dispatch Instructions by ramping immediately at their maximum ramp rate. As a result, Facilities often reached the new target early in the 30-minute interval, and were then required to maintain their output at the specified level for the remainder of the interval. This created a steep initial ramp and long stable period, and as a result most compliance challenges occurred at the start of the interval. The marginal unit was also re-dispatched every ten minutes, creating similar issues on a smaller scale for the marginal unit.

In the Real-Time Market, Facilities follow a continuous linear ramp between Dispatch Targets across each five-minute interval. This reduces steep step changes but means the Facility is always ramping, with smaller but more frequent deviations.

The impact of this change on the timing of Dispatch Non-Compliance notifications under both market designs is illustrated in Figures 2 and 3.

Under the Balancing Market, a pronounced spike in notifications was observed immediately after the hour and half-hour, as Facilities start ramping toward new targets at maximum ramp rate, with smaller spikes every ten minutes corresponding to marginal unit re-dispatch, and low notification rates between ramp events.

In comparison, in the Real-Time Market small spikes are observed every five minutes, reflecting new Dispatch Instructions being issued (and hence a change in ramping rates being applied), but likely exacerbated by issues with the DCM (see Section 7). Rates of notifications in between are only slightly lower, reflecting near-continuous ramping and fewer periods of steady operation.

Overall, the change in ramping requirements appears to have resulted in lower variability in notification rates, and while average notification rates are higher overall, this does not seem to be driven by the change in ramping rates (see Section 6.4 for details).

Furthermore, it should be noted that Tolerance Ranges are applied around the projected output, which already reflects the appropriate ramp shape. As such, the change in ramping requirements does not in itself necessitate adjustments to the existing Tolerance Ranges.

Figure 2 Non-Compliance Notifications 2022-2023 (Balancing Market)

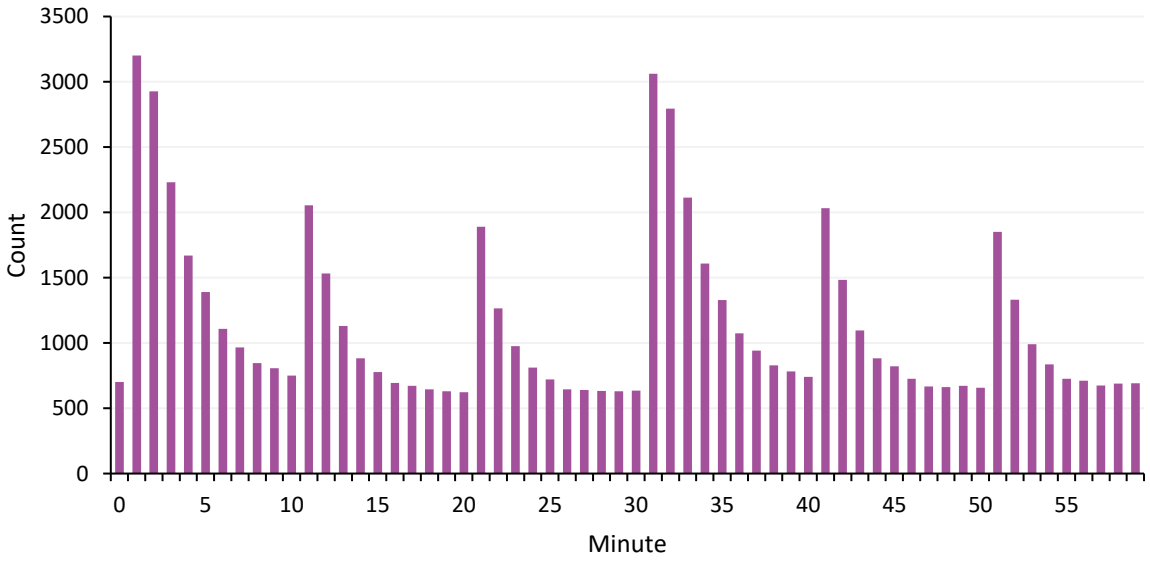
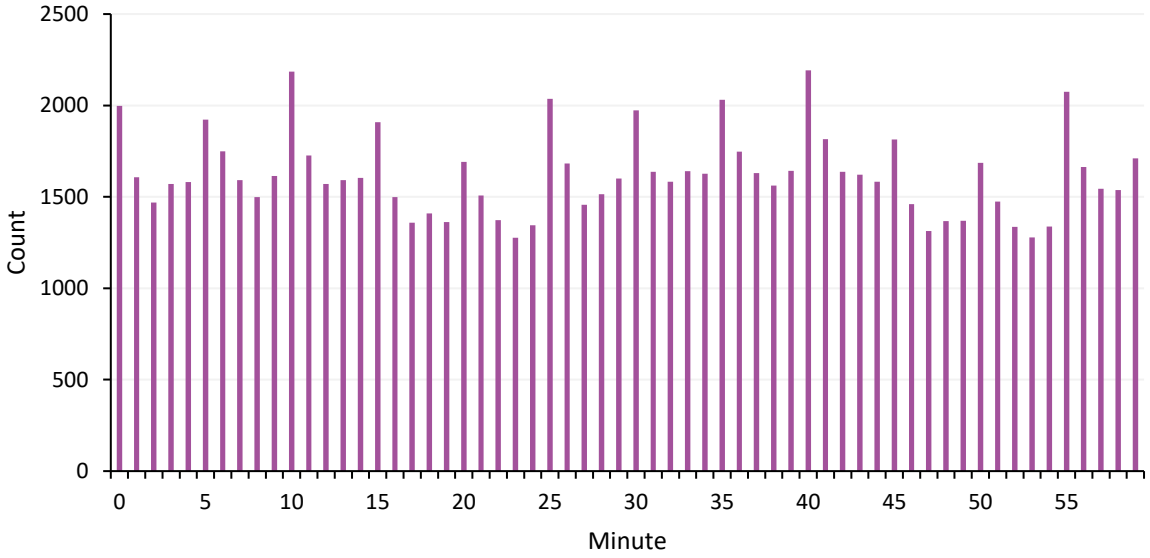


Figure 3 Non-Compliance Notifications 2024-2025 (Real-Time Market)



6.3.2 Effect of Changes to Dispatch Interval Length

The shift from 30-minute to 5-minute Dispatch Intervals reduces the magnitude of required output changes but increases how often Facilities must adjust. In the Balancing Market, large infrequent changes caused high early-interval compliance challenges, followed by longer periods of stable output whereas the Real-Time Market instead produces smaller, smoother, and more frequent adjustments, with no extended flat period, as described in Section 6.3.1.

However, this increase in frequency of dispatch instructions has not resulted in a material increase in non-compliance notifications (see Section 6.4 for details).

Furthermore, this change also allows the fleet as a whole to be re-dispatched more frequently to account for any dispatch compliance deviations, instead of relying on Regulation (previously Load-Following Ancillary Service) alone, which helps to maintain Power System Security and Power System Reliability. As such, AEMO considers the change in interval length does not in itself impact the suitability of the existing Tolerance Ranges.

6.3.3 Effect on Magnitude of Deviations

AEMO compared the magnitude of dispatch non-compliances before and after the market change by comparing the total deviation of the entire fleet, that is the sum of the deviations of every Facility in each DCM check, for Financial Years 2023 (in the Balancing Market) and 2025 (in the Real-Time Market).

AEMO found that the mean absolute deviation of was 17.6 MW in the Balancing Market and 16.6 MW in the Real-Time Market, and the median absolute deviation was 10.4 MW and 11.7 MW respectively. This indicates

that the typical size of the aggregated deviation of all Facilities in the market, at any given time, has changed negligibly as a result of market design changes.

The standard deviation of the deviations decreased slightly from 28.2 MW in the Balancing Market to 22.9 MW in the Real-Time Market, reflecting the reduction in variability described in Section 6.3.1.

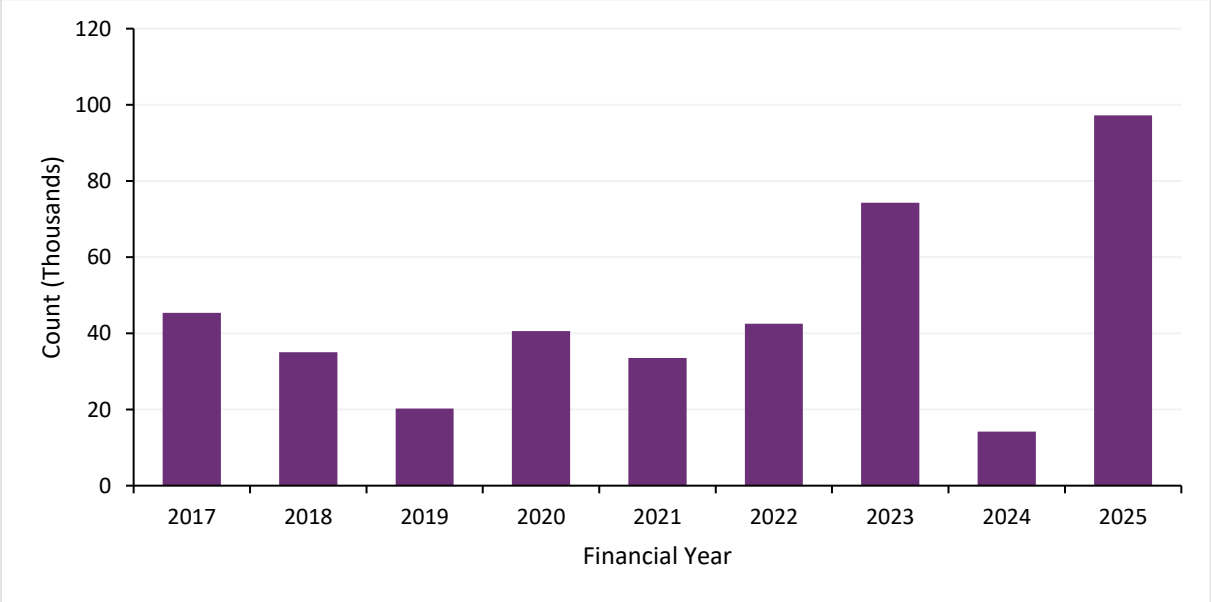
This suggests that Facilities' overall ability to follow their Dispatch Instructions has not materially changed as a result of the market design change, which supports the conclusion that this change does not in itself necessitate a change to the Tolerance Range.

6.4 Frequency of Dispatch Non-Compliance Notifications

6.4.1 Historical Trends

Figure 4 presents the total annual number of dispatch non-compliance notifications issued over the past nine years. It was observed that the total number remains relatively consistent until the last three financial years, during which time it has experienced significant growth with the exception of a large, temporary reduction in Financial Year 2024, which is attributed to a prolonged outage of the DCM (see Section 7.1).

Figure 4 Total Dispatch Non-Compliance Notifications by Financial Year

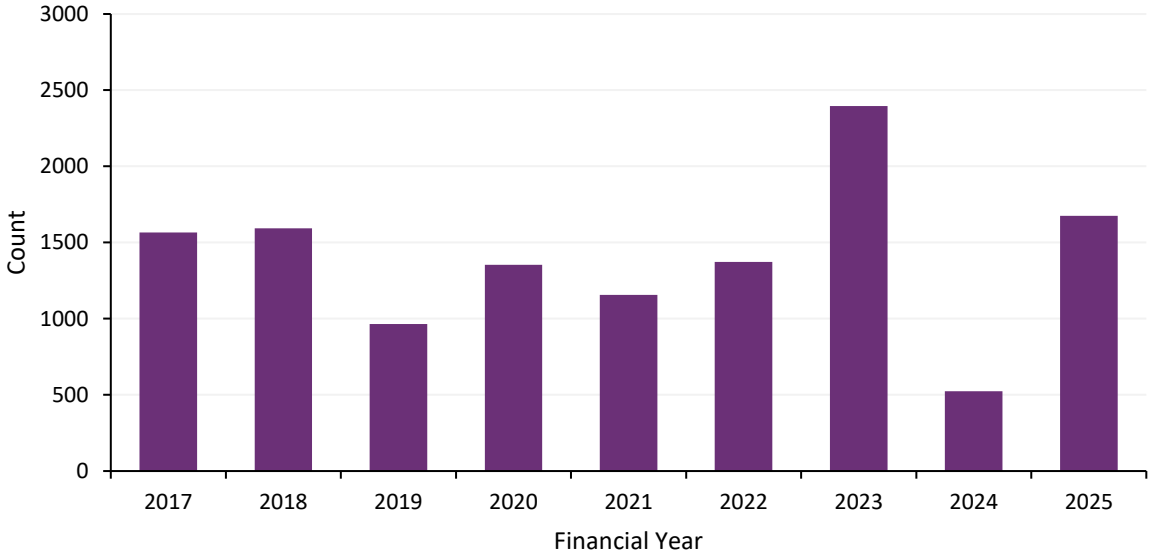


To assess whether the increase in notifications represent a change in typical Facility performance, notifications were normalised on a per-Facility basis (Figure 5), considering only Facilities that received at least one notification during the year.

It should be noted that since the commencement of the new WEM in October 2023 there has been a significant increase in the number of Facilities that received at least one notification. This is due to a combination of new Facilities commencing operation, the commencement of monitoring using the DCM on previously unmonitored Facilities, and to a lesser extent some rarely-dispatched Facilities which received no notifications in some earlier periods.

When expressed as a total number of notifications per Facility, Financial Year 2025 aligns broadly with historical patterns. As such, it appears that the main contributor to the increase in total notifications was the increase in the number of Facilities being monitored by the DCM.

Figure 5 Normalised Dispatch Non-Compliance Notifications Rates per Facility

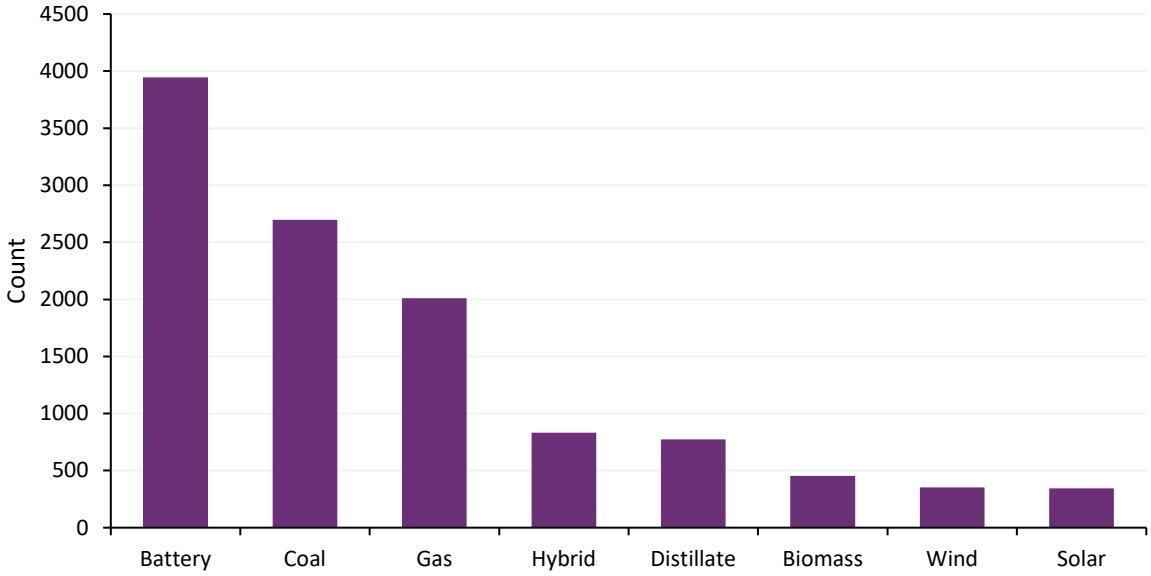


6.4.2 Fuel-Type Contribution

Figure 6 breaks down dispatch non-compliance notifications rates by Facility fuel type, normalised by the number of Facilities that received at least one notification during the year, providing further context for the trends described in Section 6.4.1.

This analysis highlights that battery facilities receive notifications more frequently than other fuel types. Prior to April 2023 there were no battery Facilities operating in the WEM, whereas since new market start, six of nine new Facilities have been battery or battery-solar hybrid Facilities, and as such the commencement of new battery Facilities has had a disproportionate effect on the growth in total notifications.

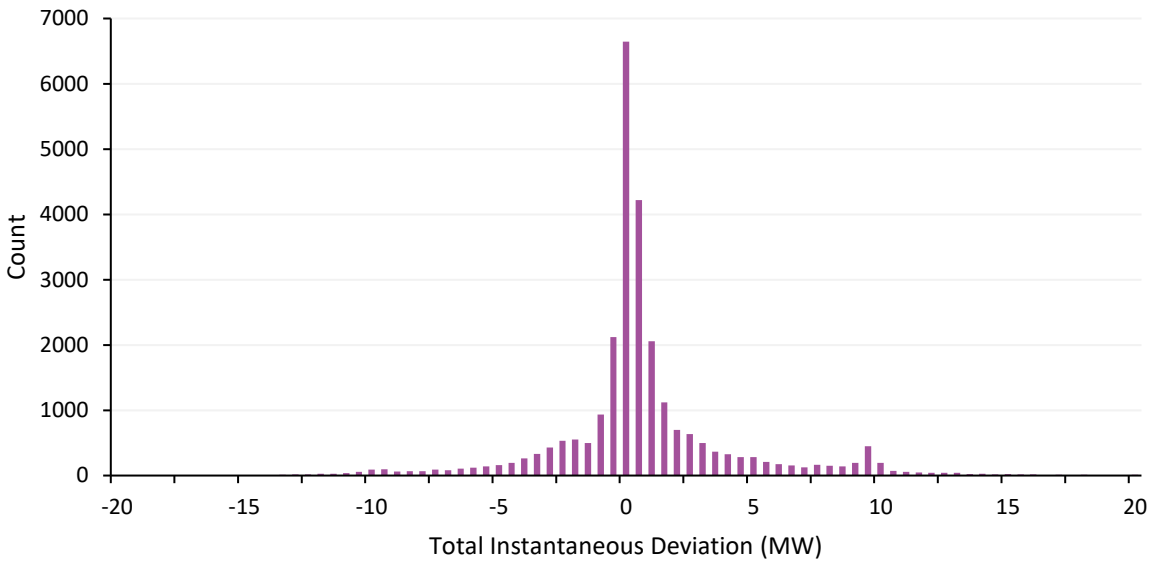
Figure 6 Dispatch Non-Compliance Notifications Rates per Facility by Fuel Type, Financial Year 2025



Battery Facilities typically have high ramp rates. As such, they have the potential to impact Power System Security by deviating significantly from their Dispatch Target within a small period of time.

To determine whether battery Facilities may require tighter Tolerance Ranges, AEMO analysed the typical aggregated dispatch deviations of battery Facilities only. Facilities providing Regulation services were excluded so as to ignore large deviations driven by Regulation. Figure 7 illustrates the results of this analysis for January 2025 which found that, 90.0% of the time, the aggregated deviation of battery Facilities was within ±6 MW (the minimum Tolerance Range), indicating a good degree of compliance and suggesting that tighter Tolerance Ranges are not required for battery Facilities.

Figure 7 Battery Fleet Deviation from Projected MW to Actual MW, excluding Regulation



Additionally, high ramp rates also make battery Facilities more likely to trigger false positive notifications due to issues with the DCM (see Section 7 for details). Therefore, tightening Tolerance Ranges for batteries may primarily have the effect of driving an increase in false positive notifications, and therefore yield limited benefits unless these issues are first addressed.

6.5 Facility-Level Performance

AEMO has considered the typical deviations of individual Facilities, by expressing deviations for each DCM check as a proportion of the relevant Facility's Tolerance Range, and aggregating results across the fleet. Figure 8 and Figure 9 illustrate the results of this analysis for January 2025, separated into Scheduled and Semi-Scheduled Facilities.

The distributions are approximately normal and centred near zero with a single, distinct peak (with a negative skew for Semi-Scheduled Facilities, reflecting the application of a Dispatch Cap as opposed to a Dispatch Target issued). This suggests that Facilities are generally compliant with their Dispatch Instructions, with variability mostly driven by fluctuation around the Dispatch Target or Cap, as applicable, as opposed to intentional deviations (notwithstanding some compliance issues discussed in Section 6.7).

The analysis shows that Facilities operated outside their Tolerance Range in 1.5% of intervals for Scheduled Facilities and 4.0% of intervals for Semi-Scheduled Facilities. These low exceedance rates indicate that Facilities are generally operating within their Tolerance Ranges, suggesting that the Tolerance Ranges are not excessively tight.

However it was also found that while most Facilities exhibit approximately normal distributions centred near zero, a small number had a high number of deviations concentrated near the extremes of (but inside) their Tolerance Ranges: these observations are discussed further in Section 6.7.

Figure 8 Deviation from Projected MW to Actual MW normalised by Tolerance Range - Scheduled Facilities

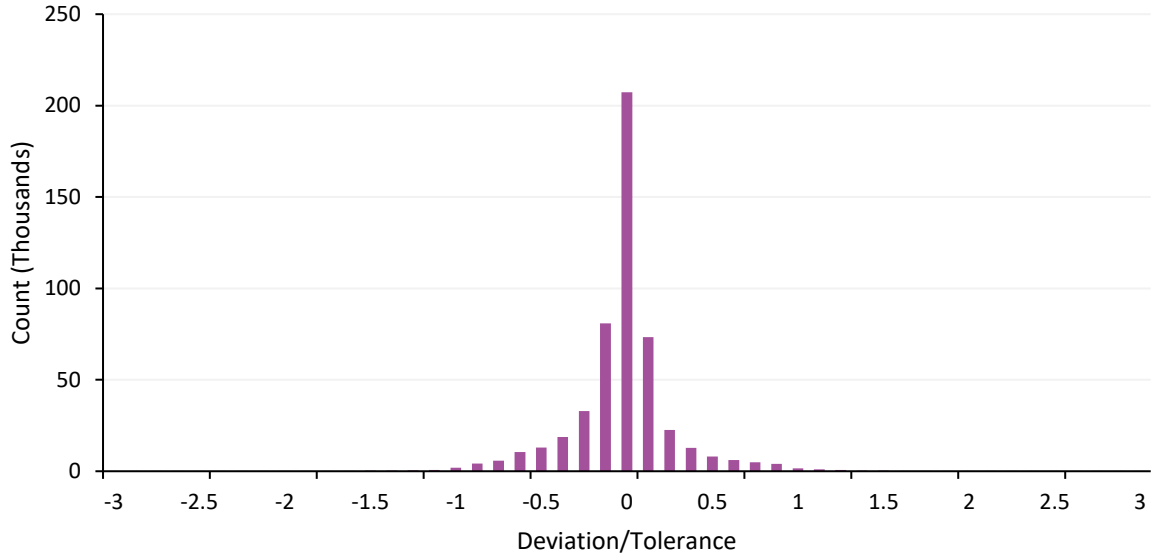
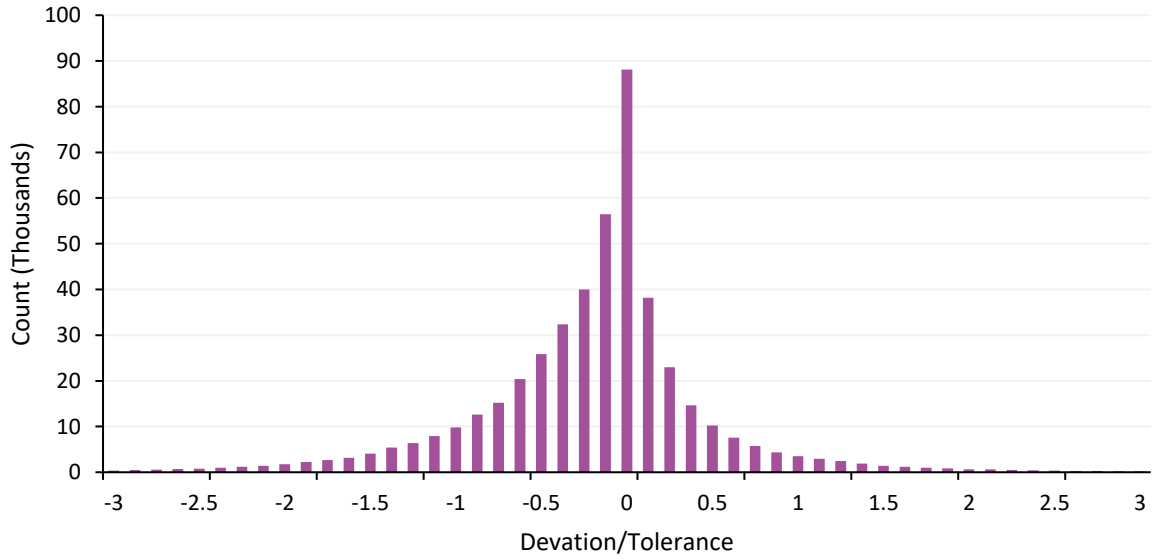


Figure 9 Deviation from Projected MW to Actual MW normalised by Tolerance Range - Semi-Scheduled Facilities



6.6 Impact on Power System Security

While Dispatch Non-Compliance is typically framed in terms of whether a Facility exceeds its Tolerance Range, it is important to recognise that small deviations by many Facilities within their Tolerance Ranges may still impose an operational burden when aggregated. Regulation must continually correct for differences between expected and actual output, and persistent or large deviations ultimately increase costs for the market.

To understand the broader system impact, AEMO analysed the aggregated deviations from all Facilities, summed for each DCM check in January 2025.

Figure 10 illustrates the distribution of deviations when Facilities providing Regulation services are excluded from the analysis. Facilities providing Regulation adjust their output to compensate for other Facilities' dispatch deviations, forecasting error, and other factors, so their deviations are removed to identify only deviations driven by normal output variability (including droop) and non-compliances.

It is observed that the median deviation is well below zero, at -15.0 MW. This results from the negative skew of Semi-Scheduled Facilities' deviations (see Figure 9), itself a result of such Facilities having a Dispatch Cap rather than a Dispatch Target. The 10th and 90th percentiles of deviations lie at -42.7 MW and +8.0 MW, a total range of 50.7 MW.

When Regulation providers are included in the analysis (Figure 11), the median shifts to +1.9 MW as Regulation cancels out the negative skew of Semi-Scheduled Facilities. However, the distribution of deviations does not narrow, with the 10th and 90th percentiles of deviations lying -26.3 MW and +26.5 MW respectively, a range of 52.8 MW, similar to results when Regulation Facilities are excluded.

If typical dispatch deviations were a major driver of Regulation usage, the distribution would be expected to be narrower when Regulation were included, as Regulation would be actively compensating for these deviations. The absence of this effect suggests that errors in demand forecasting, Semi-Scheduled Facility forecasting and DPV forecasting are significantly more material to Regulation usage than dispatch deviations.

As such, AEMO concludes that the existing Tolerance Ranges are effective at maintaining dispatch deviations to a level where they do not impact Power System Security and Power System Reliability, and are not resulting in excessive Regulation costs, and therefore it is not currently necessary to adjust the existing Tolerance Ranges for security or cost purposes.

Figure 10 Fleet Deviation from Projected MW to Actual MW, excluding Regulation

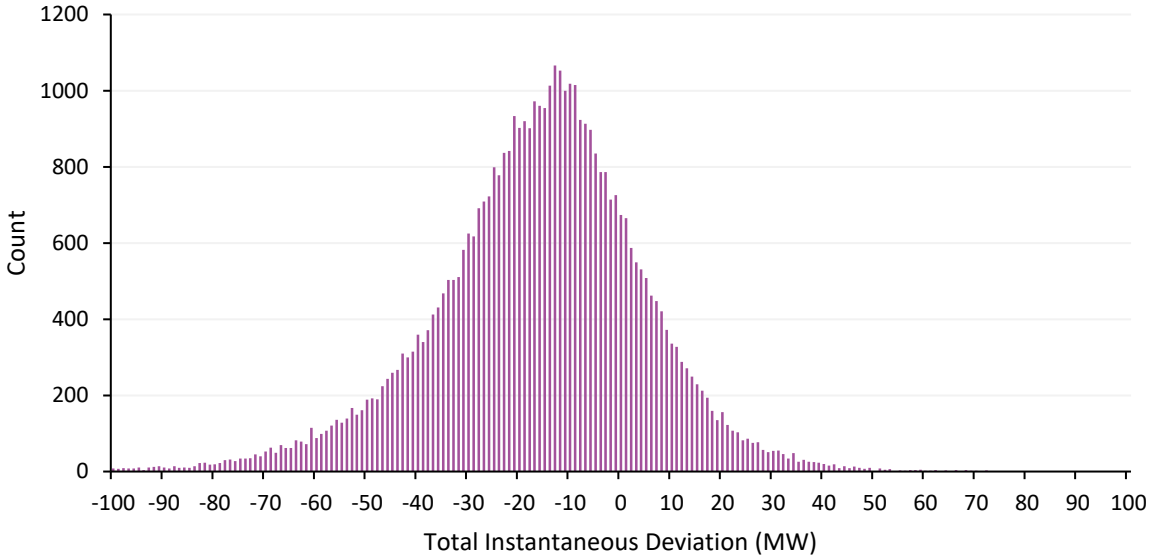
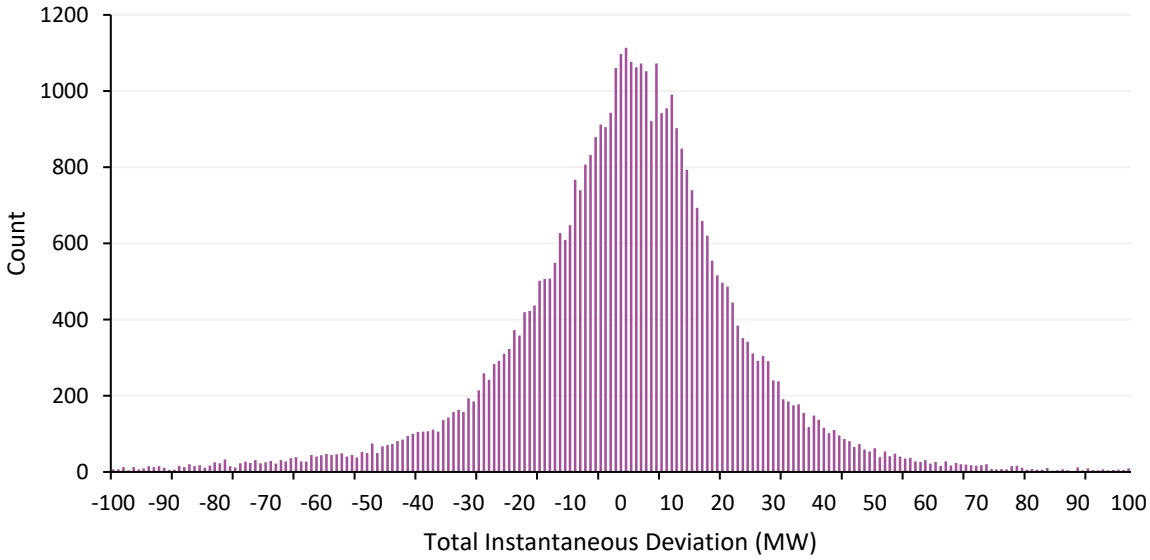


Figure 11 Fleet Deviation from Projected MW to Actual MW, including Regulation



6.7 Dispatch Non-Compliances within the Tolerance Range

As outlined in Section 2.3, a Facility may be non-compliant with Clause 7.10.1 even while operating within its applicable Tolerance Range. In the new market environment, AEMO has observed several instances of behaviour

with the potential to adversely affect Real-Time Market outcomes and pose risks to Power System Security and Power System Reliability, where a Facility was operating within its Tolerance Range.

6.7.1 Facilities Operating at the extremes of their Tolerance Range

AEMO has observed several instances of Facilities operating at the extremes of their Tolerance Range for extended periods of time. This is illustrated with an example in Figure 12, which shows the distribution of dispatch deviations for a Facility in January 2025. It may be observed that the distribution does not follow the roughly-normal shape which would be expected if a Facility is generally following its Dispatch Instructions, with some expected deviations (compare for example the more typical distribution, from a comparable Facility, exhibited in Figure 13). Instead, there are two distinct spikes in the distribution near the upper and lower Tolerance Range boundaries, indicating that the Facility is operating in these regions unusually frequently, and perhaps intentionally.

Figure 12 Example Facility Dispatch Deviation Distribution Suggesting Operation at Extremes of Tolerance Range

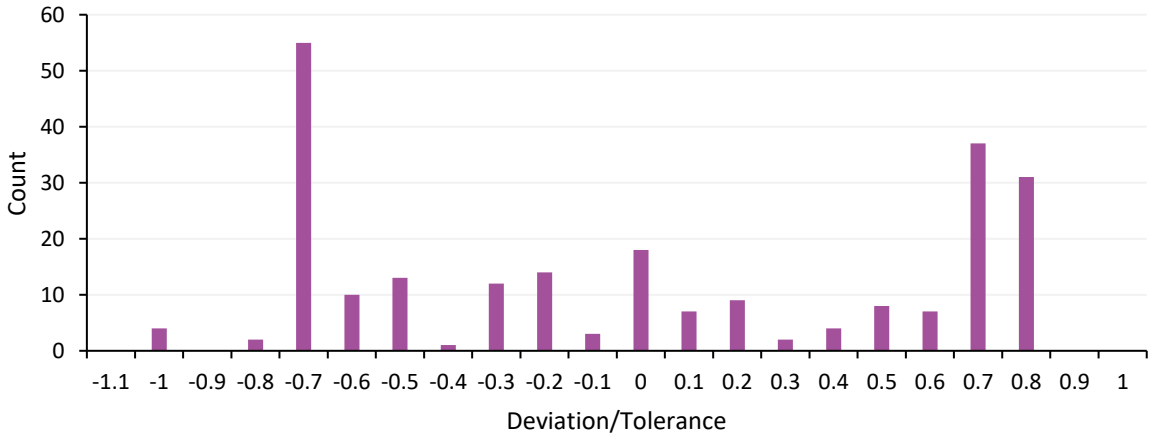
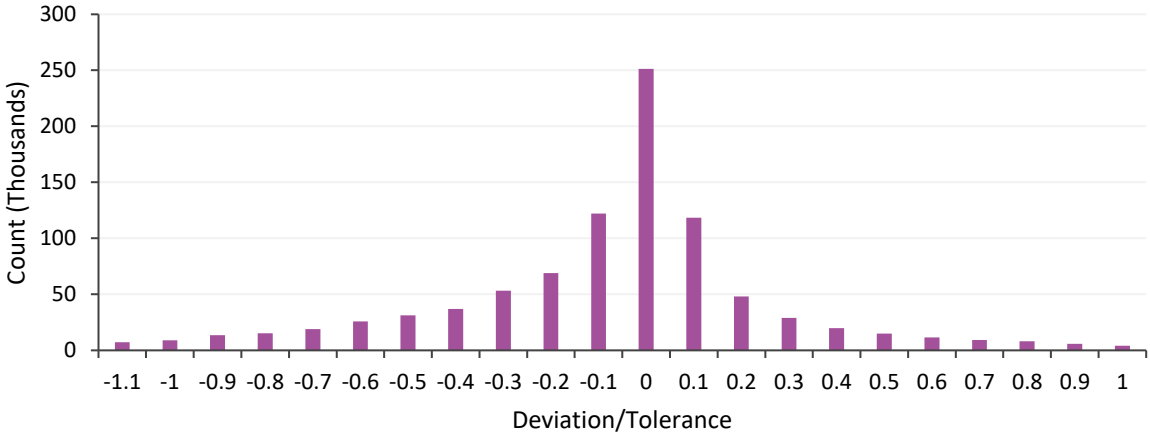


Figure 13 Example Facility Dispatch Deviation Distribution Suggesting Normal Operation

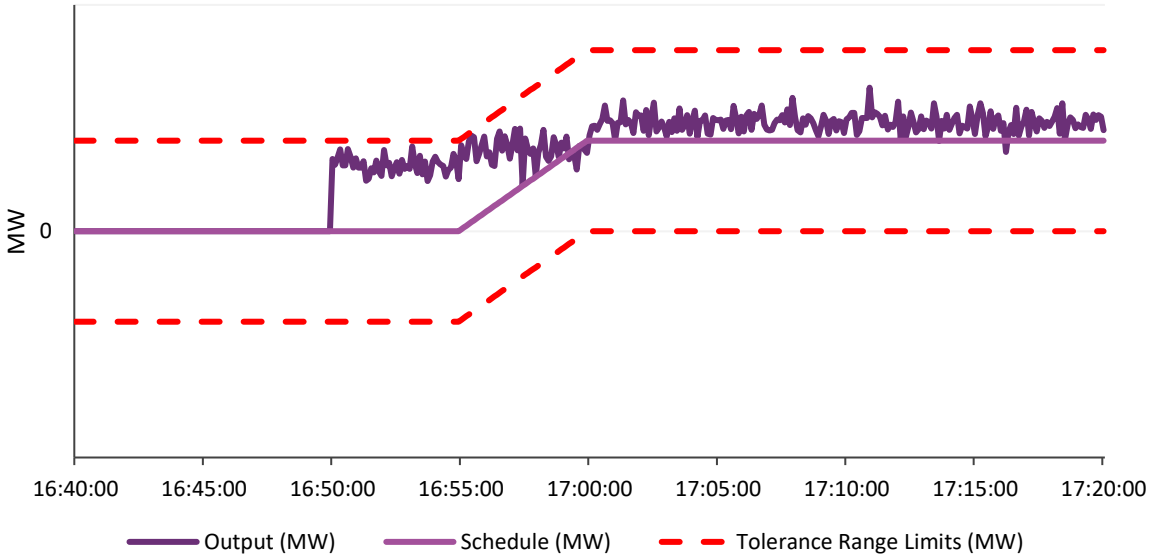


6.7.2 Facilities Failing to Synchronise

Figure 14 illustrates an example of a Facility synchronising when its Dispatch Instructions (Schedule) indicated that it should remain off, while its output remained within its Tolerance Range.

Such behaviour can lead to inefficient Market Outcomes and adverse impacts to Power System Security and Power System Reliability, and AEMO considers it to be non-compliant with Clause 7.10.1 of the *ESM Rules*.

Figure 14 Facility Synchronising Without a Dispatch Instruction

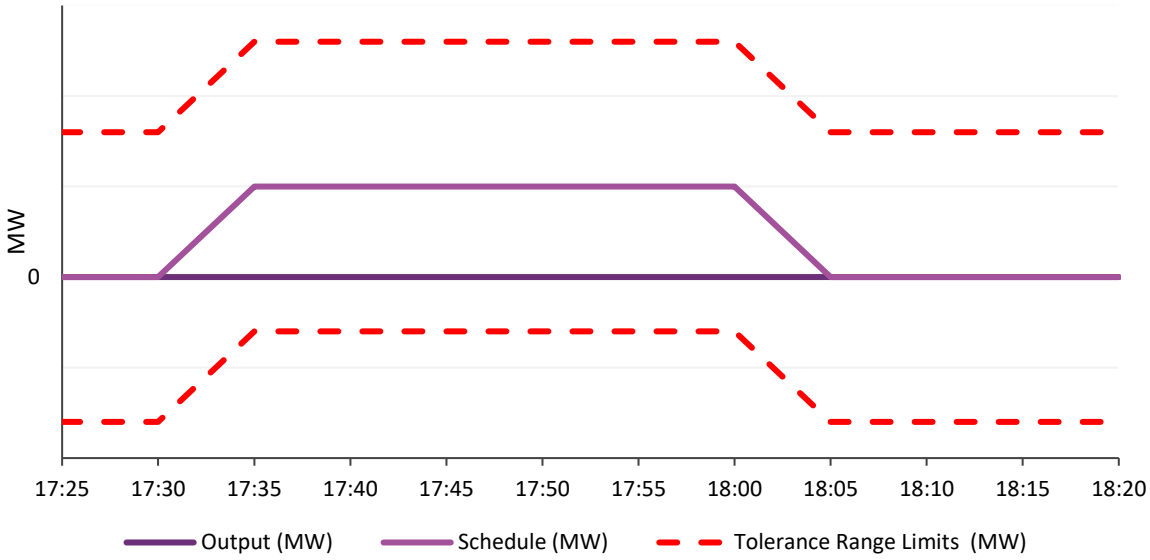


6.7.3 Facilities failing to Synchronise when Dispatched

Figure 15 illustrates an example of a Facility failing to synchronise when its Dispatch Instructions indicated that it should do so, while its output remained within its Tolerance Range.

Such behaviour can lead to inefficient Market Outcomes and adverse impacts to Power System Security and Power System Reliability, and AEMO considers it to be non-compliant with Clause 7.10.1 of the *ESM Rules*.

Figure 15 Facility Not Synchronising With a Dispatch Instruction



6.7.4 Effectiveness of the Tolerance Range

As Facilities remained within their Tolerance Ranges when engaging in these behaviours, the DCM does not detect these behaviours and does not generate dispatch non-compliance notifications.

As these behaviours have largely been observed in a small number of specific Facilities, AEMO has considered applying a tighter Facility Tolerance Range, applicable to only relevant Facilities.

Applying a tighter Facility Tolerance Range may disincentivise or assist more in detecting the behaviours described above. However:

- Unless the Tolerance Range (or Facility Tolerance Range) is extremely tight, Facilities may still be able to engage in these behaviours within the Tolerance Range;
- A Tolerance Range which is tight enough to effectively prevent and detect these behaviours, may be impractical to comply with, and may result in a large increase in unavoidable notifications; and
- Considering limitations in the DCM described in 7, a tighter Tolerance Range may increase the frequency of false positive notifications to the point that the Tolerance Range becomes ineffective.

As such, AEMO considers that a Facility Tolerance Range may currently be a less effective mechanism for detecting such potential non-compliances, than an alternative monitoring approach which detects potential non-compliances by Facilities while operating within their applicable Tolerance Range, such as those described in this section.

Implementing enhanced monitoring processes to this effect, will allow AEMO to identify a wider range of non-compliant behaviours and, where appropriate, report potential non-compliances to the Economic Regulation Authority.

However, AEMO may identify a need for Facility Tolerance Ranges in future Tolerance Range reviews, especially if improvements to the DCM allow for more reliable monitoring.

6.8 Treatment of Interruptible Loads

Interruptible Loads are Non-Dispatchable Loads whose consumption can be curtailed automatically in response to a change in system frequency. They do not receive energy setpoints from AEMO, and therefore it is meaningless to apply a Tolerance Range for the purpose of monitoring compliance to such a setpoint.

Therefore, AEMO considers that Tolerance Ranges are not relevant to Interruptible Loads.

7 Effectiveness of the DCM

This section outlines some known operational and IT issues with the DCM which limit its effectiveness.

7.1 DCM Non-Operational Period

Between 1 October 2023 and 2 May 2025, the Dispatch Compliance Monitor (DCM) experienced technical issues and was taken offline. As a result, the DCM was not operational for approximately seven months of Financial Year 2024. Consequently, the data presented in Figure 4 shows a significantly reduced number of non-compliance notifications during this period, reflecting the absence of monitoring rather than an actual improvement in compliance.

7.2 Timestamp Misalignment

The sent-out megawatt value used by the DCM sometimes lags the Facilities' actual sent-out megawatt value by up to 30 seconds. This misalignment causes the DCM to compare expected Facility output for a given time against actual output from up to 30 seconds earlier, resulting in a high number of false positive notifications.

The issue is becoming more pronounced with the increasing presence of utility-scale batteries in the South-West Interconnected System (SWIS), as these facilities are capable of high ramp rates and hence large changes in output within a 30 second period, and their Tolerance Range is limited by their Name Plate Capacity rather than their Ramp Rate.

7.3 Automatic Generation Control (AGC) Lag

For most Facilities, Dispatch Targets or Dispatch Caps are communicated to Facilities from AEMO through the AGC system. AEMO sends progressive setpoints to Facilities to achieve the required dispatch profile as described in the *Technical Specification: Automatic Generation Control, SCADA Dispatch Instructions and Fast start Facility Operational Behaviour.*

Due to infrastructure limitations, Facilities experience a delay of up to 30 seconds in receiving their AGC signals from AEMO. As an example, Figure 16 illustrates a delay of about 30 seconds between the AGC signal and the Facility response.

The DCM does not currently account for this lag, meaning Facilities may only receive Dispatch Instructions up to 30 seconds later than assumed by the DCM. As a result, at the start of each Dispatch Interval, Facilities are effectively already lagging behind their expected response and potentially already outside their Tolerance Range, and may not be able to return to their expected dispatch profile within the interval.

While such Facilities are technically outside of their Tolerance Range, this may not be a breach of Clause 7.10.1 as it results from signal delay, not Facility non-compliance. As such, many of these notifications may be false positives.

This issue is becoming more pronounced with the increasing presence of utility-scale batteries in the South-West Interconnected System (SWIS), as these facilities are capable of high ramp rates and hence large changes in output within a 30 second period, resulting in larger discrepancies between AGC signals and Facility output.

Figure 16 AGC Signal and Facility Output

7.4 Droop Response

The DCM does not incorporate the droop response mechanism implemented in the SWIS. As a result, Facilities providing droop response to frequency deviations may receive false positive notifications. Facilities with low ramp rates are particularly sensitive to this, as it takes them longer to return to their expected dispatch profile after a (comparatively faster) droop response.

8 Outcome of the Review

Drawing on the analysis presented in Section 6 and the technical issues described in Section 7, AEMO has determined that:

1. **The current Tolerance Ranges will remain unchanged for Scheduled and Semi-Scheduled Facilities.**
   AEMO's analysis indicates that there is no immediate need to tighten or relax the existing Tolerance Ranges. Changes in market design have not resulted in a material change in typical non-compliance rates or magnitudes, and an analysis of fleet-wide aggregated dispatch deviations indicates that total deviations do not materially impact Power System Security, Power System Reliability, or market costs.
2. **Demand Side Programmes and Interruptible Loads will not have an applicable Tolerance Range.**
   The provisions of Clause 7.10.1 and section 3.21 of the ESM Rules are not applicable to Interruptible Loads or Demand Side Programmes, and therefore Tolerance Ranges are not applicable to these Facility types.
3. **No Facility Tolerance Ranges will be applied.**
   AEMO did not identify any Facilities requiring relaxed Facility Tolerance Ranges due to Facility-specific characteristics. AEMO observed some instances of Facility behaviours with the potential to impact Power System Security and Power System Reliability, but determined that tighter Facility Tolerance Ranges are not likely to be an effective measure for detecting or disincentivising these behaviours, partly due to current issues with the DCM.

Additionally, AEMO has identified the following next steps to improve dispatch compliance monitoring:

4. **AEMO will investigate resolving issues within the DCM.**
   A large number of DCM notifications are false positives driven by limitations in the DCM, rather than genuine compliance issues, which limit the value of DCM notifications and would only be exacerbated if Tolerance Ranges were to be tightened. Resolving these issues will improve the effectiveness of the DCM regardless of Tolerance Range settings.
5. **AEMO will develop enhanced monitoring processes to complement the DCM.**
   AEMO has identified several non compliant behaviours with the potential to impact market effectiveness, Power System Security, or Power System Reliability, for which the DCM is not an effective monitoring tool, even if tighter Tolerance Ranges were implemented. New processes to monitor for such behaviours will strengthen AEMO's ability to identify breaches of Clauses 7.10.1 and 7.10.3 of the ESM Rules.
6. **AEMO will monitor the need for Facility Tolerance Ranges.**
   In the next Tolerance Range review, AEMO will consider the need for tighter Facility Tolerance Ranges for specific Facilities based on ongoing observations of potential non-compliances, operational experience with enhanced monitoring processes, and improved DCM capabilities.

AEMO will report on progress in the next Tolerance Range review.

9 Consultation

9.1 Process

In accordance with the *WEM Procedure: Dispatch Compliance* paragraphs 2.2.1 and 2.2.2, AEMO must consult with Rule Participants on any proposed Tolerance Range and must allow a minimum of 20 Business Days for Rule Participants to make a submission.

AEMO published the proposed Tolerance Range on 15 April 2026 and notified Rule Participants via a Market Message. The consultation period closed on 15 May 2026.

9.2 Submissions Received During Consultation Period

AEMO received one submission on the proposed Tolerance Range. The submission was received from Synergy and is summarised in Table 3.

Synergy also provided additional confidential attachments for the sole purpose of considering DCM functionality and improvements, which have been withheld from Synergy's submission published on the WEM Website.

Table 3 Summary of Feedback

Respondent	Section	Summary of Feedback	AEMO response
Synergy	8	Synergy is supportive of the review outcomes.	N/A
	7.3	Synergy has observed the time lag described in this section, noting that a delay of 10-15 seconds is common.	N/A
	7.4	Synergy suggests that mandatory droop response for all generation facilities, in all intervals, should be considered by the DCM.	AEMO will investigate incorporating droop response into the DCM.

9.3 Changes After Consultation

There were no changes to the report after consultation.

A1. Glossary

This document uses many terms that have meanings defined in the *Electricity System and Market Rules (ESM Rules).* The *ESM Rules* meanings are adopted unless otherwise specified.

Table 4 Glossary of terms and acronyms used in this report

Term	Definition
AEMO	Australian Energy Market Operator: The entity responsible for operating the Wholesale Electricity Market and managing Power System Security in the SWIS. (*ESM Rules*, Clause 2.1A)
AGC	Automatic Generation Control System: The system into which Dispatch Targets or Dispatch Caps are entered and processed by AEMO for Registered Facilities operating on automatic generation control.
DCM	Dispatch Compliance Monitor: The tool used by AEMO to identify and issue Dispatch Non-Compliance Notifications.
DSP	Demand Side Programme: Means a Facility registered in accordance with Clause 2.29.5A.
ERA	Economic Regulation Authority: The body established under Section 4(1) of the Economic Regulation Authority Act (WA).
ESM Rules	*Electricity System and Market Rules:* The WEM and the SWIS are governed by the *Electricity System and Market Rules*. See https://www.wa.gov.au/government/document-collections/electricity-system-and-market-rules
Facility Tolerance Range	Means the amount, in MW, determined by AEMO under Clause 2.13.17(b)(iii) in relation to a specific Facility, as varied under Clause 2.13.20, as applicable.
FCESS	Frequency Control Essential System Services: Services required to maintain Power System Security and Power System Reliability, including Regulation Raise/Lower, Contingency Raise/Lower, and Rate of Change of Frequency (RoCoF) Control Service. These are co-optimised with Energy within WEMDE. (*ESM Rules*, Clause 3.11.2(b)).
MWO	Mega Watt Output: The term used by the NEM in place of Name Plate Capacity (NPC) as used in the WEM.
NPC	Name Plate Capacity: The total capacity of the Machine as approved by AEMO.
PDI	Primary Dispatch Interval: The first Dispatch Interval in a Dispatch Schedule, from which operative Dispatch Instructions and Market Clearing Prices are determined.
ROC	Rate of Change: A term used in the NEM in place of the Ramp Rate as used in the WEM.
RR	Ramp Rate: The AEMO approved rate at which the Facility can ramp up or ramp down.
Tolerance Range	Means the amount, in MW, determined by AEMO under Clause 2.13.16 of the *ESM Rules*.
WEM	Wholesale Electricity Market: The market for the wholesale sale and purchase of electricity in the SWIS. (*ESM Rules*, Clause 1.1.2)