



**Energy Transformation  
Taskforce**

# Operational Planning and PASA Framework

Information Paper

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**Energy Transformation Taskforce**

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# 1. Purpose

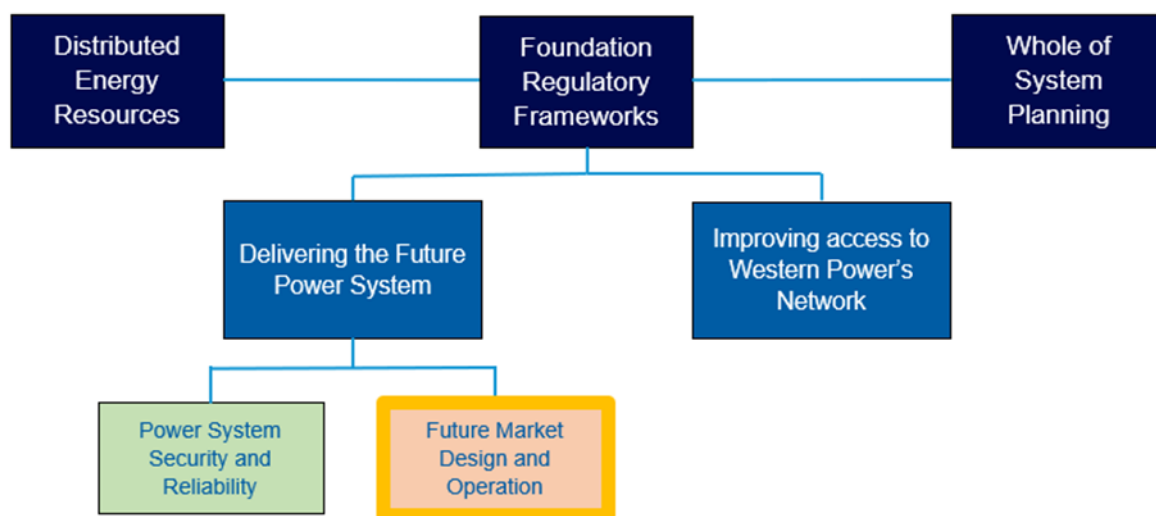
## 1.1 The Energy Transformation Strategy

This paper forms part of the work to deliver the Energy Transformation Strategy. This is the Western Australian Government's strategy to respond to the energy transformation underway and to plan for the future of our power system. The delivery of the Energy Transformation Strategy is being overseen by the Energy Transformation Taskforce (Taskforce), which was established on 20 May 2019. The Taskforce is being supported by the Energy Transformation Implementation Unit (ETIU), a dedicated unit within Energy Policy WA, a sub-department of the Department of Mines, Industry Regulation, and Safety.

More information on the Energy Transformation Strategy, the Taskforce, and ETIU can be found on the Energy Transformation website at [www.wa.gov.au/organisation/energy-policy-wa](http://www.wa.gov.au/organisation/energy-policy-wa).

This paper is prepared as part of the Future Market Design and Operation project (highlighted in Figure 1) within the Foundation Regulatory Frameworks work stream of the Energy Transformation Strategy.

Figure 1: Energy Transformation Strategy work streams



The Future Market Design and Operation project is undertaking improvements to the design and functioning of the Wholesale Electricity Market (WEM). These include:

- modernising WEM arrangements to implement a Security-Constrained Economic Dispatch (SCED) market design that optimises the benefits of the introduction of constrained network access for Western Power's network; and
- implementing a new framework for acquiring and providing Essential System Services (ESS).

## 1.2 The purpose of this paper

The purpose of this paper is to set out issues and design decisions by the Taskforce relating to operational planning for Projected Assessment of System Adequacy (PASA) and its processes under SCED which are planned to be introduced in the WEM from 1 October 2022.

The Taskforce design decisions in this paper specifically address matters relating to Medium Term PASA and Short Term PASA in respect of the adequacy of generation to meet demand, ESS shortfalls, and system reliability. This paper builds on the design decisions outlined in the following Taskforce papers:<sup>1</sup>

- [Energy Scheduling and Dispatch](#)
- [Outage Planning and Management](#)
- [Essential System Services Scheduling and Dispatch](#)
- [Revising the Operating States and Contingency Events Frameworks in the SWIS](#)

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<sup>1</sup> All Taskforce Information Papers are accessible through the Energy Transformation Strategy section of the Energy Policy WA website at [www.energy.wa.gov.au](http://www.energy.wa.gov.au)

## 2. Introduction to Operational planning

### 2.1 Background and case for change

The Projected Assessment of System Adequacy (PASA) framework in the WEM Rules sets out the processes Rule Participants and the Australian Energy Market Operator (AEMO) must follow to ensure forecasting and assessment of system adequacy to maintain power system security and reliability.

Primarily, the PASA is an assessment of whether there is sufficient available capacity to meet anticipated demand and maintain power system operating standards, allowing for future uncertainty such as:

- changes in weather patterns and events;
- planned and unplanned outage events;
- availability and variability of intermittent generation;
- availability of synchronous generation;
- availability of service providers;
- the impact and variability of embedded generation; and
- the impact of network constraints.

The management of forecast and assessment of system adequacy in the new constrained network environment will be essential to the secure and reliable operation of the power system.

The existing PASA framework and forecasting definitions were established in the context of an unconstrained network framework. The move to a constrained access framework where network constraints are expected to bind more frequently requires the amendment of the PASA framework to ensure it remains fit-for-purpose, provides the necessary information to enable AEMO to maintain system security and reliability, is not administratively cumbersome for AEMO and Rule Participants,<sup>2</sup> and provides sufficient transparency and certainty to the market to inform effective decision-making.

In addition to the move to constrained network access, the PASA framework and processes need to reflect other anticipated future characteristics of the South West Interconnected System, including:

- a move to SCED;
- a changing technology mix, characterised by higher levels of large-scale Variable Renewable Energy;
- greater penetration of Battery Energy Storage Systems;
- increased levels of Distributed Energy Resources (DER); and
- higher penetration of end-use appliances that are responsive to prices and demand (i.e. Demand Response).

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<sup>2</sup> In the context of the PASA framework, Rule Participants includes all Market Participants, and the Network Operator.

## 2.2 Overview of current arrangements

The Medium-Term PASA (MT PASA) process currently provides a view of the adequacy of available supply to meet expected demand on a weekly basis, over a three-year-ahead planning horizon. The MT PASA considers data regarding approved generation outages, transmission network outages, Demand Side Management capacity, and planned changes to installed capacity and ESS capabilities as well as energy constraints. AEMO uses the assembled data to assist it in:

- setting ESS Requirements over the coming year;
- outage planning for Registered Facilities; and
- assessing the availability of Facilities providing Capacity Credits, and the availability of other capacity (i.e. facilities without Capacity Credits).

The MT PASA report is published monthly on the AEMO website and is used by market participants to assist in their outage planning.

The Short Term PASA (ST PASA) process provides a view of the adequacy of available supply to meet expected demand in the short term (six-hourly intervals over a three-week planning horizon). This adequacy assessment is an ongoing activity as generator and network outages are submitted to AEMO and assessed, forced outages occur, and forecast demand changes.

AEMO is required to publish a ST PASA report on a weekly basis which shows peak load, reserve margin<sup>3</sup> and various other calculated values over the date range, as well as a list of approved generation outages, commissioning tests, and known transmission outages where they impact the availability of generation.

## 2.3. Current Reserve Margin

AEMO's PASA assessments are used to make determinations on outage approvals. That is, in approving outages AEMO considers whether there will be an adequate reserve margin present. AEMO's assessment also includes consideration of the current Ready Reserve Criteria, which caters for scarcity of Ancillary Services. These assessments are supplemented by manual power system studies conducted by AEMO to investigate the impact of specific network outages on power system security and power system reliability.

When AEMO identifies through PASA that the reserve margin is too low, a previously approved outage can be either cancelled, rescheduled, or recalled. However, as the ST PASA report is published weekly, AEMO is sometimes required to intervene during the intra-publication period in response to up-to-date forecasts and information.

If there are relatively minor shortages in Ancillary Services quantities in real time, AEMO generally manages the problem through short-term re-dispatch of the Synergy Portfolio. In more severe cases, AEMO may constrain Market Participants through dispatch and activating of Backup Load Following Services.

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<sup>3</sup> The reserve margin is the capacity remaining after approving outages to meet forecast peak demand, allowing for contingencies.

The current granularity of modelling and content published in MT and ST PASAs do not provide the desired level of transparency to the market in relation to when a risk to reserve margin may be emerging. This results in insufficient time for Market Participants to respond efficiently, such as by offering more capacity.

## 2.3.1 Summary of Issues

As the WEM has changed over time with an ever-greater proportion of demand being served by intermittent generation sources, limitations in the existing PASA methodologies have become increasingly evident.

The assessment of power system adequacy in a constrained environment requires more than the single estimate of demand or single forecast of non-scheduled generation outputs currently used and specified in the WEM Rules. Rather, it needs to reflect an understanding of how risks emerge and change as conditions vary on the power system. The management of those risks requires an assessment of likelihood, requiring the PASA to be able to reflect a variety of potential demand and dispatch outcomes, as well as allowing for multiple levels of uncertainty as the timeframe moves closer to the dispatch interval.

The existing PASA framework has the following deficiencies in the context of a move to SCED.

### Power System Reliability

- The current PASA rules have no direct linkage to reliability principles, without which it is more difficult to consistently drive specific intervention outcomes to resolve reliability risks before they eventuate.
- The move to SCED means that the present reserve margin calculation methodology is no longer sufficiently sophisticated to properly account for the impact of network constraints and the increasing level of variable renewable energy sources on the power system, which change in real-time and require more dynamic and flexible management.
- There is lack of clarity in the PASA framework on the treatment of generation undergoing a Commissioning Test (e.g. new generating system or following significant maintenance), which can result in capacity being assessed as available when this may not be the case (e.g. a new facility that has yet to demonstrate stable and reliable operation). This can result in an under-estimation of reliability risk.
- The framework does not allow flexibility for AEMO to determine the most appropriate forecasts to use when determining PASA. In particular, the framework does not consider that:
  - the assumptions for demand three years in advance in the MT PASA horizon should necessarily be different to an assessment three weeks in advance in the ST PASA horizon;
  - the assessment of available demand side management capacity and storage capacity changes over different time domains; and
  - non-scheduled generation output varies over time.

### Power System Security

- The publication period of both MT and ST PASA is insufficiently frequent, and the granularity of information is not adequate to inform decision-making.



- The PASA does not contain detailed information on binding network constraints and ESS requirements.
- The use of statistical estimation of non-scheduled generation output for determining the reserve margin does not allow for the range of potential outcomes that may occur and the impact of these potential outcomes on network constraints.

#### **Notification and Intervention Criteria**

- There is insufficient guidance within the PASA framework on risk notification for participants, the ability for AEMO to intervene when system security problems arise, and the resulting obligations on participants.

## 3. A new PASA framework

While the existing PASA framework contained in the WEM Rules will remain broadly fit-for-purpose under the new SCED market design, some changes to the framework are required to address the deficiencies identified above in Section 2. Section 3 outlines the key features of the new WEM PASA framework endorsed by the Taskforce.

### 3.1 Framework improvements

AEMO's PASA processes collect, analyse, and publish information that will inform the market about forecasts of supply and demand, and associated risks to power system security and reliability.

#### 3.1.1 Timeframes and granularity

The PASA processes will be administered over two timeframes:

1. MT PASA will be retained for the 3-year-ahead planning horizon with a requirement to publish daily summary information<sup>4</sup>.
2. ST PASA will be modified to a week-ahead planning horizon and will be reported at a 30-minute resolution.

The timeframes and granularity of the assessments are currently specified in the WEM Rules, along with the specific data that is required to be published. However, this approach reduces AEMO's ability to flexibly adjust timeframes and granularity of the assessments it requires in order to assess power system security and reliability. A minimum requirement to publish within a specified period will be retained in the rules (e.g. daily, weekly, etc), with flexibility in the WEM Procedure to outline a more frequent publication period in consultation with industry, and to specify publication timeframes (e.g. published on a Monday after 10AM).

To improve its ability to flexibly respond to changes in the power system, the new PASA framework will be described in a new WEM Procedure, prepared by AEMO.

#### 3.1.2 PASA report format and content

The WEM Rules currently specify what data will be made public as part of the PASA publications. The data content and format requirements for publication are restrictive and not fit for purpose for constrained dispatch in the future market. For instance, they do not include data regarding how often a particular network constraint is likely to bind.

The data used in developing MT and ST PASA reports should remain public. However, the data used and the format in which it is published should be able to be changed over time to reflect the changing needs of Rule Participants and the power system. To enable this flexibility, the format and content of PASA reports will be prescribed in a WEM Procedure, prepared by AEMO.

#### 3.1.3 Information requirements for PASA

Currently, the WEM Rules outline the requirements for Rule Participants to submit information for PASA; however, the WEM Rules contain details that will be superseded by various elements of the

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<sup>4</sup> Although daily summary data is published, AEMO may use a lower resolution model (e.g. 30-minute resolution modelling) to determine higher risk periods within the day such as system peak or system low.

new SCED market design (such as bids and offer information and outage intention plan data). The WEM Rules place inflexible requirements on Rule Participants to provide specific data unless otherwise exempted by AEMO, requiring AEMO to outline an exemption process in a Power System Operation Procedure. This creates an administrative burden for AEMO because of the lack of flexibility to change information requirements without first undertaking the onerous rule change process.

The new PASA framework will allow for data requirements to be documented in a WEM Procedure, prepared by AEMO.

### **3.1.4 Forecasts used for Operational Planning**

Assessing whether there is sufficient network capacity available when approving outage submissions is important in order to ensure power system security and reliability. However, the current framework lacks flexibility for AEMO to determine the most appropriate forecast to use when making this assessment (i.e. assessment three years in advance will have different forecasting assumptions to an assessment two weeks from the commencement of the outage).

The framework should not prescribe the type of forecast quantities to be used or published in the PASA, but rather set out an overarching PASA objective to adhere to power system security and reliability principles.

The framework should allow for flexibility to use the most appropriate forecast quantities in order to assess adequacy over the various PASA timeframes in order to meet this objective. Forecast quantities would include those for demand, non-scheduled generation, Demand Side Programs, and energy storage.

AEMO will be required to set out the methodologies it uses to determine the forecasts to be used in a WEM Procedure.

### **3.1.5 Power System Security and Reliability Assessment**

The current reserve margin methodology used in the PASA model is a simplistic indicator of available capacity and is not in itself a measure of risks to security or reliability of supply. The PASA processes should cater for different levels of uncertainty as the timeframe moves from further out to closer to the dispatch interval.

As a general principle, the more the PASA model is capable of reflecting actual power system conditions, the more reliable will be the assessment of security and reliability risks. Moving to a shorter modelling horizon (such as a one-week horizon for ST PASA) will allow the assessment to better reflect:

- demand forecasts based on recent actual dispatch, allowing for increasing levels of forecast uncertainty towards the end of the forecast time horizon;
- actual, recent Market Participant bidding information (price-quantity pairs), including a Facility's ESS capability and offers;
- actual information from the pre-dispatch process (where information on Market Participant bidding is available up to a week ahead), indicating likely dispatch outcomes;
- consideration of network constraints based on the latest projected outage conditions; and

- consideration of probabilistic approaches for linked events, such as high wind speeds leading to wind turbines disconnecting and bushfires affecting multiple transmission lines.

Under the new Operating States framework outlined in the Taskforce Information Paper: [Revising the Operating States and Contingency Events Framework in the SWIS](#), AEMO will develop and publish the Reliability Standard Implementation Procedure that will include key criterion for how AEMO will assess reliability over the different PASA horizons. PASA must be conducted in reference to the Reliability Standard Implementation Procedure, with this being specified in the PASA objective and AEMO being required to document the methodology it uses in conducting the assessment over a range of possible outcomes in a WEM Procedure. The methodology will include consideration of:

- events being considered in the assessment (e.g. planned/forced outages);
- treatment of different situations (e.g. commissioning); and
- the varying types of forecasts used over different time periods and circumstances and how increasing levels of uncertainty over the forecast period are modelled.

The WEM Procedure will outline the use of a probabilistic modelling approach similar to that used in the National Electricity Market, with potential for the following three types of modelling analyses to be used to demonstrate how to meet the reliability standard and ESS requirements:

1. A reliability run, to forecast Unserved energy (USE)
2. A constraint run, to identify which constraints are likely to bind
3. A Loss of Load Probability run, to identify which intervals are at greater risk of unserved energy.

The MT PASA would provide results that show the expectation and distribution of key results such as the level of unserved energy, ESS availability, and constraints. These results will then be used by AEMO to determine whether intervention is required to address power system security and reliability issues.

## 3.2 Taskforce design decision – PASA Framework

The Taskforce has determined that:

- The planning horizon for the Medium-term PASA (MT PASA) will be outlined in the Rules as a three-year-ahead planning horizon with summary reporting at least at a daily resolution, with flexibility to increase frequency and identify specific publication timeframes in the WEM Procedure
- The planning horizon for the Short-term PASA (ST PASA) will be outlined in the WEM Rules to be a week-ahead planning horizon and reported at least at a 30-minute resolution, with flexibility to increase frequency and identify specific publication timeframes in the WEM Procedure
- An overarching PASA objective will be outlined in the WEM Rules to require AEMO to adhere to Power System Security and Reliability Principles when undertaking forecasting and operational planning activities.
- The data used in determining PASA will be made public, subject to any data confidentiality provisions.

- AEMO will be required to document in a WEM Procedure the:
  - timeframe and granularity of assessments;
  - format and content of PASA reports;
  - assessment methodologies used to determine risks to Power System Security and Power System Reliability over a range of possible outcomes; and
  - information requirements for Rule Participants.

### 3.3 Declaration of Low Reserve Conditions and Intervention Criteria

#### 3.3.1 New Reserve Level Declaration and Notification

The current Dispatch Advisory mechanism in the WEM Rules has limited capability to identify and communicate different levels of risk to the market, e.g. a risk that is possible, likely, or very likely to occur.

In order to improve identification of forecast risks and provide more information to the market, AEMO will be required to declare Low Reserve Conditions where the:

- risk of having insufficient capacity to meet the expected demand has become unacceptable as detailed in the Reliability Standard Implementation Procedure; or
- probability of not being able to maintain Power System Security or Power System Reliability without load shedding has become high.

The new PASA process will allow for a more probabilistic determination of risk, including allowance for forecasting uncertainty in the prevailing conditions. These estimates could be based on past reserve forecasting performance regarding demand, intermittent generation output, and availability of scheduled generation. This revised approach will result in Low Reserve Condition notifications by AEMO reflecting the varying likelihood of Low Reserve Conditions over multiple operating conditions and over different forecasting timeframes.

The determination of Low Reserve Conditions based on different levels of risks will indicate how likely a Low Reserve event is to occur based on AEMO's PASA assessments. AEMO will be required to document the different Low Reserve Condition levels in a WEM Procedure along with the process for notification and will be required to notify the market as soon as practicable when a Low Reserve condition is identified.

The Taskforce has determined that:

The WEM Rules will be amended, requiring AEMO to:

- identify Low Reserve Conditions.
- describe the assessment criteria and different likelihood levels used in a WEM Procedure;
- describe the notification arrangements in the WEM Procedure; and

- publish any Low Reserve Conditions as soon as practicable, including circumstances that may require AEMO to intervene.

### 3.3.2 Intervention Criteria

The aim of describing a Low Reserve Condition is ultimately to maintain power system security and reliability, in the first instance providing transparency to the market to enable it to respond, but allowing for AEMO to intervene if the problem remains unresolved.

When a Low Reserve Condition has been identified and notified to the market, AEMO may intervene in different ways to resolve the issue. As a principle, AEMO will notify the market prior to intervening, unless there is insufficient time to do so.

AEMO's response to anticipated Low Reserve Conditions will vary across different timeframes and Registered Facility availability. Depending on the timeframe, AEMO may be able to utilise existing powers (e.g. cancel/reject outages) or may need to initiate directions under the new market arrangements. These could include directions to offer ESS where accredited ESS capacity is available but is not being offered, or directions to commit capacity where there are Reserve Capacity Obligations in order to manage forecast energy shortfalls.

The general principles for intervention by AEMO will be specified in the WEM Rules, allowing for discretion for AEMO to operate outside these general principles where reasonably necessary in order to maintain Power System Security or Power System. AEMO will be required to describe such circumstances in a WEM Procedure.

The general types of intervention will be used in the following order of priority:

1. Where a risk has been identified but the probability assessed is low or AEMO intervention to resolve the risk could reasonably be made at a later time, allow the market to respond efficiently.
2. Re-schedule outages where possible ahead of time, to avoid late cancellation of outages.
3. Where a lack of available capacity for dispatch is identified, but there is still available capacity not on outage – direct participants with Reserve Capacity Obligations and available capacity not on outage to offer.
4. Recall outages.
5. Where a lack of ESS capacity is identified, but there is still available capacity not on outage, direct:
  - a. first, any facility holding a Supplementary ESS Mechanism award for the relevant shortfall to offer first; and then
  - b. any facility accredited for the relevant ESS to offer.
6. Direct participants with available capacity to operate at a specific level or in a particular way based on registered capability.
7. Procure Supplementary Reserve Capacity or trigger the Supplementary ESS Mechanism.

The Taskforce has determined that:

- The existing capability for AEMO to intervene only after market notification will be retained, except where the condition is identified with very short notice, in which case market notification will be made by AEMO as soon as practicable.
- General principles will be included in the WEM Rules outlining the circumstances for intervention by AEMO if a Low Reserve Condition is declared.
- AEMO will be required to develop a methodology in a WEM Procedure that describes the process for AEMO to intervene, adhering to the general intervention principles.