

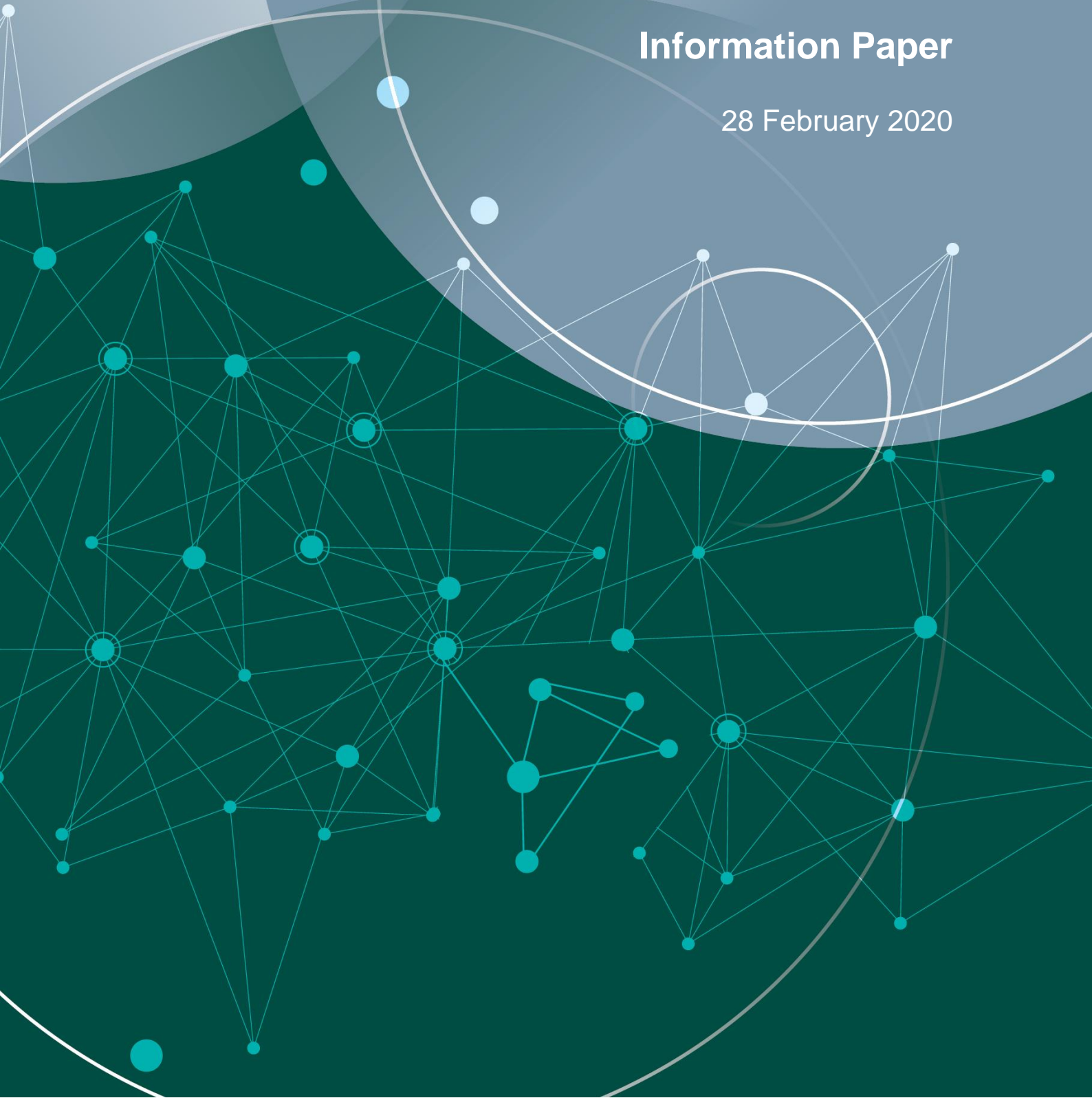


**Energy Transformation
Taskforce**

Revising the Operating States and Contingency Events Frameworks in the SWIS

Information Paper

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Energy Transformation Taskforce

28 Barrack Street

Perth WA 6000

Locked Bag 11 Cloisters Square WA 6850

Main Switchboard: 08 6551 2777

TTY (Hearing Impaired): 13 36 77

www.energy.wa.gov.au

Enquiries about this report should be directed to:

Mena Gilchrist, Assistant Director - Power System Security and Reliability

Telephone: +61 (8) 6551 4655

Email: mena.gilchrist@energy.wa.gov.au

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Abbreviations

The following table provides a list of abbreviations and acronyms used throughout this document. Defined terms are identified in this document by capitals.

Term	Definition
AEMO	Australian Energy Market Operator
Authority	Economic Regulation Authority
DSP	Demand Side Program
ESS	Essential System Services
ETIU	Energy Transformation Implementation Unit
FOS	Frequency Operating Standards
PASA	Projected Assessment of System Adequacy
PSOP	Power System Operation Procedures
PSOWG	Power Systems Operation Working Group
SWIS	South West Interconnected System
Taskforce	Energy Transformation Taskforce
TDOWG	Transformation Design and Operation Working Group
WEM	Wholesale Electricity Market

1. Introduction

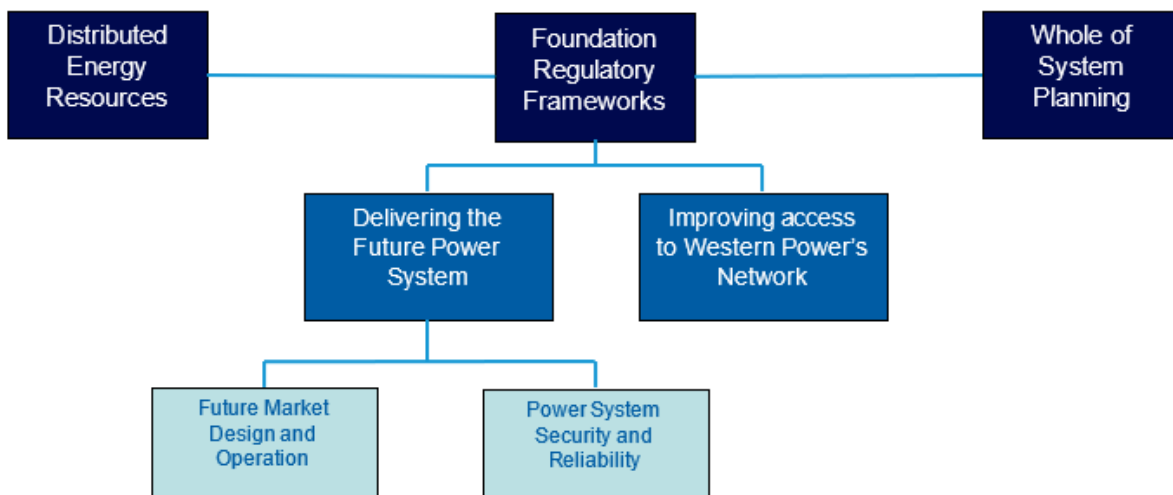
1.1 The Energy Transformation Strategy

On 6 March 2019, the Hon Bill Johnston MLA, Minister for Energy announced the McGowan Government's Energy Transformation Strategy (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 Strategy is being overseen by the Energy Transformation Taskforce (Taskforce), which was established on 20 May 2019. The Taskforce is supported by the Energy Transformation Implementation Unit, a dedicated unit within Energy Policy WA.

The Strategy is being delivered under three work streams. The revision of operating states and contingency events frameworks is part of the Delivering the Future Power System work stream, as shown in Figure 1 below. Elements of the work fit within both the Power System Security and Reliability project and the Future Market Design and Operation project, the latter of which is implementing Security-Constrained Economic Dispatch (SCED) in the Wholesale Electricity Market (WEM).

Figure 1.1: The Energy Transformation Strategy program structure



1.2 Operating states and contingency events frameworks

The frameworks for operating states and contingency events provide the mechanism for determining the secure and reliable operating boundaries of the power system, and actions the Australian Energy Market Operator (AEMO) may, or must, take to ensure that the South West Interconnected System (SWIS) is operating in a secure and reliable manner. This framework also determines when and how AEMO can intervene in the operation of the WEM to maintain or re-establish a secure and reliable power system.

Under the WEM Rules, AEMO must ensure the SWIS is operated in accordance with the Market Procedures and the Technical Envelope¹ for the applicable SWIS operating state.² Currently, three operating states are defined in Chapter 3 of the WEM Rules:

- Normal Operating State – The system is in a Normal Operating State when AEMO considers that the system is operating within the applicable Security and Equipment Limits³ and the conditions of the system are secure in accordance with the requirements of the Technical Envelope. The WEM Rules definition is explicit in that all specified conditions⁴ must be met for the power system to be in a Normal Operating State. AEMO must also refrain from any actions that would likely to result in moving to a High-Risk Operating State.
- High-Risk Operating State – The system is in a High-Risk Operating State when AEMO considers that a stated list of circumstances exist⁵ or are likely to exist within the next 15 minutes, or likely to exist at a time beyond the next 15 minutes and actions other than those allowed under the Normal Operating State must be implemented immediately by AEMO to moderate or avoid the circumstance. Examples of the circumstances which may exist are frequency or voltage deviations, unmet Ancillary Service⁶ requirements, fuel shortfalls, generator unavailability leading to load loss, or external factors such as bushfire or storms that may threaten power system security or reliability.
- Emergency Operating State – The system is in an Emergency Operating State when AEMO considers that a stated list of circumstances exist⁷ or are likely to exist within the next 15 minutes, or likely to exist after 15 minutes and actions other than those allowed under the Normal Operating State or High-Risk Operating State must be implemented immediately by AEMO to moderate or avoid the circumstance. Examples of the circumstances which may exist include significant frequency or voltage deviations, a significant generation shortfall, or involuntary load shedding.

While the concept of a contingency event as it relates to system operation is referred to in the WEM Rules, there is currently no definition for either 'contingency event' or 'credible contingency event'. A contingency event framework needs to be developed and established to support changes to the WEM and related regulatory frameworks being introduced as part of the Strategy, including:

- the creation of constraint equations by AEMO and the decisions to activate or de-activate them in short-term, operational timeframes;
- the determination of appropriate levels of Essential System Services (ESS) to meet Frequency Operating Standards (FOS) and other performance standards;

¹ The Technical Envelope represents the limits within which the SWIS can be operated in each operating state.

² The SWIS operating states define the boundaries in which to operate the power system securely.

³ A Security Limit means any technical limit on the operation of the SWIS as a whole, or in a region of the SWIS, necessary to maintain power system security, including both static and dynamic limits, and including limits to allow for and to manage contingencies. An Equipment Limit is any limit on the operation of a facility's equipment.

⁴ Listed under WEM Rules section 3.3.1.

⁵ Listed under WEM Rules section 3.4.1.

⁶ Under the new WEM arrangements to be implemented in 2022, Ancillary Services will be referred to as Essential System Services, reflecting their increasing role in maintaining energy security and reliability.

⁷ Listed under WEM Rules section 3.5.1.

- the assessment of appropriate generator performance standards to apply to a facility connecting to the SWIS; and
- the assessment of risks to power system security and reliability within planning timeframes (e.g. Projected Assessment of System Adequacy (PASA) and Outage management).

1.3 The case for change

This paper outlines modifications to the frameworks for operating states and contingency events to support the safe, reliable, and efficient operation of the SWIS into the future. This work is being undertaken in the context of significant changes to the design of the WEM being progressed under the Strategy.

The previous Taskforce information paper [Frequency Control Technical Arrangements](#) identified the following problems with the current SWIS operating states and contingency events frameworks:

- perverse possibility of being in multiple SWIS operating states at the same time (i.e. both Normal and High-Risk);
- possibility of being in no SWIS operating state (i.e. neither Normal nor High-Risk);
- lack of definitions for terms used to describe the conditions for the SWIS operating states (such as a 'significant generation shortfall'); and
- absence of two elements required to support the new ESS framework, namely:
 1. the concept of a credible contingency event; and
 2. the inclusion of a practical timeframe to respond to power system security and reliability risks.

The Taskforce has determined that addressing the above problems is required to implement the new SCED and ESS frameworks. The operating states framework is also fundamental to informing the actions AEMO may take, or is otherwise obligated to take, to ensure the power system is operated in accordance with the FOS.

The Taskforce approved changes to the FOS framework in November 2019, which are detailed in the Information Paper: [Revising Frequency Operating Standards in the SWIS](#). The implementation of the following changes will be progressed alongside the Amending Rules to implement changes to the FOS. This work is required to be complete by mid-2020 to ensure the effective operation of the SCED market model, which is scheduled to commence from 1 October 2022.

1.4 Design outcomes

In order to resolve the problems defined in Section 1.3 above, the Taskforce has determined that the revised operating states and contingency events frameworks should:

- separate reliability and security concepts in the WEM Rules in order to clarify the identification of security issues as opposed to reliability issues (see section 2.3);
- ensure AEMO has the powers necessary to manage the reliability and security of the power system;
- provide clarity and transparency on how power system security and reliability is maintained;
- describe the underlying conditions defining operating states in Market Procedures to enable them to evolve with changing technologies and operational needs over time;

- address ambiguities in the application of the operating states framework; and
- be consistent with the new SCED market model.

1.5 Consultation

Options for modifying the existing WEM operating states and contingency events framework have been developed by the Taskforce in close consultation with AEMO, Western Power, and industry stakeholders.

The former Power Systems Operation Working Group (PSOWG), formed under the Market Advisory Committee, was consulted on options for a suitable framework consistent with a move towards co-optimised dispatch of energy and ESS in November 2018. Further consultation with industry, through the Transformation Design and Operation Working Group (TDOWG), occurred on 12 February 2020.

Stakeholder views expressed through these consultation processes were broadly supportive of the changes, including increasing transparency regarding the actions available to AEMO and the timeframes over which actions would be taken.

2. Changes to the operating states framework

This section outlines amendments to the operating states framework, which will introduce new definitions or modify existing definitions to improve the clarity of actions required of AEMO and their timeframes.

2.1 Satisfactory and Secure Operating States

The Normal and High-Risk Operating States are outlined in sections 3.3 and 3.4 of the WEM Rules. The current definitions within the WEM Rules are highly prescriptive and present both barriers and uncertainty for AEMO taking actions to manage power system security consistent with good electricity industry practice. There is also no specific timeframe for AEMO to return the power system to a Normal Operating State.⁸

Replacing the current Normal and High-Risk Operating States definitions in the WEM Rules with the new terms of Satisfactory and Secure (aligned with those used in the National Electricity Market (NEM)), will remove the overly-prescriptive conditions currently hard-coded in the definitions, address the current blending of reliability and security concepts, and resolve the ambiguity and overlap between the current operating state definitions.

The Taskforce has endorsed the following terms and definitions:

- *Satisfactory Operating State* means the SWIS is operating within all relevant *Operating Standards, Equipment Limits*, and is *Stable*; and
- *Secure Operating State* means the SWIS is able to return to a *Satisfactory Operating State* following a *Credible Contingency Event*, following the appropriate *Power System Security Principles*, and having regard to the *Technical Envelope*.

The term ‘stable’ is used in the new definition of a Satisfactory Operating State. While the term is not currently defined in the WEM Rules, proper consideration of power system stability is an important part of maintaining system security. Therefore, the Taskforce has endorsed the following definition:

- *Stable* means the SWIS is operating to all power system stability requirements as described in a Market Procedure.

In the WEM Rules, AEMO is required to document the process it follows in determining operating states in a Market Procedure. This requirement will be retained. A new WEM Rule will also be introduced to require AEMO to develop a Market Procedure for how it assesses power system stability. This Power System Stability Implementation Procedure will be linked to other processes, such as Outage assessment and the development of constraint equations.

The term ‘Equipment Limit’ is used in the new definition of a Satisfactory Operating State. The term is currently defined under WEM Rules section 3.2.1 as “...any limit on the operation of a Facility’s equipment that is provided as Standing Data for the Facility.” This definition restricts the ability of AEMO to use limits that vary with conditions (e.g. dynamic ratings, temperature-based limits, seasonal ratings, time-based limitations, or temporary limits). The definition will be amended to be less restrictive and to allow for other information provided to AEMO.

⁸ Under WEM Rules 3.4.5 and 3.5.6 the requirement is to return the power system to a Normal Operating State “as soon as practicable”.

The new definition endorsed by the Taskforce is:

- *Equipment Limit* means any limit on the operation of a Facility's equipment that is provided as Standing Data for the Facility, or otherwise provided to AEMO by a Participant for its Facility or equipment.

The new Secure Operating State refers to 'Power System Security Principles'. The Taskforce has endorsed the introduction of these new principles that AEMO must follow when maintaining power system security (discussed further in section 4 below). The principles, which will be contained within the WEM Rules, will improve clarity and transparency, and guide decision-making when competing options are available. Importantly, one of the key principles to be introduced is an allowable timeframe (30 minutes) for AEMO to respond to events on the power system and return to a Secure Operating State. This is not currently specified in the WEM Rules, resulting in overly conservative operational practices.

In introducing a Secure Operating State, the powers required by AEMO to ensure the power remains within this state must be determined. The Taskforce has decided that the powers already existing under a High-Risk Operating State (WEM Rules section 3.4.3) will be retained to ensure AEMO can maintain a Secure Operating State, or return the SWIS to a Secure Operating State. This provides AEMO with the ability to:

- cancel or defer outages that have not yet commenced;
- recall outages that have commenced or take other contingency actions in accordance with their outage contingency plans; and
- utilise the overload capacity of scheduled generators (as specified in Standing Data).

2.2 Emergency Operating State

Most jurisdictions allow for special provisions under emergency conditions, which generally entail notification requirements and the ability of the system operator to take necessary actions to restore the power system to normal operation.

The additional powers AEMO has when in the Emergency Operating State are covered in WEM Rules section 3.5.5. In summary in an Emergency Operating State, AEMO may:

- cancel or defer outages that have not yet commenced;
- recall outages that have commenced or take other contingency actions in accordance with their outage contingency plans;
- utilise the overload capacity of scheduled generators;
- direct any Market Participant to provide ESS;
- issue directions to Rule Participants to operate their Registered Facilities in specific ways; and
- take other actions as considered necessary, consistent with good electricity industry practice, to ensure the system is returned to normal.

The Emergency Operating State in the current WEM Rules is also referred to in the *Network Quality and Reliability of Supply Code 2005* to provide a limitation on the obligation to compensate customers for supply interruptions.

While the current Emergency Operating State concept will be retained, modifications will be made to clarify the criteria defining the operating state, remove wording inconsistencies, and define

conditions for the operating state less prescriptively in the WEM Rules, with further detail to be included in the Market Procedure. The Taskforce has determined that the WEM Rules will be modified, such that:

- the SWIS is in an *Emergency Operating State* when, in the reasonable opinion of AEMO, circumstances exist on the SWIS that impact AEMO's ability to comply with its core obligations under the WEM Rules; and
- while not limiting its ability to declare an *Emergency Operating State*, AEMO must describe example conditions in a Market Procedure for when it may declare an *Emergency Operating State*.

The additional powers AEMO has when in an Emergency Operating State will be modified as the power to cancel outages that have not already commenced, recall outages that have already commenced, and utilise the overload capacity of scheduled generators will now be covered under the new Secure Operating State. The following additional powers will be retained for the Emergency Operating State, such that AEMO may:

- direct any Market Participant to provide ESS;
- issue directions to Rule Participants to operate their Registered Facilities in specific ways; and
- take other actions as considered necessary, consistent with good electricity industry practice, to operate the SWIS in accordance with Power System Security Principles and Power System Reliability Principles (see section 2.3 below).

2.3 Reliable Operating State

While the currently defined Normal Operating State is primarily related to security standards (e.g. voltage, equipment limits, frequency and fault levels), the High-Risk and Emergency Operating States contain both security and reliability related items. As noted in section 2.1, these will be modified under the new framework. The adoption of a Reliable Operating State in the SWIS will clarify AEMO's requirements in terms of identifying and mitigating risks to power system reliability in the SWIS.

In the NEM, the power system is assessed to be in a Reliable Operating State when AEMO has not, and expects not to, disconnect any points of load connection, or initiate load shedding on the power system and it is AEMO's reasonable opinion that the power system meets the reliability standard, having regard to the reliability standard implementation guidelines.

Assessment of reliability is complex because it varies over different timeframes. For example, during power system operation assessing reliability is straight-forward as energy is either being supplied, or not. However, assessment of reliability over longer-term planning horizons (e.g. weeks, or years) requires a risk-based approach considering many variables, including forecasts, credible contingencies, and allowable events such as the dispatch of demand side management for energy purposes. For this reason, the definition of a Reliable Operating State will require that AEMO make clear the assessments and criteria which will be used to determine reliability risks via a new Market Procedure.

The Taskforce has endorsed the following definition and concept of a Reliable Operating State.

- The SWIS is in a *Reliable Operating State* when AEMO has not initiated any manual load shedding instructions, and does not expect to initiate any manual load shedding instructions, in accordance with the assessments and criteria identified in the new *Reliability Standard Implementation Procedure*.

The Reliability Standard Implementation Procedure will include how AEMO assesses reliability in relation to the following:

- Long-term PASA – assessment of generation, demand side programs, and network capacity over a ten-year period and published annually in the Electricity Statement of Opportunities;
- Medium-term PASA – assessment of power system adequacy over a medium time horizon (currently a weekly basis for a three-year time horizon);
- Short-term PASA - assessment of power system adequacy over a short-term time horizon (currently a six-hourly basis over a three-week time horizon);
- pre-dispatch – assessment of power system adequacy over the pre-dispatch timeframe:⁹
 - 5-minute resolution, 2-hour timeframe, published every 5 minutes;
 - 30-minute resolution, 48-hour timeframe, published every 30 minutes; and
 - 30-minute resolution, 6-day timeframe, published daily.
- available capacity provided by intermittent generators and demand side programs in relation to PASA and pre-dispatch;
- implementation of outage risk levels;
- implementation of the Dispatch Criteria; and
- unserved energy.

2.4 Power System Reliability and Adequacy

In addition to defining the Reliable Operating State, it is also necessary to revisit the definitions of Power System Reliability and Power System Adequacy to ensure they are fit for purpose in the new framework.

The current definition of Power System Reliability is:

- The ability of the SWIS to deliver energy within reliability standards while maintaining *Power System Adequacy* and *Power System Security*.

The current definition of Power System Adequacy is:

- The ability of the SWIS to supply all demand for electricity in the SWIS at the time, allowing for scheduled and unscheduled outages of generation, transmission and distribution equipment and secondary equipment.

There is no consideration in these definitions of what must be done to assess reliability. As such, the Taskforce has determined that these definitions be re-drafted, consistent with the Power System Security definition by referring to a set of core principles, outlined below, that AEMO must follow and referencing the assessment principles identified in the Reliability Standard Implementation Procedure discussed above.

⁹ Previously endorsed as part of the [Energy Scheduling and Dispatch Information Paper](#)

The Taskforce has endorsed the following changes to the above definitions.

- *Power System Reliability* means the ability of the SWIS to operate in accordance with the *Power System Reliability Principles*.
- *Power System Adequacy* means the ability of the SWIS to supply all demand for electricity in the SWIS at the time, allowing for scheduled and unscheduled outages, taking into account the *Reliability Standard Implementation Procedure*.

In terms of the Power System Reliability Principles that AEMO must follow, it is reasonable for AEMO to maintain a Reliable Operating State wherever possible, and return to a Reliable Operating State as soon as practicable; however, at times it may be necessary for AEMO to shed load in order to maintain Power System Security. The principles also need to allow AEMO to assess risks to reliability and intervene where appropriate to mitigate those risks. The process and assessments used by AEMO in achieving this should also be part of the Reliability Standard Implementation Procedure discussed above to provide clarity and transparency.

The Taskforce has endorsed the following Power System Reliability Principles to be added to the WEM Rules:

- To the extent practicable, the SWIS should be operated such that it is in a *Reliable Operating State*.
- Where the SWIS is not in, or is forecast not to be in, a *Reliable Operating State*, AEMO must take action to restore or maintain a *Reliable Operating State* as soon as practicable, subject to maintaining *Power System Security*.
- AEMO will assess risks to *Power System Adequacy* and act to minimise the risks in accordance with the *Reliability Standard Implementation Procedure*.

Taskforce design decisions – Chapter 2: Changes to the operating states framework

The Taskforce has endorsed the following in relation to operating states:

- Introduce the new Satisfactory and Secure Operating States, replacing the existing Normal and High-Risk Operating States;
- Retain the existing Emergency Operating State;
- Introduce a definition for *Stable* and a requirement for AEMO to develop a Market Procedure for describing power system stability requirements;
- Modify the definition of *Equipment Limits*;
- Retain AEMO's additional powers to operate within or to return to a Secure Operating State as currently permitted under the High-Risk Operating State; and modify the additional powers permitted under the Emergency Operating State;
- Modify the definitions and operational processes around the Emergency Operating State; and,
- Create a new Reliable Operating State, and supporting framework including a set of Power System Reliability Principles, modifications to the Power System Reliability and Power System Adequacy definitions and the development of a Reliability Standard Implementation Procedure, describing how AEMO assesses reliability.

3. Changes to the contingency events framework

This section outlines a new framework for contingency events which will be defined in the WEM Rules. This includes introducing definitions for a Contingency Event, Non-credible Contingency Event and Credible Contingency Event, and allowing for reclassification of events.

3.1 Contingency Event and Credible Contingency Event

The terms Contingency event and Credible Contingency Event are not currently defined in the WEM Rules, although they are defined in the Power System Security Market Procedure as:

- *Contingency* means an event that affects the power system in a way that would be likely to result in the failure or sudden removal of a Facility or network equipment from operation.
- *Credible contingency* means a contingency that AEMO has determined is reasonably likely to occur.

These definitions do not account for large swings in load or unscheduled generation, (including both embedded and non-embedded generation) or other elements of the SWIS that are not specifically registered as facilities, such as communications infrastructure.

A new framework is to be implemented for the WEM to be used in processes being introduced as part of SCED and ESS market design on 1 October 2022, such as FOS, constraints and outages frameworks, and generator performance standards. It will include allowance for the failure of all types of network elements (not just transmission), allow for different types of facilities (including energy storage devices), and cover non-generator events including significant changes to load or unscheduled generation.

The Taskforce has endorsed the following new definitions:

- *Contingency Event* means an event affecting the SWIS which AEMO expects would be likely to involve the failure or removal from operational service of one or more *Generating Units, Facilities* and/or *Network* elements, or an unplanned change in load,¹⁰ *Intermittent Generation* or other elements of the SWIS not controlled by AEMO.
- *Credible Contingency Event* means one or more *Contingency Events*, the occurrence of which AEMO considers to be reasonably possible in the surrounding circumstances including in consideration of the *Technical Envelope*. Without limitation, examples of *Credible Contingency Events* are likely to include:
 - the unexpected automatic or manual disconnection of, or the unplanned change in output of one or more operating *Generating Units* or *Facilities*; or
 - the unexpected disconnection of one major item of *Network* equipment (e.g. transmission line, transformer or reactive plant) other than for conditions specified by AEMO (i.e. events that are possible, such as a busbar failure, but are very unlikely and as such do not constitute a Credible Contingency Event).

¹⁰ The materiality threshold for defining an unplanned change in load in this context will be defined in an AEMO-developed Market Procedure.

AEMO will also be required to document the process for Credible Contingency Event classification in a Market Procedure.

While the current definition of a Credible Contingency Event in Western Power's Technical Rules is used for network planning and investment purposes, this will need to be reviewed in light of the introduction of the above framework. This work is being undertaken by Western Power as part of a wider review of its Technical Rules.¹¹

3.2 Non-credible Contingency Event

The definition for a Credible Contingency Event includes any event AEMO considers is reasonably possible. Therefore, any other contingency event is non-credible.

However, the inclusion of a definition for Non-credible Contingency Events will allow AEMO to modify its classification of what it considers to be a Credible Contingency Event in response to abnormal conditions such as bushfires, storms, or extreme weather conditions, which may not initially pose risks to the power system. While these conditions are not considered in terms of planning for investment purposes, as they are unlikely to occur, they are important for AEMO to be able to proactively plan for such a contingency in an operational timeframe to prevent the power system becoming insecure.

This term will be used as part of the reclassification mechanism (see 3.3) and incident reporting. There is currently no such term in the Technical Rules or WEM Rules.

The Taskforce has endorsed the following definition:

- A *Non-credible Contingency Event* is a *Contingency Event* other than a *Credible Contingency Event*. Without limitation, examples of *Non-credible Contingency Events* are likely to include simultaneous disruptive events such as:
 - multiple *Facility* failures; or
 - failure of multiple *Network* elements (such as may be caused by tower collapse).

3.3 Reclassification

Providing AEMO with the ability to reclassify Non-credible Contingency Events to Credible Contingency Events is important to allow AEMO to take actions within an operational timeframe to prevent the power system from moving to a deteriorating operating state when an otherwise non-credible event is more likely to occur. The reclassification framework acts in a similar way to the descriptive elements of the current High-Risk Operating State, however it is a more general approach, and includes reporting obligations for greater transparency.

A reclassification framework will be introduced through the WEM Rules and a related Market Procedure for Non-credible Contingency Events. The framework will include the following elements:

- AEMO may reclassify a *Non-credible Contingency Event* (including multiple *Contingency Events*) as a single *Credible Contingency Event* where *Contingency Reclassification Conditions* are

¹¹ Western Power's Technical Rules Review will be undertaken in two stages. The first stage will consider all chapters except Chapter 5 and will be completed in December 2020. Chapter 5 will be considered in Stage Two which is scheduled for completion in December 2021.

identified (including events such as extreme weather conditions, bushfires, and abnormal operating conditions).

- When AEMO reclassifies a new *Credible Contingency Event*, it must promptly notify the market of the reclassification along with all relevant information available, including but not limited to:
 - the name of the new *Credible Contingency Event* (i.e. what it is to be known as);
 - a description of the new *Credible Contingency Event* (i.e. the nature of the event and the equipment impacted);
 - any relevant timeframes (i.e. when it commences, whether it is temporary, and over what timeframe the re-classification may apply); and
 - the *Contingency Reclassification Conditions* that gave rise to the reclassification as known to AEMO (other than any market confidential information).
- A definition of *Contingency Reclassification Conditions* linking back to the information that AEMO must provide in the notifying the market about the reclassification;
- A requirement to revise the notice above once information has materially changed.;
- The ability to reclassify the *Credible Contingency Event* back to a *Non-credible Contingency Event* when the *Contingency Reclassification Conditions* that gave rise to it are no longer relevant.
- A requirement for AEMO to document in a Market Procedure the factors it may use to guide reclassification; and
- A requirement for AEMO to provide periodic performance reports to the Economic Regulation Authority (Authority) to include reclassification events.

Taskforce design decisions – Chapter 3: Changes to the contingency events framework

The Taskforce has endorsed the following definitions and concepts in relation to contingency events:

- Introduce definitions for Contingency Event, Credible Contingency Event, Non-credible Contingency Event and Contingency Reclassification Conditions into the WEM Rules.
- Amend the WEM Rules to oblige AEMO to document relevant detail on what items are, and what are not, included in a Credible Contingency Event.
- Introduce a reclassification framework as outlined above into the WEM Rules and require AEMO to develop a related Market Procedure.

4. Power system security

Under the current WEM Rules, AEMO must ensure the SWIS operates in accordance with the Technical Envelope for the applicable SWIS operating state and must document in a Market Procedure how it does so.

In the Market Procedure, AEMO is required to detail how the Technical Envelope is determined, and how limits and standards are monitored. However, there are currently no specified principles in the WEM Rules that AEMO must follow when maintaining Power System Security.

The current definition of Power System Security is:

- The ability of the SWIS to withstand sudden disturbances, including the failure of generation, transmission and distribution equipment and secondary equipment.

The Taskforce has endorsed a modified definition of Power System Security so that it refers to a new set of Power System Security Principles:

- *Power System Security* means the safe scheduling, operation, and control of the SWIS in accordance with the *Power System Security Principles*.

As noted in 2.1 the introduction of the Secure Operating State requires new Power System Security Principles and operational processes to be introduced. This includes requiring AEMO to provide information to market participants around the actions it may take under different conditions and reporting to the Authority.

The Taskforce has endorsed the following set of Power System Security Principles to be added to the WEM Rules that AEMO must follow.

- To the extent practicable, the power system should be operated such that it is in and will remain in a *Secure Operating State*.
- Following a *Contingency Event*, AEMO should take all reasonable actions to return to a *Secure Operating State* as soon as possible, and in any case within 30 minutes, other than during conditions of 'Supply Scarcity'¹² or when in an *Emergency Operating State*.
- Sufficient *Inertia* should be available to meet applicable *Inertia Requirements* as described by AEMO in a Market Procedure.
- Sufficient *Fault Level* should be maintained at applicable nodes to meet the applicable *System Strength Requirements* as described by AEMO in a Market Procedure.
- A requirement for AEMO to include situations where AEMO was unable to return to a *Secure Operating State* within 30-minutes in periodic performance reports to the Authority.

¹² This is intended to allow for periods where there is insufficient available capacity for dispatch or for provision of different types of ESS and it is not possible to meet the 30-minute timeframe. This provision has also been referred to in relation to SCED, and so it may make sense to add a definition for 'Supply Scarcity' as part of the Operating States drafting to cover usage in this sense and for use in later drafting. This will be considered in greater detail during the Operating States rule drafting.

The Taskforce has endorsed the introduction of several new definitions required to support the above principles. These new definitions are required due to the terms being either currently undefined in the WEM Rules, or defined too narrowly for current and anticipated future technologies.

The endorsed new definitions are:

- *Inertia* means contribution to the capability of the SWIS to resist changes in frequency by means of an inertial response.
- *Fault Level* means a measure of current arising from fault conditions at a location on a network.

Further, the Taskforce has endorsed the following requirements, required to support the principles outlined above, being defined by AEMO in a Market Procedure:

- *Inertia Requirements*
- *System Strength Requirements*

This will provide AEMO with capability within the operating states framework to constrain on, or dispatch, particular facilities or services as the technical and market arrangements evolve.

Taskforce design decision – Chapter 4: Power system security

The Taskforce has endorsed:

- A new definition for Power System Security, Inertia and Fault Level.
- A set of Power System Security Principles.
- The requirement for AEMO to develop Inertia Requirements and System Strength Requirements in a Market Procedure.

5. Technical Envelope

The Technical Envelope is intended to provide the boundaries in which to assess power system security and reliability (e.g. the forecasts, limits and conditions that are relevant to the assessment).

The current definition¹³ is:

The *Technical Envelope* represents the limits within which the *SWIS* can be operated in each operating state. In establishing and modifying the *Technical Envelope* under clause 3.2.6 of the WEM Rules, *System Management* must:

- respect all *Equipment Limits* but only to the extent those limits are not inconsistent with the dispatch of *Facilities* that, but for the *Equipment Limits*, would be dispatched under section 7.6.1C;
- respect all *Security Limits*;
- respect all *SWIS* operating standards;
- respect all *Ancillary Service* standards specified in section 3.10; and
- take into account those parts of the *SWIS* which are not designed to be operated to the planning criteria in the relevant Technical Code.

The current definition does not refer to other important elements of assessing power system security and reliability, such as:

- Load forecasts and other forecasts.
- The existence of Commissioning Tests.
- Planned and Forced Outages.
- Network Constraints.
- Reserve Margins (e.g. reactive reserve margins, active reserve margins, ready reserve margins).
- Performance Standards (e.g. the ability for generators, loads, and storage devices to meet certain requirements at the connection point).
- inertia requirements.
- System Strength requirements.

These are necessary to include in the practical assessment of Power System Security. AEMO has an existing obligation to document the process for establishing and maintaining the Technical Envelope, so the items listed above do not need to be specifically identified in the WEM Rules.

However the general definition of the Technical Envelope needs to be revised to cater for new definitions introduced as part of these and previous Taskforce decisions, and broadened to allow AEMO to include other elements such as those listed above that should be taken into account in

¹³ WEM Rule 3.2.5.

maintaining and establishing the Technical Envelope. AEMO must then document these items in the Market Procedure.

Taskforce design decision – Chapter 5: Technical envelope

The Taskforce has endorsed the modification of the current Technical Envelope definition to cater for the new operating states framework as well as other previous Taskforce decisions, such as the new ESS framework.

The Technical Envelope definition will also be broadened in order to allow AEMO to include all the components necessary to practically assess power system security and reliability, as outlined in a related Market Procedure.

6. Related further work

6.1 Dispatch Advisories

In changing the operating states framework, the Dispatch Advisory mechanism will need to be re-visited to ensure the categories for market notification are relevant, practical and achievable. Additionally, it may be preferable to outline directions to participants (outside of Dispatch Instructions) in a dedicated section within the WEM Rules rather than via the Dispatch Advisory mechanism.

This work will be undertaken in the Future Market Design and Operation workstream, as part of the WEM Rule drafting for the implementation of SCED. This will be completed by mid-2020.

6.2 Dispatch Criteria

Elements of the Dispatch Criteria will also need to be reviewed to ensure they align with the WEM Rule changes to implement the new operating states framework.

This work will principally be undertaken as part of the WEM Rule drafting for the implementation of SCED, and linkages with the operating states framework will be built into the WEM Rules as needed. This will be completed by mid-2020.

6.3 Other consequential changes

Other consequential changes will be required in sections of the WEM Rules that refer to the current operating states framework. Examples of this are:

- Outage recall (section 3.20)
- The process of Dispatch (section 7.6)
- Reports to the Authority (section 7.12)

These changes will be considered further as part of the WEM Rule drafting over coming months, for both the operating states framework and changes related to the implementation of SCED. This will be completed by mid-2020.

6.4 Reliability framework

As part of a wider body of work over a longer timeframe, the Taskforce will review existing reliability standards across a range of instruments at the system and network level. The outcomes of this work may lead to subsequent changes to the concept of Power System Reliability and associated structures such as the Reliability Standard Implementation Procedure.