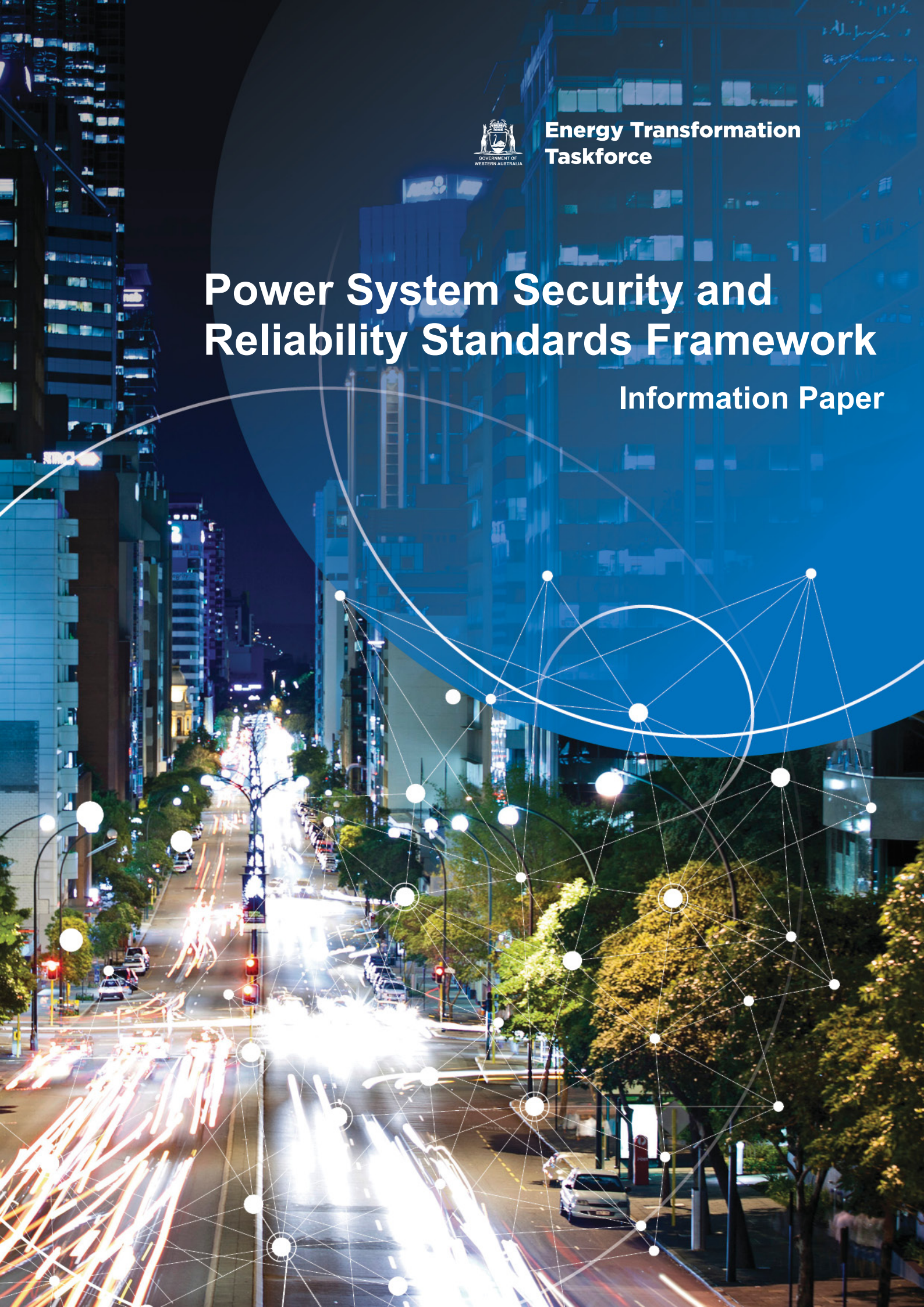

GOVERNMENT OF WESTERN AUSTRALIA

Energy Transformation Taskforce

Power System Security and Reliability Standards Framework

Information Paper

An appropriate citation for this paper is: Power System Security and Reliability Standards Framework

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Contents

Abbreviations

The following table provides a list of abbreviations and acronyms used throughout this document.

Term	Definition
AA	Access Arrangement
AEMO	Australian Energy Market Operator
ERA	Economic Regulation Authority
EPWA	Energy Policy WA
JAF	Joint Agreement Framework
NQRS	Network Quality & Reliability of Supply Code
PSSR	Power System Security and Reliability
RSAP	Reliability and Security Advisory Panel
SWIS	South West Interconnected System
Taskforce	Energy Transformation Taskforce
UFLS	Under Frequency Load Shedding
WEM	Wholesale Electricity Market
WP	Western Power

1. Purpose of this project

1.1 The Energy Transformation Strategy

This paper forms a part of the work to deliver the Energy Transformation Strategy, which is the Western Australian Government's response to the energy transformation underway and plan for the state's future power system. The delivery of the Energy Transformation Strategy is being overseen by the Energy Transformation Taskforce (the Taskforce), established on 20 May 2019. The Taskforce is supported by the Energy Transformation Implementation Unit (ETIU) – a dedicated unit within Energy Policy WA, itself a part 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 Policy WA website at www.energy.wa.gov.au.

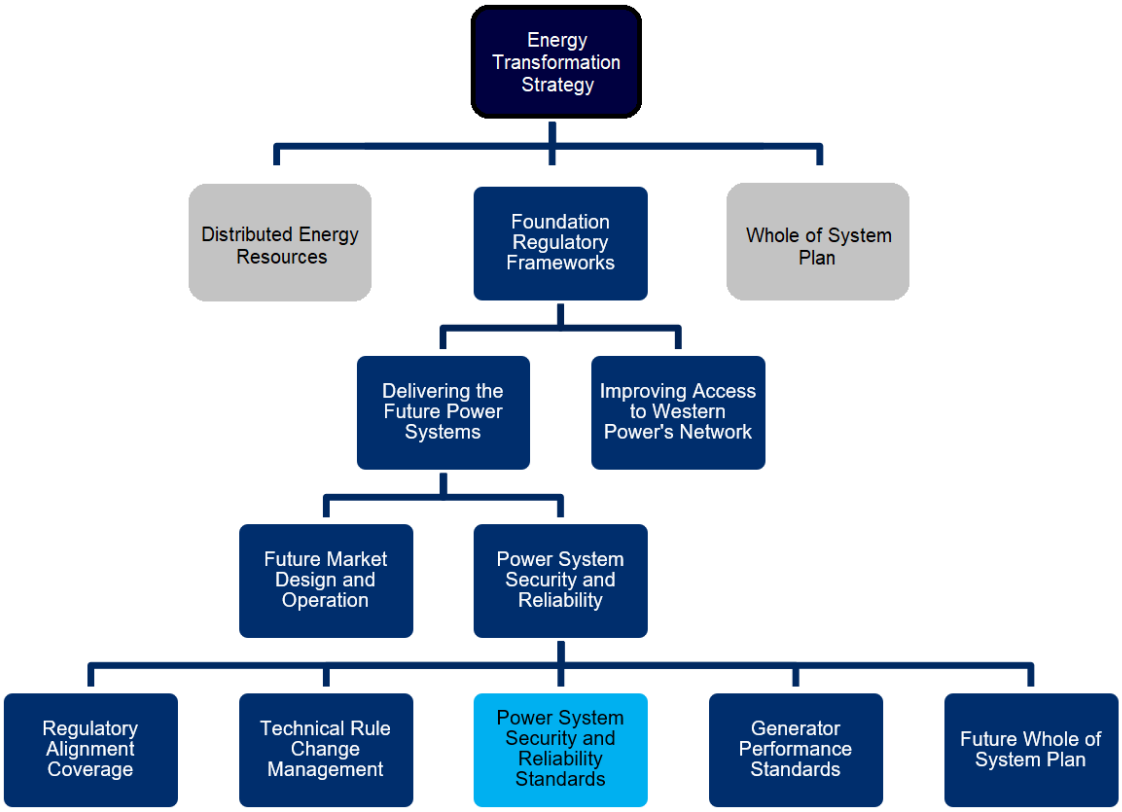

Figure 1: Energy Transformation Strategy work streams

The Power System Security and Reliability (PSSR) standards framework project is undertaken as under the Power System Security and Reliability workstream of the Delivering the Future Power System part of the Foundation Regulatory Frameworks. This project is aimed at ensuring that the governance of the PSSR standards in the SWIS allows for efficient and effective decision-making around planning, upgrading and operating the power system.

1.2 Purpose of this paper

This paper outlines deficiencies with the existing regulation and governance of the PSSR standards and recommends the establishment of a single framework to govern the way the PSSR standards are developed, managed, and applied to the planning and operation of the power system in the SWIS.

This paper builds on the work that has been completed under the Foundation Regulatory Frameworks workstream in streamlining security and reliability matters, which includes:

- Moving the Frequency Operating Standards from Western Power's Technical Rules to the Wholesale Electricity Market (WEM) Rules to enable AEMO to discharge its key function of maintaining system security through frequency management.
- Revising the Operating States and credible contingency framework in the WEM Rules and aligning its operation with the Technical Rules.
- Moving the Generation Performance Standards from the Technical Rules to the WEM Rules to improve sector compliance and the monitoring of large transmission-connected generators.
- Allowing AEMO membership of the Technical Rules Committee and to provide advice and support on Technical Rules amendments including PSSR standards.

These initiatives have made important incremental improvements to the management of the SWIS PSSR standards and the interaction between AEMO and Western Power. However, the improvements still fall significantly short of delivering a holistic end-to-end framework that regulates and governs the PSSR standards. To achieve this, the Taskforce approved ETIU undertaking the following discrete scope of work:

1. Identify gaps and overlaps in the existing set of PSSR standards contained in different legislative instruments. These standards include the Frequency Operating Standards, Generator Performance Standards (GPS), System Restart Standard, Under Frequency Load Shedding (UFLS) requirements, and Power System Stability[1];
2. Clarify the roles and responsibilities of AEMO and Western Power with respect to power system security and reliability;
3. Develop and recommend an end-to-end governance framework for PSSR standards;
4. Identify legal impediments to implementing the proposed framework;
5. Identify and recommend interim improvements with respect to certain PSSR standards for which urgent coordination is needed between AEMO and Western Power to maintain power system security and reliability in the wake of increasing intermittency and low load intervals.

[1] The Frequency Operating Standards and Generator Performance Standards have been captured under the WEM Rules through the Tranche-1 and Tranche-2 rules gazetted in December 2020. Work is underway to develop a joint agreement and coordination framework to apply to Western Power and AEMO in relation to the System Restart Standard, UFLS requirements, and Power System Stability, with the intention that the framework will be codified in the WEM rules and Technical rules as appropriate.

2. Background

2.1 Current PSSR standards framework

The PSSR Standards for the SWIS are distributed across several regulatory instruments namely the Technical Rules (TR), WEM Rules, Electricity Industry (Network Quality and Reliability of Supply) Code 2005 (NQRS Code), Western Power's Access Arrangement (AA) and the Electricity Act 1945, as shown in Table 1.

Table 1: Distribution of key PSSR standards across various regulatory instruments

PSSR Standards	Technical Rules	WEM Rules	NQRS code	Access Arrangement	Electricity Act 1945
1. Power System Performance	✓	✓			
2. Power System Operations	✓	✓			✓
3. Network Planning	✓		✓		✓
4. Generation Planning		✓			
5. Customer Performance	✓	✓			
6. Network Reliability	✓		✓	✓	✓
7. Service Standard Benchmarks			✓	✓	

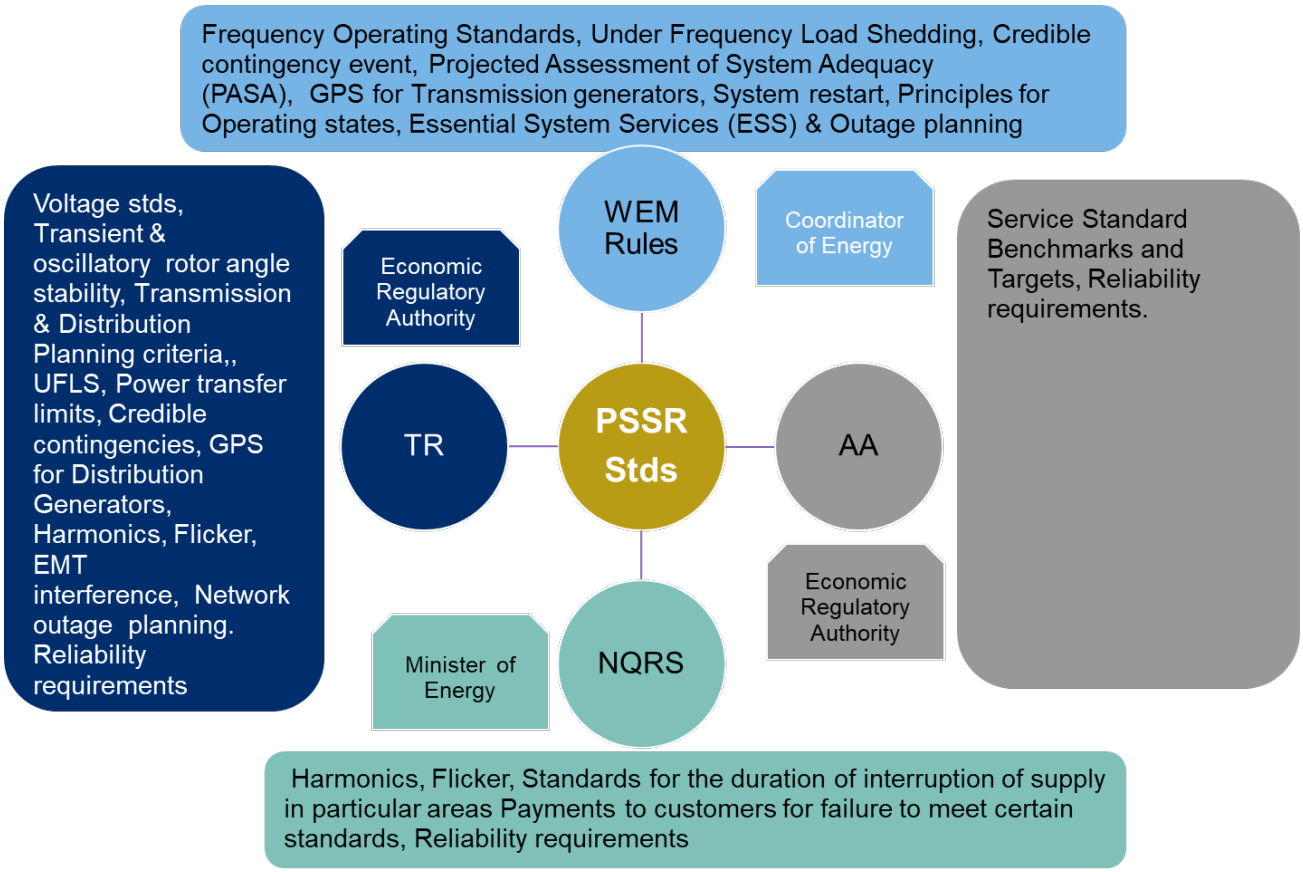

Figure 2: Distribution of key PSSR standards across the various regulatory instruments

Figure 2 provides a further illustration of specific PSSR standards contained in different regulatory instruments and their relevant governing Agency.

A major deficiency with this structure is that regulation and governance of PSSR standards is smeared across various instruments and agencies.

The WEM Rules are currently administered by the Rule Change Panel. From July 2021, the Coordinator of Energy will assume the responsibility for the administration of WEM Rules. As a result, the change management of specific PSSR standards, particularly the Frequency Operating Standard, the obligations for power system operating states, projected assessment of system adequacy studies, Essential System Service (ESS) specifications, and GPS for transmission connected generators, will be the function of the Coordinator of Energy.

Western Power's Technical Rules, which are required to be developed under the Electricity Networks Access Code 2004 are approved by the Economic Regulation Authority (ERA). The Technical Rules Committee (TRC), chaired by the Coordinator of Energy, provides technical expert advice to the ERA. The current Technical Rules set out:

- the technical performance requirements for the SWIS (including voltage, system stability and power quality);
- obligations for Western Power to build and maintain the transmission and distribution systems to meet these performance requirements;
- criteria for the planning, design and construction of the transmission and distribution systems (including the planned level of redundancy for different parts of the network determined by a N-0, N-1 and N-1-1 planning criteria);
- technical requirements for user facilities;

- inspection, testing, commissioning, disconnection and reconnection; and
- transmission and distribution system operation and coordination.

The NQRS Code is administered and approved by the Minister for Energy. The NQRS Code sets out standards relating to the quality and reliability of electricity supply for all licenced operators of electricity transmission and distribution networks (i.e. Western Power and Horizon Power). The NQRS Code sets out voltage fluctuation and harmonics requirements at the customer connection point, standards for interruption of supply to individual customers and standards for the duration of interruption of supply in particular areas.[2] The NQRS Code also specifies the performance reporting requirements for distributors that supply small use customers.

The Electricity Networks Access Code 2004 is administered and approved by the Minister for Energy. The Access Code requires Western Power's Access Arrangement to include service standard benchmarks for each reference service and a service standard adjustment mechanism detailing how Western Power's performance against the service standard benchmarks will be treated at the next Access Arrangement review. The service standards are not specified in the Access Code and are determined as part of the Access Arrangement review by the ERA every 5 years.

The *Electricity Act 1945* includes limits for power system voltage and frequency.

In summary, there is no single instrument that regulates and governs the SWIS PSSR standards end to end, which results in ambiguity and misalignment between the actions of the entities responsible for the SWIS planning and operation.

2.2 PSSR Standards work under the Energy Transformation Strategy

As part of the Energy Transformation Strategy, a number of changes to the WEM Rules, Technical Rules and Access Code have already been delivered to make urgent and critical improvements to power system security and reliability standards for the SWIS. This work, completed under the Foundational Regulatory Framework workstream, is outlined below:

Frequency Operating Standards and Generator Performance Standards

The PSSR Standards have remained relatively unchanged since the introduction of the Technical Rules in 2007. With the transfer of System Management from Western Power, AEMO in its role as the System Operator needed to be formally charged with the responsibility for frequency management. In addition, the technical compliance of some generators with the PSSR standards was unknown. The need to empower AEMO to manage the Frequency Operating Standard (FOS) and establishing a stronger compliance regime for transmission-connected generators to support security and reliability led to transitioning the FOS and the GPS from the Technical Rules into the WEM Rules. The relevant WEM Rules were gazetted in September 2020.

[2] The areas currently specified are - the Perth CBD; urban areas other than the Perth CBD; and any other area of the State. There is also currently a temporary requirement for the Eastern Goldfields and North Country requiring Western Power to have, so far as is reasonably practicable, arrangements in place to restore and maintain specified levels of supply (45MW in the Eastern Goldfields and 50MW in the North Country) to essential services loads and the majority of small use customers for unplanned and planned outages of a transmission element supplying those areas. This temporary standard applies until 30 September 2023.

Technical Rules Change Management

This project made amendments to the change management framework for the Technical Rules to permit any interested party to submit a change proposal for consideration by the ERA. With the transfer of System Management from Western Power, a gap remained regarding the ability for AEMO as System Operator to provide any input into the Technical Rules. The changes enabled AEMO to be part of the Technical Rules Committee (the advisory body that advises the ERA on Technical Rule changes), which would allow AEMO's advice on PSSR matters under the Technical Rules to be considered. The changes were reflected in the May 2020 gazettal of the Access Code.

New Operating States framework

Changes were made to the existing Normal/High Risk Operating States framework in the WEM Rules to introduce specific linkages to Power System Security and Power System Reliability concepts and definitions. The new Operating States framework introduce Security and Reliability operating principles that provide clearer obligations on AEMO to meet defined PSSR standards and are linked specifically to AEMO's core operational functions (e.g. central dispatch, outage management, Projected Assessment of System Adequacy (PASA) modelling etc.) to ensure consistent outcomes across different time horizons. The relevant WEM Rules were gazetted in December 2020.

2.3 Outstanding Issues Under the Current Framework

Notwithstanding the enhancements outlined in Section 2.2, deficiencies still remain, including:

- there is no single body with responsibility for the end-to-end governance of PSSR standards;
- absence of a consistent overarching set of technical standards for power system security and reliability with a common set of objectives that balance customer requirements, economic cost and state development needs;
- duplication and ambiguity in the roles of different entities responsible for the governance and operation of PSSR standards, which results in lack of coordination and leads to disagreements between entities over interpretation and implementation of standards;
- absence of a universal set of measurable targets, incentives and reporting to account for both power system and network operations
- lack of requirements or a specified process for consulting with end users regarding their preferences on reliability of supply;
- limitation in the existing standards for reliability, whereby the standards only consider the adequacy of network and generation (considering disturbances) during system peaks, rather than under a broader set of system conditions, such as during low load conditions where there is a high penetration of distributed energy resources (DER);
- absence of guidance on how standards for security and reliability should be operationalised across investment planning and operational timeframes;
- insufficiently granular reliability targets that do not reflect the nature of loads, and other network limitations in a location; and
- lack of economic considerations in decision-making regarding the maintenance of overall system reliability, including requirements for overall assessment of the costs of investing in the network compared to the costs of procuring services from the market.

If not addressed these problems will lead to:

- investments in the network and the procurement of services in the market becoming misaligned, resulting in increased cost of market operation and inefficient network augmentation;
- ongoing divergence in reliability within the regions of the SWIS due to the absence of appropriate regional reliability standards;
- actions undertaken by AEMO and Western Power to maintain power system reliability and security being misaligned and siloed, and not guided by common standards or a single entity responsible for coordination; and
- inability for specific needs of different end user groups to be properly addressed.

The Taskforce is seeking to ensure that appropriate standards for reliability and security in the power system are established and met, with AEMO (in its role as Market Operator and System Manager) and Western Power (in its role as Network Operator) working together to deliver secure and reliable electricity supply to all electricity users.

3. Guiding Principles

The Taskforce applied the following Principles in determining an optimal regulatory and governance framework for the SWIS PSSR Standards. These principles are consistent with the WEM objectives, but subsidiary to those described in the Taskforce Information Paper: Foundation Market Parameters.

Table 2: Guiding Principles for the PSSR Framework

Principles underpinning the SWIS PSSR Standards Framework
The framework for power system reliability and security standards should: • **be fit for purpose, future ready (to the extent it is efficient), and flexible to changes in the configuration of the power system over time;**
• **place clear responsibilities on the different entities ensuring that the entity best placed to discharge a function is required and empowered to do so through the appropriate legal instrument or subsidiary document;**
• **empower consultation with all relevant stakeholders, including end-consumers, enabling stakeholder views to be considered in decision making;**
• **leverage the existing functions of the entities responsible for delivering security and reliability standards, to the extent they support the objectives of the new framework;**
• **efficiently tailor technical standards and compliance requirements to the needs and power system characteristics of different parts of the SWIS;**
• **ensure technical standards for the power system are contained in the appropriate legal instruments, such that their application is unambiguous, consistent, and not open to duplication or gaps;**
• **where new standards are to be developed, set standards at levels that provide for an overall level of service at least equivalent to that currently provided in any given location; and**
• **ensure changes to the standards do not trigger a requirement for a large investment changes over a short period of time.**

4. The PSSR Standards Framework

The PSSR standards framework is being addressed under five main work packages, as described in Sections 4.1 to 4.5 below. The Taskforce decisions are provided in Section 4.6.

4.1 Gaps and overlaps in the PSSR standards

With the assistance of Western Power's and AEMO's experts, the Taskforce:

- examined the various PSSR standards and processes documented in the Technical Rules, WEM Rules, the NQRS code and the Access Arrangement to identify gaps and overlaps, and determine which standards should be considered for a reformed PSSR standards framework discussed in section 4.1.3; and
- identified the standards that need urgent attention in the interim period, as discussed in section 4.1.5.

The outcomes of this analysis are presented in Appendix A.

4.2 The roles of Western Power and AEMO in implementing the PSSR standards

Establishing consistent PSSR standards alone does not guarantee outcomes for consumers. It is the application and coordination of those standards across the different planning and operational timeframes that ensure required outcomes are achieved. Different standards need to apply in a planning timeframe as opposed to an operational timeframe as it can result in power system security issues and overall costs of supply being higher than otherwise.

For example, the standards for network build requirements are captured in the Technical Rules, catering for normal and abnormal operating conditions. These requirements rely on fundamental assumptions around available generation capacity, which is managed separately via the WEM Rules through processes like the Reserve Capacity Mechanism (including the long-term (LT) PASA), which are governed by standards different to those in the Technical Rules. If these standards and processes are not consistent or not coordinated consistently and effectively, there is a risk that:

- insufficient network is built to cater for expected/anticipated generation capacity and its dispatch; and/or
- insufficient generation capacity is procured to deliver energy to consumers via network that has been built.

It is possible for each standard to be completely satisfied independently, and yet there may still be issues for supply of energy to end-consumers.

Figure 3 below illustrates the various planning and operational processes that are currently managed by AEMO and Western Power. Each of these key processes require consistent standards, sharing of information and consistency of approach between the organisations to ensure that reliable and secure energy supply for consumers is achieved and maintained.

	Plan (3-10 yrs)	Design , Procure, Construct (3-5 yrs)	Operate (Real time – months)
AEMO	LT PASA, Load & Generation forecast Support Western Power's planning activities	Procure ESS, NC-ESS, Reserve Capacity Support Western Power's design activities	Direct and manage System Stability & Security – manage frequency, set secure voltage limits, determine operating states, approve outage and plan for the medium & short term (ST & MT PASA)
Western Power	Network Development Plans (Study & plan for network growth & stability based on several generation scenarios) Load forecast for 1-30 yrs		

Figure 3: Responsibilities for PSSR over planning and operational timeframes

AEMO and Western Power need to actively work together to manage SWIS power system security and reliability. While the high-level obligations and responsibilities of the two entities are described in the relevant primary legislation and subsidiary instruments, the interaction of their roles and responsibilities for network planning and real-time system operation is less clear. For example, the SWIS voltage limits are prescribed in the Technical Rules. Western Power as the Network Service Provider is responsible for planning, designing and building the network to adhere to these limits over a network planning horizon, which typically lasts 10 years.

However, over the system operation timeframe, which typically spans from weeks ahead to real-time, the operational voltage limits could vary according to the location and the conditions of the power system. Even though Western Power may have designed the network to deliver to specific long-term voltage limits, AEMO may need to establish more stringent real-time operational voltage limits for secure power system operation. This real-time operational voltage limit then needs to be communicated and coordinated with Western Power, which will then need to manage the network according to the operational voltage limits. However, there is currently no ability for AEMO to manage operational voltage limits under the WEM Rules or to obligate AEMO and Western Power to coordinate their operations in accordance with the Technical Rules.

As illustrated in Figure 3, the roles and responsibilities of Western Power and AEMO vary over time and providing clarity on each entity's responsibility over the entire timeframe is critical.

Since the roles and responsibilities of Western Power and AEMO are not clearly codified in either the Technical Rules or the WEM Rules, to support operational activities between the two entities, a non-binding Western Power-AEMO Operating Protocol was developed by the two entities. This protocol has been in effect since July 2017 and covers the processes and handover of responsibilities for various PSSR elements. To formalise this protocol the WEM Rules will be amended as part of Tranche 4 amendments.

Additional clarity on the roles of Western Power and AEMO will be provided by the Taskforce through the development of the Non Cooptimised Essential System Services Framework.

4.3 A single, end-to-end Governance Framework for PSSR Standards

The Taskforce considers that an optimal option to align the various PSSR standards and streamline the roles and responsibilities of the entities managing power system security and reliability in the SWIS, is to bring together all relevant PSSR Standards in a single instrument under a centralised governance framework . A centralised PSSR standards framework governed by a single entity will ensure end-to-end consistency is maintained as the standards are established or modified. The selection of the single governance entity should ensure that relevant economic factors, customer needs and state development needs are balance effectively in the evolution of the PSSR standards. There are currently five entities that discharge specific functions in relation to power system security and reliability management. Figure 3 below illustrates these roles.

Figure 3 below illustrates these roles.

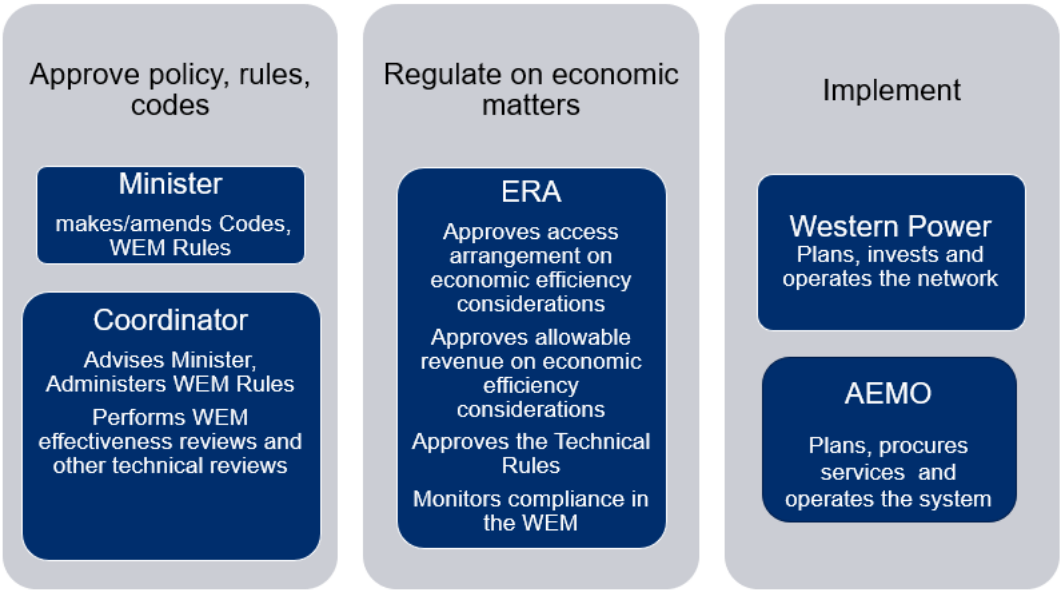

Figure 4: Roles of key entities in managing PSSR in the SWIS

4.3.1 The Governance Body

The Taskforce considers that the Coordinator is best placed to govern a centralised PSSR standards framework. This is because the Coordinator is in the best position to consider and balance the different economic, technical, consumer and state energy policy needs when determining or modifying the PSSR standards. As the entity responsible for the administration of the WEM Rules, and advising the Minister on changes to the Access Code and the NQRS Code, and as chair of the Technical Rules Committee, the Coordinator is best placed to enable effective and consistent decision-making across these regulatory instruments.

4.3.2 The Advisory Body

The Taskforce considers that the Coordinator should be supported in its governance role by an advisory panel - a Reliability and Security Advisory Panel (RSAP), that has representation from AEMO, Western Power, customer groups and industry representatives. The role of the RSAP will be

to recommend new rules/standards, amendments to the existing PSSR standards and to assess amendments requested by third parties. The RSAP can undertake studies or seek the services of consultants to undertake technical and/or economic analyses. The RSAP can also engage with customers to understand their expectations in relation to, and willingness to pay for, quality and reliability of supply. The Coordinator would act on the advice of the RSAP.

4.3.3 The Role of AEMO and WP

The role of AEMO and Western Power will broadly continue as described under the Electricity Industry Act, the WEM Regulations and Rules, and the Access Code and the Technical Rules. However, consequential amendments may be required in order to give effect to the centralised framework.

4.3.4 The Role of the ERA

The ERA's responsibility for economic regulation, compliance monitoring and enforcement will remain. However, the ERA's role as the body responsible for approving the Technical Rules is not consistent with the establishment of a single end to end PSSR standards regulatory and governance framework. Further, the ERA's skills and role as the economic regulator is not aligned with its role as a regulator of technical standards. The Taskforce considers that the governance of the Technical Rules should be brought into the centralised governance framework. This change requires amendment to primary legislation. Removing the legal impediments to the establishment of this framework, including the change of the Technical Rules governance, is discussed in the next section.

4.4 Legal impediments to implementing the framework

A single end-to-end PSSR standard which is supported by a centralised governance framework will require legislative change and cannot currently be implemented under the Access Code, Technical Rules or the WEM Rules. The hierarchy of the key regulatory instruments are shown in Figure 5.

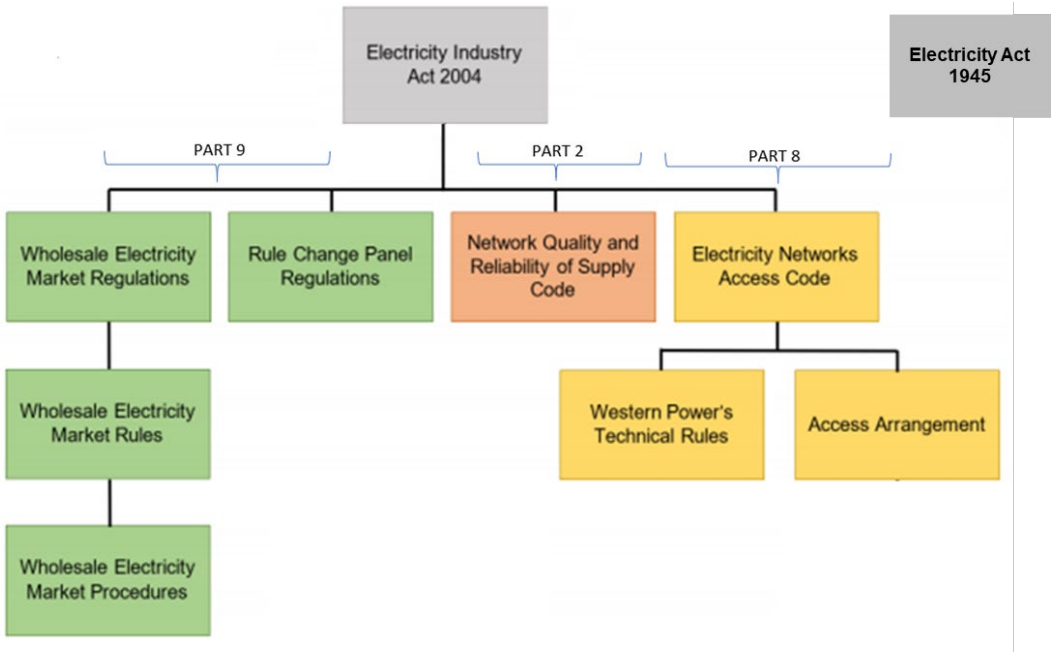

Figure 5: Hierarchy of regulatory instruments under the Electricity Industry Act 2004

Currently, the *Electricity Industry Act 2004* (the Act) makes provision for the key regulatory instruments that contain the PSSR standards and the functions of AEMO, Western Power and ERA, as follows:

- Part 9 of the Act empowers the *Electricity Industry (WEM) Regulations 2004* which describes the functions of AEMO.
- Part 8 of the Act empowers the Electricity Network Access Code 2004, which makes provision for Western Power's network coverage, the Access Arrangements, and the Technical Rules amongst other matters. It also places the responsibility on the ERA for the governance of the Technical Rules.
- Part 2 of the Act empowers the NQRS Code for Licensees, including licensees who do not operate in the SWIS. The Code is administered by the Minister for Energy supported by Energy Policy WA.
- The *Electricity Act 1945* includes limits for power system voltage and frequency.

The establishment of a centrally governed end-to-end PSSR standards framework will require changes to the Act. The changes will need to:

- Replace the ERA with the Coordinator of Energy as the body that governs the Technical Rules;
- Enable the recovery of the costs, including the costs of the RASP, of supporting the centralised framework;
- Move relevant PSSR standards from the Technical Rules into the centrally governed instrument and adjust the Access Code or other legislation as necessary.
- Move relevant PSSR standards from the WEM Rules into the centrally governed instrument and adjust WEM regulations or other legislation as necessary.
- Move relevant PSSR standards from the NQRS Code into the centrally governed instrument.
- Establish the RSAP, and the change management rules under the centrally governed instrument.

A diagrammatic representation of the proposed governance framework is shown in Figure 6 below.

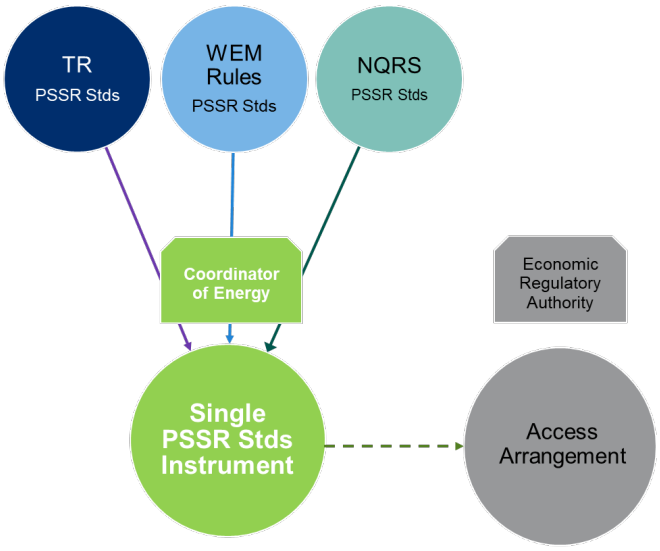

Figure 6: Proposed governance framework

4.5 Interim improvements to maintain security and reliability – Joint Agreement Framework (JAF)

Implementation of the centralised framework through legislative change is expected to potentially require 2-3 years. In the meantime, problems in maintaining security and reliability may continue to exacerbate due to the fast penetration of intermittent and distributed energy sources. Although some improvement is brought about at the process level, by formalising the Western Power and -AEMO operating protocol in the WEM Rules, the PSSR standards gaps and overlaps across the WEM Rules and the Technical Rules will continue to exist. Unless the coordination between Western Power and AEMO is codified in the relevant instruments, the operating protocol will not be able to clarify the requirements at the process level, and there is a risk that neither entity will be obligated to resolve any emerging system security issues in a timely manner, or that both will in an uncoordinated way.

To manage this risk, the Taskforce has determined that an interim Joint Agreement Framework (JAF) between Western Power and AEMO related to specified PSSR standards should be established through changes to the WEM Rules and the Technical Rules. The key matters that will be included in the JAF are:

- appropriate standards for UFLS in the WEM Rules and the Technical Rules to ensure roles and responsibilities are clear for AEMO and Western Power and provisions are made for network investment and service procurement
- appropriate requirements for AEMO under the WEM Rules to set operational voltage limits
- amendments to the change management for the FOS and the GPS under the WEM Rules to ensure Western Power is consulted and its input is taken into consideration.
- amendments to the change management of the Transmission Planning Criteria under the Technical Rules to ensure AEMO is consulted and its input is taken into consideration.
- appropriate standards for System Restart in the WEM Rules and the Technical Rules to ensure roles and responsibilities are clear for AEMO and Western Power and provisions are made for network investment and service procurement.

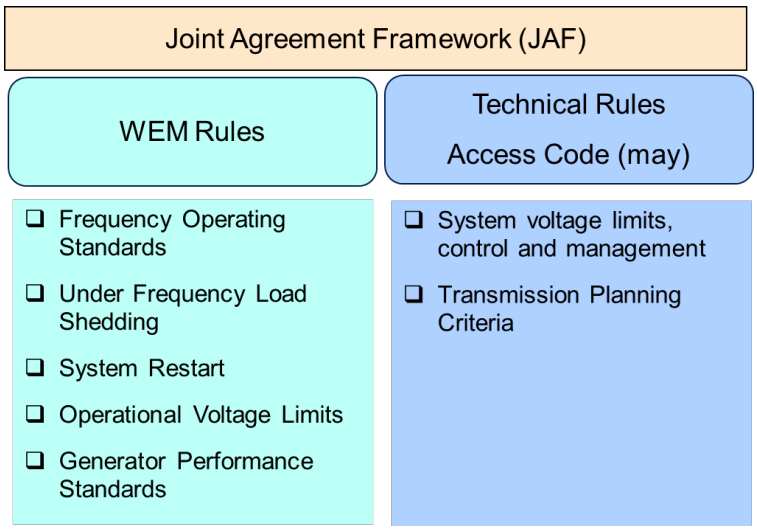

Figure 7: Interim Joint Agreement Framework expressed under the WEM Rules and Technical Rules

The Joint Agreement Framework will cover each of the PSSR standards outlined above. To implement the interim JAF, the WEM Rules and Technical Rules will be amended to ensure consistent approach to the development and maintenance of the framework. AEMO and Western

Power will be obligated to follow basic principles of consultation and agreement in the process of amending the relevant standards and implementing changes to planning and operational processes.

The following standards will be covered by the JAF:

4.5.1 The Frequency Operating Standards and Generator Performance Standards

The FOS and GPS were removed from the Technical Rules and included in the WEM Rules as part of Tranche 1 WEM Amending Rules. They are not currently covered by any specific change management process and therefore can be adjusted as part of a standard rule change process which usually takes six months. While it is important that industry and members of the public have the opportunity to propose amendments, the implications on security and reliability and costs to consumers as a result of delays in making changes can be significant. It is also important that both Western Power and AEMO, as the principal entities responsible for power system security and reliability, are involved in any proposed changes from the outset.

Additional changes to the FOS and GPS will be drafted as part of Tranche 5 WEM Amending Rules in the second half of 2021. These changes will enable joint consultation and agreement between AEMO and Western Power prior to any proposed amendments being submitted to the Coordinator. These additional change management provisions would potentially change when the new centralised governance framework and the RSAP are established.

4.5.2 Operational voltage limits

AEMO will be empowered to determine secure voltage limits in operational timeframes, taking into account planned voltage limits as specified in the Technical Rules and other specific voltage related considerations as advised by Western Power. Western Power will then be required to manage the network voltage in accordance with those operational voltage limits. This requirement is to be captured as part of the principles being determined for the new AEMO-WP Operating Protocol in the WEM Rules. This change is scheduled for Tranche 4 of WEM Amending Rules.

4.5.3 System Restart

Proposed amendments to the System Restart framework under Section 3.7 of the WEM Rules were consulted on with stakeholders in November 2020 and January 2021. These proposed amendments, which form part of the JAF, place clear obligations on AEMO and Western Power to coordinate actions in the event of a major supply disruption or system shutdown. These draft rules are scheduled for Tranche 5 of the WEM Amending Rules.

4.5.4 Under Frequency Load Shedding

The obligations for the specification and implementation of UFLS are captured both in the Technical Rules and the WEM Rules. However, there is fundamental misalignment in the way the obligations are implemented, with important coordination elements missing. The need to revise the requirements and processes is becoming more critical in the context of high DER penetration, as has been captured in Action Item 10 under the DER Roadmap.

Western Power and AEMO have worked collaboratively to establish a revised set of UFLS requirements and a revised drafting of the relevant sections in the WEM Rules and Technical Rules to support the JAF. Further detail on this is provided in Appendix B. The WEM Rule changes are

scheduled to be gazetted as part of Tranche 5 and a Technical Rule submission is scheduled for July 2021.

4.6 Taskforce decision

The Taskforce has determined that:

- A centralised framework will be implemented to provide for the regulation and governance of a single end-to-end PSSR standard for the SWIS, including the establishment of:
  - a single instrument containing all relevant PSSR standards;
  - a centralised governance framework under the Coordinator of Energy, supported by a Reliability and Security Advisory Panel.
- Legislative reform should be recommended to the Minister by Energy Policy WA to enable the implementation of the centralised framework in an appropriate regulatory instrument.
- An interim Joint Agreement Framework for specific PSSR standards will be established through changes in WEM Rules and Technical Rules to ensure security and reliability is maintained during the development of a longer term, single set of PSSR standards under a centralised governance.

A.1 Appendix A – The PSSR standards to be transitioned to the centralised framework

Q1: Does a change to the standard have a material impact on power system security and reliability	Q2: Does a change to the standard have a material impact on the overall costs of delivering secure and reliable supply to the end-consumer	Q3: Does a change to the standard require significant changes for AEMO and/or WP to operationalise	Outcome
N	N	N	Not a candidate for centralisation
N	N	Y	Potential candidate for centralisation (Should be protected for change management/jointly agreed at a minimum)
N	Y	N	Strong candidate for centralisation
N	Y	Y	Strong candidate for centralisation
Y	N	N	Strong candidate for centralisation (quarantined /Jointly agreed at a minimum)
Y	N	Y	Strong candidate for centralisation
Y	Y	N	Strong candidate for centralisation
Y	Y	Y	Strong candidate for centralisation

A.2 Appendix B – Under Frequency Load Shedding (UFLS)

Under Frequency Load Shedding (UFLS) is a safety net, designed to limit the impact of extreme contingency conditions, e.g. non-credible contingencies, which exceed the capability of primary frequency control tools.

UFLS is designed to reduce demand on the power system quickly in an attempt to stabilise the system frequency on the remaining system and prevent a total collapse. The traditional design of UFLS specifies minimum quantities of load to be automatically shed when the system frequency hits specified low frequency levels (UFLS stages). In the SWIS this load shedding is largely implemented across distribution feeders based on historical load levels at peak time.

However, as was identified under the DER Roadmap, changes in demand profile and the growth of embedded generation in the distribution network are challenging the traditional design of the UFLS scheme, the networks' ability to comply with the current requirements and whether the current requirements are fit for purpose in a high DER environment.

Studies are currently underway to determine the performance of the current UFLS design under a range of system conditions as well as assessing the performance of the system over the next ten years. This analysis will allow Western Power and AEMO to identify if any changes (major or minor) to the design or settings of the existing scheme are required in order for it to be effective.

Some broader regulatory framework changes are needed to provide the opportunity for Western Power and AEMO to jointly monitor and adjust the performance of UFLS to ensure it continues to be an effective system going forward.

UFLS requirements/obligations are currently located in both the WEM Rules and in the Technical Rules:

- Technical Rules contain:
  - obligations on Western Power to build/maintain UFLS schemes
  - static specifications for minimum load shedding quantities and frequency levels
- WEM Rules contain:
  - obligations on AEMO to specify load shedding plans
  - obligations on Western Power to configure UFLS relays to implement load shedding plans
  - obligations on Western Power to report

As can be seen, the current framework is limited in terms of be able to adjust the requirements for the UFLS scheme due to overlapping obligations and specifications.

Additionally, setting requirements for the scheme will require consideration of many different variables and scenarios going forward due to several key factors:

- inherent variability of the demand
- proliferation of embedded generation connected to the distribution network
- the move to more inverter-based market generation and the resulting reduction in system inertia
- the potential future growth of DER participation in energy and security support services

Therefore, the fundamental requirements of the new regulatory framework must allow for:

- Coordination between AEMO and Western Power to ensure the factors identified above are adequately catered for in the design and operation of the scheme
- Flexibility to adjust, modify or replace the UFLS scheme based on the actual (or forecast) dynamics of the power system

Proposed Joint Agreement Framework

To support the above requirements, a Joint Agreement Framework (JAF) is proposed for UFLS which specify the coordination arrangements in determining the objectives and requirements of the scheme, and the follow-on design/implementation/monitoring requirements.

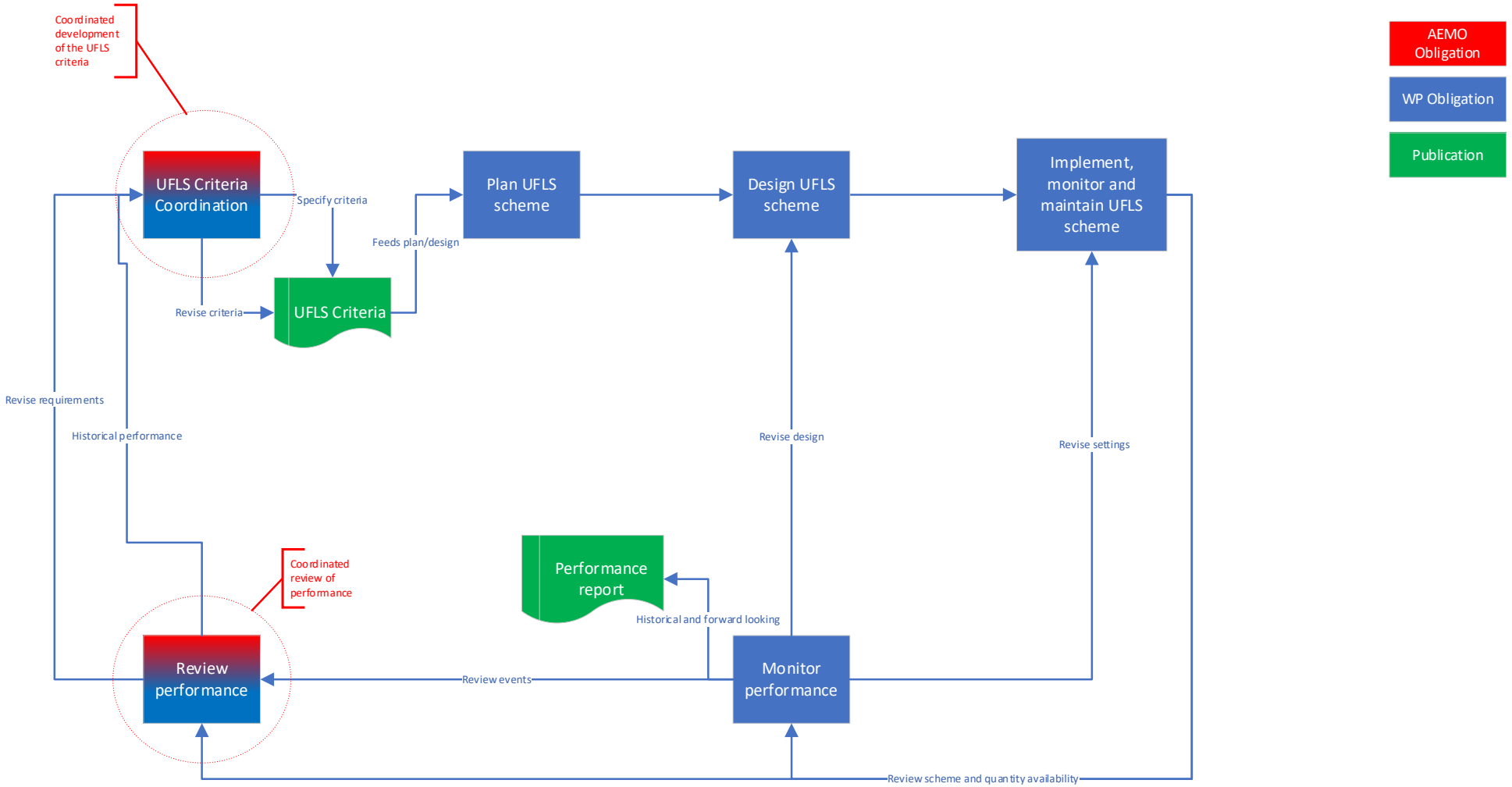

Figure 8: Roles and responsibilities for UFLS under the new JAF

UFLS Criteria Coordination

The WEM Rules currently requires AEMO to specify the requirements for automated load shedding. It is proposed that this obligation be expanded to require coordination with Western Power and focus instead on load shedding specifically, but what the required criteria of the scheme should be.

This could be done in several ways, for example:

- Specifying required minimum frequencies to attain following different events
- Specifying required min MW levels of load to be shed under different conditions and following different events
- Specifying high level outcomes (e.g. stable frequency) for certain events

The framework should not be specific about the methodology, instead allowing the flexibility for the criteria to be developed based on the required outcomes.

The UFLS Criteria Document (Publication)

Once the criteria has been agreed, the proposal is for this to be captured in a formal document published under the WEM Rules that can be referenced by the Technical Rules for Western Power to plan, design and build to.

It is not intended that this be a WEM Procedure as it is developed and maintained as part of this joint agreement framework.

Plan and Design UFLS scheme

It is proposed that the Technical Rules be revised to require Western Power to plan, design and build the UFLS scheme based on the UFLS Criteria Document published under the WEM Rules above. This activity would feed into standard annual planning activities and subsequent design and maintenance activities to adjust/refine the scheme as needed.

Western Power will also continue to have the obligation to design the UFLS scheme in accordance with the required UFLS criteria.

If during planning or design of the scheme an issue is identified in the published UFLS criteria that results in ambiguity or an inability to plan or design effectively, there should be capability within the framework for AEMO and Western Power to agree on a revision to the UFLS Criteria Document such that the scheme can be planned and designed effectively.

Implement, Monitor and Maintain UFLS scheme and Monitor Performance

Western Power will continue to have the obligation to implement and maintain the UFLS scheme, with additional requirements added to the Technical Rules to periodically review availability and performance of the scheme, and to revise settings as needed to ensure the requirements of the UFLS Criteria are met. There is benefit in also requiring publication of performance of the scheme following an event.

Review Performance

Finally, the WEM Rules currently requires Western Power to provide details to AEMO on compliance with load shedding plans. This obligation will be revised to require Western Power to share information on the availability and performance of the scheme, and to coordinate with AEMO on revising the UFLS Criteria where required.