Power System Operations Working Group –
Meeting 2:

Operating States

November 16th 2018

Agenda

1. Follow up on Autonomous Islands
2. Brief Introduction on Constraints work
3. Short break (if needed)
4. Operating States Discussion

Ground Rules

A few ground rules to get us started

- There is a large amount of material to work through in the workshop today, and the session chair will try to keep us on time in order to have sufficient time for discussion
- It is assumed that attendees have pre-read the papers that have been circulated and so in the interests of time, the slides will focus on the key items to discuss and conversations may need to be captured off-line in order to move onto the next item
- Should it not be possible to get through all the material within the available workshop time, a second session may be scheduled depending on the amount of material remaining and availability of attendees, or alternatively feedback may be provided out-of-session
- Questions and issues raised should be relevant to the discussion at hand, although questions/issues affecting other areas of the reform (or outside of the reform) will still be captured
- We will attempt to capture all questions/answers discussed during the session today, for circulation after the workshop along with these slides and any revisions to the papers as a result of the workshop discussions
- All feedback/discussion is relevant, if attendees do not have a chance to ask a question or raise an issue, please feel free to make use of the PSOWG mailbox: WARPSO@aemo.com.au

Autonomous Islands - Update

Introduction to Constraints

Operating States

Operating States - recap

Why do the WEM Operating States need to be reviewed?

- The existing operating states definitions under the WEM Rules create a number of potential ambiguities, for example:
  - It is possible to be in "neither" a High Risk or Normal Operating state
  - It is possible to be in "multiple" Operating States concurrently
  - There is no clarity around what an "overload" is or "the ability to manage the overload"
  - There is no recognition of the ability to use short term overload ratings
  - Some terms are not defined, such as "hard circuit rating"
  - The timeframes as currently described do not recognise the capability of AEMO to act to avoid the problem occurring in the first place
  - An Emergency Operating State includes transmission separation, which can occur under planned circumstances (e.g. Eastern Goldfields)

Operating States – design outcomes

The design outcome is intended to address the following key items:

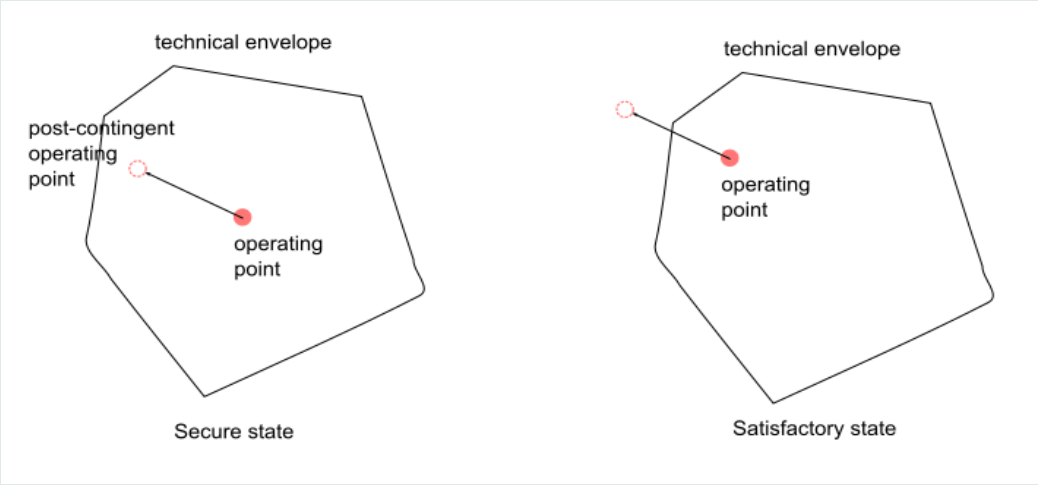
- Remove the "hard coding" of specific conditions within the definitions
- Remove the "blending" of reliability and security concepts
- Ensure powers to manage power system security under the existing framework are not removed or diminished
- Provide clarity and transparency on how power system security is maintained
- Address ambiguities in the application of the Operating States framework
- Be consistent with a move towards co-optimised security constrained ancillary services and economic dispatch.

Is this reasonable?

Operating States – recommendations

Satisfactory and Secure:

- A *Satisfactory Operating State* is when the power system is operating within all applicable limits and operating standards, and is stable.
- A *Secure Operating State* is when the power system is *satisfactory* and will remain or return to *satisfactory* following a *credible contingency event* considering the *technical envelope*



Operating States – recommendations

Satisfactory and Secure:

- The term ***Stable*** is not currently defined in the WEM Rules, however proper consideration of power system stability is an important part of maintaining system security.

- The recommendation for the PSOWG to consider is:

Recommendation 1

- Replace the WEM Normal Operating and High Risk Operating State with definitions of a Secure Operating State and Satisfactory Operating State where:

  Satisfactory Operating State refers to the SWIS operating within all relevant Operating Standards, Equipment Limits and Security Limits, and is Stable.

  Stable refers to the SWIS operating to all power system stability requirements as described in the Power System Operating Procedure.

  Secure Operating State refers to the ability of SWIS 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.

- Maintain the requirement for AEMO to document in a Power System Operation Procedure the process that it follows in determining these states, including determining when the SWIS is Stable.

Operating States – recommendations

Credible Contingencies:

- In utilising the definitions contained in recommendation 1, consideration needs to be given to a suitable definition of *Credible Contingency Event*.
- In looking at this, consideration also needs to be given to ensuring the definitions cater for:
  - the loss of non-generation facilities (e.g. storage, intermittent loads, etc)
  - all relevant network elements
  - large swings in load or unscheduled generation (including both embedded and non-embedded generation)
  - other elements of the SWIS that are not specifically registered as facilities (e.g. communications infrastructure)
- It is important that the rule definitions are not overly restrictive in preventing AEMO from identifying legitimate system events that needs to manage in order to maintain power system security
- It is also important that there is transparency for the market in the determinations that AEMO makes around credible contingency events
- It should be noted that there is a separate definition of Credible Contingency Event in the Technical Rules for network investment purposes

Operating States – recommendations

Credible Contingencies:

- The recommendation for the PSOWG to consider is:

Recommendation 2

- Create a new definition in the WEM Rules for Contingency Event, including "facilities" and changing "transmission elements" to "network elements":

  Contingency Event - means an event affecting the *SWIS* which *System Management* 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, Intermittent Generation or other elements of the SWIS not controlled by AEMO.

- Create a new definition in the WEM Rules for Credible Contingency Event (including some mandatory items for inclusion), removing the singular concept and including "facility" to cater for other technologies. Also allowing for a more generic description of when network equipment disconnection would/would not be considered credible:

  Credible Contingency Event - means one or more *Contingency Events*, the occurrence of which System Management 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:

  (1) the unexpected automatic or manual disconnection of, or the unplanned change in output of one or more, operating *Generating Units* or *Facilities*; or

  (2) the unexpected disconnection of one major item of *Network* equipment (e.g. transmission line, transformer or reactive plant) other than for conditions specified by System Management.

- Create a PSOP obligation to include documenting Credible Contingency Event classification.

  System Management must document in a Power System Operation Procedure the items to be included, or not included, as a *Credible Contingency Event.*

Operating States – recommendations

Credible Contingency Reclassification:

- The framework should ensure there is the ability to re-classify things normally considered non-credible as credible under special conditions
- The reclassification mechanism would utilise a definition of *Non-Credible Contingency Event*.
- The reclassification mechanism should:
  - have the ability to re-classify as credible temporarily
  - have transparency
  - provide for review

Recommendation 3

Introduce a definition of 'non-credible contingency event':

- 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:

  (1) multiple *Facility* failures; or

  (2) failure of multiple *Network* elements (such as may be caused by tower collapse).

Operating States – recommendations

Credible Contingency Reclassification:

- The recommendation for the PSOWG to consider is:

Recommendation 4

Introduce a re-classification framework into the WEM Rules for Non-Credible Contingency Events including the following:

- System Management may re-classify a **Non-Credible Contingency Event** (including multiple **Contingency Events**) as a single **Credible Contingency Event** where **Contingency Re-classification Conditions** are identified (including events like extreme weather conditions, bushfires, abnormal operating conditions).
- When System Management re-classifies a new **Credible Contingency Event** it must promptly notify the market of the re-classification 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** (e.g. nature of the event and the equipment impacted).
  - Any relevant timeframes (e.g. whether it is temporary, over what timeframe the re-classification may apply, when it commences).
  - The **Contingency Re-classification Conditions** that gave rise to the re-classification as known to System Management (other than any Market Confidential information).
- A definition of **Contingency Re-classification Conditions** linking back to the information that AEMO must provide in the publication of the re-classification.
- A requirement to revise the notice above once information has materially changed.
- The ability to re-classify the **Credible Contingency Event** back to a **Non-Credible Contingency Event** when the **Contingency Re-classification Conditions** that gave rise to it are no longer relevant.
- A requirement for System Management to document in the Power System Operating Procedure guidelines it may use to support the re-classification process (without limiting the ability for System Management to use the process).
- Requirement for System Management to provide periodic performance reports to the Economic Regulation Authority to include re-classification events.

Operating States – recommendations

General Principles:

- The framework should encode some key principles for the general maintenance of power system security
- The framework should still make allowance for extreme conditions where following the general principles would create non-desirable outcomes (e.g. customers off supply unnecessarily)
    - E.g. manually shedding load to avoid automated load shedding for the next contingency
- The framework should describe maximum allowable timeframes applicable
- The framework should be flexible enough to cater for emerging issues such as inertia and system strength issues

Operating States – recommendations

General Principles:

- The recommendation for the PSOWG to consider is:

Recommendation 5

- Create a set of Power System Security Principles that AEMO must follow in maintaining a Secure Operating State, including:
  - 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 the maximum timeframe specified in the definition of Secure Operating State, other than during conditions of Supply Scarcity or when in an Emergency Operating State.
  - Sufficient Inertia should be available to meet applicable Inertia Requirements.
  - Sufficient Fault Level should be maintained at applicable nodes to meet the applicable System Strength Requirements as described by AEMO in the Power System Operating Procedure.
  - A requirement for System Management to provide periodic performance reports to the Economic Regulation Authority to include situations where System Management was unable to return to a Secure Operating State within 30-minutes.
- Create the following definitions:

Inertia - Contribution to the capability of the *SWIS* to resist changes in *frequency* by means of an inertial response.

Inertia Requirements - described by AEMO in the Power System Operating Procedure.

Fault Level – a measure of current arising from fault conditions at a location on a *network*.

System Strength Requirements - described by AEMO in the Power System Operating Procedure.

Operating States – recommendations

Powers to manage Power System Security:

- In moving away from the Normal and High Risk Operating State definitions, we need to ensure the existing powers to manage power system security are maintained (and not diminished).
- A High Risk Operating State currently allows System Management the ability to:
  - Cancel or defer planned 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 (as specified in Standing Data).
- This last point requires some thought as to how it can be accommodated via the usual dispatch mechanisms

Recommendation 6

Allow for the following conditions:

- Where System Management is, or would be, unable to follow the Power System Security Principles to operate within or to return to a Secure Operating State, System Management may:
  - cancel or defer planned 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 (as specified in Standing Data).
- Provide advice to the Public Utilities Office to consider how the last bullet point can be accommodated in the proposed energy market design.

Operating States – recommendations

Emergency Operating State:

- The Emergency Operating State currently existing in the WEM Rules is referred to in the *Network Quality and Reliability of Supply (NQRS) Code 2005*
- The recommendation for the PSOWG to consider is:

Recommendation 7

Retain the overarching structure for an Emergency Operating State, but clarify criteria, remove wording inconsistencies and place obligation to define conditions in further detail in the Power System Operating Procedure:

- The SWIS is in an Emergency Operating State when, in the reasonable opinion of System Management, circumstances exist on the SWIS that impact its ability to comply with its core obligations under the WEM Rules.
- Not limiting its ability to declare an Emergency Operating State, System Management must describe example conditions in the Power System Operating Procedure for when it may declare an Emergency Operating State.

Operating States – recommendations

Powers to manage Emergencies:

- In adjusting the framework, we need to ensure the existing powers to manage power system security during emergencies are maintained (and not diminished).
- An Emergency Operating State currently allows System Management the ability to:
  - Cancel or defer planned 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 (as specified in Standing Data).
  - Direct any Participant to provide Ancillary Services.
  - Issue directions to Rule Participants to operate their Registered Facilities in specific ways.
  - Take other actions as considered necessary, consistent with good electricity industry practice, to ensure the system is returned to normal operations.
- The first three points are already covered in recommendation 6
- The point around Ancillary Services requires some thought as to implications on usual dispatch mechanisms, settlement and compliance

Operating States – recommendations

Emergency Operating State:

- The recommendation for the PSOWG to consider is:

Recommendation 8

Ensure the re-drafting of the Emergency Operating State continues to allow for the following conditions:

- In an Emergency Operating State, System Management may:
  - Direct any Participant to provide Ancillary Services.
  - Issue directions to Rule Participants to operate their Registered Facilities in specific ways.
  - Take other actions as considered necessary, consistent with good electricity industry practice, to ensure the system is returned to normal.
- Provide advice to the Public Utilities Office to consider how the first bullet point can be accommodated in the proposed ancillary service market design.

Operating States – recommendations

Reliable Operating State:

- The framework should work to ensure supply is being maintained in accordance with a set of reliability guidelines or principles (referred to in current WEM Rules Power System Reliability definition but not defined):

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

- The framework should discern between uncontracted load shedding and contracted load shedding, for example:
  - relating to the provision of a load shedding service as part of an Ancillary Service (e.g. interruptible load)
  - relating to the normal dispatch of demand side management services

Recommendation 9

Create a Reliable Operating State definition and a placeholder, adjusting the load shedding items to cater for DSM dispatch and Ancillary Services

- The SWIS is in a Reliable Operating State when:
  - System Management is not initiating and is not expecting to initiate any manual load shed instructions imminently, other than as part of normal energy or Ancillary Service dispatch.
  - In System Management's reasonable opinion, the SWIS meets and is projected to meet the relevant Reliability Standard, having regard to the Reliability Standard Implementation Guidelines.

Operating States – associated areas

Power System Security definition:

- The current definition in the WEM Rules is:

  Power System Security: The ability of the SWIS to withstand sudden disturbances, including the failure of generation, transmission and distribution equipment and secondary equipment.

- There is benefit in linking this to the Operating States framework, the PSOWG is requested to consider:

Recommendation 10

Modify the definition of Power System Security to refer to the operating states framework:

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

Operating States – associated areas

Equipment Limits:

- The current definition in the WEM Rules limits the provision of this to Standing Data which restricts the use of more dynamic and time-based values, such as:
  - Seasonal limits
  - Dynamic limits
  - Temporary limits
  - Time-based Overload limits
- To ensure that these normal operational limits are appropriately catered for within the Operating States framework, the PSOWG is requested to consider:

Recommendation 11

Modify the definition of Equipment Limit to be less restrictive:

- An **Equipment Limit** means any limit on the operation of a Facility's equipment that is not a Security Limit, but is provided as Standing Data for the Facility, or otherwise provided to AEMO by a Participant for its Facility or equipment in accordance with the Power System Operating Procedure

Operating States – other thoughts

Technical Envelope

- The current WEM Rules definition covers some of the major items, but does not currently cover other key elements that need to be considered such as load forecasts, commissioning tests, planned and forced outages, generator performance standards, reserve margins, etc. It is proposed that this be the subject of a separate small discussion paper to work through.

Dispatch Advisories

- In changing the Operating State framework, the Dispatch Advisory mechanism will need to be re-visited to ensure the categories for market notification are relevant and practical and do not create obligations that cannot be practically met. Additionally, it may make sense to deal with directions to participants (outside of Dispatch Instructions) in their own section within the rules rather than via the Dispatch Advisory mechanism.

AEMO

Operating States – other thoughts

Dispatch Criteria

- Similar to Dispatch Advisories, in changing the Operating State framework, elements of the Dispatch Criteria will need to be re-visited to ensure they are aligned (WEM Rules 7.6.1, 7.6.1D(e), 7.6A.3(a)).

Any other thoughts?

Questions or general business

Any other questions or general business?

Thank you

Thank you very much for your attendance and thoughtful contribution

- We will endeavour to send a copy of these slides, along with notes from todays workshop out to attendees and interested parties within the next 5 business days
- Please feel free to send any other questions or thoughts to the PSOWG email inbox:

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