

# Outage Assessment

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## Current version release details

Version	Effective date	Summary of changes
16.0	20 March 2024	Updated Sections 8 and 9 with additional conditions where planned outages will be Unlikely to Proceed (UTP).

**Note: There is a full version history at the end of this document.**

# 1. Introduction

## 1.1. Purpose and scope

This the Outage Assessment procedure is a *power system operating procedure* under clause 4.10.1 of the National Electricity Rules (NER).

This procedure has effect only for the purposes set out in the NER. The NER and the National Electricity Law prevail over this procedure to the extent of any inconsistency.

The purpose of this procedure is to detail the assessment process for outages of transmission plant in the NEM.

## 1.2. Definitions and interpretation

### 1.2.1. Glossary

Terms defined in the National Electricity Law and the NER have the same meanings in this procedure unless otherwise specified in this clause.

Terms defined in the NER are intended to be identified in this procedure by italicising them, but failure to italicise a defined term does not affect its meaning.

In addition, the words, phrases and abbreviations in the table below have the meanings set out opposite them when used in this procedure.

Term	Definition
AEMO Operational Zone	As defined in each of the Regional Power System Operating Procedures, except for Queensland, in which case it is taken to mean the Queensland Transmission Network, as defined in the Regional Power System Operating Procedure - Queensland
AWEFS	Australian Wind Energy Forecasting System
ASEFS	Australian Solar Energy Forecasting System
CA	Contingency Analysis
CIR	Congestion Information Resource
DS	Dispatch
DSA	Dynamic Security Assessment
ECS	Emergency Control Scheme
FCAS	Frequency Control Ancillary Service
I/S	In service
INFO	Information Only
LOR	Lack of Reserve
Max Avail	Maximum Availability in the energy bid
MT	Medium term
MTLTP	Medium Term Likely to Proceed
NER	National Electricity Rules, and 'NER' followed by a number denotes that numbered rule or clause of the NER.
NOS	Network Outage Scheduler

Term	Definition
NSP	Network Service Provider
OOS	Out of service
PASA	Projected Assessment of System Adequacy
PD	Pre-dispatch
PDLTP	Pre-dispatch Likely to Proceed
POE	Probability of Exceedance
PSS/E	Power System Simulator for Engineering
PTP	Permission to Proceed
PTR	Permission to Restore
ST	Short term
STLTP	Short Term Likely to Proceed
TNSP	Transmission Network Service Provider
VSAT	Voltage Security Assessment Tool
UTP	Unlikely to Proceed

### 1.2.2. Interpretation

This procedure is subject to the principles of interpretation set out in Schedule 2 of the National Electricity Law.

## 1.3. Related documents

Reference	Title	Location
NER Chapter 3 and 4	National Electricity Rules	<a href="https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules/current">https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules/current</a>
SO_OP_6300 Series	AEMO power system operating procedures	[Restricted access] <a href="https://aemcloud.sharepoint.com/sites/EXT-LNK-AEMOOP?OR=Teams-HL&amp;CT=1636675936285">https://aemcloud.sharepoint.com/sites/EXT-LNK-AEMOOP?OR=Teams-HL&amp;CT=1636675936285</a>
SO_OP_3715	Power System Security Guidelines	<a href="https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/power_system_ops/procedures/so_op_3715-power-system-security-guidelines.pdf">https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/power_system_ops/procedures/so_op_3715-power-system-security-guidelines.pdf</a>
SO_OP_2000	AEMO Operating Procedure - Glossary	<a href="https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/power_system_ops/procedures/so_op_2000-glossary.pdf">https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/power_system_ops/procedures/so_op_2000-glossary.pdf</a>
	NEM Operational Forecasting and Dispatch handbook for wind and solar generator	<a href="https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/dispatch/policy_and_process/nem-operational-forecasting-and-dispatch-handbook-for-wind-and-solar-generators.pdf">https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/dispatch/policy_and_process/nem-operational-forecasting-and-dispatch-handbook-for-wind-and-solar-generators.pdf</a>

## 2. General Principles

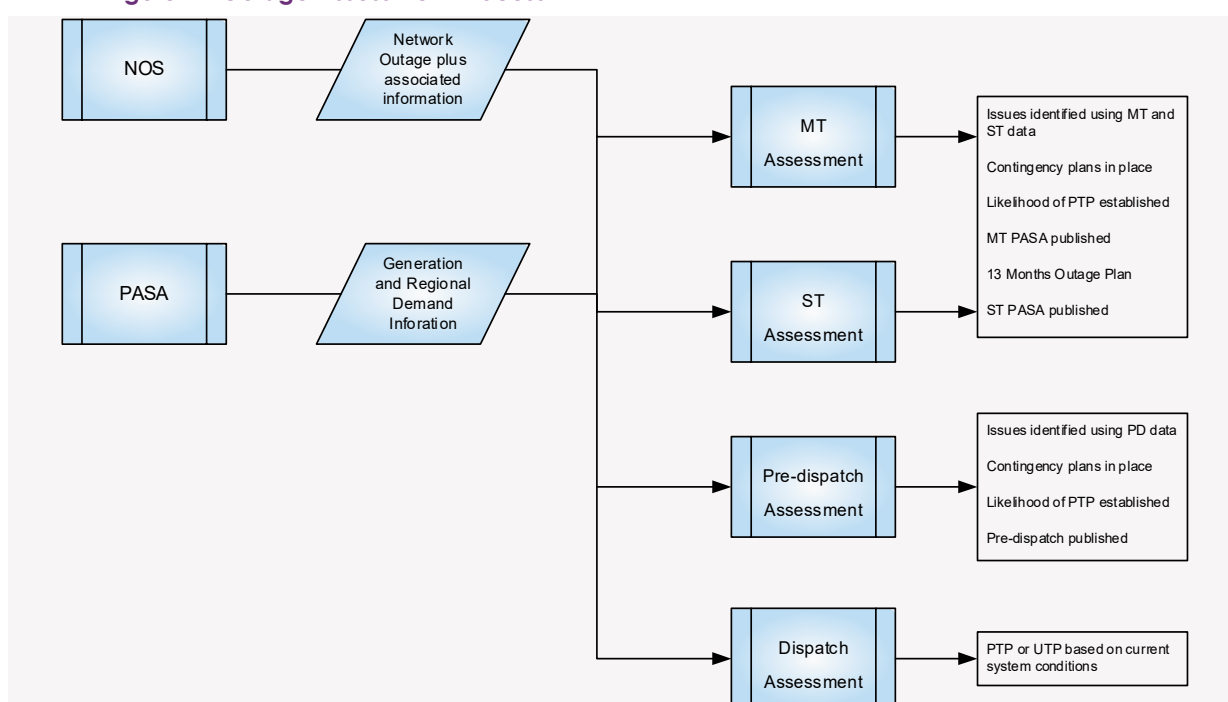
AEMO will only allow an *outage* to proceed on the basis that the *outage* will not result in a *power system security* or *reliable operating state* violation. Consideration must also be given to what actions would be required to return the *power system* to a *secure operating state* within thirty minutes following a *credible contingency event* or a significant change in *power*

system conditions during the outage period. This principle applies to all outages including concurrent and/or high impact outages.

The AEMO outage assessment process relies upon information provided by registered participants of changes in transmission system and generation conditions. The primary method of communication is via the AEMO Network Outage Scheduler (NOS) for transmission system outages and market systems for bids for scheduled plant.

AEMO provides an outage assessment function in the medium term, short term and pre-dispatch periods before transmission network outages are given permission to proceed (PTP) at the time of dispatch. An overview of the process is presented in Figure 1.

**Figure 1 Outage Assessment Process**



### 3. Responsibilities

AEMO is responsible for power system security and the application of network constraints to the market system. A detailed outage assessment can only be carried out successfully if a sufficient level of information is provided to AEMO in a timely manner. NSPs require appropriate responses from AEMO to aid in their transmission outage planning process and registered participants in general require information for their own purposes. The following NER references highlight these areas. For information on PASA timeframes refer to NER 3.7 and 3.7A, in particular:

- 3.7.1: Administration of PASA.
- 3.7.2: Medium Term PASA.
- 3.7.3: Short Term PASA.
- 3.7A: Congestion Information Resource.

For information on dispatch timeframe refer to NER 3.8, in particular:

- 3.8.1: Central Dispatch.
- 3.8.10: Network Constraints.
- NER Chapter 4 outlines obligations regarding *power system security*.

To ensure the *network outage* assessment process is managed in an ordered manner a distribution of responsibility applies for the medium term, short term, *pre-dispatch* and *dispatch* periods. Specific *AEMO* departments are responsible for the assessment of *transmission system outages* as depicted in Table 3.

**Table 1 Responsibility of Transmission Outages**

Time Period	AEMO Staff Area
<i>Dispatch</i>	NEM RTO
<i>Pre-dispatch</i>	NEM RTO
<b>Short Term</b>	Operations Planning
<b>Medium Term</b>	Congestion Modelling

## 4. Timing of Outage Submission

*Outages* should be submitted to *AEMO* at the earliest possible time, so that forecast *network capability* is accurately reflected. To assist in processing and audit of submitted *outages* there are three classifications associated with time of submission. Planned, short notice and unplanned classifications are defined in the *AEMO* glossary. The reason for the existence of each is summarised in this section.

### 4.1. Planned Outages

For planned *outages*, information must be provided to *AEMO* via the NOS. Based on this and other market information, outcomes of the *outage* assessment process are:

- Feedback to the NSP on the likelihood of an *outage* proceeding.
- Development and invocation of any required *constraint* sets or equations.
- A consistent forecast of *power system* reliability and *network capability* to participants throughout the MT *PASA*, ST *PASA* and *pre-dispatch* timeframes.
- Publication of 13 Month Outage Plan as a part of Congestion Information Resource (CIR).

### 4.2. Short Notice Outages

For short notice *outages*, the advice is the same as for planned *outages* with one additional requirement. As well as the NOS information, phone communication by the TNSP is required to ensure a timely response to the short notice condition by *AEMO*.

### 4.3. Unplanned Outages

A TNSP must immediately advise *AEMO*, by telephone of any unplanned *outages* in the *AEMO* Operational Zone and any other unplanned *outages* where a NOS entry would normally be required as detailed in the *regional power system operating procedures*. For any unplanned outage that requires *AEMO* to invoke a *constraint* a NOS entry must be provided as soon as

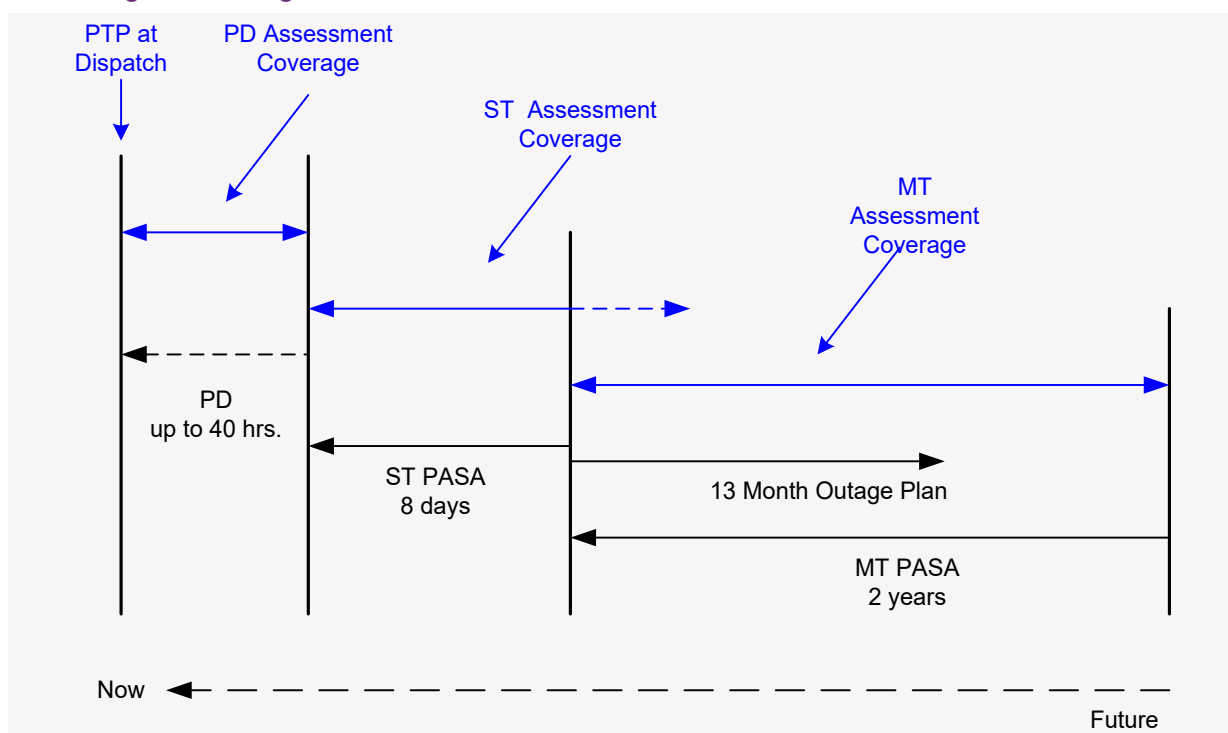
possible after the event, regardless of the outage duration. For unplanned *outages* not requiring a *constraint*, a NOS entry is only required if the equipment is not returned to service within 15 minutes.



## 5. AEMO Outage Assessment Timetable

In general, at least one *outage* assessment will take place for each planned *outage* submitted to the NOS during each defined timeframe of medium term (MT), short term (ST), *pre-dispatch* (PD) and *dispatch* (DS). There is some overlap of ST and MT assessment times. The aim of this is to assist in meeting ST requirements prior to the publication of ST PASA. As part of the *Congestion Information Resource*, AEMO also publishes information on planned *network outages* for the subsequent 13 months. This 13 Month Outage Plan fits within the MT period. The timetable applicable to the *outage* assessment process is presented in Figure 2.

**Figure 2 Outage Assessment Timeline**



The ideal processing situation is for AEMO to perform a single *outage* assessment during each timeframe, considering all *outages* entered in the NOS at that time. In practice this is sometimes not feasible because the load forecast or the *outage* information in NOS may have changed. Hence, additional *outage* assessments may be carried out during each timeframe.

## 6. Outage Submission to AEMO via NOS

The degree of information required by AEMO to process *outages* is limited to what is needed to correctly model the situation and assess *power system security* and reliability of *supply* implications.

The AEMO Network Outage Scheduler (NOS) has been developed to transfer this information between each TNSP and AEMO. NOS operation is referenced in this document but is not illustrated as it is a specialist software package for specific users. Accordingly independent assistance is available in this area.

## 6.1. NOS Outage Submission for a Network Element

The prime considerations when assessing an *outage* is the impact on *power system security* and reliability of *supply* caused by the unavailability of a *network element*. This is not related in any way to the number of work groups performing specialised tasks. AEMO requires NOS submission of all *network elements* affected, with grouping of *network elements* in NOS if elements are associated on an operational basis. Some examples to clarify this would be as follows:

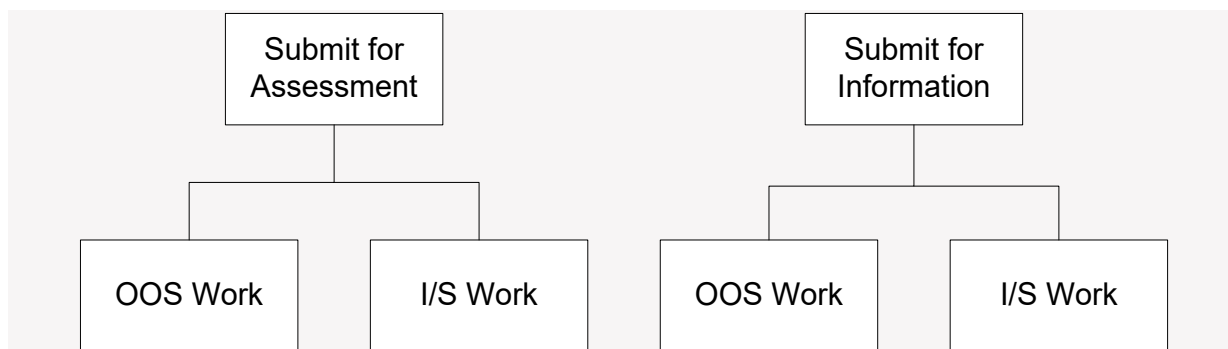
- Multiple work groups during an *outage* of one *network element*.
  - One NOS entry only is required to identify the *network element*.
- Associated *network element outages*.
  - Associated *network element outages* should be included in the same NOS submission. Some examples of this would be:
    - A bus *outage* that offloads a *transmission* line. The bus and line are to be submitted as one NOS record. In the case of a bus *outage*, of a bus connected to a breaker and a half scheme, the breakers connected to the OOS bus do not have to be submitted if no other equipment is offloaded. The exception is when a *constraint* is required with an associated breaker that will be out of service.
    - Breaker and a half or double selection bay *outages*. The bay components as well as the disconnected line, transformer, etc. are to be submitted as one NOS record. If the bay equipment is not included it will be assumed that isolation has been made on an equipment isolator and the bay restored to normal service during the *outage*.
    - A transformer *outage*, where the transformer is directly connected to a line. The offloaded line and the transformer must also be submitted.
    - A circuit breaker *outage*, which removes other equipment from service. The circuit breaker as well as the other OOS equipment must be submitted.
  - Short duration off-loading of equipment during switching may be required to achieve isolation for an *outage*. An example of this would be where equipment is connected to a bus via an isolator only and the bus is required to be switched to achieve isolation. For this and similar scenarios, not requiring a *constraint* the following applies:
    - Off-loading of less than 15 minutes duration during switching must be noted in the booking notes of the NOS record.
    - Off-loading of greater than 15 minutes duration during switching must be advised by independent NOS submission.

For scenarios where a *constraint* is required during switching, a NOS submission will be required.

## 6.2. Classifications of Outage Submission

The definitions provided below are associated with the processing of *outages* via NOS. There are two high level classifications of NOS entry (assessment and information). These indicate if assessment is required by AEMO or not. Within each of these classifications, the *outage* is sub-categorised as out-of-service (OOS) or in-service (I/S) as illustrated in Figure 3.

**Figure 3 Outage Classifications**



The details of what *outages* are required to be submitted to NOS, and the associated classifications, are detailed in the *regional power system operating procedures*. The general principles used to determine the classification of *outages* are detailed below.

### 6.2.1. Submit for Assessment

The scope of assessment is to ensure the *power system* in AEMO Operational Zone (as defined in the regional power system operating procedures) remains in a secure and reliable operating state.

All *outages* in this category require PTP / PTR from AEMO. *Outages* submitted for **assessment** include:

- All *outages* in AEMO Operational Zone. For protection *outages* refer to section 6.2.2 below.
- *Outages* not in AEMO Operational Zone where:
  - The *outage* may cause a security violation in AEMO Operational Zone.
  - The *outage* involves *constraint* invoke or revoke. In this case the scope of assessment is limited to *constraint* management.
  - The *outage* has FCAS implication by placing large loads at risk. In this case the scope of assessment is limited to *constraint* management.
  - The *outage* affects bus connections within AEMO Operational Zone.
  - The *outage* involves reactive *plant* that is regarded as supporting the *transmission system*.
- Any *transmission lines* taken out of service for voltage control.

### 6.2.2. Submit for Information

*Outages* in this category do not require PTP/PTR from AEMO. Generally, *outages* submitted for **information** include:

- Protection *outages* of equipment in AEMO Operational Zone, if:
  - Duration is less than 8 hours (for transmission lines protections), and
  - Only one protection system will be taken out of service, and
  - Duplicated protection system remains in service, and
  - There are no constraints, or any other operative action required during the *outage*

Any other protection outages of equipment in AEMO Operational Zone need to be submitted to AEMO via NOS as 'For assessment'.

- *Transmission system* equipment not in AEMO Operational Zone but represented in the *AEMO network* model.

The INFO category relates to equipment *outage* information provided to *AEMO*, primarily for the purpose of *network* modelling accuracy. The task of maintaining system security in TNSP's operational zone lies with the respective TNSP acting as an agent of *AEMO*. It does not require assessment by *AEMO*. However, the NSP is required to acknowledge all security violations have been addressed.

Additional information and contingency plans associated with this category may be requested at any time at the discretion of *AEMO*. *Outages* in this classification are detailed in the relevant *regional power system operating procedures*.

*AEMO* may at any time request that an *outage* normally in the 'information' category be submitted to NOS for complete *AEMO outage* assessment. If this occurs, the circumstances must be logged and reported to the Manager NEM RTO for review.

### 6.2.3. Outages not requiring a NOS entry

Generally *AEMO* does not require notification of the following types of *outages* in the *TNSP's Operational Zone* **unless specifically listed** in the relevant *regional power system operating procedures*:

- In-service protection or communication *outages* where a protection, metering or control scheme is made unavailable.
- Radial lines and associated protection and communication schemes where the *outage* does not cause an *outage* to the interconnected system.
- 132/110 kV bulk supply transformers where there is no interruption to the interconnected system.

*AEMO* may at any time request any *outage* in the above categories be entered in NOS if *AEMO* considers the information is required for *AEMO* to carry out its *power system security* functions.

### 6.2.4. Out-of-service work

- Where *network* switching results in the off-loading or removal of a *network element*, or
- Where an emergency control scheme (ECS) or other automated function is made unavailable resulting in reduced *capability* of the *power system*. For this purpose, an ECS is not a component of the protection system associated with a single item of equipment. It is an automated scheme that results in modification to power flow given specified trigger conditions and has an identifiable equipment name in NOS. This includes:
  - Schemes designed to reduce *power system* loading.
  - Schemes designed to modify *power system* configuration.
  - Schemes designed to modify *generation*.

### 6.2.5. In-service work

Where a *power system* service (*secondary equipment*) is disabled.

This may include:

- Where a protection, metering or control scheme is made unavailable.

- Where it is planned to momentarily interrupt and immediately restore load during testing of an automated scheme such as auto-reclose.
- Where communication equipment being made unavailable such that a function associated with the *transmission network* is disabled.
- Where telemetered information or other functionality normally provided to AEMO is made unavailable due to any nature of work.
- Where transformer auxiliary systems (fans etc.) are disabled and transformer capacity is impacted

This does **not** include live line work where the only consequence is that the auto-reclose is made unavailable.

### 6.3. Detail Accompanying Outage Submission

#### Out-of-service

The critical aspect is the impact on the *network*. In the simplest case, *plant* is advised as being unavailable and is then removed from the AEMO *network* model during analysis. Once it is removed from the AEMO *network* model, the detail of physical work being undertaken does not, in most cases, provide any more useful information. For routine *outages*, high level work information is available in the mandatory NOS fields, accordingly work detail is not required in the NSP Booking Notes unless specifically requested by AEMO. *Network* configuration for out-of-service and Info work is critical for AEMO modelling purposes and must be provided.

#### In-service

The nature of the work is required but specifically in terms of impact or services affected and risk which require assessment by AEMO. The NOS entry should clearly state the equipment, service or data that is made unavailable and the impact on *power system security* and operation of the NEM.

Table 4 lists the information required for the different categories of *outages* submitted to NOS. This is a general guide and more information may be requested by AEMO at any time.

**Table 2 NOS Detail Required**

Information Required in NOS	Submit as OOS Work	Submit as I/S Work	Submit as Info
Provide specific equipment ID	Yes	Yes	Yes
List HV equipment taken 'Off-Load'	Yes	N/A	Yes
Detail any <i>Network Configuration Changes</i>	Yes	N/A	Yes
List secondary equipment being disabled	N/A	Yes	No
List any Service or Information to AEMO being disabled	Yes	Yes	Yes
List abnormal risk issues	Yes	Yes	Yes
List possible security violations	Yes	Yes	Yes
Acknowledge that violations are addressed	Yes	Yes	Yes
Contingency Plan is attached	Yes	Yes	No
Provide exact detail of work being undertaken	No	Yes	No

## 7. High Impact Outages

AEMO has the responsibility to make available to *registered participants* information about the potential for, or the occurrence of, a situation which could significantly impact, or is significantly impacting on the *power system*.

To meet this requirement AEMO may identify certain *network outages* as “High Impact Outages”.

These are *outages* during which, in AEMO’s reasonable assessment, the *power system* can be operated in a *secure operating state*, however following a *credible contingency event* the actions taken by AEMO to return the *power system* to a *secure operating state* within thirty minutes could have a significant impact on the *power system* and the market.

The basis for identifying High Impact Outages in the *NEM transmission network* is governed by the outcomes of network studies or past experience where it is identified that:

- During the outage there is a potential for *Energy* and *FCAS* prices to approach the Market Price Cap or Market Price Floor; and/or
- Following a *credible contingency event* there is a potential for one or more of the followings:
  - a reduction in supply that may be expected to result in *involuntary load shedding*
  - separation of parts of the *network* into large islands of scheduled *generation, networks* and loads; e.g. North / South Tasmania, any region(s) separated from the NEM.
  - requirement for *market* intervention through issuing of *directions*; or
  - disconnection of *generation* in the *region*, which exceeds the size of the single largest *credible contingency* under normal operating conditions.

In the assessment of High Impact Outages, AEMO will determine the maximum supportable demand for the *region* or area affected where applicable. This will be the demand above which *load shedding* would be required to return the *power system* to a *secure operating state* within thirty minutes should the *credible contingency event* occur.

If the forecast demand is within 200 MW of the maximum supportable demand, AEMO will issue a market notice identifying the *outage* and provide information about the potential impact on the *power system* on the occurrence of a *credible contingency event* during that *outage*.

The updated list of upcoming High Impact Outages in the *NEM* can be found on [AEMO’s website](#) which is updated weekly.

If the recall time is greater than 30 minutes for the defined high impact outage, relevant TNSP should also provide the summary of work in the NOS booking notes.

AEMO will indicate if an outage is considered a High Impact Outage (HIO) in NOS by ticking the HIO Tickbox in NOS. The NOS has a facility to also note the market notice number issued for that outage. Note – unlike the other tickboxes in NOS this tickbox is exclusively operated by AEMO. Refer to Figure 4.

Figure 4 High Impact Outage Tickbox and Market Notice No. field

<b>Certainty</b> <b>Resubmit Reason</b> <b>High Impact Outage Status</b> <b>Market Notice</b>	Scheduled Information Update <input type="checkbox"/> <input type="text" value="123456"/>	<input type="button" value="Save Market Notice No."/>
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## 8. Outage Assessment

During each time period of MT, ST and PD, *AEMO* will assess *outages* and respond to the relevant TNSP. Advice provided by *AEMO* at all times prior to *dispatch* will indicate probable violations as they become apparent, given the conditions of study. The parameters associated with assessment in each timeframe are discussed in this section.

### 8.1. Medium Term Outage Assessment

MT *outage* assessment includes the use of a number of uncertain study variables. Three significant variables are:

- *Generation* configuration.
- *Region* demand.
- System configuration.

These three variables have the potential to change the outcome of a security assessment. Hence for MT assessment, the process is aimed at identifying possible security or *reserve* issues given typical study parameters.

#### 8.1.1. MT Study Method

Any of the following study methods may be used for MT *outage* assessment:

- MT *PASA reserve* assessment in the following cases:
  - Where an inter-regional transfer limit reduction is the only impact of the *outage* and it is addressed by the applied *constraint* in MT *PASA*.
  - Where an intra-regional *transmission* limitation is the only impact of the *outage* and it is addressed by the applied *constraint* in MT *PASA*.
- Previous relevant study results including clash lists, *outage* guides, or similar. The source of such documentation may be *AEMO* or TNSP for MT application.
- The *AEMO* EMS applications, Powerflow, CA, VSAT, Short circuit analysis and DSA.
- PSS/E in cases where there is a need to study system augmentation.

#### 8.1.2. MT Study Parameters

- *Network* Configuration (including bus tie status) as advised via the NOS.
- *Generation* as per typical system conditions with regard to availability in MT *PASA* (this includes *semi-scheduled* wind and solar farm *generation* output based on *AEMO* forecasts).
- Worst case *generation* pattern, including maximising *generation* in a particular power station or within a specific area if necessary.
- Any agreed specific *generation* condition advised by the TNSP via NOS.
- Any *network* limits advised by the TNSP via NOS.
- Any agreed *network support agreement* advised by the TNSP via NOS.
- Any arrangements included in a contingency plan advised by the TNSP via NOS.

- Demand will be 50% POE forecast.

If the outage is driven by generator and network changes (such as new connections), AEMO has minimum timeline requirements for the provision of information. These are in place so that AEMO has enough time to undertake internal processes and update its various systems such as AEMO's Energy Management System (EMS), constraint equations and dynamic models. More information is available online<sup>1</sup>.

### 8.1.3. MT Assessment Priority

AEMO will endeavour to provide a response to Medium Term *outage* notifications at the earliest possible time. Response time may vary depending on resources available at the time. Generally *outages* will be assessed on a chronological basis in the following priority order:

- 1) *Outages* requiring *constraints* within the 13 Month Outage Plan.
- 2) *Outages* not requiring *constraints* within the 13 Month Outage Plan.
- 3) Other *outages* in MT timeframe.

This priority order will be modified to accommodate any *outage* assessment if requested via phone by a TNSP.

### 8.1.4. MT Study Results

General results should indicate any system security violations or *reserve* issues detected. More specific cases may include the possible restriction of *generation* at particular sites due to an *outage*. Any *constraint* development required should be identified at this stage and implemented as soon as complete. Any issues to be addressed should be resolved as soon as possible, if required any issues will be raised in NOS and *outage* assessment will not proceed further until the issue is resolved.

If outstanding issues are not resolved within the MT timeframe (typically 8-10 days before the *outage* start date), such as inadequate limits advice, contingency plans, or conflicting *outages*, the *outage* status will be set to UTP in NOS, and the constraints should be revoked. The TNSP should be informed before any *outage* is set to UTP. Refer to Section 9.16 for more information.

If all issues associated with an assessment have been addressed the *outage* status will be changed to MTLTP in NOS.

## 8.2. Short Term Outage Assessment

ST *outage* assessment includes the use of more reliable variables than the MT assessment however two of the variables, *generation* and demand, are still not known with a great amount of certainty. These and possibly other variables have the potential to change the outcome of a security assessment study. Hence for ST assessment, the process is aimed at identifying possible security or *reserve* issues given typical real time study parameters.

Within the ST assessment timeframe is the requirement to comply with NER clause 4.10.3 (b). This states that AEMO will endeavour to give at least 3 days' notice to relevant DNSPs in cases where *network* switching planned by a TNSP could affect security of supply to a distribution *network*. In accordance with *regional power system operating procedures*, this notice will be provided to the DNSP by the TNSP on AEMO's behalf.

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<sup>1</sup> Refer to: <https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/participate-in-the-market/network-connections/aemo-timing-requirements-for-the-provision-of-information>



### 8.2.1. ST Study Method

Both of the following study methods are used for ST *outage* assessment:

- The AEMO EMS applications, Powerflow, CA, VSAT, Short circuit analysis and DSA.
- ST PASA *reserve* assessment.

### 8.2.2. ST Study Parameters

- *Network* configuration (including bus tie status) as advised via the NOS.
- *Generation* as per typical real time conditions with regard to availability in ST PASA (this includes *semi-scheduled* wind and solar farm *generation* output based on the AWEFS/ASEFS forecast and their bid Max Avail).
- Worst case *generation* pattern, including maximising *generation* in a particular power station or within a specific area if necessary.
- Any agreed specific *generation* condition advised by the TNSP via NOS.
- Any *network* limits advised by the TNSP via NOS.
- Any agreed *network support agreement* advised by the TNSP via NOS.
- Any arrangements included in a contingency plan advised by the TNSP via NOS.
- Demand will be 50% POE forecast.

### 8.2.3. ST Assessment Priority

The primary consideration with regard to priority is to provide assessment of all *outages* approaching *pre-dispatch* for security purposes. The secondary consideration is to provide *outage* related information to the market via standard AEMO publications. AEMO resources are committed full time to ST assessment functions; however response time may vary depending on workload at any time. The practical conditions influencing this include submission of Short Notice *outages*, the delayed notification of contingency plan and other *outage* detail, as well as assessment time committed to the more complex *outage* study cases.

### 8.2.4. ST Study Results

Results will indicate all issues and solutions detected during study such as:

- System security violations.
- *Reserve* issues.
- Restriction of specific *generators*.
- Contingency plans.
- Requirements for additional limits advice or constraints.

If any outstanding issues are not resolved within the ST timeframe, the *outage* status will be changed to UTP in NOS. Forecast *reserve* issues are subject to high uncertainty, due to changing forecasts and generator availability. Therefore, if an *outage* status is set to UTP due to forecast *lack of reserve 2* (LOR2) conditions, AEMO will leave the outage constraints invoked to encourage a market response. The TNSP should be informed before any outage is set to UTP. Refer to Section 9.16 for more information.

If it is clear that the forecast reserve issues cannot be resolved by a market response, AEMO will revoke the outage constraints and the planned outage will not proceed.

If all issues associated with an assessment have been addressed the *outage* status will be changed to STLTP in NOS.

## 8.3. Pre-dispatch Outage Assessment

PD *outage* assessment is more accurate than any previous study due to increasing certainty associated with *dispatch* of *generators*, demand and *network* configuration. As time approaches *dispatch* PD studies will obviously be extremely close to the situation during the *outage*.

### 8.3.1. PD Study Method

Both of the following study methods are used for PD *outage* assessment:

- The AEMO EMS applications, Powerflow, CA, VSAT, Short circuit analysis and DSA.
- *Pre-dispatch reserve* assessment.

### 8.3.2. PD Study Parameters

- *Network* configuration (including bus tie status) as advised via the NOS.
- *Generation* as per *pre-dispatch* schedule (this includes *semi-scheduled* wind and solar farm *generation* output based on the AWEFS/ASEFS forecast and their bid Max Avail). Note that arrangements made between a TNSP and *generator* to accommodate an *outage* should be reflected in the *pre-dispatch* schedule.
- Worst case *generation* pattern, including maximising *generation* in a particular power station or within a specific area if necessary.
- Any *network* limits advised by the TNSP via NOS.
- Any agreed *network support agreement* advised by the TNSP via NOS.
- Any arrangements included in a contingency plan advised by the TNSP via NOS.
- Demand will be the 50% POE PD forecast.

### 8.3.3. PD Assessment Priority

The primary consideration with regard to priority is to provide assessment of all *outages* approaching *dispatch* for security purposes. The secondary consideration is to provide *outage* related information to the market via standard AEMO publications. PD assessment is performed by control room staff and response time may vary throughout PD depending on workload associated with the real time operation of the *network* at any time.

### 8.3.4. PD Study Results

Results will verify all issues and solutions detected during previous study as well as identify and resolving any issues not previously detected.

If an outage status is UTP due to forecast LOR2 conditions, and if the forecast reserve issues are not resolved by a market response, AEMO will revoke the outage constraints and the planned outage will not proceed. Refer to Section 9.16.1 for more information.

If all issues associated with an assessment have been addressed the *outage* status will be changed to PDLTP in NOS.

## 8.4. Dispatch Outage Assessment

If system conditions do not change significantly the PD assessment may be used as a basis for providing PTP of *outages* at the *outage* start time. Otherwise a final check must be made using

real time data immediately prior to *outage* start. The *outage* status will be changed to PTP in NOS when AEMO are satisfied that all associated issues have been addressed, including confirmation:

- Of any agreed *network support agreement* advised by the TNSP via NOS.
- Of any arrangements included in a contingency plan advised by the TNSP via NOS.
- That required solar farm inverters and wind farm turbines have been disconnected.

If any *network support agreement* or contingency plan advised of by the TNSP via NOS are not in place and are required to ensure system security, the *outage* status should be changed to UTP.

If required solar farm inverters and wind farm turbines have not been *disconnected* before NSP seeking PTP for a planned *outage*, AEMO will not give PTP for the *outage* until required solar farm inverters and wind farm turbines are *disconnected*.

## 8.5. Contingency Plans

A contingency plan is required to resolve any issue that is detected due to a *network* equipment *outage*.

If there are security violations and a contingency plan has not been provided, AEMO may phone or email to advise of simple issues or raise an issue in the NOS for more significant cases. In both of these scenarios the issue will be a summary of the violations that need to be addressed and information will need to be submitted by the TNSP.

Once an issue has been raised in NOS, an *outage* will not be assessed further until the issue is resolved. Planned *outages* that normally require a contingency plan should be submitted in the NOS with the contingency plan to reduce the possibility of delay during assessment.

The issue in NOS will be accompanied with a broad outline of the expected situation such as an indication of likely pre-contingent and post-contingent violations. Detail of the method employed to rectify violations is to be provided by the TNSP.

For contingency plans provided in the medium term only a preliminary plan may be possible in some circumstances as system conditions may be largely unknown, such a plan would be structured in broad terms and indicate the most probable contingency measures. Plans provided on this basis must be revised and made available to AEMO as soon as system conditions are considered to be more predictable, in any event detailed contingency plans should be available for the short term assessment carried out by AEMO.

A contingency plan may consist of a simple statement or may consist of detailed arrangements depending on the issues that need to be addressed. AEMO is responsible for the approval of contingency plans provided by a TNSP.

A contingency plan must include any arrangements made between a *generator* and TNSP to accommodate a *network outage*. The arrangement will then be reflected in the *dispatch* of *generation*. Any arrangements detailed in NOS that require a manual response from a *generator* will be confirmed with the *generator* by AEMO immediately prior to PTP.

## 8.6. Constraint Application

AEMO will apply *constraints* considered necessary to ensure that system security obligations are met at all times. This is simply a reflection of *transmission network capability* in the market system.

A significant amount of *constraint* application results from *network outages* advised to AEMO via NOS. The principle of *constraint* application with regard to NOS *outage* records is as follows:

- All *constraints* considered necessary to manage an *outage* advised via NOS will be invoked by AEMO at the earliest practical time. This includes *constraints* to reflect any *network support agreement*.
- *Constraints* using time based equipment ratings will only be applied if a contingency plan exists. The plan must detail the method of reducing equipment loading following a contingent event within the specified time to an appropriate value. For example, the use of 15 minute *transmission* line ratings with an action plan to reduce loading post-contingency to within continuous rating within 15 minutes. This scenario may involve agreements between *generators* and NSPs.
- *Constraints* will be applied when an *outage* for NSP work has resulted in a reduction to the capacity of *scheduled plant* at its *network* connection. However, if the purpose of the *outage* is for work by the *plant* operator and not the NSP, then a *constraint* will not be applied to the *plant*. The intent is to indicate via *network constraints*, a reduction in *network capability* rather than a reduction in *scheduled plant* capacity. Bids are to reflect the level of the *scheduled plant's* capacity. The zero MW *constraint* on the output should be invoked for the NSP *outage*, if the *outage* restricts the generation even if the *outage* is coordinated with the *generator*. However, in case of *aggregated generators*, *constraints* will not be invoked as it is not practical.
- Constraints will be invoked on affected *embedded generating units* (*scheduled* and *semi-scheduled generators* only) connected to the DNSP network when there is an impact on TNSP equipment. When there is no impact on the TNSP network, constraints will normally not be applied. The affected *embedded generators* need to liaise and confirm with the DNSP whether the *outage* has been communicated to AEMO and then, managed in central dispatch. If not, the *generators* should use following methods to communicate their *outage(s)* to AEMO in the *dispatch*, *pre-dispatch* and *PASA* timeframes:

For *scheduled generators*: Update bids (Max Avail, PASA Avail) to no greater than the DNSP limit / *outage* level for the duration of the *outage*.

For *semi-scheduled generators*:

- (a) Dispatch timeframe – update the *generating unit's* SCADA Local Limit signal to reflect the reduced export limit.
  - As a backup, or if the SCADA Local Limit is not configured, the *semi-scheduled generator* can update the *generating unit's* bid Max Avail to the outage or generator runback level.
  - As a last resort, the *semi-scheduled generator* can also request the AEMO Control Room to apply a quick *constraint* to the outage or runback level if the SCADA Local Limit and energy bid are unable to be updated. The quick *constraint* description should state the reason for the limit (e.g. NSP limit or Participant advised limit).
  - *Semi-scheduled generating units* participating in self-forecasting must reflect the reduced export limit (due to outages or runbacks) in their self-forecasts unless it has already been communicated via the bid Max Avail.
- (b) Pre-dispatch and PD/STPASA timeframe:

- Update the intermittent generation availability (Upper MW Limit, Elements Available) in the Markets Portal or via API, unless it has already been communicated via the bid Max Avail.

It is the responsibility of the DNSP to check that the *generator* has reduced its output before commencing the planned *outage*. However, the DNSP is not responsible for notifying AEMO of distribution limits affecting *scheduled* and *semi-scheduled generators*. Notification by the DNSP is only required when the *outage* is affecting significant<sup>2</sup> load or non-scheduled/non-market generation.

- *Constraints* will not be applied for the testing of *scheduled plant* secondary systems when the *plant* is offline. The *plant* is required to arrange for correct (zero) indication to be available to AEMO at these times so that market systems do not respond to incorrect data.
- *Constraints* will not be applied for a reduction of capacity of non-scheduled wind or solar *generation*. Any limitations to the output of a non-scheduled wind or solar farm will be entered directly into the AWEFS or ASEFS forecasting system by AEMO.
- *Constraint* sets for single and multiple outages can be invoked concurrently except for cases where specific advice has been provided that the invocation of both *constraint* sets is not allowed.<sup>3</sup>

## 9. NOS Outage Acknowledgements

When submitting an *outage* there are six tick boxes for the TNSP to consider. Note –Only NSPs can update these tick boxes and AEMO cannot edit them by design.

Figure 5 NOS Outage Acknowledgements

Information Only	<input type="checkbox"/>	Affected DNSPs aware	<input type="checkbox"/>
Project Work	<input type="checkbox"/>	Affected TNSPs aware	<input type="checkbox"/>
Unplanned Outage	<input type="checkbox"/>	Affected Generators aware	<input type="checkbox"/>

### 9.1. Information Only

Indicates the category of the *outage* is ‘Submit for Information’.

### 9.2. Affected DNSPs aware

The relevant DNSP is aware of an *outage* which may potentially impact on their *network* operation and has not raised any objection. Refer also to NER 4.10.3.

### 9.3. Affected TNSPs aware

The relevant TNSP is aware of an *outage* which may potentially impact on their *network* operation and has not raised any objection.

<sup>2</sup> At least 30MW of aggregated load or non-scheduled/non-market generation affected by the outage(s).

<sup>3</sup> AEMO’s internal constraint dictionary states clearly in the ‘constraint set name’, when single outage constraints are not to be invoked along with multiple outage constraints.

#### 9.4. Affected Generators Aware

The relevant generator is aware of an outage which directly impacts on their connection to the network and has not raised any objection.

#### 9.5. Project Work

Indicates the outage is for project work.

#### 9.6. Unplanned outage

Indicates the outage was unplanned.

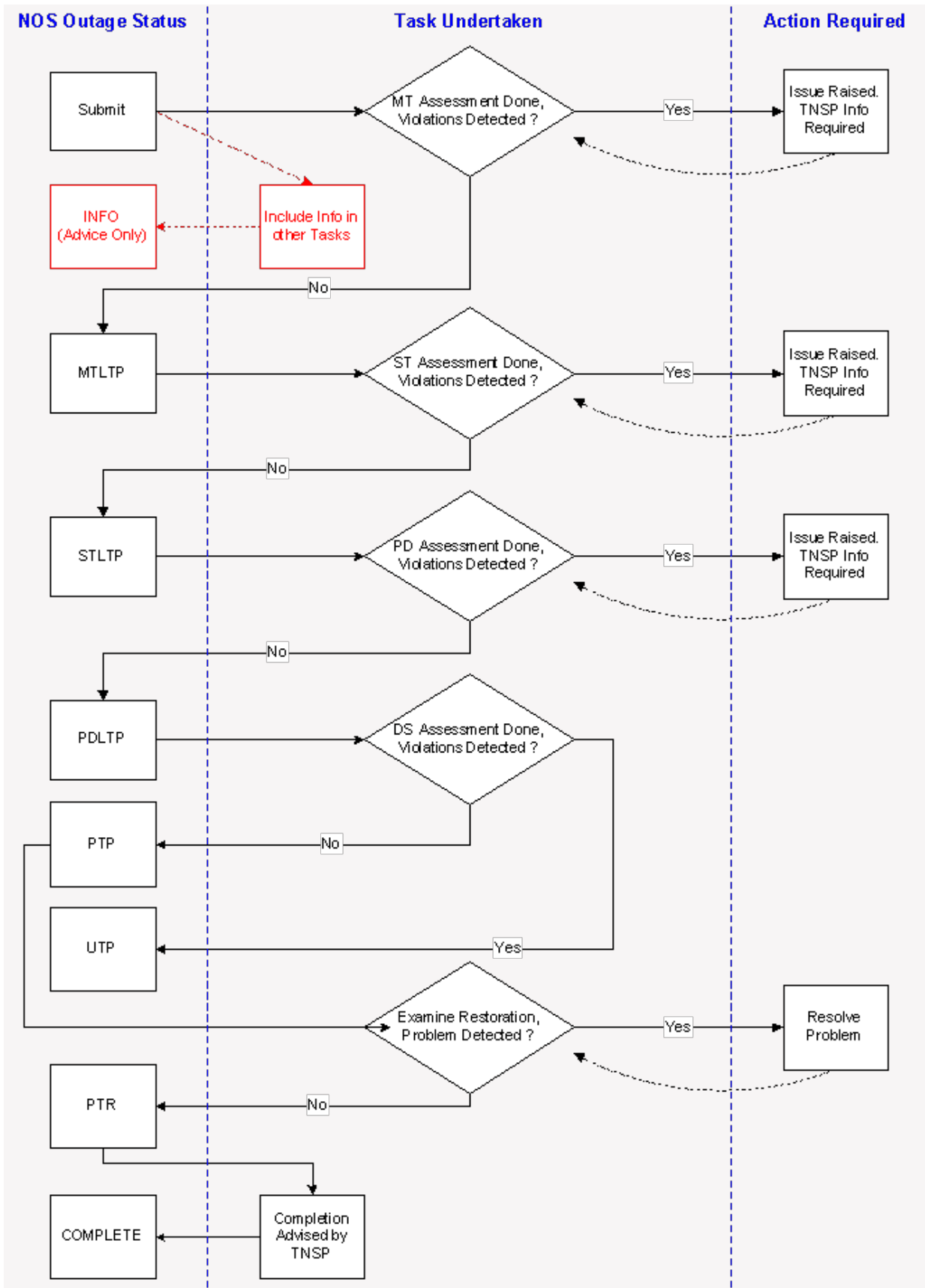
#### 9.7. NOS Outage Status

This section explains the NOS *outage* status cycle. An overview of the cycle is depicted in Figure 6.

#### 9.8. Recall Time

Recall Time is the time taken to completely restore the equipment to service (including switching time) when required. Appropriate recall time should be provided in the planned *outage* submission.

Figure 6 NOS Status Cycle

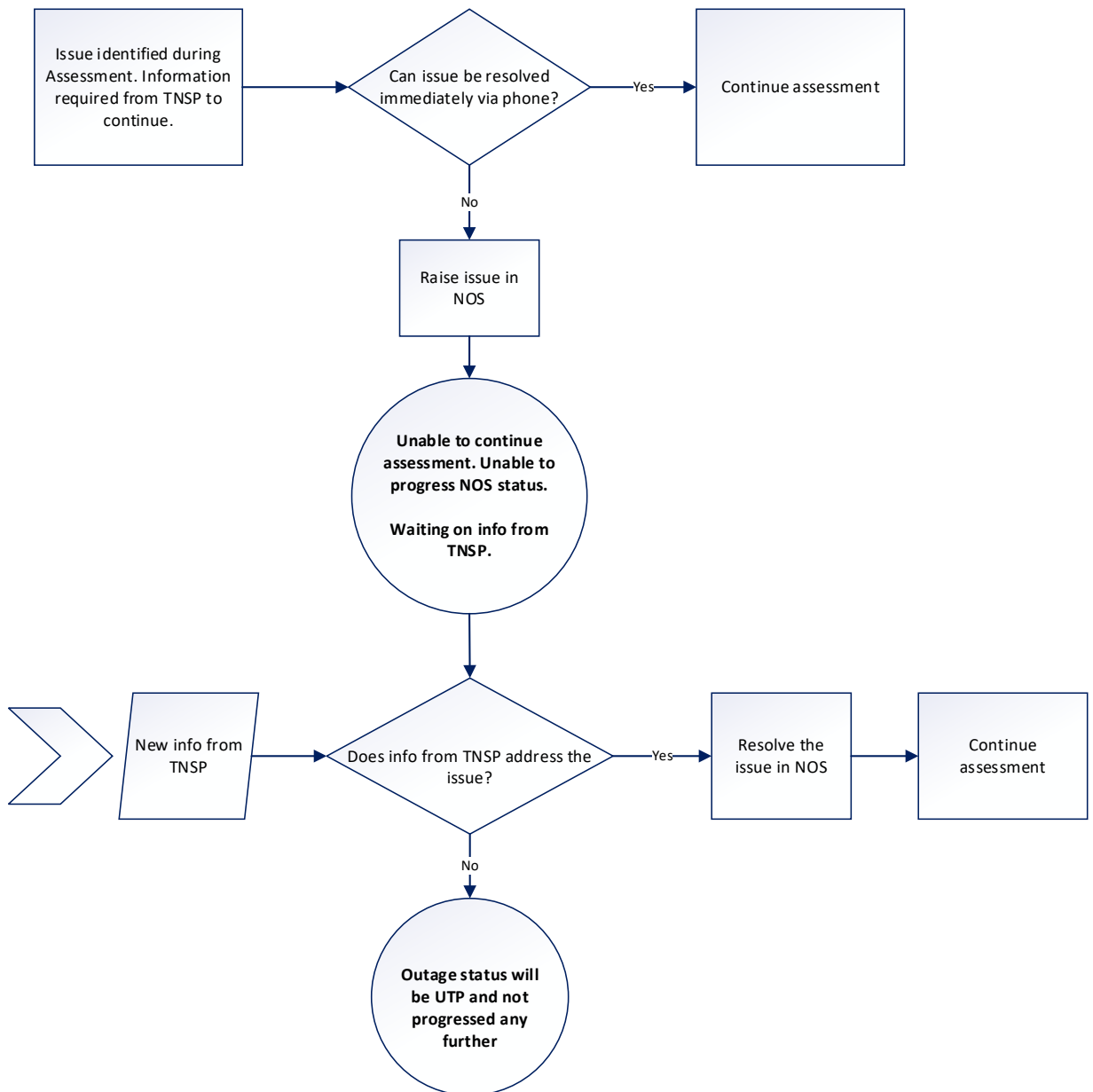


## 9.9. Issues Raised

The NOS has a facility to note issues that need to be resolved. This facility is used to log violations that have been observed during assessment. In general, if an issue has been raised then no further assessment will take place until the issue has been addressed. The record is essentially frozen until sufficient information is provided. Only when sufficient information has been included to resolve the issue will assessment continue.

An example of the process is depicted in Figure 7:

**Figure 7 Issues Process**





## 9.10. SUBMIT

The NOS status of SUBMIT indicates an *outage* has been submitted to AEMO for assessment. Assessment may have started, detail may be attached by AEMO, but the appropriate stage of assessment has not been completed.

## 9.11. INFO

The NOS status of INFO indicates an *outage* has been submitted to AEMO “for information”.

## 9.12. MTLTP

The NOS status of MTLTP indicates the *outage* has been assessed in the MT timeframe and is likely to proceed. That is, with the MT assessment parameters available, no issues have been identified and given similar conditions the *outage* is likely to obtain PTP at the time of *outage* start.

## 9.13. STLTP

The NOS status of STLTP indicates the *outage* has been assessed in the ST timeframe and is likely to proceed. That is, with the ST assessment parameters available, no issues have been identified and given similar conditions the *outage* is likely to obtain PTP at the time of *outage* start.

## 9.14. PDLTP

The NOS status of PDLTP indicates the *outage* has been assessed in the PD timeframe and is likely to proceed. That is, with the PD assessment parameters available, no issues have been identified and given similar conditions the *outage* is likely to obtain PTP at the time of *outage* start.

## 9.15. PTP

The NOS status of PTP indicates AEMO has given the NSP permission to proceed with the *network outage*. It is based on the principle that AEMO has determined the *transmission network* will remain in a secure and reliable operating state.

For OOS Work, The TNSP must request PTP from AEMO immediately prior to the high voltage switching that will remove the load carrying capability of equipment.

For I/S Work, The TNSP must request PTP from AEMO immediately prior to disabling the service.

Due to possible changes on the *network*, PTP is valid for a maximum time of 15 minutes. If the impact on the *network* due to the *outage* has not been established during this time, then the TNSP must discuss the situation with AEMO. PTP must be confirmed at this time.

PTP can only be provided by AEMO at the *outage* start time as it is governed by real time and expected conditions on the *network*. It may be based upon study done during the *pre-dispatch* period if system conditions have not changed significantly; otherwise PTP will be based on

study prior to *outage* start. Any previous advice regarding likelihood of PTP is irrelevant at this time as real time information is used for this assessment.

The *outage* status will be changed to PTP in NOS when AEMO are satisfied that all associated issues have been addressed, including confirmation of:

- Any agreed *network support agreement* advised by the TNSP via NOS.
- Any arrangements included in a contingency plan advised by the TNSP via NOS.

If any *network support agreement* or contingency plan advised of by the TNSP via NOS are not in place and are required to ensure system security, the *outage* status should be changed to UTP.

## 9.16. UTP

AEMO may advise that an *outage* is Unlikely To Proceed at the time of *outage* start when system conditions are known with certainty. In some cases, UTP may be advised at an earlier time if there is a low probability that an *outage* will proceed under the expected conditions. If an *outage* status is changed to UTP, then a reason must be recorded in NOS.

Some conditions that may result in UTP during the outage assessment process are:

- Issues raised in NOS that have not been resolved.
- A predefined condition for PTP has not been met. This includes insufficient limits advice, constraints, contingency plans, or an outage clash. Refer to Section 8.2.4 for additional information.
- Unforeseen circumstances or previously unidentified issues have become apparent.

AEMO may advise UTP for *outages* of *transmission network* equipment based on the following:

- Where it would be necessary to issue a direction or a clause 4.8.9 instruction for the purposes of maintaining the *power system* in a secure operating state, a reliable operating state or for reasons of public safety.
- Forecast conditions are such that the planned *outage(s)* would result in *power system security* breaches or *lack of reserve* (LOR) conditions (refer to Section 9.16.1 for more information).

AEMO may advise UTP for *outages* of secondary equipment or in-service work based on the following:

- Where the *outage* would result in a significant disruption to the operation of the market due to the unavailability of metering services.
- Where the secondary equipment *outage* or in-service work would result in a significant disruption to the operation of the market and no satisfactory back-up arrangements are in place to minimise such disruption.
- Where the *outage* is not in accordance with the requirements of NER clauses 4.8.2(a), 4.6.5 or S5.1.2.1(d).
- The following conditions are not reasons for AEMO advising that a planned *outage* is unlikely to proceed:
  - If during the planned *outage* there was to be an occurrence of a contingency event, which resulted in the *power system* being satisfactory but no longer in a condition considered to be secure on the occurrence of a further contingency event, then that is not a reason for UTP. An acceptable management plan in this case would be for AEMO to issue a direction or clause 4.8.9 instruction to return the *power system* to a secure operating state within 30 minutes.

- If the planned *outage* was the cause of negative residues, *AEMO* would not withhold permission to proceed, delay or recall the *outage*.

### 9.16.1. Lack of Reserve (LOR) conditions

Forecast LOR2 conditions may be identified 7 days in advance.

- A planned outage cannot proceed (*AEMO* will not issue MTLTP, STLTP, PDLTP) if it results in a LOR2 condition or makes an existing LOR2 condition worse.
- Reserve conditions are subject to high uncertainty, due to changes in forecasts (demand and intermittent generation), and generator availability. This uncertainty is managed by:
  - Publishing Market Notices when an LOR2 is forecast, to seek a market response. Where possible, the Market Notice will state the latest time *AEMO* will determine permission can be given for a planned outage to proceed.
  - In the ST timeframe, *AEMO* may set the outage status to UTP in NOS, but leave the outage constraints invoked, to encourage a market response.
  - If there is insufficient market response, *AEMO* will revoke the relevant outage constraints at the agreed latest time to proceed and inform TNSP that the outage cannot proceed.

## 9.17. PTR

PTR is the acknowledgement that the NSP can restore the *network outage*. The *network outage*, including any associated high voltage switching, is expected to be complete immediately following PTR being provided by *AEMO*.

For OOS Work, the TNSP must request PTR from *AEMO* immediately prior to the high voltage switching that will restore the load carrying capability of equipment.

For I/S Work, unless otherwise requested, PTR from *AEMO* is not required. However, 'Completion' must be submitted without delay.

Due to possible changes on the *network*, PTR is valid for a maximum time of 15 minutes. If the impact on the *network* due to *outage* restoration has not been established during this time, then the TNSP must discuss the situation with *AEMO*. PTR must be confirmed at this time.

## 9.18. Complete

The completion of the *outage* has been submitted by the TNSP, all equipment is returned to normal operating state.

## 9.19. Withdrawn

The *outage* is not required and 'Withdrawal required' has been submitted by the TNSP.

## 10. Co-ordination of Outages across Regional Boundaries

*Transmission* lines in the NEM interconnected *network* can span different *regions* and therefore each end may be under the control of a different NSP or asset owner. This section is devoted to providing a clear process for *AEMO* to co-ordinate the *outages* of equipment across inter-regional boundaries and lines of asset ownership.

### 10.1. Work at one end of an Interconnector Transmission line.

Where an *outage* is submitted by a NSP for work on its end of a *transmission* line only, then this NSP is responsible for coordinating the switching of the line out-of-service after receiving Permission to Proceed from *AEMO*. The same applies for returning the line to service, after receiving Permission to Restore from *AEMO*.

### 10.2. Work at both ends of an Interconnector Transmission line

Where an *outage* is submitted for work on both ends of a *transmission* line by the different asset owners or NSP's the following process will apply.

1. *AEMO* will nominate one of the two associated NSP's to coordinate switching the line out of service. *AEMO* will verify the nomination, having previously entered a statement to this affect in the NOS notes section for each NOS entry at the PDLTP approval stage.
2. After receiving Permission to Proceed from *AEMO*, the nominated NSP coordinates switching the line out of service, advising *AEMO* that the line is out-of-service on completion.
3. Once the nominated NSP advises *AEMO* that the *transmission* line is out of service, the other NSP is given Permission to Proceed.
4. On completion of the work by both parties and after Permission to Restore is received from *AEMO* the nominated NSP coordinates the switching to return the *transmission* line to service.

## Version release history

Version	Effective Date	Summary of Changes
15.0	7 August 2023	<ul style="list-style-type: none"> <li>• Updated semi-scheduled generation forecast methodology (section 8.1.2).</li> <li>• Included bid Max Avail as an ST and PD study parameter in (sections 8.2.2, 8.3.2).</li> <li>• Clarified requirements for DNSPs and DNSP-connected generators during outages on the DNSP network, including use of bid Max Avail (section 8.6).</li> <li>• Minor drafting updates.</li> </ul>
14.0	19 October 2022	<ul style="list-style-type: none"> <li>• Updated NOS Outage Submission for a Network Element and information added to clarify requirement of constraint during switching to achieve plant isolation (section 6.1).</li> <li>• Modification to sections 6.2.1 and 6.2.2 regarding protection system outages that can be submitted as For Information only.</li> <li>• Added notes regarding HIO Tick box feature in NOS (section 7).</li> <li>• Included requirement of disconnecting solar farm inverters and wind farm turbines where required before seeking PTP for planned outages (section 8.4).</li> <li>• Updated Constraint Application (section 8.6).</li> <li>• Minor editorial changes.</li> </ul> <p>Updated to AEMO external procedure template.</p>

Version	Effective Date	Summary of Changes
13.0	24 December 2019	Moved the information about basic principles used in outage assessment from the 'High Impact Outages' section to the 'General Principles' section
12.0	18 May 2019	Updated following NOS upgrade project
11.0	23 May 2018	Updated constraint invocation to semi-scheduled generators. Updates on Recall Time for High Impact outage. Clarify outage submission for assessment including transmission lines switched off for voltage control.
10.0	24 February 2017	Clarified conditions under which the outage status can be changed to Unlikely to Proceed.
9.0	22 February 2017	Updated the basis for identification of High Impact Outages (HIOs) and provided the link to the published list of upcoming HIOs on AEMO website.
8.0	04 September 2015	Updated information on Constraint application section and Out of service work and in-service work. Added new sections on Recall time for planned outages. Reviewed the entire procedure.
7.0	23 September 2014	Updated Short Term Outage Assessment Section to make DNSP aware monitoring flexible. Updated MT Outage Assessment responsibility to Congestion Modelling. Minor edits.
6.0	26 May 2014	Changes made to reflect incorporation of ASEFS into market systems processes.
5.0	19 February 2014	Format changes, and minor edits only. Glossary updated. AEMO Operational Zone meaning given.
4.0	14 January 2014	Updated to reflect the commencement of Instrument of Delegation with TransGrid and Powerlink.
3.0	13 November 2013	Information related to assessment of concurrent outages has been added in the constraints application section.
2.0	17 September 2013	Inclusion of 13 Month Outage Plan in planned outage section.
1.0	15 August 2013	New procedure created to reflect the cessation of the TNSP Operating Agreements and commencement of the Instruments of Delegation from AEMO to SPI PowerNet and Transend dated 12 August 2013.