



Market Suspension and Systems Failure

Prepared by: AEMO [Markets]

Document ref: SO_OP_3706

Version: 36

Effective date: 30 May 2023

Status: FINAL

Approved for distribution and use by:

Approved by: Michael Gatt

Title: Executive General Manager Operations

Date: 29/05/2023

aemo.com.au

New South Wales | Queensland | South Australia | Victoria | Australian Capital Territory | Tasmania | Western Australia

Australian Energy Market Operator Ltd ABN 94 072 010 327

Contents

Current version release details	3
Next Review	3
1. Introduction	4
1.1. Purpose and scope	4
1.2. Definitions and interpretation	4
1.3. Related documents	5
2. Failure of EMMS Server	5
3. Failure of AEMO Control Centre	5
4. Market Suspension	5
4.1. Grounds for Suspension	5
4.2. Authority to Suspend or Resume Spot Market Operation	6
5. Market Suspension due to a Black System	6
6. Market Suspension due to a Jurisdictional Direction	6
6.1. Types of Direction	6
6.2. Threshold for Suspending the Spot Market	6
7. Market Suspension due to an Inability to Operate the Spot Market in Accordance with the Provisions of the Rules	7
8. Market Suspension due to IT Failures	7
8.1. Failure of the Dispatch Process	7
8.2. Failure of SCADA	7
9. Procedure during Market Suspension	10
9.1. Declaration of Market Suspension	10
9.2. Dispatch during Market Suspension	10
9.3. Pricing during Market Suspension	10
10. Resumption of the Spot Market	12
10.1. Conditions for resumption	12
10.2. Notice of resumption	13
Appendix A. SCADA System Failure	14
A.1 Overview	14
A.2 Automatic substitution processes	14
A.3 Market site failover rule	15
Version release history	16

Tables

Table 1 Glossary..... 4
 Table 2 Related Policies and Procedures 5

Figures

Figure 1 Market Suspension Logic 9
 Figure 2 Market Suspension Pricing Regime Logic..... 11

Current version release details

Version	Effective date	Summary of changes
36	30 May 2023	Updated Appendix A: Total Demand calculation in NEMDE definition.

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

Next Review

Next Review Date	Review Type
15 June 2023	Periodic

1. Introduction

1.1. Purpose and scope

These are the *power system operating procedures* made under clause 4.10.1 of the National Electricity Rules (**NER**).

These Procedures have effect only for the purposes set out in the NER. The NER and the National Electricity Law prevail over these Procedures to the extent of any inconsistency.

These Procedures explain how *AEMO* manages situations where market systems fail, or which may require suspension of the *spot market*.

AEMO may suspend the *spot market* in one or more *regions* under clause 3.14.3 of the NER if:

- a *black system* occurs;
- *AEMO* is given a jurisdictional direction to suspend; or
- it has become impossible to operate the *market* in accordance with some or all of the NER, generally as the result of a major IT failure.

1.2. Definitions and interpretation

1.2.1. Glossary

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

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

The words, phrases and abbreviations in the table below have the meanings set out opposite them when used in these Procedures.

Table 1 Glossary

Term	Definition
ADE	Aggregate Dispatch Error
DFS	Demand Forecasting System
EMMS	Electricity Market Management System
EMS	Energy Management System; used for SCADA
MW	megawatt
NEMDE	National Electricity Market Dispatch Engine
NER or Rules	National Electricity Rules
NRM	Negative Residue Management
RHS	Right Hand Side
RTO	Real Time Operations (section of <i>AEMO</i>)
SCADA	Supervisory Control and Data Acquisition
TNSP	<i>Transmission Network Service Provider</i>

1.2.2. Interpretation

The following principles of interpretation apply to these Procedures unless otherwise expressly indicated:

- (a) These Procedures are subject to the principles of interpretation set out in Schedule 2 of the National Electricity Law.
- (b) References to time are references to Australian Eastern Standard Time.

1.3. Related documents

Table 2 Related Policies and Procedures

Reference	Title	Location
SO_OP_3705	<i>Dispatch</i>	AEMO Website
SO_OP_3710	<i>Load Forecasting</i>	AEMO Website
SO_OP_3715	<i>Power System Security Guidelines</i>	AEMO Website

2. Failure of EMMS Server

Services will automatically move from the failed node to a second node. An *outage* will be experienced while the service is restarted on the next node.

If all nodes are unavailable (due to the loss of a production EMMS site) then transfer of EMMS functions to the alternate site will be initiated. The following services may be impacted during this *time*:

- *dispatch* and *pre-dispatch*;
- EMMS production Oracle database; and
- infoserver database.

Rebids will not be accepted under these conditions.

3. Failure of AEMO Control Centre

In the event of *control centre* failure, AEMO will advise all *Market Participants* with regard to the operational status of each *control centre*.

4. Market Suspension

4.1. Grounds for Suspension

The only circumstances in which AEMO may declare the *spot market* in a region to be suspended are set out in clause 3.14.3(a) of the NER. These conditions are discussed in greater detail in sections 5-8. The *spot market* will not be suspended solely because:

- the *spot price* has reached the *market price cap* or *market floor price*;
- AEMO has issued a *direction* or intervened in the *market*; or
- AEMO is unable to operate *pre-dispatch* or PASA processes.

4.2. Authority to Suspend or Resume Spot Market Operation

AEMO's NEM RTO Manager in charge of the shift has the authority to declare a suspension or resumption of the *spot market*.

Once suspended, the *spot market* remains suspended until the declaration is revoked by AEMO informing *Market Participants* that the *spot market* will resume and the time that it will resume.

5. Market Suspension due to a Black System

In accordance with clause 3.14.3(a)(1) of the NER, AEMO will immediately suspend the *spot market* in a *region* if the *power system* in that *region* has collapsed to a *black system*.

6. Market Suspension due to a Jurisdictional Direction

6.1. Types of Direction

Jurisdictional *directions* that may require AEMO to suspend the market can take different forms:

- (a) If AEMO has been directed by a *participating jurisdiction* to suspend the *market* in a *region* following the formal declaration by that *participating jurisdiction* of a state of emergency under its essential services, emergency management or equivalent legislation:
 - AEMO will suspend the *market* in that *region* in accordance with the *direction*.
- (b) If AEMO has been directed by a *participating jurisdiction* to operate all or part of the *power system* in a manner contrary to the provisions of the *Rules* following the formal declaration by that *participating jurisdiction* of a state of emergency under its essential services, emergency management or equivalent legislation:
 - AEMO will assess the impact of the *direction*. If the impact is greater than the threshold level specified in section 6.2, AEMO will suspend the *spot market* in that *region*.

6.2. Threshold for Suspending the Spot Market

- (c) If the impact of a jurisdictional *direction* to operate the *power system* in a manner contrary to the provisions of the *Rules*, or the impact of a *power system* emergency results in *dispatching generation, load or market network services* using manual *dispatch instructions* (due to the unavailability of *network constraints* or the *inability of non-conformance procedures to maintain power system security*), with a cumulative effect on at least 20% of the predicted *regional load*, then AEMO will determine that it is impossible to operate the *market* in accordance with the provisions of the *Rules*.
- (d) Notwithstanding the above threshold, AEMO may suspend the *spot market* in a *region* in situations where the impact of the jurisdictional *direction*, or the cumulative effect of *generation, load or market network services dispatched* using manual *dispatch instructions*, is less than 20% of the predicted *regional load*, if AEMO determines that it is nevertheless not possible to operate the *spot market* in accordance with the provisions of the *Rules*.

7. Market Suspension due to an Inability to Operate the Spot Market in Accordance with the Provisions of the Rules

AEMO may not be able to operate the *spot market* in accordance with NER in the following circumstances:

- (e) IT failures – see section 8.
- (f) Following a major *power system* emergency other than a *black system*. In this event AEMO will assess the impact on *spot market* operation using the threshold given in section 6.2 to determine whether to suspend the *spot market*.

8. Market Suspension due to IT Failures

When determining under clause 3.14.3(a)(3) of the NER whether it has become impossible to operate the *spot market*, the following criteria will guide AEMO's decision to suspend the *spot market*.

8.1. Failure of the Dispatch Process

After thirty minutes of AEMO becoming aware of an IT failure *that has resulted in the failure of the dispatch process*, the *market* may be suspended in a *region* if the failed IT system is not expected to be available within a further 10 minutes.

A failure of the *dispatch* process includes, but is not limited to, the following:

- failure of NEMDE to solve;
- failure to communicate *dispatch instructions* to a significant proportion of *Market Participants* within a *region*; and
- *rebidding* failure – where the *rebidding* failure is, in AEMO's reasonable opinion, due to AEMO IT systems and affects all *Market Participants* for both main and backup *rebidding* systems.¹

8.2. Failure of SCADA

If a large number of SCADA points have failed it may not be possible to remediate these inputs and maintain accurate dispatch. In such a case the following considerations will guide AEMO's decision to suspend the *spot market* in a *region*:

- Thirty minutes have elapsed since AEMO became aware of the IT failure, and the failed IT system is not expected to be available within a further 10 minutes.

OR

¹ If some *Market Participants* are unable to *rebid*, for example due to a communications failure outside AEMO's control, AEMO will assess the impact on *spot market* operation using the threshold given in section 6.2 to determine whether to suspend the *spot market*.

If and for so long as the *spot market* is not suspended, the non-conformance procedures will apply to *Market Participants* who are unable to *rebid* (refer to [SO_OP_3705 Dispatch](#)).

- Changes in *power system* conditions since the last valid *dispatch* run result in variations² in *dispatch* that persist for 3 consecutive *trading intervals* and in each of those intervals the variation exceeds:
 - (i) 200 MW on the Queensland to New South Wales Interconnector; or
 - (ii) 100 MW on the Heywood Interconnector; or
 - (iii) 200 MW on the Victoria to New South Wales Interconnector.

OR

- Constraints have violated in *dispatch*, where the violations cannot be managed through the hand dressing of SCADA.

OR

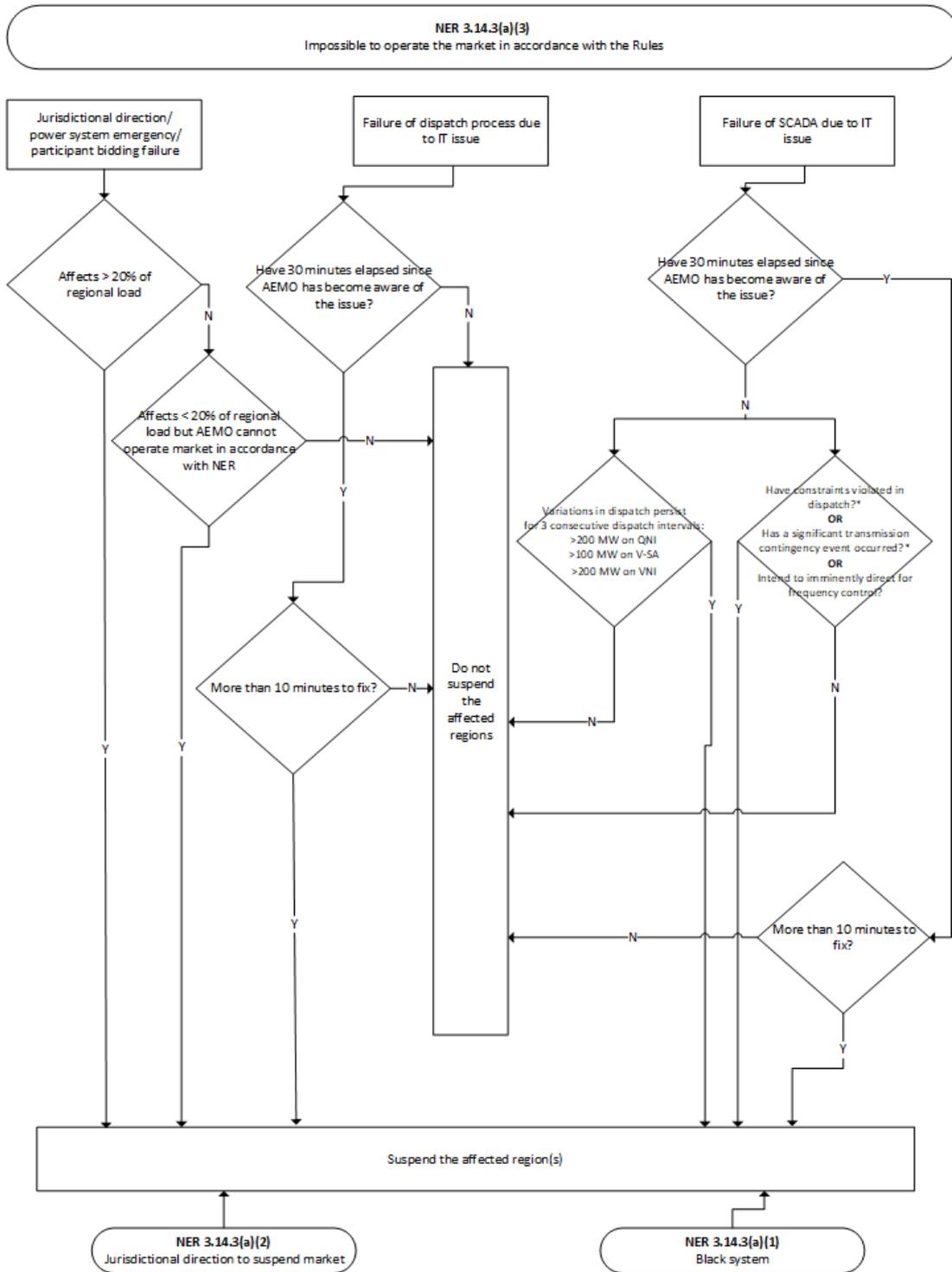
- A significant *transmission contingency event* has occurred (e.g. a major *generating unit* or *transmission network element* has come out of service) which cannot be managed through the hand dressing of SCADA.

OR

- AEMO intends to imminently direct for *frequency* control.

SCADA prioritisation and remediation is detailed in Appendix A.

² That is, actual flows on the interconnector less the interconnector's target MW flow from NEMDE



*where this cannot be managed through the hand dressing of SCADA

Figure 1 Market Suspension Logic

9. Procedure during Market Suspension

9.1. Declaration of Market Suspension

- (a) If AEMO suspends the *spot market in one or more regions*, AEMO will issue a *Market Notice* advising the *market* of:
 - (i) the *suspended region(s)*;
 - (ii) the pricing mechanism to be applied in each *suspended region*;
 - (iii) the reasons for the *market suspension*; and
 - (iv) the fact that *spot prices* and *ancillary service prices* for the first one or two *trading intervals* of the *market suspension* may be subject to manual review.
- (b) In the event of failure of the normal *Market Notice Message System*, AEMO will communicate with *Market Participants* using the *AEMO Emergency Messaging System*.

9.2. Dispatch during Market Suspension

- (a) In a *region* or *regions* where, in AEMO's reasonable opinion, it remains possible to do so, *dispatch* is to continue in accordance with NER rule 3.8.
- (b) If, in AEMO's reasonable opinion, it is not possible in a *region* or *regions* to continue to *dispatch* in accordance with NER rule 3.8, then AEMO may use a recently *published pre-dispatch schedule*.
- (c) Where possible, *dispatch instructions* will be issued electronically via market systems or the *automatic generation control system (AGC)*. AEMO may issue *dispatch instructions* in some other form if in its reasonable opinion the normal processes are not available. *Market Participants* in respect of *scheduled plant* will be notified of the applicable form for *dispatch instructions* through available communication channels.
- (d) The *pre-dispatch schedule* is not considered current if:
 - (i) the difference between actual demand and forecast demand exceeds the *load forecasting error threshold* (refer to [SO OP 3710 - Load Forecasting](#));
 - (ii) there has been a material change to *scheduled plant* status (eg. unit availability);
or
 - (iii) there has been a material change to *constraints* in *dispatch* (eg. transfer limit has changed).

9.3. Pricing during Market Suspension

- (a) During suspension of the *spot market*, prices may either be determined in accordance with NER rule 3.9, or in accordance with the published *market suspension pricing schedule* under NER clause 3.14.5(e). The flowchart below outlines the *process* followed by AEMO when determining prices during *market suspension*.

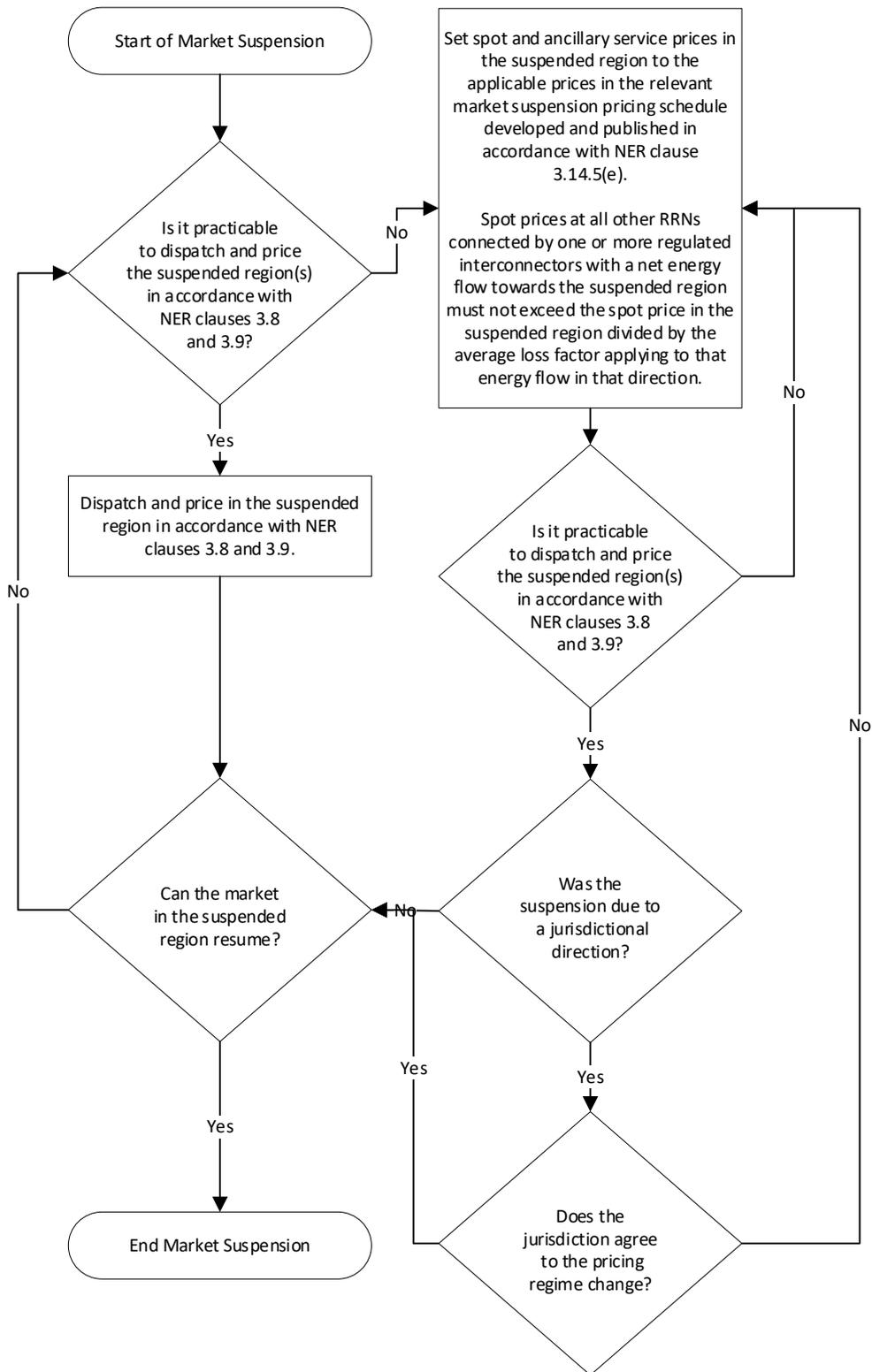


Figure 2 Market Suspension Pricing Regime Logic

- (b) NER clause 3.14.4(c) states that the *spot market* in a *region* is suspended from the start of the *trading interval* in which the declaration of a *market suspension* occurs. Because *spot* and *ancillary service prices* are published at the start of a *trading interval*, the prices

in the first *trading interval* of a *market suspension* will need to be reviewed, except in the case of a *region* being suspended with *dispatch* and pricing continuing under NER rules 3.8 and 3.9. If a declaration of *market suspension* occurs at a point in a *trading interval* after the pricing run for the subsequent *trading interval* has been triggered, then prices in the subsequent *trading interval* will also require manual review, except in the case of normal *dispatch* and pricing continuing. AEMO will endeavour to publish any manually reviewed prices by the end of the following *business day*.

- (c) If the pricing regime during a *market suspension* changes from pricing under NER rules 3.8 and 3.9 to the *market suspension pricing schedule*, or vice versa, AEMO will issue a Market Notice informing *Market Participants* of the change and when it will occur. Where the pricing regime changes from the *market suspension pricing schedule* to pricing under NER rules 3.8 and 3.9, AEMO will provide a minimum two hours' notice to allow an orderly transition to such pricing, and will communicate with *Market Participants* in the *suspended region* prior to setting a time for the *spot market* to resume. Note that the pricing regime can change from the *market suspension pricing schedule* to pricing under NER rules 3.8 and 3.9 only if:
 - (i) it is practicable to operate *central dispatch* and determine *spot prices* and *ancillary service prices* for the *suspended region* in accordance with NER rules 3.8 and 3.9; and
 - (ii) the directing jurisdiction agrees to the change, where the *market suspension* was due to a jurisdictional direction.
- (d) If the *market suspension pricing schedule* is being used in a *suspended region*, then:
 - (i) those prices are not subject to MPC override (NER 3.9.2(e)(1)), intervention pricing (NER 3.9.2(e)(2) and 3.9.3), or price revision due to manifestly incorrect inputs (NER 3.9.2B);
 - (ii) those prices are still subject to *administered price caps* and *administered floor prices* (NER 3.14.2); and
 - (iii) *spot prices* in all other *regions* connected by one or more *regulated interconnectors* that have a net *energy flow* towards the *suspended region* will be capped at the price in the *suspended region* divided by the average *loss factor* applying to that *energy flow* in that direction, unless the *spot price* in the exporting *region* has been replaced due to:
 - (A) a manifestly incorrect input (NER 3.9.2B); or
 - (B) a failure of the dispatch algorithm (NER 3.8.21(b)).
- (e) Prices during a *market suspension* – either pricing under NER rules 3.8 and 3.9 or the *market suspension pricing schedule* – will be published in real time. This will allow automated Negative Residue Management (NRM) *constraints* to control counterprice flows. However, the prices in the *market suspension pricing schedule* will not be published in *pre-dispatch*. This means there is a risk that automated NRM based on *pre-dispatch* forecasts might not be accurately triggered during a *market suspension*. AEMO considers that this risk is manageable given the uncertainty associated with *pre-dispatch* forecasts, the rarity of *market suspensions*, and the potential for manual application of NRM *constraints* if necessary.

10. Resumption of the Spot Market

10.1. Conditions for resumption

If the *spot market* was suspended in a *region*, the *spot market* can be resumed only if all the following conditions are satisfied:

- (a) (if applicable) the *black system* condition no longer exists;

- (b) (if applicable) the jurisdictional direction to suspend the *spot market* has been revoked;
- (c) the original cause of the *market suspension* has been eliminated or sufficient steps have been taken to exclude its influence on *market* processes and AEMO assesses that the possibility of suspending the *spot market* within the next 24 hours due to the same cause is minimal; and
- (d) AEMO determines that it can operate the *market* in accordance with the provisions of the NER.

10.2. Notice of resumption

- (a) AEMO will issue a Market Notice informing *Market Participants* of the decision to resume the *spot market*, and the time at which the resumption will occur.
- (b) As a general principle, the notice period before resuming the *spot market* will be commensurate with the amount of time the *spot market* has been suspended, and the time reasonably necessary to allow an orderly transition to normal *dispatch* and pricing. AEMO will provide a minimum of:
 - (i) two hours' notice before resuming the spot market if the suspension was due to a *black system* or jurisdictional direction; and
 - (ii) 30 minutes notice (6 *trading intervals*) if the *market* was suspended due to a failure of AEMO's *market* systems.
- (c) AEMO will communicate with *Market Participants* in the *suspended region* prior to setting a time for the *spot market* to resume.

Appendix A. SCADA System Failure

A.1 Overview

SCADA data is used by NEMDE in the real-time *dispatch process*. The dispatch process selects SCADA data for processing in the following order:

1. Manually substituted data.
2. Good quality data (for *transmission line* megawatt and megavar flows, this may be the good alternative-end measure if the primary-end measure is deemed abnormal by EMS).
3. Automatically substituted data (see below).

A.2 Automatic substitution processes

When SCADA data fails or if there is partial SCADA system failure, and there is no alternative data, NEMDE dispatch uses the following automatic substitution processes:

- (a) For Scheduled and Semi-Scheduled MW data:
 - (i) **For Trader MW data** ('T' terms and unit Initial MW): if data is suspect, NEMDE will use the unit *dispatch* target from the previous *trading interval* indefinitely.
 - (ii) **For Interconnector MW flow data** ('I' terms and Initial Flow): if data is suspect, NEMDE will use the *interconnector flow* target from the previous *trading interval* indefinitely.
 - (iii) **For Region forecast demand data** ('R' terms and Total Demand): NEMDE calculates this as:

SCADA initial scheduled demand³ (EMS ID: *.XDEM) – Regional summation of initial *Scheduled loads*⁴ + Regional summation of initial *Wholesale Demand Response*⁵ - estimated Regional share of interconnector and MNSP losses⁶ + DFS forecast demand change⁷ + SCADA aggregate dispatch error adjustment (EMS ID: *.ADE)

If the SCADA initial scheduled demand is suspect (due to old *dispatch* targets in EMS) NEMDE will use the cleared scheduled demand less aggregate dispatch error (ADE) determined in the previous *trading interval*. These values are stored in the EMMS.

Zero will be used if the SCADA forecast demand change or the SCADA ADE are suspect.

- (b) For unscheduled data ('A', 'S' terms):

³ SCADA scheduled demand = sum of scheduled and semi-scheduled generation plus net import. If MW is suspect quality, the previous dispatch target is substituted. This calculation is done in EMS.

⁴ Regional summation of initial *Scheduled loads* = sum of SCADA MW of *Scheduled loads* in the region. If SCADA MW is suspect quality the previous dispatch target is substituted. This calculation is done in NEMDE.

⁵ Regional summation of initial *Wholesale Demand Response* = sum of Initial MW of *Wholesale Demand Response Units* in the region. If SCADA data is available, Initial MW is SCADA MW of the unit. If SCADA MW is suspect quality or the unit is not registered to provide SCADA data, previous dispatch target is substituted. This calculation is done in NEMDE.

⁶ The estimation of the regional losses are based on the initial interconnector flows. This calculation is done in NEMDE.

⁷ The calculation uses the Demand Forecasting System (DFS) 5-minute demand forecast which is not directly from SCADA, and uses statistical models to automatically generate forecasts for every trading interval in the dispatch and 5-minute pre-dispatch timeframe.

- (i) If all SCADA is suspect, NEMDE will use the last good values for 72 hours and thereafter the *constraint* RHS default values (subject to the *market* site failover *rule below*).
 - (ii) If only individual SCADA points are suspect, NEMDE will use the last good value indefinitely (subject to the *market* site failover *rule below*).
 - (iii) For aggregated *scheduled generating units*, the risk of the largest *generating unit* trip may need to be assessed for each individual plant. In such cases, AEMO defines the risk for each individual plant as a separate analog term 'A' in *constraint* RHS terms.
- (c) For Entered Value data ('E' terms)
- (i) Limits (line ratings) have no quality flagging.
 - (ii) Limits are seasonal-based and sourced from EMS tables, or via SCADA as dynamic ratings.
 - (iii) Are not subject to the *market* site failover *rule below*.
- (d) Dynamic line ratings
- (i) TNSPs provide dynamic line ratings via SCADA ('A' terms). These ratings are written to a Limit Record ('E' terms). The value in the Limit Record is used by NEMDE. If the SCADA value is suspect then the last good value remains in the Limit Record.
 - (ii) AEMO may replace the Limit Record value with either a manually entered value or the default work book ratings supplied by the TNSP.

A.3 Market site failover rule

At any *time* if a SCADA point is suspect in the first *trading interval* following a *market* site failover, then NEMDE will use the default value.

Version release history

Version	Effective Date	Summary of Changes
35.0	24 Oct 2021	Terminology updates for Five-minute Settlement (5MS) rule change. Updates for <i>Wholesale Demand Response</i> (WDR) rule change: Updated Appendix A: 'R' RHS term and Total Demand calculation in NEMDE
34.0	15 June 2021	Updated Section 8 to clarify market suspension triggers during an IT failure. Updated template. Removed references to mandatory restrictions.
33.0	1 December 2017	Integration of 1 December 2017 Rule changes. Clarification of conditions for resuming the market. Document restructure.
32.0	17 July 2017	Figure 2 'Market Suspension Pricing Decision Map' corrected to reflect the Rules. S5: Clarify the SCADA validation and substitution process S8.1: Clarify conditions for resuming spot market S10.2: Clarified MPC override during market suspension. Clarified the need to constrain exports if pricing uses pre-dispatch or market suspension pricing schedules S11: Added minimum notice period before transitioning to normal dispatch pricing. Minor changes in S9, 10 and Appendix.
31.0	18 May 2016	Removed the use of BUDS in sections 9.1 and Appendix A. Outlined AEMO actions in section 9.3. Minor changes to figure 2. Removed the alternate method of issuing dispatch instructions in section 9.1.