

MARKET SUSPENSION AND SYSTEMS FAILURE

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Next Review

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1 Introduction

1.1 Purpose and scope

This Procedure forms part of the *power system operating procedures* under clause 4.10.1 of the NER. It explains 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 Definitions

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

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

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

Table 1 Glossary

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

1.2.2 Interpretation

The following principles of interpretation apply to this Procedure 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.

2 Related Policies and Procedures

Table 2 Related policies and procedures

Policies and Procedure	Title
SO_OP_3705	Dispatch
SO_OG_3710	Load Forecasting
SO_OP_3715	Power System Security Guidelines

3 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.

Re-bids will not be accepted under these conditions.

4 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*.

5 Market Suspension

5.1 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 6-9. 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.

5.2 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.

6 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*.

7 Market suspension due to a jurisdictional direction

7.1 Types of direction

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

- 1) 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.
- 2) 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 7.2, *AEMO* will suspend the *spot market* in that *region*.

7.2 Threshold for suspending the spot market

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*.

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*.

8 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:

- IT failures – see section 9.
- Following a major *power system* emergency other than a *black system*, *AEMO* will assess the impact on *spot market* operation using the threshold given in section 7.2 to determine whether to suspend the *spot market*.

9 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*.

9.1 Failure of the Dispatch Process

The *market* may be suspended in a *region* if:

- 1) 6 or more consecutive *dispatch intervals* have been missed, leading to a failure to communicate dispatch instructions to a significant proportion of *Market Participants* within the region¹; and
- 2) the appropriate IT system is not expected to be available within a further 10 minutes; and
- 3) changes in *power system* conditions since the last valid *dispatch* run result in errors in *dispatch* exceeding:
 - 200 MW in the New South Wales *region* (suspension in the NSW *region* only); or
 - 200 MW in the Victorian *Region* (suspension in the VIC *region* only); or
 - 150 MW in the Queensland *region* (suspension in the QLD *region* only); or
 - 80 MW in the South Australian *region* (suspension in the SA *region* only); or
 - 80 MW in the Tasmanian *region* (suspension in the TAS *region* only); or
 - 350 MW in two or more *regions* (suspension in all *regions*).

9.2 Failure of SCADA

SCADA prioritisation and remediation is detailed in Appendix A. Wherever possible *AEMO* will arrange for failed SCADA inputs to be hand-dressed on a five minute cycle to maintain an accurate *dispatch*. However, if a large number of SCADA points have failed this will no longer be possible, and in such a case the *market* may be suspended for a given *region* if:

- 1) SCADA failure lasts 6 or more consecutive *dispatch intervals*; and
- 2) the appropriate IT system is not expected to be available within a further 10 minutes; and
- 3) changes in *power system* conditions since the last valid *dispatch* run result in errors in *dispatch* exceeding the levels specified in section 9.1 (3).

9.3 Failure of Rebidding Systems

The *market* may be suspended for a given *region* for a rebidding failure if:

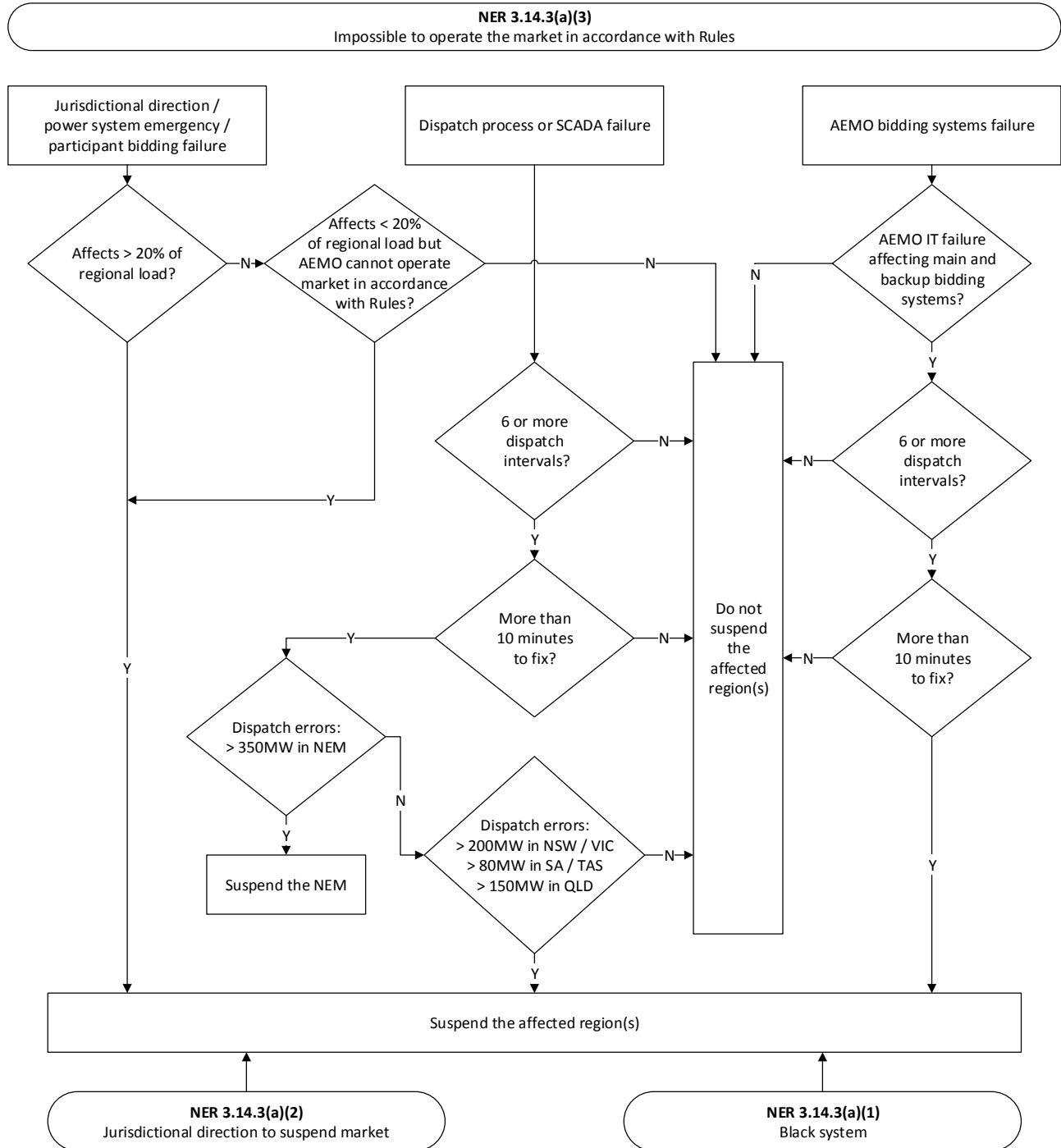
- 1) in *AEMO's* reasonable opinion, the rebidding failure is due to *AEMO* IT systems and affects all *Market Participants* for both main and backup rebidding systems; and
- 2) the rebidding failure lasts 6 or more consecutive *dispatch intervals* from the time that *AEMO* is aware of the issue; and
- 3) the appropriate IT system will not be available within a further 10 minutes.

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 7.2 to determine whether to suspend the *spot market*.

¹ Failure of NEMDE to solve, or a widespread *AEMO* IT failure – either EMS or SCADA – seems the most probable mode of failure of the dispatch process. In this case the entire NEM is likely to be affected.

If and for so long as the *spot market* is not suspended under this section 9.3, the non-conformance procedures will apply to *Market Participants* who are unable to *rebid* (refer SO_OP_3705 Dispatch²).

Figure 1 Market Suspension Logic



² http://www.aemo.com.au/-/media/Files/Electricity/NEM/Security and Reliability/Power System Ops/Procedures/SO_OP_3705---Dispatch.pdf

10 Procedure during Market Suspension

10.1 Declaration of Market Suspension

If AEMO suspends the *spot market* in one or more *regions*, AEMO will issue a Market Notice advising the *market* of:

- the suspended *region(s)*;
- the pricing mechanism to be applied in each suspended *region*;
- the reasons for the *market suspension*; and
- the fact that *dispatch prices* and *ancillary service* prices for the first one or two *dispatch* intervals of the *market suspension* will be subject to manual review.

In the event of failure of the normal Market Notice Message System, AEMO will communicate with *Market Participants* using the AEMO Emergency Messaging System.

10.2 Dispatch during Market Suspension

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.

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*.

Where possible, *dispatch instructions* will be issued electronically via market systems or the *automatic generation control system*. 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.

The *pre-dispatch schedule* is not considered current if:

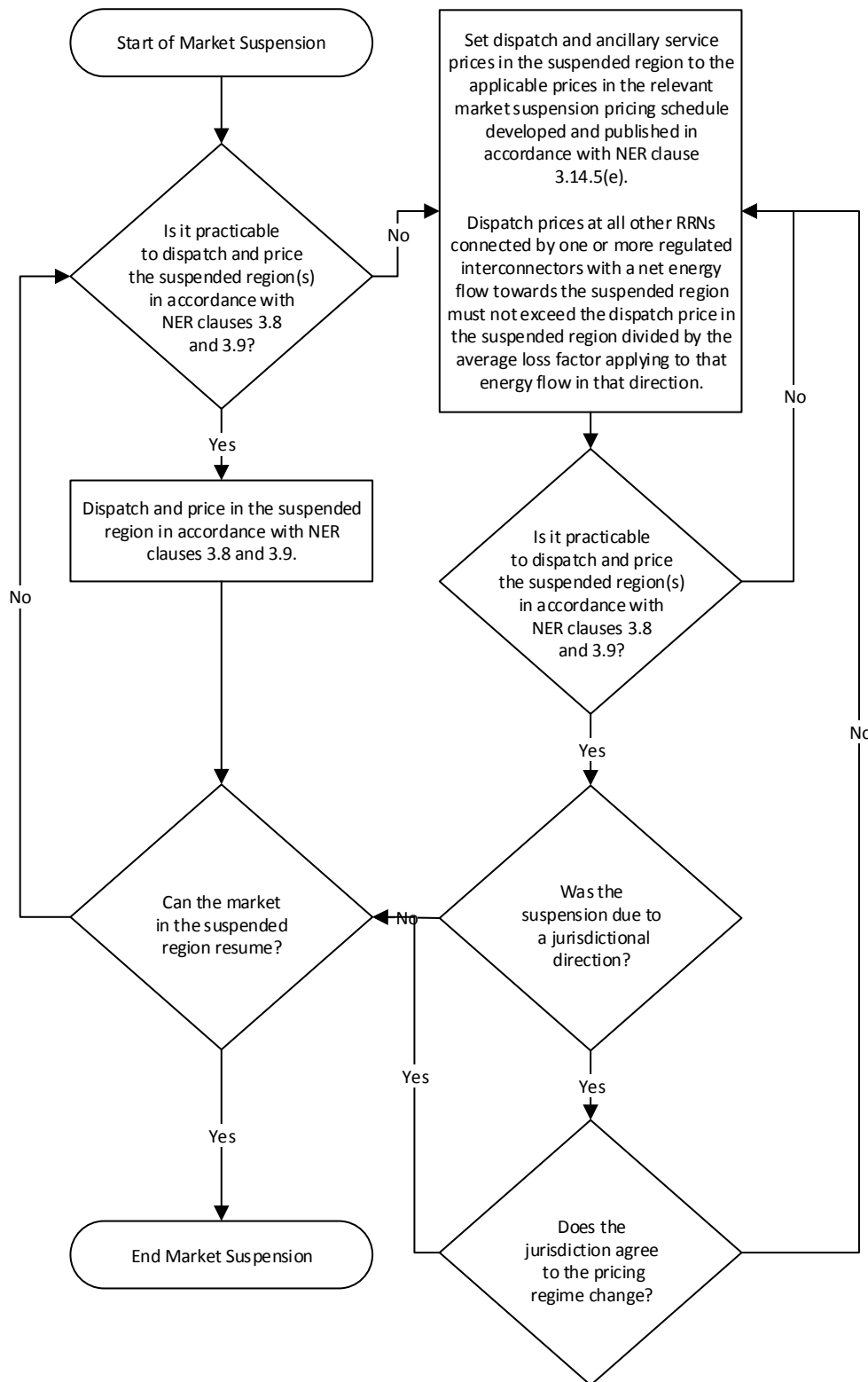
- 1) the difference between actual demand and forecast demand exceeds the load forecasting error threshold (refer to SO_OP_3710 - Load Forecasting³);
- 2) there has been a material change to *scheduled plant* status (eg. unit availability); or
- 3) there has been a material change to *constraints* in *dispatch* (eg. transfer limit has changed).

10.3 Pricing during Market Suspension

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

³ http://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3710---Load-Forecasting.pdf

Figure 2: Market Suspension Pricing Regime Logic



NER clause 3.14.4(c) states that the *spot market* in a *region* is suspended from the start of the *dispatch interval* in which the declaration of a *market suspension* occurs. Because *dispatch* and *ancillary service prices* are published at the start of a *dispatch interval*, the prices in the first *dispatch 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 *dispatch interval* after the pricing run for the subsequent *dispatch interval* has been triggered, then prices in the subsequent *dispatch 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*.

If the pricing regime during a *market suspension* changes from *dispatch* pricing to market suspension schedule pricing, or vice versa, AEMO will issue a Market Notice informing *Market Participants* of the change and when it will occur. In the case of the pricing regime changing from market suspension pricing to dispatch pricing, AEMO will provide a minimum two hours' notice to allow an orderly transition to normal *dispatch* 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 *dispatch* pricing only if:

- it is practicable to operate *central dispatch* and determine *dispatch prices* and *ancillary service prices* for the suspended *region* in accordance with NER rules 3.8 and 3.9; and
- the directing jurisdiction agrees to the change, where the *market suspension* was due to a jurisdictional direction.

If market suspension schedule pricing is being used in a suspended *region*, then:

- 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), price revision due to *manifestly incorrect inputs* (NER 3.9.2B) or *mandatory restriction* pricing (NER 3.12A.6);
- those prices are still subject to *administered price caps* and *administered floor prices* (NER 3.14.2); and
- *dispatch 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 *dispatch price* in the exporting *region* has been replaced due to:
 - a *manifestly incorrect input* (NER 3.9.2B); or
 - a failure of the *dispatch algorithm* (NER 3.8.21(b)).

Prices during a *market suspension* – either *dispatch* pricing or market suspension schedule pricing – will be published in real time. This will allow automated Negative Residue Management (NRM) *constraints* to control counterprice flows. However, market suspension schedule prices 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.

11 Resumption of the Spot Market

11.1 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:

- 1) (if applicable) the *black system* condition no longer exists;
- 2) (if applicable) the jurisdictional direction to suspend the *spot market* has been revoked;
- 3) 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
- 4) AEMO determines that it can operate the *market* in accordance with the provisions of the NER.

11.2 Notice of resumption

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.

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:

- 1) two hours' notice before resuming the spot market if the suspension was due to a *black system* or jurisdictional direction; and
- 2) 30 minutes notice (6 *dispatch intervals*) if the *market* was suspended due to a failure of AEMO's *market systems*.

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

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).

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:

For Scheduled and Semi-Scheduled MW data:

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

SCADA initial scheduled demand⁴ (EMS ID: *.XDEM) + SCADA forecast demand change⁵ (EMS ID: *.DF) + 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 *dispatch interval*. These values are stored in the EMMS.

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

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

- 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).
- If only individual SCADA points are suspect, NEMDE will use the last good value indefinitely (subject to the market site failover rule below).
- 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.

For Entered Value data ('E' terms)

- Limits (line ratings) have no quality flagging.
- Limits are seasonal-based and sourced from EMS tables, or via SCADA as dynamic ratings.
- Are not subject to the market site failover rule below.

Dynamic line ratings

⁴ SCADA scheduled demand = sum of scheduled and semi-scheduled generation plus net import. If MW is suspect quality, the previous dispatch target is substituted.

⁵ The EMS 5-minute Demand Estimator calculates this based on historical SCADA scheduled demands that are equivalent to the SCADA initial scheduled demand in terms of the handling of suspect data.

- 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.
- AEMO may replace the Limit Record value with either a manually entered value or the default work book ratings supplied by the TNSP.

A.1 Market site failover rule

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