NEMMCO

**National Electricity Market Management Company Limited**
ABN 94 072 010 327

# *Review of system restart ancillary service arrangements* – Final report

*Volume 1*
*(Recommended arrangements)*

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## Executive summary

Conduct of this review is a requirement of the Code [Clause 3.1.4(a1)], which imposes on NEMMCO an obligation to review and report on a long term strategy for the provision of system restart services, taking account of:

- the need to restore the power system within a reasonable time;
- the desirability of acquiring supplementary services where benefits exceed the costs; and
- options, including embedded generation, to be developed over a period of 3 years.

Code consultation procedures are to be followed in the conduct of this review.

A **Scoping paper** for the review[1] was published in February 2003 and the review formally commenced on 30 May 2003.

*Context of the review*

NEMMCO acknowledges the fundamental importance of having responsive, reliable and effective system restart services available in the unlikely event of widespread electricity supply failure. However, even if almost unlimited resources were applied to preparation for *system shutdowns*, the nature of failure modes and subsequent (partial) *system shutdowns* is such that it is not possible to guarantee contracted *restart services* would be able to restore customer supply capability within given time frames.

In reality, resources available to assist with the restoration of customer supply are not unlimited – as with any aspect of power system design, trade-offs must be made between service dependability and cost in the procurement of *system restart ancillary services* (SRAS). The extent of the trade-off is further confused given the impracticality of accurately assessing the monetary value of any (incremental) *restart service*.

The recommended arrangements contained herein have been formed following NEMMCO's consultation and consideration of written and verbal comments on the initial **Proposal**[2] and a **Draft report**[3]. Consultancy advice on specific matters has also assisted NEMMCO in the development of its recommendations. One of the appendices in this **Final report** provides a high level summary of the key amendments to the draft recommendations as a result of NEMMCO's considerations.

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1 NEMMCO, **Review of system restart ancillary service arrangements – Scoping paper**, February 2003. This paper is available from http://www.nemmco.com.au.

2 NEMMCO, **Review of system restart ancillary service arrangements – Proposal**, December 2003. This paper is available from http://www.nemmco.com.au.

3 NEMMCO, **Review of system restart ancillary service arrangements – Draft report**, April 2003. Consultation on that **Draft report** closed on 21 May 2004. This paper is available from http://www.nemmco.com.au.

Terms with specific definitions as described in the Glossary to this **Final report** are *italicised*.

A fundamental premise underlying the development of the arrangements proposed herein is, given the distinctions to be made between:

- the ideal world where competition is strong and information regarding *restart service* costs and benefits is easily available and accurate; and
- the real world where competition is limited and information regarding *restart service* costs and benefits is neither is easily available nor necessarily accurate,

it is impracticable and unreasonable to strive for an approach to *restart service* procurement that promises anything other than an answer that is approximately right.

*Recommended arrangements*

Several changes to the current arrangements for procurement of SRAS are recommended in several areas, including (but not limited to):

- the adoption of an outcomes-based standard;
- the specification of assumed levels of infrastructure damage as a basis for testing whether the standard has been met;
- the development of the concepts of *primary* and *secondary restart services* that differ in terms of availability and reliability;
- the potential for contracting additional services over and above the number required to meet the outcome-based standard;
- an ability to specifically incorporate private 'off-market' or *customer specific MW support* arrangements into the NEM restart plan; and
- adoption of principles to enhance the prospects that contracting outcomes are aligned with reasonable terms and conditions in at least most circumstances.

Readers should note the important distinction between *black start capability* and *restart service*. A unit (or group of units) with *black start capability* cannot make a material contribution as a *restart service* if it does not have the ability to subsequently energise lines to other (large) generating units. Existing Code definitions with respect to similar terms are considered inadequate.

The key differences between what is recommended and the status quo is outlined below.

**Table 1: Summarised comparison of the recommended arrangements and the status quo**

| | Recommended arrangements | Status quo |
|---|---|---|
| **Restart service standard** | • Codified requirement for an appropriate regulatory body to establish a *system restart service standard*.<br>• Outcomes-based standard that defines parameters for restoration of customer supply capability assuming a specified level of system damage has been incurred in association with the shutdown. | • No independently established standard – broad objectives outlined in ITT. |
| **Procurement guidelines** | • Minimum requirements re: type, number and independence of services.<br>• Flexibility in the type of *restart service* needed to meet the standard – primary and secondary services differentiated in terms of availability and reliability.<br>• Specification of criteria for procurement. | • Procurement requirements – 2 services per *electrical sub-network*, one of which must be fast restart – specified in Invitation to Tender (ITT). |
| **Risk mitigation and promotion of competition** | • Facility to contract additional services over and above the number necessary to meet the standard – additional secondary services. | • No specific measures. |
| **Tendering and assessment process** | • Assessment of service feasibility with opportunity to revise expressions of interest to correct technical oversights. | • Assessment of service feasibility with no opportunity to revise tenders. |
| | • Detailed assessment and modelling of feasible (conforming) services with explicit requirement to modify NSP facilities where necessary to ensure effectiveness of *restart service*. | • Limited modelling only. |
| | • Restart facility not required to be installed / commissioned until contract is offered. | |
| | • Up to 17 months from tender close to contract start. | • 6 weeks from tender close to contract start. |

| | **Recommended arrangements** | **Status quo** |
|---|---|---|
| **Testing** | • Test of *black start capability* required for all contracted services prior to provision of services and payments under a SRAS contract.<br>• Testing of facilities and ability to deliver the *restart service* is required for *primary restart services* prior to provision of services and payments under a SRAS contract.<br>• Prospective service providers responsible for the arrangement of all testing. | • Testing of *black start capability* required for all contracted services within 6 months of commencement of contract.<br>• Testing beyond *black start capability* conducted if it can be arranged by the service provider with NEMMCO's assistance. |
| **Payments for service and contractual conditions** | • Primary services contracted for 4 years with 2 x 1 year options exercisable at NEMMCO discretion.<br>• Secondary services contracted for 1 year only.<br>• Primary services remunerated for a) availability; b) each of 3 (Part A, B and C) test components as specified in the tender; and c) costs for necessary modifications to 3rd party facilities. *Primary service premium* paid in addition to other agreed prices.<br>• Secondary services remunerated for a) availability; b) Part A and Part B test components as specified in the tender; and c) costs for necessary modifications to 3rd party facilities.<br>• NEMMCO or appropriate regulatory body to set: *primary service premium*; and allowance for spending on additional *restart services*. | • All services contracted for length of period specified in the ITT.<br>• Payments for availability as specified in the tender. |
| **Private 'off-market' MW support arrangements** | • Clear mechanism for approving and coordinating 'off-market' MW support arrangements. | • No mechanism for coordinating private MW support arrangements. |

| | Recommended arrangements | Status quo |
|---|---|---|
| **Electrical sub-networks** | • Boundaries based on the physical characteristics of the system and system security imperatives. | • Follows past jurisdictional practice. |
| **Restart plans and procedures** | • All generators, MNSPs, TNSPs and DNSPs required to develop procedures to explicitly dove-tail with overarching NEM restart plan. | • Generators and MNSPs only required to develop *local black system procedures* – no specific links to NEM restart plan. |
| **Ensuring reasonable terms and conditions for contracted services** | • Any tender offering unreasonable terms and conditions may be required to participate in good faith negotiations with objective to agree reasonable terms and conditions.<br>• Codified principles to be established to guide outcomes expected from good faith negotiations or subsequent dispute resolution. | • Good faith negotiations only triggered on the basis of the number of conforming tenders.<br>• No guidance available to guide outcomes expected from good faith negotiations or subsequent dispute resolution. |
| **Recovery and discovery of SRAS costs** | • Generators and market customers share costs 50:50.<br>• Costs 'smeared' across the market – not allocated on sub-network or regional basis. | • Generators and market customers share costs 50:50.<br>• Costs 'smeared' across the market – not allocated on sub-network or regional basis. |
| **Use of SRAS** | • Can be used for management of power system emergency where there is otherwise no external power supply to a contracted *restart service*. | • To be used only where *black system* has been declared. |
| **What if available service not sufficient to meet requirements ?** | • NEMMCO to issue specific tender with objective of getting specific facilities constructed – facility to be managed independently of NEMMCO. | • Not clear. |

*Conclusion and request for comment*

Consistent with the published intent for the review, the review has concentrated on:

- establishment of a system restart procurement standard;
- procurement strategies (assessment & modelling);

- guidelines for development of plans / procedures; and
- clarification of obligations and allocation of responsibilities.

Also consistent with the published intent, the review has left the following matters for continued management by operational personnel:

- comment on implementation of actual plans / procedures;
- development of communication protocols; and
- operational issues.

However, as indicated earlier, the review recommendations ensure responsibility for these matters is clearly allocated.

NEMMCO believes the recommended arrangements outlined herein reflects the following desirable characteristics:

- common standards and principles for *restart service* capability to be consistently applied across the NEM;
- maximisation of the chances of rapid restoration in the widest possible range of circumstances; and
- providing a level of assurance to the market that it would not be burdened with expenses for the maintenance of *restart services* beyond those that represent 'good value'.

Appendices to this **Final report** include:

- a summary of consultation comments on NEMMCO's **Draft report** and NEMMCO responses to those comments;
- a summary of changes to proposed arrangements as a result of consideration of respondent comment;
- high level guidelines for technical capabilities, assessment and testing of tendered *restart services*; and
- high level guidelines for the development of *system restart plans* and *local black system procedures*.

# 1 Introduction

## 1.1 Requirement to undertake a review

A review of *system restart ancillary services* (SRAS) is required to be undertaken by NEMMCO in accordance with requirements of clause 3.1.4 (Market design principles) of the National Electricity Code (the 'Code') which is reproduced in Appendix 3 of Volume 2 of this **Final report**.

Specific areas of focus for this review have been established through a **Scoping paper** that has been subject to open consultation. In essence, the scoping exercise identified the following (broad) matters as relevant to the review process:

- clarification of the requirement or standard to guide the procurement of system restart services;
- clarification of the technical requirements for the delivery of the system restart service. Consideration could include issues such as:
  - locational factors – how might 'local' network considerations impact upon the effectiveness of system restart services?
  - technical requirements relating in particular to the issues of energising the grid in abnormal modes, so that the process remains robust;
- risks and risk management – what is the nature of the risks that need to be accounted for in centrally managed restart procedures, and how are those risks best managed?
- administrative factors such as:
  - the form of tendering and level of contracting required;
  - consideration of whether there is there any scope for making use of non-contracted facilities; and
  - making provision for 'off market' *customer specific MW support*.

## 1.2 Context for the review

NEMMCO acknowledges the fundamental importance of having responsive, reliable and effective system restart services available in the unlikely event of widespread disruption of electricity supply. However, even if almost unlimited resources were applied to preparation for *system shutdowns*, the nature of failure modes and subsequent (partial) *system shutdowns* is such that it is not possible to guarantee that contracted *restart services* would be able to restore customer supply capability within given time frames.

In reality, resources available to assist with the restoration of customer supply capability are not unlimited – as with any aspect of power system design, trade-offs must be made between reliability and cost in the procurement of SRAS.

In addition to consideration of submissions both prior and subsequent to the finalisation of the **Scoping paper** for the review, the initial **Proposal** was informed by an **Options paper**[4] prepared for NEMMCO by Harding Katz Pty Ltd.

Further consultancy advice has also been sought on:

- guidelines for ensuring contracting outcomes align with reasonable terms and conditions[5];
- the need to adjust the balance of the allocation of SRAS costs between generators and customers[6].

Documentation noted above, and consideration of respondent comments (written and verbal) on the initial **Proposal**, assisted NEMMCO in the preparation of a **Draft report**.

The recommended arrangements contained herein have been formed following NEMMCO's consideration of comments received on the **Draft report** and subsequent meetings with respondents. One of the appendices in this **Final report** provides a high level summary of the key amendments to the **Draft report** as a result of NEMMCO's considerations.

Terms with specific definitions as described in the Glossary to this **Final report** are *italicised*.

## 1.3 The difficulty of determining the 'correct' amount of service

### *1.3.1 An ideal world*

In an ideal world, the efficient volume and price of *restart services* to be procured would be established in a competitive market via some unambiguous assessment of the dollar value of every possible combination of available *restart services*.

The decision criterion in this ideal world would be to:

> Choose the lowest possible cost combination of *restart service*s consistent with:
>
> the cost of the last (incremental) service procured $\geq$ the probability weighted value of lost load avoided as a result of the last (incremental) service being procured

Implicit in this decision criterion is a number of assumptions:

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[4] Harding Katz Pty Ltd [1], **Options paper: Review of system restart ancillary services**, August 2003. Published as a companion paper to NEMMCO's initial **Proposal**. This paper is available from http://www.nemmco.com.au.

[5] The Allen Consulting Group, **Guidelines for dealing with non-competitive tenders for System Restart Ancillary Services in the NEM**, March 2004. This paper is available from http://www.nemmco.com.au.

[6] Harding Katz Pty Ltd [2], **Allocation of restart service costs between customers and generators, Further advice to NEMMCO**, March 2004. This paper is available from http://www.nemmco.com.au.

- the price of each service reflects:
  - opportunity cost of incremental capital (facilities) required to deliver the service;
  - cost for maintenance of the facility;
  - cost for training for use of the facility;
  - cost for testing of the facility;
  - cost for usage of the facility;
  - risks associated with: testing; maintenance; usage; probability of success in winning (and continuing) a contract;
- in estimating the probability weighted value of lost load avoided as a result of the last (incremental) service procured, the following parameters are known:
  - the probability of a *system shutdown* event;
  - the probable value of the lost load avoided in a *system shutdown* event by having the optimal combination of services contracted, with probable value influenced by:
    - : < 100% availability of each contracted service – for what portion of the contracted period would the service be unavailable due to maintenance or forced outages?
    - : < 100% reliability of each contracted service – if *black system* conditions could be fully simulated, say 1,000 times, on how many occasions would the facility fail to deliver the contracted service?

It should also be noted that the incremental value of the last (incremental) service procured is affected by which other *restart services* are also contracted. For example:

- the incremental value of Service X might be $100 if it was contracted in addition to Service Y; but
- the incremental value of Service X might be only $20 if it was contracted in addition to Service Z.

### *1.3.2 The real world*

In reality, difficulties in assessing the correct volume and price for *restart services* abound:

- the market for *restart services* is limited and not necessarily competitive;
- *restart services* are a public rather than a private good – the value a party publicly places on avoiding lost load would be distorted by whether or not they perceive a consequent liability to pay for the service to avoid that lost load;

- setting aside the difficulties in accurately revealing individual value, the aggregate probability weighted value of incremental lost load avoided is impractical if not impossible to assess with any accuracy for the following reasons:
  - we cannot be certain about the probability of a *system shutdown* event occurring;
  - the volume of lost load avoided is extraordinarily difficult to identify;
  - the value of that lost load will vary according to type and location of load affected; time of day/year;
- assessment of service reliability is likely to be subjective;
- some of the costs of developing and maintaining *restart services* are inseparable from other generation related operations and, hence, true costs are estimated; and
- risk premiums will vary according to an individual party's appetite for risk and assessment of the remainder of the market in which it is competing.

Given these uncertainties, it is impossible to arrive at an absolutely correct assessment of 'best value' – service volume and price cannot be efficiently determined by the market alone. Sensible guidelines and principles should nevertheless yield an answer that is 'approximately right'. The alternative approach of attempting to 'accurately' determine the appropriate value for every measurable parameter seems most likely to yield an answer that is 'precisely wrong'.

Accordingly, transparent administrative processes need to be applied to determine appropriate requirements regarding the number and type of *restart service* to be procured. Where competition in the provision of *restart services* is lacking, some administrative guidance in determining service price may also be appropriate.

## 1.4 Structure of this paper

The recommendations for amended SRAS arrangements are presented in two volumes:

- **Volume 1**, which includes:
  - a description of the consultation process and related activities;
  - a description of each element of the recommended arrangements and a rationale for the suggested approach;
  - a brief conclusion; and
  - glossary.
- **Volume 2**, which provides appendices covering the following supporting material:
  - Appendix 1 – a summary of consultation comments on NEMMCO's **Draft report** and NEMMCO responses to those comments;

- Appendix 2 – a high level summary of changes to recommended arrangements as contained in the **Draft report** as a result of NEMMCO's consideration of respondent comment on the **Draft report**;
- Appendix 3 – an outline of existing Code clauses relevant to system restart arrangements;
- Appendix 4 – a summary of existing sub-network maximum demands to provide additional context for the determination of electrical sub-networks;
- Appendix 5 – high level guidelines for technical capabilities, assessment and testing of tendered *restart services*;
- Appendix 6 – high level guidelines for the development of system restart plans and local black system procedures; and
- Appendix 7 – a discussion of the characteristics of *restart service* dependability.

# 2 Long term system restart ancillary service arrangements: recommended form

The recommended standards and guidelines that follow are intended to inform the procurement of *system restart ancillary services* (SRAS) and to create a link between procurement strategies and the development and management of restart plans and procedures. In order to achieve these objectives, significant changes to existing arrangements are being recommended.

This section covers detail with respect to the following key elements of the recommended arrangements:

- establishment of an outcomes-based *system restart service standard* that defines parameters for restoration of customer supply capability assuming a specified level of system damage has been sustained in association with the shutdown – the current standard is vague;
- specification of *procurement guidelines* that define separate (performance-based) service categories and minimum service levels; this includes a facility to contract with additional services to mitigate risks and promote competition – current practice only requires contracting with two services, one of which must be fast restart[7], for each region;
- establishment of a tendering and contracting process for *restart services* that encompasses comprehensive assessment, modelling and testing of tendered services – existing assessment and testing requirements are not clearly specified;
- facilitation of *customer specific MW support* arrangements;
- establishment of a consistent process for determining *electrical sub-networks* for which *restart services* are to be contracted, with sub-network boundaries based on the physical characteristics of the system and system security imperatives – current arrangements align *electrical sub-network* boundaries with market region boundaries;
- formal integration of *system restart plans* and *local black system procedures* including extension of *local black system procedures* to TNSPs and DNSPs.

Some key terms in the recommended arrangements are defined as follows:

- *black start capability* – following *disconnection* of a *generating unit* from the *power system* it is subsequently able to deliver electricity to its *connection point* without having taken *supply* from any part of the *power system* since *disconnection*[8]; and

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[7] The characteristics of a 'fast restart service' are defined in NEMMCO's recent *Invitations to Tender* (ITTs) for non-market ancillary services and include (among other things) capability of "restarting within 1 hour and delivering energy to the main system to the contracted level within 2 hours".

[8] This is a proposed definition. The Code currently defines *black start capability* as: "(in relation to a *generating unit*) the ability to start and *synchronise* without using

- *restart service* – the process of supplying sufficient energy and establishing a connection via the transmission infrastructure to restart other (large) generating units[9].

Readers should note the important distinction between *black start capability* and *restart service*. A unit (or group of units) with *black start capability* cannot make a material contribution as a *restart service* if it does not have the ability to subsequently energise lines to other (large) generating units. Existing Code definitions with respect to similar terms are considered inadequate.

Readers should also bear in mind the fact that the primary purpose of procuring a *restart service* is to provide the capability to restart other generating units. The task of the *restart service* has not been performed until it has assisted in the restoration of other generating units.

Each aspect of the recommended arrangements is now discussed in detail.

## 2.1 System restart service standard

There should be no expectation that this procurement orientated standard would necessarily be useful in assessing the performance of contracted services in restoring the system after a *system shutdown*. The objective of the standard is to provide a framework for modelling and assessment of *restart service* contracting options. In order to contract the 'right' amount of *restart services*, the standard necessarily makes assumptions about the condition of the system following shutdown for the purposes of modelling – there is only a limited likelihood that system conditions at the time of the shutdown event would match those exact circumstances.

*Description of recommendations*

It is recommended that the *system restart service standard* be as follows:

> *Restart services* should be procured for each *electrical sub-network* sufficient to:
>
> - resupply and energise all the auxiliaries of 50%* of available generating capacity in the affected sub-network within 2½* hours of a *system shutdown* occurring[10]; and
>
> - restore 40%* of the black sub-network's peak demand supply capability from the transmission network within *x** hours of a *system shutdown* occurring.

supply from the *power system*". If there is no supply from the power system, there is nothing to synchronise with – hence the proposed modification to the existing definition.

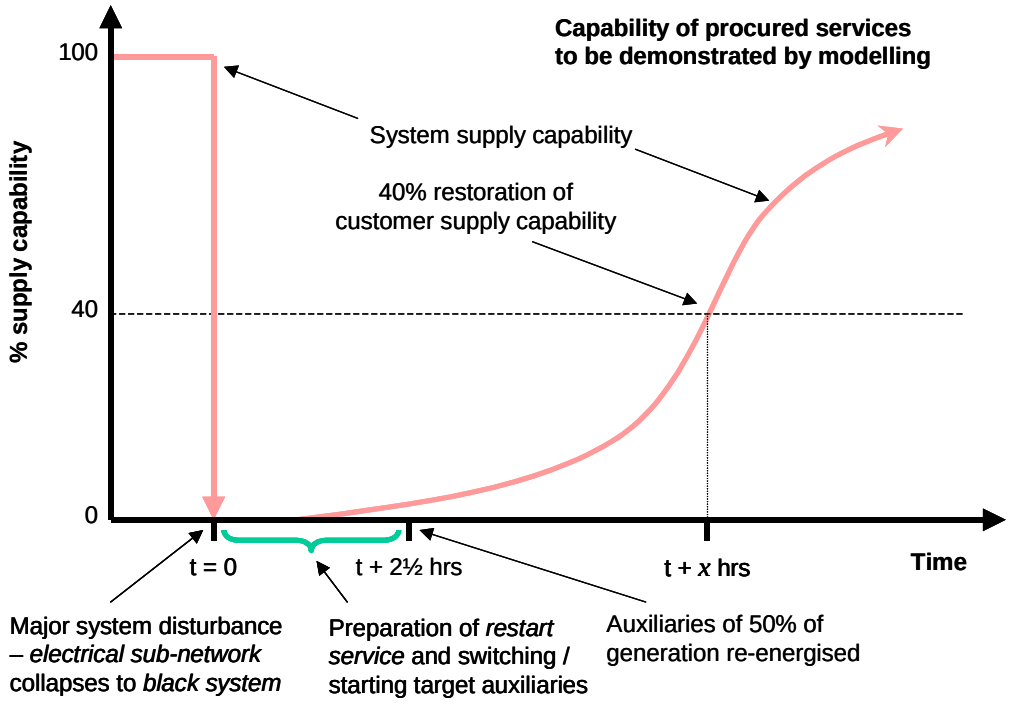
[9] This is a proposed definition. The Code currently defines *system restart* as: "In respect of a *generating unit*, means the service of generating in order to assist other *generating* units to start during a *black system* condition".

[10] It should be noted that alternative views exist regarding the most appropriate form of interim restoration benchmark. An alternative to expressing the interim target in terms of restored auxiliary supply is to express the interim target in terms of restored customer loads. See discussion in Section A1.1.2 of Volume 2 of this **Final report**.

* Each of the parameters in the standard (percentages and time frames) indicated above are illustrative only and the value of each parameter would be determined by the appropriate regulatory body.

It is recommended that a NEM *system restart service standard* of this form be established by an appropriate regulatory body in a manner similar to the current NEM reliability standard[11]. A requirement for the appropriate regulatory body to set a standard on the advice of NEMMCO would be included in the Code. The Code would not, however, prescribe the form of the standard – the regulatory body would have the ability to consult widely on the form of standard to be adopted notwithstanding any advice provided to it by NEMMCO.

**Figure 1: Schematic of the outcome-based standard**




In assessing whether the standard has been met, modelling of the capability of prospectively contracted *restart services* is to proceed on the basis of defined combinations of the following assumptions:

**Assumption A**

Supply is disrupted to the extent that there is an absence of voltage on all of the transmission system in all *electrical sub-networks*.

**Assumption B1**

All transmission and generating assets remaining intact, operational and available for service following the system disturbance that led to *system shutdown*.

[11] The current NEM reliability standard is, "maximum of 0.002% of regional unserved demand in any region" as published in *Reliability Panel determination on reserve trader and direction guidelines*, National Electricity Code Administrator, June 1998.

**Assumption B2**

Non availability of either:

- any one power station contracted to provide *restart services* for a target *electrical sub-network*; or
- any one significant transmission facility[12] within a *target electrical sub-network* such that it cannot be utilised in the system restoration process,

but all other transmission and/or generating assets remain intact, operational and available for service.

The recommended procurement process ensures the standard is met for each of two circumstances as described below. These different circumstances relate to representative *system shutdown* scenarios.

Where **Assumption A** and **Assumption B1** hold – that is, the system has completely shut down, but without sustaining permanent damage to plant – the following test (Test 1) is to apply to modelling the capabilities of combinations of *restart services* prospectively procured to assist in the restoration of each *electrical sub-network*:

**Test 1**

*Restart services* are to be procured sufficient to simultaneously meet the standard in each *electrical sub-network*.

Where **Assumption A** and **Assumption B2** hold – that is, the system has completely shut down, with a defined level of damage sustained to critical plant – the following test (Test 2) is to apply to modelling the capabilities of combinations of *restart services* prospectively procured to assist in the restoration of a *target electrical sub-network*:

**Test 2**

*Restart services* are to be procured sufficient to meet the standard in the *target electrical sub-network*.

That is, services prospectively procured must meet the standard in the target sub-network, regardless of possibly not meeting the standard in other sub-networks. In applying Test 2, each sub-network is to be modelled in turn as the *target electrical sub-network*, with the nominated damage level modelled and the test separately applied to each *electrical sub-network* in the power system.

Application of the above principles suggests that modelling will not necessarily need to be able to demonstrate that the standard will be met for the following circumstances:

- for every sub-network simultaneously when **Assumption A** and **Assumption B2** hold; or

[12] If the non-availability of any transmission facility (for example, a series of lines in close proximity or on a common tower) has the potential to adversely impact, in a significant manner, the effectiveness of a *restart service* and/or supply restoration times, that corridor would be deemed 'significant' for the purposes of modelling that *restart service*.

- for any sub-network should infrastructure damage be more serious than that indicated under **Assumption B2**.

In addition to the requirement to meet the tests indicated above, service procurement guidelines (Section 2.2) will also apply to determining whether or not appropriate levels of *restart service* have been procured.

*Rationale*

Defining an outcomes-based standard has two basic purposes:

- it provides a benchmark that would guide the procurement of *system restart ancillary services*; and
- it provides a basis for the modelling required to develop a new *system restart plan*.

Time frames required to restore customer supply capability and the extent of restoration following the occurrence of a *black system* condition are affected by a number of factors:

- location (electrical distance from load and other generation) of contracted *restart services*;
- technology of units supplying *restart services*;
- technology of units that are targets for *restart services*; and
- the condition and status of power system infrastructure immediately following the occurrence of a *black system* condition.

Each of these factors create unknowns in terms of timeliness of customer supply restoration. Although restoring customer supply capability is important, NEMMCO believes that benchmarking performance against such a parameter in the early phase of system recovery might give a misleading impression of the success (or otherwise) of restoration efforts[13]. Accordingly, the interim benchmark for power system restoration focuses on the resupply and energisation of the auxiliaries of available generating capacity. The later phases of the restoration process focus on the outcome of resupplying the bulk of customers in a sufficiently timely manner. System loading on a peak demand day in each sub-network ("peak demand") is used as the restoration metric because it provides a reasonably stable benchmark to be applied in ex ante modelling – assumptions would otherwise need to be made about the time of day/week/year the black system condition occurred.

Codifying a requirement for an appropriate regulatory body to set a standard on the advice of NEMMCO without prescribing the form of the standard, provides significant opportunity for advice from parties other than NEMMCO to bear on the nature and form of the standard.

[13] NEMMCO is conscious of ensuring that, in formulating a standard, innovative restart technologies that may be very effective in assisting the achievement of desired longer term outcomes are not inadvertently precluded from consideration because of an overly prescriptive standard.

In procuring SRAS and developing restart plans and procedures, the cause of the *system shutdown* is not (and cannot be) the focus. However, given the potential seriousness (in both social and economic terms) of *system shutdowns*, it would be prudent to develop restart strategies that mitigate the effects of plausible (although low probability) modes of system failure, subsequent system conditions and the consequent effect on the restart process. Hence, there is a requirement that the restoration standard can be met simultaneously for all sub-networks should there be no infrastructure damage, but also that for any one sub-network, the standard can still be met even when plausible levels of damage have been sustained.

The outcomes-based standard suggests specified restoration time frames and percentages should be capable of demonstration via modelling recovery from widespread *system shutdown* where specific assumptions are made. These assumptions relate to highly plausible infrastructure damage levels that could be sustained as part of the shutdown event – without stipulating whether the damage has caused the shutdown, or is a result of it. However, it might be argued that other post-event infrastructure conditions are equally plausible and could also be the subject of modelling assumptions, with additional or alternative modelling influencing the assessed effectiveness of prospectively contracted *restart services*.

The power system is designed and operated to withstand the occurrence of single credible contingency events, and the set of multiple contingencies (non-credible contingency events) is very large, making prediction and assignment of probabilities of possible multiple contingency events difficult or impossible. Further, it is not practicable – or even possible – to model every single mode of failure and combination of infrastructure (non)availability likely to be associated with *system shutdowns*.

The choice of infrastructure damage condition implicit in the assumptions used to model procurement against the standard, arguably provides a basis for conservatively assessing the likely effectiveness of alternative combinations of *restart services*. Modelling conditions beyond those indicated would not, in NEMMCO's view, constructively inform the procurement process[14]. Also, it would be uneconomic to mitigate against all such events, even though it is possible to demonstrate that a particular event might lead to system conditions quite different from those that are to be modelled.

The conservative nature of the standard is emphasised by recognising that events over recent years have demonstrated the propensity of the Australian grid to form highly viable islands following a disturbance, rather than necessarily cascading to shutdown. Accordingly, there is potential for an event leading to a *black system* condition to be contained to a single *electrical sub-network*, thereby creating alternative sources of restoration assistance.

Further conservative aspects of the standard can also be identified. The nature of the standard ensures there is at least one back-up *restart service* technically capable of assisting restoration of any target sub-network, located either within or outside that sub-network. The standard would still be met

[14] Failure of system infrastructure more extensive than implied in the generic failure state would mean subsequent system restoration is likely to be a highly complex exercise and likely timings difficult or impossible to assess before the event.

should any one of these services (or a significant transmission facility) happen to be unavailable.

NEMMCO does not consider it to be unreasonable that the standard is not required to be met in every sub-network simultaneously should there be total *system shutdown* and non-availability of either a contracted *restart service* or a significant transmission corridor. Should this level of damage occur a choice would need to be made as to which of two sub-networks was to be given initial priority in restoration. Such a decision could only be made by operational personnel at the time, taking prevailing system conditions into account. Concern regarding the possibility of delayed restoration in any sub-network would be mitigated by the ability for NEMMCO to procure services over and above the level required to meet the standard (see Section 2.2).

**Relationship between the standard and criteria for declaring a black system**

There is a need to both highlight and explain apparent inconsistencies between elements of the *system restart service standard* and criteria for declaring and exiting *black system* conditions. The inconsistencies arise from the absence of a guaranteed equivalence of: a) the boundaries *electrical sub-networks*; and b) the boundaries of the market *regions*.

The criteria for determining the boundaries in each case are fundamentally different.

- *electrical sub-networks* boundaries are determined in the basis of purely technical issues and reflect the way the system is likely to shut down;
- *region* boundaries are pricing related and designed to cover periods of normal market operation.

In order to effectively and efficiently manage SRAS, *restart services* need to be contracted and deployed on the basis of *electrical sub-networks*, which NEMMCO contends should be based on physical characteristics of the system and system security imperatives (see Section 2.5). Accordingly benchmarks for the likely success of the restoration process (assessed ex ante) following widespread failure of supply need to be based on how quickly supply can be restored in an *electrical sub-network*.

Where supply failure is widespread, suspension of the market is an essential management tool – in the event of a *black system* NEMMCO may declare the spot market to be suspended[15]. However, the Code only provides for suspension of the market on a regional basis. Therefore, the criteria for declaration of a *black system* condition have been referenced to loss of forecast supply within a *region* (not within an *electrical sub-network*).

[15] See NEMMCO, **Power system emergencies, black system conditions and market suspension – Final report**, August 2003. This paper is available from http://www.nemmco.com.au.

## 2.2 Service definition and procurement guidelines

*Description of recommendations*

The recommendation for guidelines regarding the procurement of SRAS relies on the establishment of:

- definitions for the categories of *restart service*;
- criteria for the number of *restart services* of each type to be procured; and
- requirements for the independence of *restart services*.

It is proposed the two *restart service* categories are defined in terms of availability and reliability as follows:

*Primary restart service* – a contracted service that is:

- contracted to be available 98% of the time[16]; and
- highly likely to perform in the manner intended if and when called upon to do so.

*Secondary restart service* – a contracted service that is:

- contracted to be available at least 75% of the time[17]; and
- more likely than not to perform in the manner intended if and when called upon to do so.

The likelihood of being able to deliver the required reliability levels would need to be verified to NEMMCO's satisfaction through a combination of technical assessment and physical testing.

As a consequence of the differences in availability, reliability and contribution to meeting the outcome based standard of the two service categories, the services will be further distinguished in terms of the extensiveness of physical testing[18].

NEMMCO's criteria for procurement of *restart services* would be as follows:

1. *Restart services* will be assigned to specific sub-networks. Services could be assigned to multiple sub-networks only where there is a demonstrable capability for a single service to simultaneously contribute to restoration of more than one *electrical sub-network* without degrading the service to any other sub-network to which it was also assigned.

[16] 98% availability is to be achieved over the term for which services are contracted (up to 6 years), subject to services not falling below 95% availability in any rolling 12 month period.

[17] To be assessed over the period of the contract (12 months).

[18] Assessment and testing is discussed in Section 2.3.3 and Appendix 5 of Volume 2 of this **Final report**; contract conditions and remuneration are discussed in Section 2.7.1.

2. Preference will be given to meeting the requirements for service in each *electrical sub-network* with diverse / strategically located *primary restart services*. Other things being equal, preference will be given to contracting with *restart services* that contribute to faster restoration of customer supply capability.

3. NEMMCO should make effort to minimise the overall cost of procurement of *restart service*s subject to ensuring overall service quality and capability is not significantly compromised.

4. If NEMMCO is unable to meet the requirements for service in each *electrical sub-network* with *primary restart services* consistent with contracting under reasonable terms and conditions for all services, the best value available *secondary restart service* should be contracted as a substitute for 'missing' *primary restart services*. *Secondary restart services* substituting for *primary restart services* would NOT be eligible for the *primary service premium*.

5. Additional *secondary restart services*, over and above the number of *restart services* required to meet the *system restart service standard*, may be acquired for each *electrical sub-network*, at NEMMCO's discretion. In exercising its discretion, NEMMCO should ensure:

   (a) the additional services are likely to be effective in improving restoration time frames or in mitigating the non-availability of other contracted services;

   (b) the cost of additional services acquired for each *electrical sub-network* does not exceed benchmarks for spending on additional services as specified in Section 2.7.1[19].

Where it is not possible to contract with sufficient *primary restart services* to meet the *system restart service standard,* it may be necessary to consider the use of *secondary restart services* to meet the requirements of the standard, In such cases, an alternative combination of assumptions would be applied in assessing whether the standard has been met. Assumption A and Assumption B2 as noted in Section 2.1 would still be used in one test of the adequacy of prospectively procured *restart services*. However, Assumption B2 would not be applied but an alternative and more onerous assumption would be used in its place as follows:

**Assumption B2***

Non-availability of either:

- any **<u>two</u>** power stations contracted to provide *restart services* for a *target electrical sub-network*; or

[19] Note that the Codified terms of reference for this review indicated that the "long term strategy for the provision of *system restart* services [should take] into account … the desirability of acquiring supplementary *system restart capability* on a competitive basis to reduce the time required to resupply *loads* where benefits outweigh the costs". NEMMCO has separately concluded (see Section 1.3) that it is impractical, if not impossible, to establish the value of incremental services on the basis of any benefit-cost analysis, although it is recognised that supplementary restart services may still add value to the restoration beyond the cost of acquiring the incremental service.

- **any one power station** contracted to provide *restart services* for a *target electrical sub-network* **and** any one significant transmission facility within a *target electrical sub-network* such that it cannot be utilised in the system restoration process,

but all other transmission and/or generating assets remain intact, operational and available for service.

Where **Assumption A** and **Assumption B2*** hold, the following test (Test 2) is to apply to modelling the capabilities of combinations of *restart services* prospectively procured to assist in the restoration of a *target electrical sub-network*:

**Test 2**

*Restart services* are to be procured sufficient to meet the standard in the *target electrical sub-network*.

Each sub-network is to be modelled, in turn, as the *target electrical sub-network* and Test 2* separately applied to each sub-network.

The 'independence requirement' for *restart services* would be as follows:

*Restart services* for each *electrical sub-network* are to be procured such that at least two of the services contracted to meet the *system restart service standard* are *independent*.

In this context only, *independent* requires contracted units with *black start capability* to not have a reliance on common network assets (including whole sub-stations or transmission corridors) to facilitate the delivery of *restart services*.

In contracting with services in addition to the number needed to meet the *system restart service standard*, the independence requirement would be relaxed to the extent that reliance on any one sub-station or one transmission corridor in common with another *restart service*, would not rule out an ability to contract with additional services. However, no power station would be able to carry more than one *restart service* contract (primary or secondary).

*Rationale*

This section would meet the requirement laid down in Clause 3.11.3(b)(1) of the Code for NEMMCO to "develop and *publish* a procedure for determining the quantity of each kind of *non-market ancillary service* required for *NEMMCO* to achieve the *power system security and reliability standards*".

In one sense, if services are contracted such that restoration times associated with the outcome-based standard are likely to be achieved, there would be no need to separately define requirements for the independence and/or number of services to be available for each *electrical sub-network*. However, for the avoidance of doubt and to provide clarity and guidance in the procurement process, it is considered prudent to also specify conditions associated with the type, independence and number of *restart services*[20].

[20] The combination of a *system restart service standard* and *procurement guidelines* is consistent with the notion of a 'hybrid system restoration standard' that is discussed in Harding Katz [1] *(op. cit.)* Section 4.3.

In the ideal world, 'type' of *restart service* is not an issue because all variations in service characteristics would be appropriately reflected in service volume, value and, hence, service price. However, in the real world, service characteristics will need to be packaged, where the appropriateness of a package is determined by unavoidably subjective assessments as to the relative value of specific service characteristics.

The need to restore the power system within a reasonable time leads NEMMCO to conclude there is a requirement for 'dependable' and 'diverse / strategically located' *restart services*:

- 'dependable' (technically capable of doing the job, highly available, highly reliable and comprehensively tested) because stakeholders need to be confident that the *restart service* will work if and when called upon[21]; and

- 'diverse / strategically located' because stakeholders want the comfort of restart plans being robust to a range of contingencies.

*Restart services* will vary substantially in terms of: availability; reliability; proximity to other generation; proximity to load; and time required to respond to an instruction to restart. Even services with broadly similar technologies will have variations in availability, reliability and response time. Recognising the variability in *restart service* characteristics creates a challenge of how best to manage that capability in a contracting sense.

Creating a 'one size fits all' contract – where all services considered 'acceptable' are subject to similar requirements – ignores the distinction between services with very different levels of dependability, and thus difficulties will emerge in developing a consistent approach to assessing the relative merits of alternative services. What are the 'correct' technical requirements to be applied in unambiguously and appropriately defining a dependable *restart service*? Where should the 'dependability' line be drawn?

An alternative to specifying requirements such as those above (or similar) in a 'one size fits all' contract is to:

- create a range of contracts that place each service in an appropriate class; and then

- determine as consistent as possible an approach to awarding contracts on the basis of guidelines and principles that appropriately reflect a preference for service dependability and locational diversity.

In this way the highly dependable services could still be given priority in the awarding of contracts, but the less dependable, although potentially useful services, could also play an important role in the development of a robust system restart strategy.

[21] A discussion of how capability, availability and reliability might combine to create a dependable *restart service* is contained in Appendix 7 of Volume 2 of this **Final report**.

The category of *primary restart services* has been established to define the requirements of highly dependable *restart services*[22]. Where either availability or reliability of any tendered unit or group of units is (likely to be) significantly less than 100%, NEMMCO is proposing that such a service would not be considered to be sufficiently dependable to qualify for service as a *primary restart service* provider.

The category of *secondary restart* services, which are subject to less onerous technical requirements than a *primary restart service*, has been established as a means of enabling less dependable, but potentially useful services to also play a role in the development of system restoration strategies[23].

Having established an appropriate distinction between types of *restart service*, there are several factors relevant to the choice of the appropriate number of *restart services* of each type to be procured. These factors are as follows:

- The outcomes based *system restart service standard* will provide guidance as to the preferred number of dependable or *primary restart services*, but the possibility (and consequences) of being unable to procure a sufficient number of *primary restart services* to meet the standard needs to be recognised.

- Some view needs to be formed as to the number of less dependable *secondary restart services* required to provide the same level of confidence in the system restoration process as the preferred number of dependable or *primary restart services*.

- Given the impracticality (if not impossibility) of accurately assessing the value of incremental *restart services*, there is a possibility that supplementary *restart services*, (over and above the number of dependable or *primary restart services* required to meet the standard) may add value to the restoration process beyond the cost of acquiring the incremental service.

- A basic principle of the NEM is that it be operated in an efficient manner – reasonable measures should be taken to reduce risks, but nowhere is there an expectation that a blank cheque should be available that allows risk to be totally eliminated.

Weighing up each of these factors leads NEMMCO to the conclusion that there can be no unqualified correct answer to the question: How many of each type of service should be procured? However, sensible guidelines and principles should nevertheless yield an answer that is 'approximately right'. Given the nature of the service that is being sought, and the possible consequences of having insufficient services on hand at the time they are required, a prudent approach would be to err on the side of having too much

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[22] Once the primary service status threshold for dependability (availability and reliability) of a *restart service* has been reached, where a choice exists, NEMMCO does not consider it would be economically prudent to pay more than a modest premium for further improvements in the dependability of a given *restart service*.

[23] It is noted that units with *black start capability* would not necessarily seek a primary service contract – maintenance and flexible operating requirements of some generators may impinge in the availability and reliability of any *restart service* it was inclined to offer.

rather than too little service under contract. Accordingly, NEMMCO has suggested a set of criteria for determining the number of *primary* and *secondary restart services* to procure that takes account of differences in dependability of the two types of service and imposes some limit on spending on supplementary services.

Maximum confidence in the reliability of *restart services* would be gained where contracted services have been subject to rigorous and extensive testing of their capabilities, including testing of associated transmission network facilities and, where appropriate, distribution network facilities. Accordingly, preference would be given to contracting with:

- fully tested, high reliability and high availability *primary restart services*; and
- service combinations that contribute to faster restoration of customer supply capability.

Less extensively tested, (potentially) lower reliability and lower availability *secondary restart services* would be contracted in place of primary services only where suitable primary services were not available under reasonable terms and conditions.

Contracted *restart services* for an *electrical sub-network* need not necessarily be located within that sub-network in order to be effective – restart of generation within a *target electrical sub-network* may be technically viable from a neighbouring sub-network using existing (assumed intact) transmission corridors[24]. However, the expressed preference for services capable of contributing to faster restoration of customer supply capability is likely to provide some advantage to *restart services* located nearer large groups of generation.

The range of risks NEMMCO seeks to manage by providing opportunities to contract additional *secondary restart* services are:

- contracted *primary restart services* experiencing unscheduled outages or unforeseen failure of future (annual) restart tests;
- the availability for service of system infrastructure being unforeseen to the extent that contracted *primary restart services* are not effective in restoring supply within desirable time frames;
- *black start capability* being withdrawn from the market (or never offered) because of perceived inability to meet the testing requirements to be considered a *primary restart service*;
- *black start capability* being withdrawn from the market because of lack of (near-tem) opportunity to earn a return on the investment in the capability – this could arise where:
  - a tenderer for a *restart service* contract was unsuccessful; or

[24] The extent of the assessment and testing required to demonstrate technical viability of tendered *restart services* is discussed in Sections 2.3.2, 2.3.3 and Appendix 5 of Volume 2 of this **Final report**.

  - new generation technology being introduced into the NEM, with new restart facilities becoming available soon after the close of opportunities to tender for *restart services*; and

- the market developing in a way that there is insufficient choice of *restart services* when tenders are assessed and the outcome-based standard cannot be met with *primary restart services* alone, with the consequence that lower availability and less rigorously tested services need to be contracted in their place.

Creating opportunity to contract for additional *secondary restart services*, over and above the number of services necessary to meet the *system restart service standard*, helps mitigate these risks. Providing specific guidance to NEMMCO in how its discretion in acquiring additional secondary services should be exercised is a practical way of managing, within reasonable bounds, the uncertainty associated with the value of such services.

In seeking to contract for additional *restart services* the objective is to yield a diversity of restart sources. Accordingly, NEMMCO would seek to avoid contracting with any two *restart services* (primary or secondary) that could be subject to a common point of failure. Hence the limitation of only one *restart service* for any power station.

Where NEMMCO is forced to resort to less reliable secondary services as a substitute for primary services, applying more onerous assumptions in testing whether the standard has been met[25] provides a higher 'sufficiency of service' hurdle that NEMMCO believes to be appropriate.

Independence of *restart services* is considered important, as the restart process should not be exposed to a single point of failure – where 'single point of failure' is broadly interpreted – that could disable all *restart services* for an *electrical sub-network*. The assumptions to be applied in testing service adequacy foreshadows the possible non-availability of (at least) either one contracted restart station or one transmission corridor. If there are two (or more) *independent restart services* available to each sub-network, infrastructure non-availability to the extent indicated by the assumptions to be applied would not leave the sub-network without an effective *restart service*[26].

## 2.3 Tendering / assessment / contracting

Under the current tendering/contracting arrangements, the degree to which potential restart sources must currently demonstrate their capability prior to being contracted is not defined. Tenderers may assert their capability of independent restart and ability to accept a block of load located beyond their own plant boundaries, but that does not necessarily provide certainty that the *restart service* is likely to be successful at doing so when called upon for test or restart purposes.

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[25] **Assumption B2*** relates to non-availability of either: **<u>two</u>** *restart services* (instead of one); or one *restart service* **<u>and</u>** one transmission corridor (instead of one transmission corridor only).

[26] If a group of power stations could demonstrate there were multiple independent paths to the transmission network, it is possible that they would not be subject to a common point of failure.

Services offered under recommended arrangements may relate to the capabilities of a single unit, a group of units or even a combined service involving several parties and items of infrastructure.

Expectations and responsibilities should be clearly defined for all parties involved in the processes of:

- defining minimum technical requirements for plant intended to provide *restart services* [NEMMCO responsibility];
- describing and warranting the capability of the tendered services [tenderer responsibility];
- high level assessment of service feasibility [NEMMCO responsibility];
- assessment and detailed modelling of service viability [responsibility of NEMMCO with assistance from TNSPs]; and
- physical testing of services (to be) contracted and associated network infrastructure [tenderer / NSP responsibility].

Given the technical nature of SRAS, determination of the detail of these processes is considered to be an operational matter and therefore beyond the scope of this review. Nevertheless, the objectives the above processes should be required to meet and the party responsible for achieving them could, legitimately, be established by this review.

It is recommended that the following objective applies to the above technical definition, assessment and testing process:

> Assessment and testing of all related *restart service* infrastructure should be conducted in such a way as to demonstrate – prior to the provision of services and payments under a SRAS contract – a reasonable degree of certainty that the contracted services would perform in the manner warranted if and when required to do so.

Although this objective is expressed only in terms of the outcomes of physical testing of infrastructure, meeting this objective would require robust processes to be established for each of the service definition and assessment steps. The obligation to establish robust processes that aim to meet this objective would be placed on NEMMCO as described more fully below.

The nature of the assessment and testing process being recommended places a heavy onus on prospective service providers to present comprehensive proposals and warranties regarding the capabilities of the offered *restart service* infrastructure. Accordingly, it would be incumbent on parties contemplating tendering to provide *restart services* to engage in discussions with NSPs and NEMMCO prior to submission of any expression of interest to ensure issues associated with necessary modification of network infrastructure are identified (and addressed where practicable). Clearly this process will rely on a constructive interaction between prospective service providers and other parties such as NSPs. Consideration will therefore need to be given to ensuring appropriate obligations apply to the parties concerned.

### *2.3.1 Assessing technical capability and feasibility of offered services*

*Description of recommendations*

Prior to final tenders being required, an 'Expression of interest' (EOI) phase would apply to prospective service providers. Expressions of interest would be invited for the supply of *restart services* to each *electrical sub-network* on an annual basis. Prospective service providers must indicate whether the service is offered as: a potential *primary restart service*; or a potential *secondary restart service*; or both. Each EOI would require prospective services to satisfy certain minimum technical requirements (specified by NEMMCO prior to calling for expressions of interest) written so as to avoid unnecessarily restricting the scope of potentially successful restart technologies.

Technical capabilities to be warranted by prospective service providers for SRAS would include but are not necessarily limited to:

- overall availability and reliability[27] of the unit or group of units that incorporate the tendered *restart service*;
- ability to restart without external electricity supply;
- (for *trip to house load*, or TTHL, only) appropriate unit protection facilities to initiate TTHL mode;
- maximum MW export capability;
- time frame to commence export;
- period for which readiness to provide *restart services* can be maintained following loss of external supply;
- ability to connect to a dead transmission bus;
- ability to energise a network corridor to an appropriate (large) unit;
- the maximum size of load block the *restart service* is able to accept; and
- time frame to reach maximum MW export capability.

Submitted expressions of interest should warrant the capability of nominated services to meet minimum technical requirements, and willingness to verify those capabilities through tests to be conducted prior to the scheduled provision of services and payments under the SRAS contract. A proposed testing program is to be submitted as part of each EOI.

At the time the EOI is submitted, it would not be expected that all equipment required to make the *restart service* effective has been either commissioned or

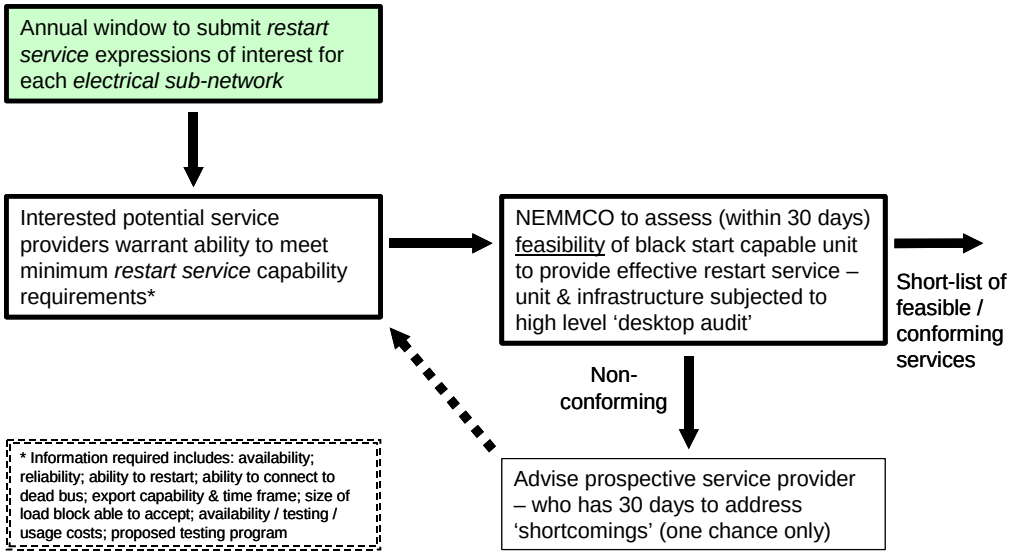
[27] NEMMCO acknowledges that defining reliability of *black start capability* is particularly problematic. However, potential *restart service* providers could demonstrate claims to having highly reliable *black start capability* by referring to appropriate independently assessed technical data. The only alternative would be to rely on commonly accepted industry benchmarks of reliability for plant of similar technology and condition.

installed – installation and commissioning of equipment would only be required following receipt of notification from NEMMCO of an intention to contract with that service provider.

NEMMCO is to undertake an initial assessment of tenders to establish the feasibility of the offered service – that is, whether that service claims to meet all minimum technical requirements and seems capable of providing effective *restart services* to significant generation capacity within the target sub-network. NEMMCO would also assess the proposed testing program included in the EOI to ensure it would:

- adequately demonstrate the capability of offered plant to deliver *restart services*; and
- not impose unacceptable risks on the security of the power system; and
- not unduly impact the operation of the market.

**Figure 2: Expression of interest and feasibility assessment process**




Only when NEMMCO assesses an EOI to offer a feasible *restart service* that is prepared to submit to an adequate testing program would it be it be deemed worthy of proceeding to formal tender and the next phase of assessment.

Should NEMMCO identify (within 30 days of the initial EOI deadline) any aspect of the offered service that either:

- fails to meet minimum technical requirements; or
- prevents it from delivering effective *restart services*,

the prospective service provider is to be given a further 30 days to revise its EOI to overcome identified deficiencies. Prospective service providers would not be given any further opportunities to revise their EOI following that period. If a prospective service provider did not submit an EOI that was considered by NEMMCO as able to provide a feasible service following the first opportunity to revise the EOI, then no further offers would be considered from that service until the next annual EOI round.

At the end of the second 30 day period of the EOI assessment process – expiring of the time allowed for revised offers to be submitted – prospective service providers are required to lodge binding prices[28] for:

- service availability;
- service testing;
- service usage; and
- modification of third party facilities network required to enable delivery of effective *restart services*).

A further 30 days (a total of 90 days from the initial EOI deadline) is set aside for NEMMCO to finalise the list of feasible *restart services* qualified to proceed to formal tendering.

**Distinguishing between feasible and non-feasible restart services**

A unit with *black start capability* may claim to meet technical requirements with respect to: ability to restart without external electricity supply; ability to connect to a dead transmission bus; and ability to energise a network corridor to the next (large) unit designated in the restart procedure. However, unless the unit also had the technical capability to accept a block of load of a size at least equal to the needs of the auxiliaries of some other (large) generating unit, it would be unable to make a material contribution as a *restart service* – that is, it would not be considered to be a feasible service.

Nevertheless, the unit in question may offer some value in providing *customer specific MW support* and it would be able to enter into private commercial arrangements for that purpose (as discussed in Section 2.4), subject to meeting guidelines and conditions attaching to *local black system procedures* (see Section 2.6).

*Rationale*

It should be noted that, unlike recent ITT processes, NEMMCO will not be specifying requirements for: maximum MW export capability; time frame to commence export; and time frame over which readiness to provide *restart services* can be maintained without external supply. These parameters could define a competitive advantage of one service over another and, as such, NEMMCO believes there is potential benefit to the market by providing an opportunity for service providers to tell NEMMCO "how high they can jump", which may be substantially higher than where the bar is currently set.

In order to encourage the maximum number of potential service providers to submit expressions of interest, and hence make the process as competitive as possible, there is no requirement to have all necessary restart facilities installed and commissioned at the time the tender is submitted. The actual investment in facilities can be delayed until such time as an invitation to contract for *restart services* has been provided by NEMMCO.

[28] Prices submitted at this stage could only be changed following invocation by NEMMCO of the requirement to negotiate in good faith in accordance with the process outlined in Section 2.7.2.

An opportunity to revise a *restart service* EOI is provided to prevent minor technical matters (that could be simply overcome) standing in the way of NEMMCO contracting with a 'good value' service provider. Only one opportunity to revise offers is provided each year to prevent negotiations dragging out endlessly.

Initial assessment of the feasibility of the service and the adequacy of the proposed testing program should be possible within 30 days. If a prospective service provider was advised (within 30 days) that initial assessment of a potential service indicated it was not considered a feasible service or that its proposed testing program was inadequate, a further 30 days to submit a revised EOI and a subsequent 30 days for NEMMCO to re-assess the service could mean that a total of 90 days from the initial EOI deadline might elapse before all feasible *restart services* have been identified.

Given every EOI must be accompanied at the later stage of EOI assessment by binding prices for service availability, testing, usage, and third party facility modification, it is incumbent on parties submitting an EOI that the nature of the service they are proposing to offer has been comprehensively researched.

Prior to inviting expressions of interest to provide *restart services*, NEMMCO will issue guidelines regarding the nature of the testing program that *restart services* would be expected to undertake (see Appendix 5 of Volume 2 of this **Final report**).

### *2.3.2 Assessing viability and best value combination of services*

*Description of recommendations*

When all non-feasible services have been identified and eliminated from further consideration, remaining expressions of interest would have qualified to proceed to formal tendering and will need to be subjected to more detailed modelling and assessment of their viability. At this point in the process, NEMMCO would require tenderers to provide data, models and parameters of relevant plant, sufficient to facilitate thorough assessment of the network impacts and power station impacts of the use of the tendered service[29].

Viability of potential *restart services* would be assessed through:

- identification and examination of technical features of the transmission network and, where appropriate, the distribution network, that might stand in the way of delivery of effective *restart services*; and
- consideration of any other technical factors NEMMCO reasonably considers relevant to the delivery of effective *restart services*.

Modelling to be conducted as part of an assessment of service viability would need to be conducted in a manner such that it demonstrates the ability of the unit with *black start capability* to:

- tolerate deviations to frequency through governor action; and

[29] For example, models would need to be able to demonstrate any harmonic resonance effects of the service and the ability of the service to control both voltage and frequency.

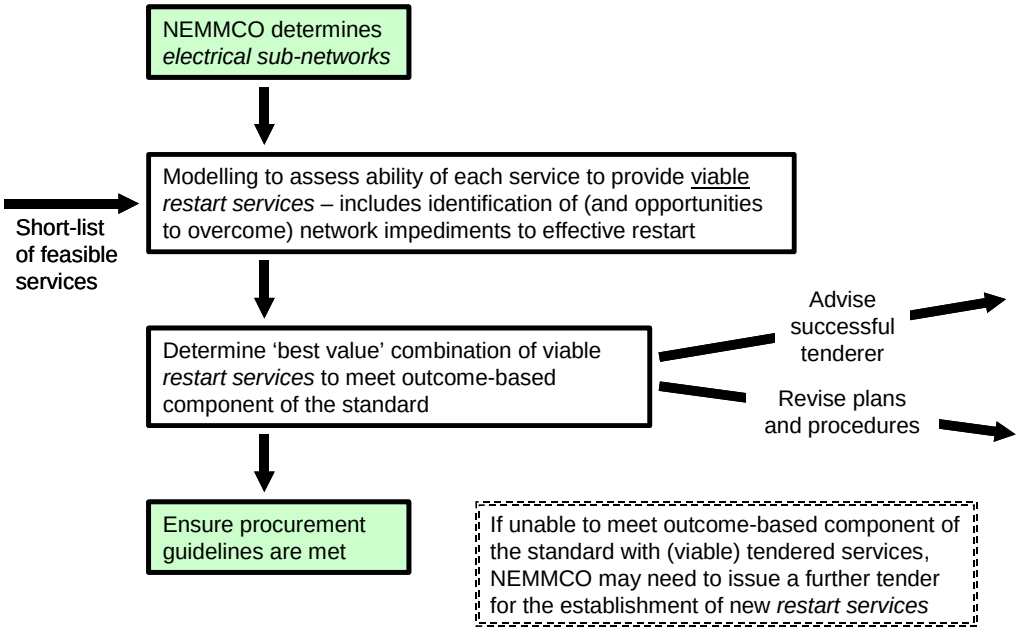
- perform in a manner capable of contributing to the management of reactive requirements of the relevant transmission corridor.

Assessment would also comprise an 'audit' of network assets and protection systems between the tendered restart facility and probable target generators for the purpose of facilitating system restoration.

In certain circumstances (specific to the tendered *restart service* and associated transmission corridors) it may be appropriate to undertake additional forms of assessment and modelling. However, the above may represent a minimum level of assessment that needs to be passed before a tendered *restart service* would be considered for physical testing and contracting.

Consistent with the objective for pre-contracting process outlined at the beginning of Section 2.3, assessment and modelling of the viability and effectiveness of units with *black start capability* should be conducted in such a way as to minimise the chances of reasonably foreseeable circumstances preventing any of the various components of restart testing from being successfully concluded.

**Figure 3: Detailed assessment (modelling)**




Once the viability of individual services have been established, various combinations of service will be assessed against the outcome-based standard (Section 2.1) and the service procurement guidelines (Section 2.2). Best value would be represented by the lowest cost combination of *restart services* demonstrated by modelling as capable of meeting the standard and the first four criteria of the service procurement guidelines. The modelling conducted in this phase of assessment would depend on whether secondary services need to be considered in order to meet the service standard – if secondary services are being considered more onerous assumptions are applied to whether or not the standard has been met.

In determining lowest cost in this context, consideration would be given to:

- tendered prices for availability and testing of a service; and
- any advised costs for modification or augmentation of either the transmission or distribution network or other third party facilities (required to ensure delivery of effective *restart services*)[30].

Within 6 months of the initial deadline for submission of tenders, NEMMCO is to issue notification of intention to contract with *primary* or *secondary restart services* as appropriate.

*Rationale*

Adequate consideration of the viability of potential *restart services* – especially tenders to provide a new *restart service* – is likely to involve significant research into the technical parameters of network infrastructure (for example, examination of protection settings and reactive power characteristics). In all probability, NEMMCO will need to engage in discussions with TNSPs to identify and assess how to best overcome any technical limitations of the network that may stand in the way of a feasible *restart service* being deemed viable. It should be noted at this point that prospective service providers will not be able to revise their tender prices to take account of unexpected requirements and costs to modify third party or network facilities to make their service viable. Accordingly, prudent risk management would suggest that a degree of investigation and negotiation has already occurred to identify likely required expenditures on the part of a service provider prior to lodging a tender. Nevertheless, detailed assessment of facilities would still need to be jointly carried out by NEMMCO and the relevant TNSP using, if available, studies the TNSP may have conducted in response to enquiries from prospective service providers.

In parallel with investigative work involving TNSPs, NEMMCO will need to undertake potentially complex modelling to determine the system restoration capabilities of various combinations of feasible *restart services*. This modelling will need to be supported by appropriate data, parameters and models made available to NEMMCO by the tenderer.

Only when both the detailed technical assessment of relevant infrastructure and the modelling tasks have been completed – and the extent of any changes required to NSP infrastructure have been identified – would NEMMCO be in a position to make any final assessment of the 'best value' combination of viable *restart services*.

The need to apply judgement in the process of establishing viability and best value service combinations has been minimised by:

- application of the service procurement guidelines;
- consistent modelling of alternatives against the outcomes-based standard; and
- consideration of service cost.

[30] Limitations on the extensiveness of modification and funding of changes to NSP facilities is discussed in Section 2.7.1.

However, NEMMCO does not believe it is possible to eliminate all forms of judgement from these assessment processes.

It is only once NEMMCO and TNSPs have engaged in comprehensive modelling that the full extent of any potential deficiencies in the viability of a particular service can be properly understood. Part of the assessment required may involve aspects of the connection between large target generators and the transmission network.

Allocating a total of 90 days to undertake the technical assessment and modelling of feasible *restart services* is considered appropriate given the likely complexity of the work involved.

### *2.3.3 Preparation for contracting, commissioning / testing of invited services and revision of restart plans and procedures*

*Description of recommendations*

Any new *restart service* (for which NEMMCO has issued a notice of intention to contract) would require time to install, commission and arrange for appropriate testing of facilities necessary for the delivery of *restart services*. A period of time would also need to be reserved for NSPs to make changes to any control or other facilities (network asset reconfiguration and/or augmentation) that otherwise stand in the way of the delivery of effective *restart services* from contracted parties.

Parties that have been issued with a notice of intention to contract would be given one month to:

- negotiate a time frame for completion of works a NSP might need to undertake to make a *restart service* viable; and
- negotiate and finalise terms of the SRAS contract that specifies:
  - testing requirements of the *restart service*;
  - completion of testing requirements prior to any payment for provision of SRAS; and
  - liquidated damage provisions for failure to satisfy testing requirements – the quantum of liquidated damages would be a genuine pre-estimate of the damage that may be suffered as a result of the *restart service* not being provided at the time stipulated in the contract.

It is recommended that a total of 6 months be set aside to allow for required negotiation and coordination between *restart service* providers and NSPs in relation to preparation of the service being tendered.

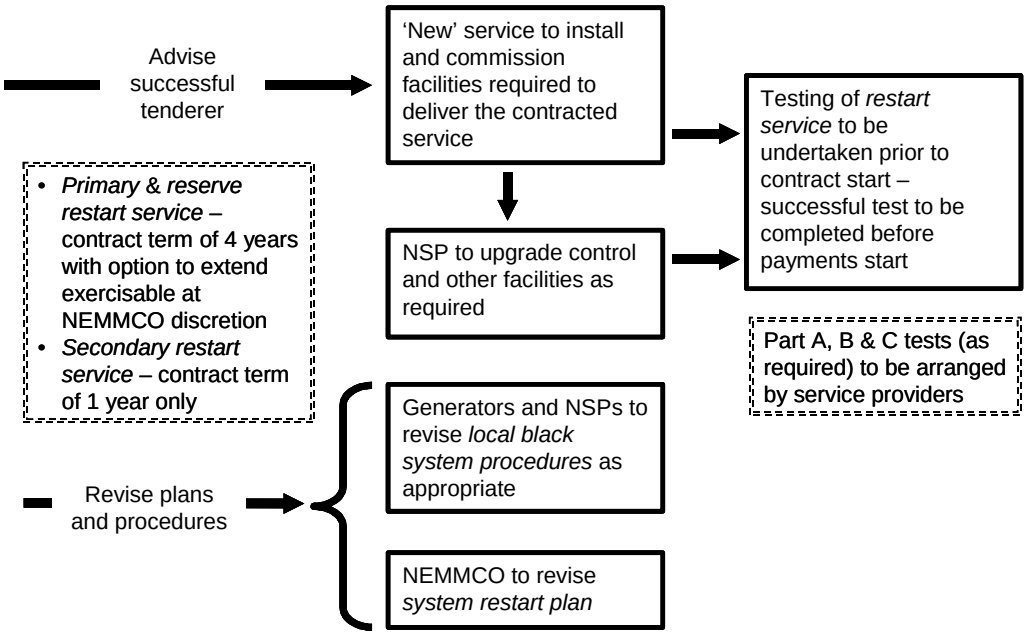
*Primary restart services* would need to complete each part of a 3 component test prior to scheduled provision of services and payments under the SRAS contract. The test components (further detailed in Appendix 5 of Volume 2 of this **Final report**) would be as follows:

- Part A (to be conducted annually and prior to scheduled provision of services and payments under the SRAS contract) – demonstration of *black start capability* and stable operation supplying its own auxiliaries while disconnected from the main network;

- Part B (to be conducted annually and prior to scheduled provision of services and payments under the SRAS contract) – energising a previously de-energised connection point at an appropriate voltage[31]; and

- Part C (to be conducted once for each contract term[32] prior to scheduled provision of services and payments under the SRAS contract) – energise a load that is representative of the load that would need to be energised in the process of starting another generating unit; and demonstrate ability to adequately control frequency and voltage in a small island.

**Figure 4: Service commissioning and testing process**




*Secondary restart services* would only be required to undertake Part A and Part B tests.

Prior to testing the *restart services* NEMMCO intends to contract:

- NEMMCO (if required) would prepare revised *system restart plans* to take account of potential use of newly contracted *restart services*; and

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[31] NEMMCO may require Part B tests to extend beyond the generating unit's connection point should there be any reasonable doubt as to the generating unit's ability to energise circuits at an appropriate voltage towards target generating units and load. Where a Part B test needs to be extended beyond a generating unit's connection point, the test beyond the connection point would need to be conducted every two years or where there have been changes made to relevant parts of the network. Part B tests to at least a generating unit's connection point will have to be conducted annually if a *restart service* contract is to be retained.

[32] Where NEMMCO exercises its option to further contract with a primary service – 2 x 1 year options will be available – it is not anticipated that Part C tests would need to be conducted for the purpose of these additional 1 year terms.

- Participants (if required) will be required to make appropriate changes to *local black system procedures*.

It is recommended that a 3 month window be set aside for the conduct of tests for *restart services*. Subject to tests being approved by NEMMCO, responsibility for arranging and conducting the tests would fall to prospective *restart service* providers.

Delays in preparation of facilities and/or testing beyond the scheduled date for provision of services and payments under the SRAS contract would result in either delays in start of payment under the contract, or termination of the contract.

Failure by a "prospective" SRAS provider to successfully complete appropriate restart tests as initially scheduled would probably require NEMMCO to extend the contract of an "existing" SRAS provider (an 'extended contract') for a period of 12 months. Failure of any test would not necessarily disqualify a tenderer – tests could be retaken within one month of initial test failure, with a limit of one retest for each Part. Remuneration would only be provided for successful tests. Failure of a second test, or failure to conduct a second test prior to the originally scheduled time for provision of services, may lead to termination of a contract.

Depending on the circumstances of the test failure and ability to subsequently successfully perform restart tests, consideration would be given to offering the tenderer a contract to provide *secondary restart services* as appropriate, once any replacement 'extended contracts' had expired.

*Rationale*

Providers of new *restart services* who have not yet installed the equipment required to deliver *restart services* will require some time for equipment installation and commissioning. NSPs may also require time to make any necessary changes to the configuration and operation of their infrastructure.

Part A testing serves to demonstrate the most fundamental capability of a contracted *restart service* – the ability to restart independently or survive separation from the main network. In order to provide comfort that the necessary equipment is being maintained in good order, and that appropriate training is regularly conducted, it is reasonable to expect Part A testing of contracted services to be conducted at least annually.

The purpose of Part B testing is essentially serving to ensure:

- appropriate sync-check bypass facilities are configured and operating correctly; and

- the voltages able to be maintained at the connection point are consistent with what would be required to ensure appropriate voltages at remote ends of transmission lines.

Part B tests beyond a generating unit's connection point, if considered necessary[33], would only be required every two years, given the potentially

[33] See footnote 31.

intrusive nature of such a test. Part B tests at least up to a generating unit's connection point would be required annually.

As Part C tests are potentially the most intrusive and difficult to arrange of all tests, NEMMCO would accept these tests being conducted every 4 to 6 years depending on how often primary service contracts are renewed and NEMMCO's options are extended. It would be highly desirable for the load used in Part C tests to be at the (remote) end of a transmission line, although NEMMCO would give consideration to accepting a Part C test that energises and supplies a load either near to or inside a generator's connection point.

Combined with the requirement to undertake Part A testing of black start capability, the Part B test represents a reasonable minimum demonstration of the capability of offered *restart services* up to generator's connection point. Part B testing of a *restart service* beyond a generator's connection point would only be required where reasonable doubts exist as to a generator's ability to energise appropriate transmission lines.

An inability on the part of the tenderer to arrange and pass these testing requirements would lead to NEMMCO seriously questioning the capability of the offered service. Under such circumstances there is arguably little basis for proceeding with a contract for *restart services*.

The assessment of the quantum of liquidated damages in a contract with a successful tenderer will include, among other things, the cost of NEMMCO entering into interim arrangements at additional cost to the market to replace the service that is unable to deliver as expected.

Adjustment of *system restart plans* (to be carried out by NEMMCO) and *local black system procedures* (to be carried out by participants) can proceed in parallel with work being performed by providers of new *restart services* and NSPs.

A testing window of 3 months is provided for the following reasons:

- separate tests are likely to required in multiple *electrical sub-networks* with multiple service providers in each sub-network and the testing program may require some coordination by NEMMCO;
- physical testing of restart capability may need to be segmented for logistical (coordination) reasons;
- some tests may need to be re-conducted because of failure of the initial test.

Potential service providers that are only seeking the status of (additional) *secondary restart services* would be 'excused' from having to conduct Part C tests.

NEMMCO would require successful tenders to complete appropriate restart tests prior to provision of services and payments under a SRAS contract because it is reasonable to expect a degree of comfort that the service would work if and when called upon to do so. Responsibility for arranging and

conducting the tests appropriately resides with the potential service provider[34]. Nevertheless, NEMMCO would assist in test coordination to ensure that, wherever reasonably possible, tests are scheduled in such a way as to minimise their impact on the market.

### *2.3.4 'Standard' tendering cycle and contract length*

*Description of recommendations*

The tendering / assessment / contracting cycle for *restart services* is to be independent of the cycle applying to the procurement of other non-market ancillary services. Network control ancillary services and *system restart ancillary services* are fundamentally different in nature and require very different forms of assessment and testing prior to the *bona fides* of the service being established.

Contract terms for *restart services* are recommended as follows:

- long-term contracting for *primary restart services* would be for 4 years with 2 x 1 year options exercisable at NEMMCO's sole discretion; and
- short-term contracting for *secondary restart services* would be for 1 year only.

Given that *secondary restart service* contracts (at least) would be expiring each year, expressions of interest to provide *restart services* would be called on an annual basis.

Annual notice would be provided by 31 January each year indicating the nature of *restart services* (primary or secondary) required in each *electrical sub-network*.

The following milestones would apply:

- **31 March** (15 months prior to scheduled provision of *primary restart services*) – closing date for expressions of interest.
- **30 April** (14 months prior to scheduled provision of *primary restart services*) – NEMMCO to advise prospective service providers whether initial offer is deemed technically feasible and, if not, invite resubmission of that EOI within 1 month.
- **31 May** (13 months prior to scheduled provision of *primary restart services*):
  - closing date for submission of any revised EOI for services initially considered non-feasible; and
  - prospective service providers required to lodge binding prices associated with expressions of interest.

[34] Service providers are arguably in the best position to manage the risk of failure of any test. Accordingly, repetition of any test necessary to prove the bona fides of a *restart service* prior to the commencement of a contract, would be at the expense of the prospective service provider.

- **30 June** (12 months prior to scheduled provision of *primary restart services*) – NEMMCO to advise final list of technically feasible expressions of interest that will proceed to formal tender and detailed technical evaluation.

- **30 September** (9 months prior to scheduled provision of *primary restart services*) – NEMMCO to advise successful tenderers of intention to contract.

- **31 October** (8 months prior to scheduled provision of *primary restart services*):

  – successful tenderers to conclude negotiations with NSPs and third parties whose facilities may require modification to support effect delivery of a *restart service*; and

  – deadline for execution of the SRAS contract.

- **31 March** (3 months prior to scheduled provision of *primary restart services*) – due date for restart tests to commence.

  If additional *secondary restart service* 'slots' are available, the Part A and Part B tests could be conducted at anytime convenient to the service provider and, subject to NSP facilities supporting the viability of the service, payments as a secondary service provider could commence immediately the service was declared available.

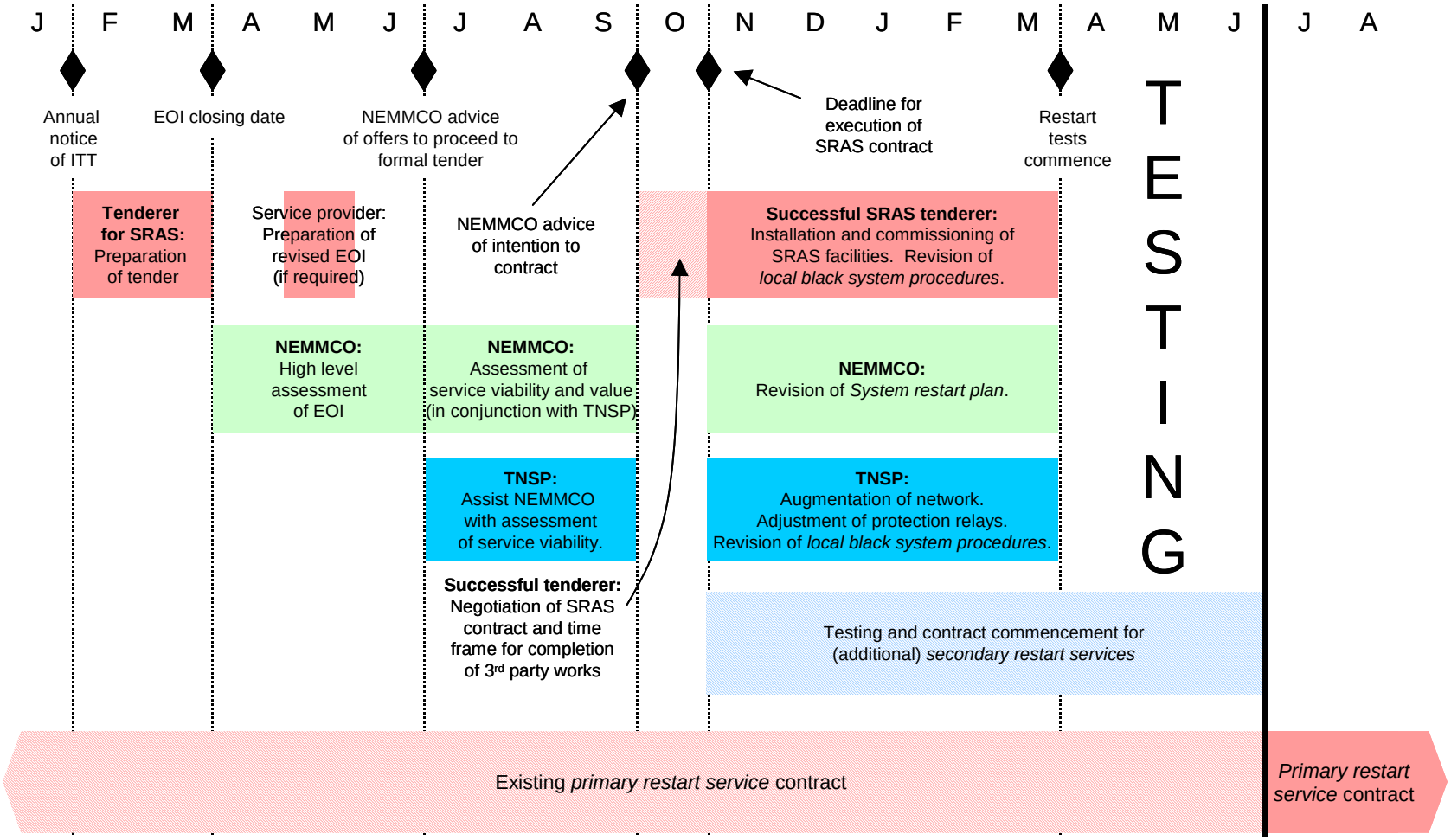
- **1 July** – start of contract payments for *primary restart services*.

A schematic representation of these time frames is provided in Figure 5.

NEMMCO would retain an option to accept a lesser term for any *restart service* and determine a service commencement date and expiry date provided the period is inside the time frame for the standard *primary restart service* contract[35]. To continue to provide an incentive for prospective service provider to strive for primary status under such circumstances, the *primary service premium* would be incorporated into annual payments, with each contract year attracting a premium of ¼ of the full *primary service premium* should that service be contracted. Further, if a service provider was willing to pass all the requirements (availability, reliability and testing) for being contracted as a *primary restart service*, but was only prepared to be contracted for a limited period, annual payments of ¼ of the *primary service premium* would apply on the same basis.

[35] For example, although to be a conforming tender the *ancillary service* is to be available for a term of 4 years, *NEMMCO* may accept a tender but for a shorter period such as 1 year.

**Figure 5: Timelines and involvment of relevant parties in the tendering/assessment/contracting process**



*Rationale*

The technical considerations in the provision of *system restart ancillary services* can be quite complex – especially where new service providers are involved. Accordingly, the time frame for adequate assessment of tenders needs to take these complexities into account and is likely to be quite different to the appropriate time frames for the assessment of other non-market ancillary services.

Although, initially, contracts for *restart services* in all *electrical sub-networks* may be open to tender at the same time, some flexibility in contract start and finishing dates is considered desirable. Flexibility of contract time frames and the timing of restart tests will enable NEMMCO to:

- extend the contracts of existing services where:
  - it is financially attractive to do so; and/or
  - new services fail initial tests; or
  - additional services are required to cover short term contingencies;
- make early use of new additional *secondary restart services* where such services have satisfied all criteria to be considered viable and have successfully completed (at least) Part A and Part B tests[36].

Timing has been chosen so as to avoid the need to finalise contracts over the summer holiday period.

Innovative contracting time frames and terms are recommended in order to appropriately balance the following requirements:

- prudent contracting terms with SRAS providers – taking account of the set-up costs and times for the services; and
- to bring additional competitive pressures to bear upon the provision of SRAS.

Although secondary service contracts are only for 12 months and the tendering / assessment period extends for several months, NEMMCO does not consider the assessment period to be excessive. The first time a new service is tendered it is inevitable that its assessment could take some effort on the part of both the tenderer and NEMMCO. However, subsequent assessments could proceed on the basis of experience from previous exercises and later processes should not be onerous on either party – lead times for contracting could be easily taken into account.

[36] In the case of *trip to house load* (TTHL) services, a convenient time to conduct a test would be when a unit is due to be taken out of service for maintenance and the TTHL facility could be tested (at minimum cost) during the scheduled shut-down phase of the unit.

## 2.4 Customer specific MW support

*Description of recommendations*

Parties either within or outside the market would be able to negotiate *customer specific MW support* from units with *black start capability* (where that unit is not subject to a *restart service* contract) to be provided in event of widespread supply failure. Such a service may be sought where parties wish to seek some form of supply restoration guarantee, beyond the expected delivery capability of contracted *system restart ancillary services*.

Arrangements of this nature would be subject to approval by NEMMCO to ensure they would not adversely impact on system-wide restart plans. Aspects of proposed *customer specific MW support* arrangements that are likely to be considered in whether or not they would be approved include:

- the nature and extent of transmission infrastructure that would need to be dedicated to service such arrangement;
- the way in which such an arrangement might interact with the NEM system restart plan, which must generally be afforded priority where conflict arises;
- the existence of adequate arrangements with a NSP to facilitate proposed *customer specific MW support*; and
- whether or not a private arrangement might adversely affect the ability of system resources to honour obligations regarding jurisdictionally specified schedules of sensitive loads or other load shedding priorities.

*Customer specific MW support* arrangements would not be included in the assessment of adequacy of contracted *restart services* to meet the *system restart service standard*, nor would the cost of such arrangements be considered in the recovery of overall *restart service* costs imposed on market participants.

*Rationale*

It is conceivable that NEMMCO modelling could indicate satisfaction of the *system restart service standard*, but a particular party requires *customer specific MW support* in the event of widespread supply failure. In order to support a desired (higher) level of restart capability, participants and other parties would need to enter into private commercial arrangements for the provision of such services.

Given the voluntary and supplementary nature of such private arrangements, they would be entered into purely at the expense of the parties involved.

Section 2.6 discusses the conditions likely to be placed upon private MW support arrangements and the manner in which such arrangements are able to be accommodated within broader restart plans and procedures.

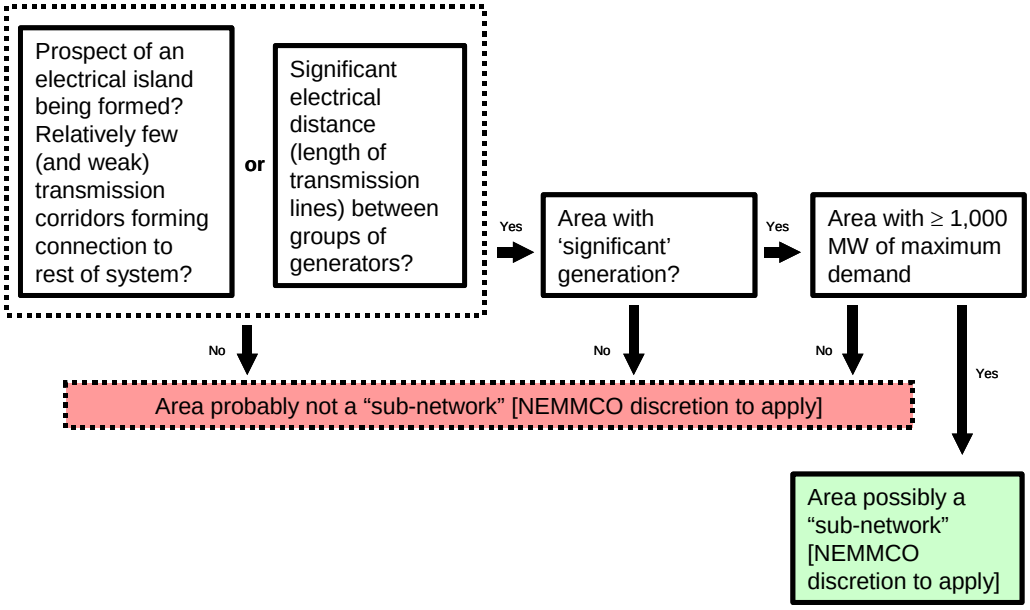
## 2.5 Determination of electrical sub-networks

*Description of recommendations*

*Electrical sub-networks* (geographically defined areas of the power system) would be determined by NEMMCO in consultation with *Jurisdictional Co-ordinators* and TNSPs, taking account of (but not limited by) the following factors:

- the number and strength of transmission corridors connecting an area to the remainder of the system;
- the electrical distance (length of transmission lines) between groups of generation;
- the amount of generation in an area; and
- the amount of load in an area[37].

**Figure 6: Process to determine boundaries for sub-networks**




NEMMCO would be required to publish boundaries of *electrical sub-networks* determined in accordance with the above criteria prior to calling for expressions of interest to provide SRAS[38]. *Electrical sub-network* boundaries would not necessarily coincide with market region boundaries.

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[37] For illustrative purposes, a benchmark of 1,000 MW maximum demand has been proposed. A benchmark (that can be consistently applied) needs to be established, relating to the minimum level of peak demand in an area for which it would be reasonable to procure dedicated *restart services*. Further discussion on the implication of benchmark levels is set out later in this Section 2.5.

[38] Flexibility in the interpretation of *electrical sub-network* boundaries will be necessary given that the network topology will evolve, with the possibility of new boundaries being declared (in some instances) mid-way through SRAS contract periods.

*Rationale*

Given the possibility of various forms of system separation and creation of *black system* islands, there should be some consistent basis for defining the areas for which *restart services* need to be contracted.

Rather than defining *electrical sub-networks* in the Code, it is suggested that NEMMCO be given the role of determining the boundaries of *electrical sub-networks* taking account of some guiding principles.

The relevance of the factors it is suggested that NEMMCO take into account is outlined below.

- **The number and strength of transmission corridors connecting an area to the remainder of the system** – Separation of the system, and formation of electrical islands, is most likely to occur at points of (relatively limited) connection between adjoining areas. Where these electrical islands are of a significant size it is likely to be justified for them to have dedicated *restart services* available.

- **The electrical distance between groups of generation** – If there is significant electrical distance (long transmission lines) between groups of generation, there is a greater risk that a remote unit with *black start capability* would be ineffective in restarting an 'isolated' group of generators. In such circumstances, it may be prudent to ensure units with *black start capability* are normally assigned to service particular isolated groups of significant generation capacity.

- **The amount of generation in an area** – A unit with *black start capability* would be of limited use (in system restoration terms) if it was unable to restore supply capability to significant amounts of generation within any electrical island it was likely to become part of. Accordingly, a potential electrical island containing little or no generation would not be viable as its own *electrical sub-network*.

- **The amount of load in an area** – In determining the merits of procuring separate restart capability for any given area of the network that has the potential to become electrically isolated from the remainder of the network, a balance must be found between:

  – the (prospective) economic and social benefits gained by maintaining separate restart capability; and

  – the on-going costs to the market of maintaining the (additional) required restart capability.

  Given the radial characteristics and limited connections to many small parts of the Australian network, it is unlikely to be appropriate (or economically efficient[39]) to contract with potentially high cost system *restart services* to cater for every part of the network that carries a risk of becoming electrically isolated from the remainder of the system.

[39] See Section 1.3 of this **Final report** for a discussion on the conceptual difficulties involved in assessing the values needed to determine the 'correct' level of *restart services*.

Accordingly, a benchmark should be established to facilitate consistent assessment of areas that may warrant dedicated restart capability[40].

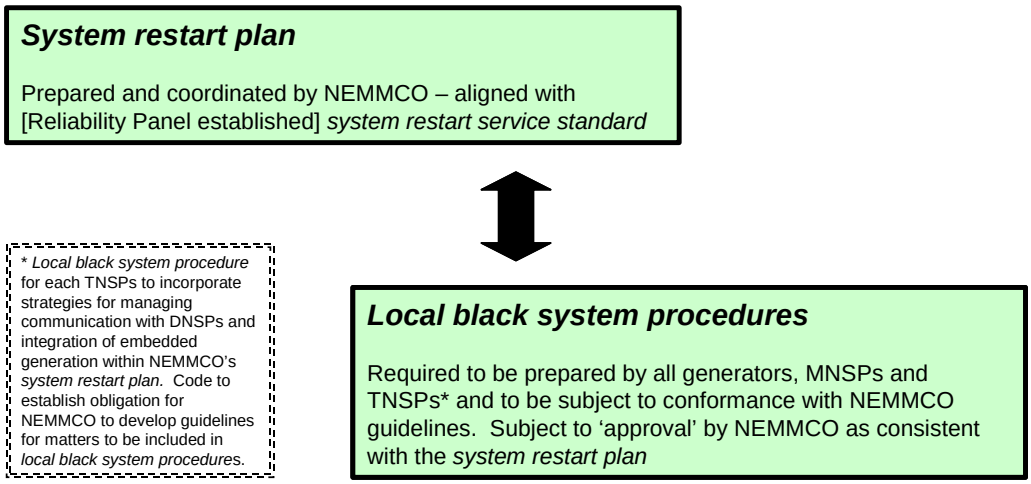
Operation of restart plans and processes is a fundamental system security matter for which NEMMCO already has responsibility and, necessarily, degrees of discretion. Given the potential system security implications of *electrical sub-network* boundaries, NEMMCO considers it important there be no perception that commercial self interest has influenced determination of those boundaries. Accordingly, consultation on sub-network boundaries is restricted and does not involve market participants. Allowing NEMMCO to determine the boundaries of sub-networks – in consultation with *Jurisdictional Co-ordinators* and TNSPs – provides some flexibility to take account of system configurations that cannot necessarily be foreseen, but which need to be effectively managed for the purpose of maintaining system security.

## 2.6 Restart plans and procedures

*Description of recommendations*

NEMMCO is recommending that the structure and responsibilities surrounding development of NEM restart plans be clarified. The NEM *system restart plan*, which is developed by NEMMCO, needs to be the central element and overriding instrument of the suite of plans and procedures that underlie the actual management of any *black system* event. Preparation of a NEM restart plan by NEMMCO will be a Codified obligation. Development of communication protocols to support the implementation of the *system restart plans* is to be NEMMCO's responsibility – relevant parties are to be consulted as necessary.

**Figure 7: Relationship between system restart plans and local black system procedures**



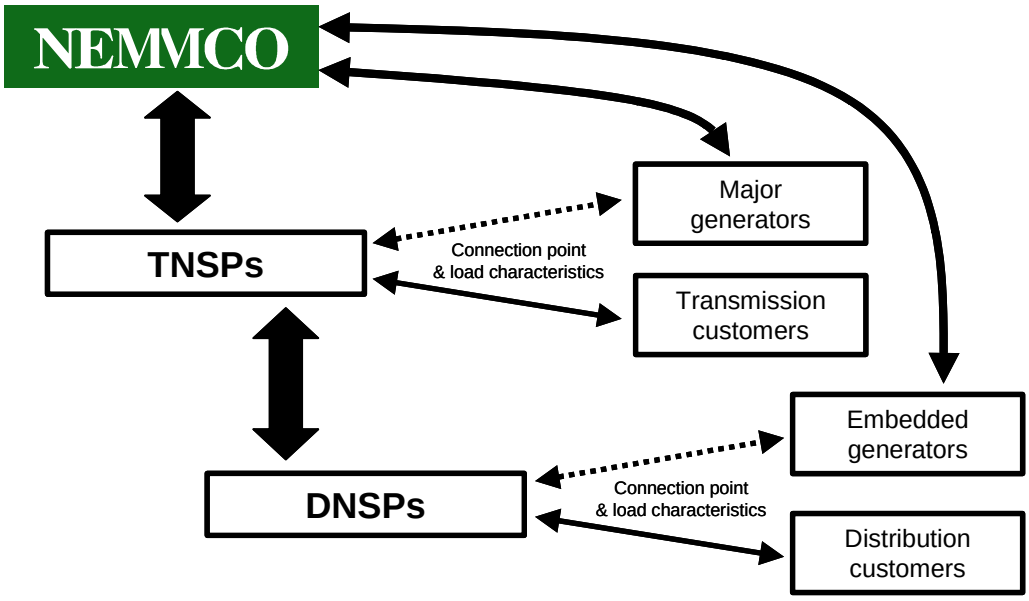

[40] The smallest area in terms of load for which specific *restart services* are currently procured is North Queensland – actual maximum demand for summer 2002-03 for this network area was close to 1,100 MW. Appendix 4 of Volume 2 of this **Final report** contains a brief summary of maximum demands for various network areas to facilitate consideration of the implications of alternative benchmarks.

Effective plans and procedures can be developed, and all stakeholders kept appropriately informed in relation to system restoration matters, via the following process:

- NEMMCO to liaise directly with all TNSPs and generators;
- TNSPs to liaise directly with DNSPs and customers connected to their transmission network[41]. TNSPs to also liaise with generators regarding connection point characteristics and the nature of switching that may need to be conducted during the process of system restoration; and
- DNSPs to liaise directly with parties connected to their distribution network.

Each party should have the responsibility to ensure they establish and maintain effective lines of communication that facilitate exchange of all information relevant to their participation in any system restoration process. Obligations along these lines would be included in the Code[42].

**Figure 8: Communication responsibilities in (preparation for) black system conditions**




*Local black system procedures* should be developed by all registered generators, MNSPs, TNSPs and DNSPs in a manner consistent with

[41] The objective of TNSP liaison with DNSPs and customers is to ensure all parties understand the nature of connection point characteristics and capabilities, as well as the size and nature of critical loads. As NSPs will be undertaking physical switching in response to NEMMCO instructions it is vital that likely responses to, and impact of, possible switching combinations is well understood.

[42] This set of protocols is not intended to deal with matters beyond the scope of system restoration arrangements.

guidelines established by NEMMCO (in conjunction with *Jurisdictional Co-ordinators*)[43].

TNSPs' *local black system procedures* should incorporate strategies for managing communication with DNSPs and integration of embedded generation within the NEM *system restart plan*.

Wherever possible, support will be given to local arrangements under the coordination of DNSPs that could result in the dispatch of embedded generation to meet local load requirements under emergency conditions. Opportunities to provide supply via the distribution network prior to supplies being available via the transmission network should be taken. However, where such arrangements are contemplated, appropriate *local black system procedures* will need to clearly define mechanisms for coordinating the restoration of distribution network electrical islands into the power system once supply is available from the transmission network. Where facilities are available, it may be possible to synchronise local islands with the main system when they reach each other. If the synchronising facilities are not available, it may be necessary to shut down the smaller island to allow that part of the network to be re-energised from the main system.

If participants maintain *black start capability* notwithstanding their lack of success in winning a *restart service* contract, such capability should be noted in *local black system procedures*.

Any 'off-market' arrangements for provision of *customer specific MW support* from units with *black start capability* (see Section 2.4) that are not part of NEMMCO's system restart obligations are to be incorporated in *local black system procedures*. NEMMCO will approve such 'off-market' *customer specific MW support* where possible as part of considering the relevant *local black system procedure*, and take account of such arrangements in the *system restart plan*. NEMMCO may not be in a position to approve and accommodate such arrangements should they be inconsistent with Jurisdictional schedules of *sensitive loads* or load shedding priorities[44].

Some detail of the nature of the guidelines that will apply to the development of *system restart plans* and *local black system procedures* is provided in this paper as Appendix 6 of Volume 2 of this **Final report**.

*Rationale*

The overall *system restart plan* for the NEM must be directed at coordinating restoration of the entire system with deployment of the plan supported by *local black system procedures*, not vice versa. The development of guidelines for

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[43] This element of the proposal is a variation from existing arrangements [Clause 4.8.12] that only require generators and MNSPs to prepare *local black system procedures*. For smaller (and/or non-market, non-scheduled or embedded) generators, NEMMCO may choose to delegate responsibility for approval of relevant *local black system procedures* to TNSPs or DNSPs as appropriate.

[44] Via Clause 4.3.2(f) of the Code, the *Jurisdictional Co-ordinator* for each *participating jurisdiction* has the authority to provide NEMMCO with a schedule of *sensitive loads* in that jurisdiction, specifying the priority, in terms of security of *supply*, that each *load* specified in the schedule has over the other *loads* when supply is limited and being rationed.

construction of *local black system procedures* is intended to ensure maximum support in this regard.

*Local black system procedures* will be the formal mechanism by which NEMMCO will be appraised of stakeholders' ability to support a NEM restart plan. As network topology and contracted *restart service* providers change, restart plans and procedures may also change. Consequently, development of restart plans and procedures may be an evolving process as relevant information is exchanged.

Generators, MNSPs, TNSPs and DNSPs each have important roles to play in the implementation of strategies underlying an overall *system restart plan*. Accordingly, each of these parties should be subjected to procedures – conforming to common guidelines – appropriately integrated with the restart plan.

Once restart plans and procedures have been settled, NEMMCO, together with TNSPs and DNSPs, should ensure any additional information necessary for the smooth management system restoration activities is exchanged between relevant parties. Although development of communication protocols to support implementation of the *system restart plans* is to be NEMMCO's responsibility, the detail of those protocols is an operational matter beyond the scope of this review.

Identification of all units with *black start capability* (contracted or not) is considered important because the circumstances of the *black system* condition may be such that non-contracted services could still play an important role – perhaps following direction by NEMMCO – in more timely restoration of customer supply[45].

Support will be given by NEMMCO – subject to incorporation in *local black system procedures* – to specific locational arrangements regarding:

- dispatch of embedded generation to support local load requirements under emergency conditions; and
- 'off-market' *customer specific MW support* arrangements.

If any conflict arises between deployment of the NEM *system restart plan* and deployment of 'off-market' *customer specific MW support* due to the specific circumstances of a *black system* condition, deployment of the NEM *system restart plan* will take priority. This highlights the need for such arrangements to be approved in advance – to minimise the chances of conflict or misunderstanding during the process of deployment.

[45] A unit with *black start capability* will not necessarily seek a *restart service* contract. An example of such capability might be energy limited plant facing extraordinary circumstances such that it is unable to guarantee sufficient energy reserves to meet contractual obligations under *black system* conditions. See also Harding Katz [1] *(op. cit.)* Section 7.

## 2.7 Administrative and operational issues

### *2.7.1 Payments for restart services and contractual conditions*

*Description of recommendations*

Expressions of interest and subsequent formal tenders for potential *restart services* would be required to separately identify required payments for:

- service availability – payment for the costs incurred in maintaining in-house restart capability, plus training and availability of staff to restart functions if and when called upon to do so. Where appropriate, availability price would differ according to whether the service is offered as a *primary restart* service or *secondary restart service*[46];
- service testing – payment for the costs associated with the conduct, as appropriate, of each of the Part A (annual), Part B (annual) and Part C (once per contract term) tests[47];
- service usage – payment for the costs incurred in the restart process itself over and above normal plant operation; and
- third party facility adjustment costs.

It is expected prices outlined above would include reasonable allowances for risks associated with gaining a contract for system restart ancillary services and delivering on those contract obligations.

In submitting prices for testing, and developing a test program, prospective service providers have an obligation to ensure that the formally tendered price incorporates all payments necessary to cover the cost of:

- modifications to any facility owned by a third party (for example, NSP infrastructure) necessary to make a tendered service viable; and
- third party involvement in tests.

*Restart service* providers would be remunerated[48] as follows:

- *primary restart services* – a total payment comprising the following:
  - (through the course of each year of the contract) amounts reflecting the tendered price for service availability and conduct of Part A and Part B tests; plus

[46] Costs of maintaining plant to a standard suitable for duty as a *primary restart service* could be quite different to the costs of maintaining plant to a standard suitable for duty as a secondary restart service. For example, additional maintenance and equipment may be necessary to meet the higher availability and reliability requirements for primary services.

[47] Costs for Part C testing would only apply to tenderers for restart services seeking duty as primary service providers.

[48] Remuneration at tendered prices may be subject to revision if NEMMCO triggers the requirement to negotiate in good faith should terms and conditions offered be considered unreasonable (see Section 2.7.2).

  - (following successful completion of the tests and once per contract term) amounts reflecting the tendered price for conduct of Part C tests; plus
  - third party facility adjustment costs; plus
  - a *primary service premium* of a value to be determined by NEMMCO or an appropriate regulatory body.

    Each contract year, ¼ of the premium would be payable. If a primary service contract was extended at NEMMCO's option, beyond the nominal 4 year term, a further ¼ of the premium would be payable for each year NEMMCO's option was taken;

- *secondary restart services* (including additional *secondary restart services* as provided for under the Section 2.2 procurement criteria):
  - amounts reflecting the tendered price for service availability and conduct of Part A and Part B tests; plus
  - third party facility adjustment costs.

The allowance associated with the acquisition of additional secondary services[49] should be determined by NEMMCO or an appropriate regulatory body.

Where any contracted *primary* or *secondary restart service* is required by NEMMCO to perform its contracted function, it would be:

- obliged to act as quickly as it is reasonably able to do; and
- paid the service usage component as specified in its contract.

Failure of any annually required test under primary restart contracts would lead to claw back of half the availability payments due under the contract since the completion of the most recent successful restart test. In the case of *primary restart services*, failure of a test would lead to forfeiture of the *primary service premium*.

*Primary restart services* would be contracted for a standard term of 4 years with 2 x 1 year options exercisable at NEMMCO's (sole) discretion – provision of services and payments under a SRAS contracts would generally commence on 1 July[50].

*Secondary restart services* would be contracted for a standard term of 12 months. Subject to 'slots' being available, additional secondary service contracts could commence at any time following successful completion of Part A and Part B tests and the declared availability of the service.

Where a contracted *restart service* becomes unavailable, NEMMCO must be notified (in advance wherever possible), with return to service times specified

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[49] See criterion 5(1)(b) for the procurement of restart services (Section 2.2).

[50] The recent ITTs for non-market ancillary services have contracted with *restart services* for periods of around 2 years. The merits of longer contract periods are further discussed in Harding Katz [1] *(op. cit.)* Section 5.1.

in contracts. Subject to the conditions below, *primary restart services* would receive the agreed availability payment for 100% of trading intervals, even though their availability requirement and achievement may only be 98%.

If non-availability of a *primary restart service* exceeds 438 hours in any rolling 12 month period during the term of the contract or the service fails to average 98% availability during the term of the contract[51], unless exceptional (force majeure) circumstances could be demonstrated:

- the *primary service premium* for the current financial year would be forfeited;
- the service would be deemed a *secondary restart service*;
- "claw back" would apply to availability payments previously made in excess of the deemed availability; and
- any guarantee of continuation of the contract beyond the end of the current financial year would be withdrawn.

Subject to the conditions below, *secondary restart services* would receive the agreed availability payment only for trading intervals for which they were deemed available[52].

> For example, a secondary service provider may have an agreed availability payment of $10 / trading interval, with a contracted minimum availability of 75%. If the service achieves 90% availability through the term of its contract it would receive the $10 / trading interval for 90% of trading intervals. If the service achieves 75% availability through the term of its contract it would receive the $10 / trading interval for 75% of trading intervals.

If non-availability of a *secondary restart service* exceeds 2,190 hours in the 12 month contract term[53] the contract may be cancelled unless exceptional (force majeure) circumstances could be demonstrated.

Given the length of the contract for *primary restart services* (up to 6 years if options are exercised) contains a degree of inflation risk for contracted parties, appropriate contract payments would be escalated each year by CPI.

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[51] 438 hours in 12 months represents 5% of time. 98% availability is to be achieved over the initial 4 year term of the contract, subject to services not falling below 95% availability in any rolling 12 month period.

[52] NEMMCO proposes to re-assess availability in a manner identical to that included in existing SRAS contracts. See clause 11.10 in recent non-market ancillary service agreements.

[53] 2,190 hours in 12 months represents 25% of time – the contract requirement for secondary services would be for 75% service availability. If a primary service provider is forced to revert to secondary service status, availability assessment and limitations on "claw back" would be on the basis of the most recent 12 month period.

*Rationale*

The basic approach to pricing will be to seek tenders for provision of *primary* or *secondary restart services* – that is, services meeting specific technical requirements – and remunerating contracted service providers on the basis of tendered prices, provided tendered prices are not unreasonable. Guidance as to what constitutes reasonable terms and conditions will be incorporated in the Code (see Section 2.7.2 of this **Final report**).

In order to encourage competition for highly dependable *primary restart service* slots, NEMMCO believes that some premium should be awarded to services selected for duty as a primary service provider – that is, rewarding parties that contribute to the achievement of the most desirable outcomes.

It is NEMMCO's hope that the guidelines associated with ensuring reasonable terms and conditions[54] will encourage all prospective service providers to submit tenders that reflect something close to costs including a reasonable commercial margin. However, it is noted that if remuneration to all contracted *restart services* only reflected costs including a commercial margin, there is little incentive for a tenderer to strive for status as a highly dependable primary service provider. Presuming there is a community desire and preference for contracting with highly dependable *primary restart services* wherever reasonable and practicable, the *primary service premium* would provide the appropriate incentive to improve the dependability of offered services.

NEMMCO is of the view that the premium should be determined as an absolute amount rather than as a percentage of tendered price. Such an approach is less likely to encourage padding of initially tendered prices.

The allowance for the acquisition of additional secondary services should be determined such that it might represent the social value to be placed on additional security and certainty in the restart process.

Requiring tenderers to identify separate costs for availability, testing and usage reflects the fundamentally different nature of each of these service components. Should there be any need to repeat tests, a fair basis for remuneration can be easily established. The fact that prospective service providers must nominate a testing price that incorporates all payments necessary to cover third party involvement in tests, suggests that if adequate testing required the use of NSP infrastructure, the prospective service providers would need to negotiate the nature of the test with the relevant NSPs prior to:

- finalising this component of the tender price; and
- establishing a form of testing program to be submitted to NEMMCO for approval.

Subject to negotiations between prospective service providers and NSPs being sufficiently detailed, the nature of any risks that might arise during a test could be identified and appropriately managed.

Tenderers will not be able to revise tendered prices for services to cover unforeseen costs that may be incurred in making their tendered service viable.

[54] See Section 2.7.2.

Consequently, in order that remuneration risks are fully managed prior to an EOI being submitted for assessment, prospective service providers would need to have engaged in their own assessment[55] of the capabilities of their proposed service and associated network infrastructure.

The prospective revision of service status "claw back" and proposals represent, in NEMMCO's view, reasonable incentives for maintaining the service to (at least) the standard for which it was contracted.

The obligation for a contracted *restart service* "to act as quickly as it is reasonably able to do" reflects an expectation that the service provider will treat assisting with the timely restoration of the system to be a matter of the highest priority.

### *2.7.2 Ensuring reasonable terms and conditions for all parties*

*Description of recommendations*

In order to enhance the prospects that contracting outcomes are aligned with reasonable terms and conditions in at least most circumstances, an alternative to the existing threshold for triggering good faith negotiations is recommended as follows:

> If in NEMMCO's judgement it would be unable to acquire the required amount of the relevant non-market ancillary services at reasonable terms and conditions from those conforming offers submitted in response to a call for offers under clause 3.11.5, then NEMMCO and those Code Participants that submitted tenders selected by NEMMCO must negotiate in good faith to agree reasonable terms and conditions.
>
> If part of the required quantity of the non-market ancillary services are offered at what NEMMCO considers to be reasonable terms and conditions then NEMMCO may at its discretion acquire that partial quantity at the tendered terms and conditions and negotiate with other tenderers for any remaining amounts necessary for NEMMCO to meet its obligations under the Code.
>
> In assessing the reasonableness of the terms and conditions of the conforming offers NEMMCO must have regard to the price that would be offered by an efficient producer of a substitute service on a comparable scale and technology operating in a competitive market.

NEMMCO also recommends the following principles be incorporated in the Code to aid good faith negotiations [and possible deliberations by an *Adviser*] under Clause 3.11.5.

1. NEMMCO's overarching objective in its purchase of non-market ancillary services should the attainment of economic efficiency.
2. The tenderer involved in good faith negotiations with NEMMCO must provide to NEMMCO (on a confidential basis) the information necessary to properly inform good faith negotiations.
3. Prices should be based on efficiently incurred long run incremental costs of providing the service.

[55] Where appropriate, a prospective service provider's own assessment would include negotiation with any third party that might be involved in delivery of the intended service.

4. Remuneration* should be sufficient (but not more than sufficient) to encourage efficient investment in non-market ancillary services and innovation in the provision of those services.

5. Remuneration* for providers of non-market ancillary service providers should provide a normal return on capital, adjusted for risk. This return should be equal, or close to equal, to the opportunity cost of the capital employed.

6. NEMMCO should seek to procure the combination of services that will result in the best value for money.

7. **[For dispute adviser only]** Consistent with clause 1.3 of the Code a dispute adviser must use best endeavours to ensure that remuneration for a non-market ancillary service provider should closely approximate the outcome that would be obtained in a competitive market.

* Remuneration in the sense discussed here would exclude consideration of the *primary service premium*.

At any time prior to execution of a contract, or up to the point of a determination through the independently facilitated process, a tenderer would be able to withdraw its offer to provide *restart services*.

*Rationale*

The market for *restart services* is not deep, and there is the distinct possibility that competitive disciplines could be absent when potential service providers develop their expressions of interest and subsequent tendered prices. However, participants that ultimately pay for SRAS deserve some assurance that the costs they incur for the delivery of that service are reasonable[56].

The Code currently makes provision for a process to require parties to negotiate in good faith to agree reasonable terms and conditions where a tender is deemed non-competitive. In NEMMCO's view[57], the threshold currently applied in determining whether the tender process is non-competitive is not sufficient to ensure contracting outcomes aligned with reasonable terms and conditions in all circumstances. Specifically:

- the existing definition of 'non-competitive' may fail to oblige parties to negotiate in good faith even though some or all tenders only offer services under unreasonable terms and conditions;
- the Code is silent regarding the nature of the outcomes to be expected from good faith negotiations should they be triggered; and
- should any good faith negotiations fail to reach agreement as to reasonable terms and conditions, the matter may be referred to a dispute adviser for determination, yet the Code is silent regarding the nature of the outcomes to be expected from a dispute adviser.

[56] See Harding Katz [1] *(op. cit.)* Section 5.2 for a discussion on *Obtaining value for money*.

[57] Supported by consultancy advice from The Allen Consulting Group *(op. cit.)*, Chapter 6.

The recommended changes to existing arrangements are designed to overcome each of these noted deficiencies.

### *2.7.3 Recovery and discovery of system restart costs*

*Description of recommendations*

NEMMCO recommends that SRAS costs continue to be allocated and recovered across the entire market on the basis of 50% to customers and 50% to generators using energy as the metric. Costs would not be allocated on a regional or *electrical sub-network* basis.

The terms of any contract agreed would remain confidential between NEMMCO and the service provider.

*Rationale*

For reasons set out below, the recommendations regarding recovery and discovery of SRAS costs reflects the status quo.

However, it should be noted that continuation of existing arrangements has the potential to result in cross-subsidisation of costs across the market – that is, the costs incurred in contracting with *restart services* for a sub-network could differ from the costs recovered (on an energy basis) within that sub-network.

If cross-subsidisation is a concern and/or the prevailing market view is that SRAS are procured for the benefit of individual sub-networks rather than for the benefit of the market as a whole, an alternative to recovering costs on an energy basis across the market would be to allocate costs on either a sub-network or regional basis. Such an approach to allocation of costs would probably be required if restoration (procurement) standards were to differ substantially between either jurisdictions, market regions, or *electrical sub-networks*[58]. Allocation on a sub-network basis would be potentially administratively complex, but equitable. Allocation on a regional basis would be relatively administratively simple, but potentially inequitable given the possibility that region boundaries would not coincide with sub-network boundaries[59].

On balance, NEMMCO is of the view that SRAS cost recovery should not be recovered on either a sub-network or regional basis, but costs should be allocated uniformly across the market. Given it is recommended that a uniform *system restart service standard* would apply across the whole NEM, the benefits to the market of restoring the system are unlikely to differ across sub-network or regions. Furthermore, in the case of a *black system* in a single *electrical sub-network*, it likely that other sub-networks could assist in restoring

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[58] See Section A1.1.1 of Volume 2 of this Final report for further discussion on this matter.

[59] For further discussion on this point see the box in Section 2.1 *Relationship between the standard and criteria for declaring a black system*. Administrative simplicity or complexity is judged against the need to establish new systems with different basic characteristics to existing systems. Some ancillary service costs are already allocated on a regional basis. No NEM costs are yet allocated on a sub-network basis.

supplies. This support may be available because adjacent sub-networks restart first, or are not in *black system* condition. It is contended that these arguments support a case for sharing the restart procurement costs across the whole market.

With regard to the sharing of costs between customers and generators, it is evident that both sets of parties benefit from the 'insurance' that is provided. For generators, the benefit of an orderly restart of services is that the market for energy is quickly restored, thereby enabling the generators to continue delivering their output to the market – the means by which they derive income. For customers, the absence of energy would impose substantial costs in terms of lost output or 'utility', and therefore restoring supply as rapidly as possible is also a highly beneficial service.

If the beneficiary pays principle were to be applied to the allocation of SRAS costs, it might be reasonably argued that customers benefit more than generators – this line of reasoning would lead to a larger cost allocation to customers than the existing 50%. However, there is no compelling reason to apply the beneficiary pays principle (as compared to other pricing principles) to the allocation of SRAS costs. In fact, it should be noted that Clause 3.1.4(a)(8) of the Code states:

> where arrangements require participants to pay a proportion of *NEMMCO* costs for *ancillary services*, **charges should where possible be allocated to provide incentives to lower overall costs of the national electricity market**. Costs unable to be reasonably allocated this way should be apportioned as broadly as possible whilst minimising distortions to production, consumption and investment decisions [emphasis added]

That is, the relevant governing clause of the Code makes no reference to 'beneficiary pays' as a principle to be considered in determining the allocation of SRAS costs.

While it will always be possible to advance arguments in support of revisiting the present allocation of costs between customers and generators, there does not appear to be a strong case for revisiting the current 50% cost allocation between these two groups of participants. In reaching this view, it is noted that customers (as consumers) and generators (as producers) are both dependent on the normal operation of the wholesale market. It seems unreasonable to argue that one half of the wholesale market (either consumers or producers) is more dependent on its operation than the other[60].

The allocation of costs, per se, does not impact on the type and number of *restart services* to be procured. The type and number of *restart services* procured is determined through establishment of an outcome-based standard and service procurement guidelines that have been developed through a consultative process with a clear objective of minimising NEMMCO's discretion in terms of choice of services to be contracted.

Allocation of costs may, however, impact on the incentive for various parties to contribute to the effective management of SRAS costs. Accordingly, allocating a share of the costs to both customers and generators gives each group an incentive to contribute to minimisation of SRAS costs.

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[60] See Harding Katz [1] *(op. cit.)* Section 6; and Harding Katz [2] *(op. cit.)*.

Where a market for a service is reasonably liquid, transparency of price related information is likely to promote competitive outcomes. However, the market for *restart services* is relatively thin and NEMMCO is of the view that publishing detailed contract price information is likely to weaken NEMMCO's negotiating position with existing service providers to the detriment of the market overall[61]. Special considerations of a commercially sensitive nature may need to be taken into account in contracting with parties for the provision of SRAS. Confidentiality needs to be maintained in such circumstances. Mechanisms will be in place to ensure contractual outcomes represent good value for the market. Further, the availability of enhanced Code provisions and guiding principles to assist in the interpretation of 'reasonable terms and conditions' would also play a role in ensure the market is not detrimentally affected by the non-publication of contract price information.

### *2.7.4 Prices under black system – incentive to make generation available*

*Description of recommendations*

NEMMCO recommends that prices applying during *black system* conditions reflect the appropriate methodology from the existing set of pricing methodologies referred to Clause 3.14.5 of the Code. Existing procedures give NEMMCO the discretion to suspend the market if a *black system* is declared, with specific pricing rules prevailing during market suspension. It would be expected that any pricing methodology applied when the *black system* condition was declared, with the market subsequently suspended, continues to apply until market suspension was lifted[62].

*Rationale*

Whenever there is a portion of unserved load or constrained-off generation within a region, to the extent that contracts do not make special provision for such circumstances, contracted parties are exposed to financial risks. For example, with a pure contract for difference generators and retailers may agree to exchange the value of the difference between the contract strike price and the pool price for a given number of MWs, regardless of the volume of energy generated or consumed. In such circumstances, the higher the pool price, the greater the financial risk to contracted generation *vis a vis* the risk to contracted retailers. In this case – where the market is suspended and prices cannot be set with reference to other regions or pre-dispatch schedules – the most equitable outcome appears to be to set the administered pool price as close as possible to typical contract prices[63].

To the extent that there is concern that the administered price would not be sufficiently high to encourage desired generation to make itself available,

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[61] See Harding Katz [1] *(op. cit.)* Section 5.2.3.

[62] The current construction of the Code arguably does not allow a single pricing methodology to prevail through any market suspension event – it seems possible that the method of pricing could change each trading interval while the market was suspended.

[63] Clause 3.14.5(g)(2) establishes the administered price reflecting "*NEMMCO's* reasonable estimate of typical *market* prices" that is likely to apply under *black system* condition.

directions could be issued where necessary. Where directions are issued, clear compensation mechanisms are laid down in the Code.

NEMMCO recognises the possibility of supply failure (with involuntary load shedding) not being sufficiently widespread to cause declaration of *black system* and suspension of the market. In such circumstances the regional reference price in affected regions would be set at VoLL. Any risks associated with such situations are best managed by market participants themselves.

### *2.7.5 Use of restart services when 'black system' has not been declared*

*Description of recommendations*

Amended SRAS arrangements will make provision for contracted *restart services* to assist in both:

- the restoration of a *black system*; and
- the mitigation of any other power system emergency as required by NEMMCO.

Specifically, the circumstances in which contracted SRAS capability would called upon by NEMMCO are as indicated below.

> Use of contracted *restart services* would be limited to situations where there is no external power supply to a generator. Such circumstances could be a result of either:
>
> - a sufficiently widespread system failure to warrant declaration of a *black system* condition; or
> - a localised supply failure that does not warrant declaration of a *black system* condition.

*Rationale*

Although remote, the possibility exists that small 'electrically black' islands could form that do not coincide with *electrical sub-network* boundaries and do not warrant the declaration of a *black system* for an entire region. In these circumstances – or other unforseen circumstances – usage of contracted (or non-contracted) *restart services* could prove valuable in mitigating the effects of power system emergencies that are not widespread.

## 2.8 Black start capability commissioned by NEMMCO

*Description of recommendations*

If the tendering process does not bring forth sufficient services to meet the *system restart service standard*, NEMMCO may issue an invitation to tender for a specific service that could cause a unit with suitable *black start capability* to be installed at an appropriate location. The installed unit would need to meet all the modelling and testing requirements as imposed upon other contracted SRAS providers and to be managed in such a way as to ensure its continuing availability. On-going management of the unit for other (non-conflicting) market purposes would be allowed, but any activities of this nature remain the responsibility of the contracted party.

*Rationale*

Failure to meet the *system restart service standard* leaves the NEM exposed to delays in restoration of customer supply capability where system damage in the event of a *black system* condition matches or exceeds that contemplated by the assumptions applied to testing as discussed in Sections 2.1 and 2.2.

Where adequate *restart services* are not available, there is the possibility that delays in restoration would be unacceptable to the extent that market participants would be prepared to incur the cost of constructing new *restart service* facilities[64]. Subject to being required to maintain the *black start capability* of the unit, allowing on-going management of the specially installed restart facilities for other (non-conflicting) market purposes would diminish the total costs of providing specific *restart services*.

The alternative to this approach is to accept that standard will not be met for the time being and – provided there is at least one contracted service provider for each *electrical sub-network* – to re-run the tender process the following year with no guarantee that additional or adequate *restart services* would be made available.

[64] The subject of NEMMCO causing new restart capability to be constructed is discussed in Harding Katz [1] *(op. cit.)* Section 5.2.2 in the context of developing price benchmarks for *restart services*.

# 3 Conclusion

## 3.1 Assessing the proposal against the review scope

Consistent with the published intent for the review, the review has concentrated on:

- establishment of a system restart procurement standard;
- procurement strategies (assessment & modelling);
- guidelines only for development of plans / procedures; and
- clarification of obligations and allocation of responsibilities.

Also consistent with the published intent, the review has left the following matters for continued management by operational personnel:

- comment on implementation of actual plans / procedures;
- development of communication protocols; and
- operational issues.

However, as indicated earlier, the review recommendations ensure responsibility for these matters is clearly allocated.

NEMMCO believes the recommendations outlined herein reflects the following desirable characteristics:

- common standards and principles for restoration of customer supply capability to be consistently applied across the NEM;
- maximisation of the chances of rapid restoration in the widest possible range of circumstances; and
- providing a level of assurance to the market that it would not be burdened with expenses for the maintenance of *restart services* beyond those that represent 'good value'.

## 3.2 Code changes

Code changes to reflect the in-principle outcomes of the review will be prepared for submission to NECA or the Australian Energy Markets Commission, as appropriate, in accordance with the requirements of Clause 3.1.4(a2)(8) of the Code. Consultation on those detailed Code changes will take place via the formal Code change process. The Clauses outlined in Appendix 3 in Volume 2 of this **Final report** have been identified as the Clauses most likely to be impacted by these changes.

# 4 Glossary

Following is a glossary of terms used in this paper.

| Term | Definition |
|---|---|
| *black start capability* | Following *disconnection* of a *generating unit* from the *power system* it is subsequently able to deliver electricity to its *connection point* without having taken *supply* from any part of the *power system* since *disconnection* |
| *black system* | The absence of voltage on all or a significant part of the transmission system or within a region following a major supply disruption, affecting one or more power stations and a significant number of customers – formal declaration of a *black system* condition requires loss of 60% of forecast supply |
| *customer specific MW support* | Privately contracted (off-market) arrangements to supply energy to loads in the event of widespread system failure – see Section 2.4 |
| *electrical sub-network* | Geographically defined area of the network for which *restart services* are to be contracted, with boundaries based on the physical characteristics of the system and system security imperatives – see Section 2.5 |
| *independent (restart services)* | Units with *black start capability* that do not have a reliance on common network assets (including whole sub-stations or transmission corridors) to facilitate the delivery of *restart services* |
| *local black system procedures* | Procedures to be developed by all generators, MNSPs, TNSPs, and DNSPs in accordance with guidelines issued by NEMMCO specifying technical capabilities and requirements and plans for dealing with *black system* conditions – see Section 2.6 |
| *primary restart service* | A contracted *restart service* that is:<br>• guaranteed to be available 98% of the time; and<br>• highly likely to perform in the manner intended if and when called upon to do so |
| *primary service premium* | A payment to successful tenderers for *primary restart services* in addition to tendered/agreed prices – value of the premium is to be determined by NEMMCO or an appropriate regulatory body |
| *procurement guidelines* | Conditions associated with the independence and number of *restart services* to be contracted – see Section 2.2 |
| *restart service* | The process of supplying sufficient energy and establishing a connection via the transmission infrastructure to restart other (large) generating units |

| Term | Definition |
|---|---|
| *secondary restart service* | A contracted *restart service* that is:<br>• guaranteed to be available at least 75% of the time; and<br>• more likely than not to perform in the manner intended if and when called upon to do so |
| *system restart service standard* | A standard for restoration of the *power system* following a *black system* event that would be required by the Code to be established by an appropriate regulatory body on the advice of NEMMCO – see Section 2.1 |
| *system restart plan* | A plan developed by NEMMCO specifying the strategies and procedures to be used in recovering from *black system* conditions – see Section 2.6 |
| *system restart ancillary services* (SRAS) | The set of contracted *restart services* procured by NEMMCO |
| *system shutdown* | Widespread failure of supply that may (or may not) qualify as a *black system* condition |
| *target electrical sub-network* | An *electrical sub-network* that is the object of assessment as to whether prospectively procured *restart services* are capable of meeting the *system restart service standard* when assumptions A and B2 hold – see Section 2.1 |
| *trip to house load* (TTHL) | Large generating units that can disconnect from the network through a major system incident and continue to supply their own auxiliaries or an isolated segment of system load |
| viable *restart service* | A feasible *restart service* that has been subjected to extensive assessment and modelling and, subject to any necessary (minor) modifications being made to NSP facilities, is deemed capable of providing an effective *restart service* |