

Settlements guide to ancillary services payment and recovery

Prepared by: AEMO Operations/NEM Settlements

Document ref: XX-XXXX

Version: ~~5-06~~

Effective date: ~~04 October 2023~~ 02 June 2024

Status: ~~FINAL~~ DRAFT

Approved for distribution and use by:

Approved by: ~~David Tagg~~ Chin Chan

Title: ~~Acting~~ Group Manager Market Management

Date: ~~04/10/2023~~

aemo.com.au

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

Australian Energy Market Operator Ltd ABN 94 072 010 327

Contents	Current version release details	3
1.	Introduction	4
2.	Market ancillary services	8
2.1.	Contingency FCAS	8
2.2.	Regulation FCAS	8
2.3.	FCAS Payments	8
2.4.	FCAS Recovery	9
2.5.	Co-optimisation	13
3.	Non-market ancillary services	13
3.1.	NSCAS and SRAS	13
3.2.	NSCAS Payments	13
3.3.	NSCAS Cost Recovery	14
3.4.	SRAS Payments	14
3.5.	SRAS Cost Recovery	15
3.6.	Testing Payment Recovery	16
4.	Glossary of terms	17
Appendix A.	Worked examples	19
A.1	Contingency FCAS Recovery Calculations	19
A.2	Regulation FCAS Recovery Calculations	20
A.3	NSCAS Recovery Calculations	22
A.4	SRAS Recovery Calculations	25
Appendix B.	Data tables	27
Appendix C.	Ancillary Service Reporting in the Settlement Report	28
C.1	Market Ancillary Service Payments	28
C.2	Market Ancillary Service Recovery	29
C.3	Non-Market Ancillary Service Payment	29
C.4	Non-Market Ancillary Service Recovery	30
Appendix D.	Ancillary Service Reports on AEMO’s Website	32
Version release history		37

Tables

<u>Table 1</u>	<u>Ancillary service payment summary</u>	<u>6</u>
<u>Table 2</u>	<u>Ancillary service recovery summary</u>	<u>6</u>
<u>Table 3</u>	<u>Contingency Raise FCAS costs by region</u>	<u>19</u>
<u>Table 4</u>	<u>CRMP Sent Out Energy</u>	<u>19</u>
<u>Table 5</u>	<u>Regulation Raise FCAS costs</u>	<u>20</u>
<u>Table 6</u>	<u>Consumption Energy by CRMP</u>	<u>20</u>
<u>Table 7</u>	<u>Total CRMP Consumed Energy by Requirement Region</u>	<u>21</u>
<u>Table 8</u>	<u>MPF and Recovery Calculations</u>	<u>21</u>

Table 9 Residual MPF and Recovery Calculations	22
Table 10 Input Data for Loadshed Recovery Calculations.....	23
Table 11 Information for Reactive Power Recovery Calculation.....	23
Table 12 Input data for CRMP with ACE values (A) SRAS Recovery Calculations.....	25
Table 13 Input data for SRAS Generator Recovery Calculation	25
Table 14 Market Ancillary Service Payment by Service Type	27
Table 15 Market Ancillary Service Payment by Service Type	28
Table 16 Market Ancillary Service Payment by Transmission Connection Point.....	29
Table 17 Market Ancillary Service Recovery by Service Type	29
Table 18 Non-Market Ancillary Service Payment by Service Type.....	30
Table 19 Non-Market Ancillary Service Payment by Contract ID.....	30
Table 20 Non-Market Ancillary Service Recovery by NMAS Type	30
Table 21 Non-Market Ancillary Service Recovery by Service Type	31
Table 22 Ancillary Service Recovery Summary Table Names.....	33
Table 23 AS Payment Summary Table Names	35

Figures

Figure 1 Market ancillary services summary.....	5
Figure 2 Non-market ancillary services summary	5
Figure 3 Current Ancillary Service Payment and Recovery Files.....	32
Figure 4 Historical AS Payment and Recovery Files	33
Figure 5 Customer Recovery Rates	36
Figure 6 Generator Recovery Rates.....	36

Current version release details

Version	Effective date	Summary of changes
x.xt6	02 June 2024	Update to reflect National Electricity Amendment (Integrating energy storage systems into the NEM) Rule 2021 No.13 and National Electricity Amendment (Implementing integrated energy storage systems) Rule 2023 No.2 to reflect IESS rule change and nNew AEMO format

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

1. Introduction

Terms shown in *italics* are defined in the National Electricity Rules (Rules or NER) and have the same meaning when used in this guide. A glossary of other terms used in this guide can be found in section 4.

AEMO procures *ancillary services* to fulfil its obligations, under the Rules. *Ancillary services* are used to assist in maintaining or restoring a safe and secure *power system*.

Ancillary service costs depend on the service prices offered by the *Registered Participants* who provide them, and the quantity required at any given time. They can vary substantially from period to period.

AEMO recovers *ancillary service* costs from [Cost Recovery Market Participant CRMPs Market Participants \(CRMPs\)](#). The costs of different types of service are recovered in different ways, in accordance with criteria set out in the Rules. This is all done as a part of the settlement process.

This document provides a high-level understanding of the methodology used in the settlement process for payment and recovery of *ancillary service* costs.

This introduction provides a brief overview of what *ancillary services* are and a summary of how the costs are paid and recovered by AEMO. The subsequent chapters detail the methodology for payment and recovery of *market* and *non-market ancillary service* costs used in the settlement calculations. Worked examples and a list of useful reference documents are provided in the appendices.

Ancillary services in the National Electricity Market (NEM) can be broadly grouped under one of the following three categories:

- Frequency control *ancillary services* (FCAS)
- Network support and control ancillary services (NSCAS)
- System restart ancillary services (SRAS)

There are ten types of FCAS, which are all *market ancillary services*. NSCAS and SRAS are *non-market ancillary services*, (see Figure 1 and Figure 2). For more information please see [Guide to Ancillary Services in the National Electricity Market](#).

AEMO procures these services from *Registered Participants* by:

- *Dispatching* them via the NEM dispatch engine (NEMDE) based on Market Ancillary Service Arrangements (for *market ancillary services*).
- Ancillary Service Contractual Agreements (for *non-market ancillary services*).

Figure 1 Market ancillary services summary

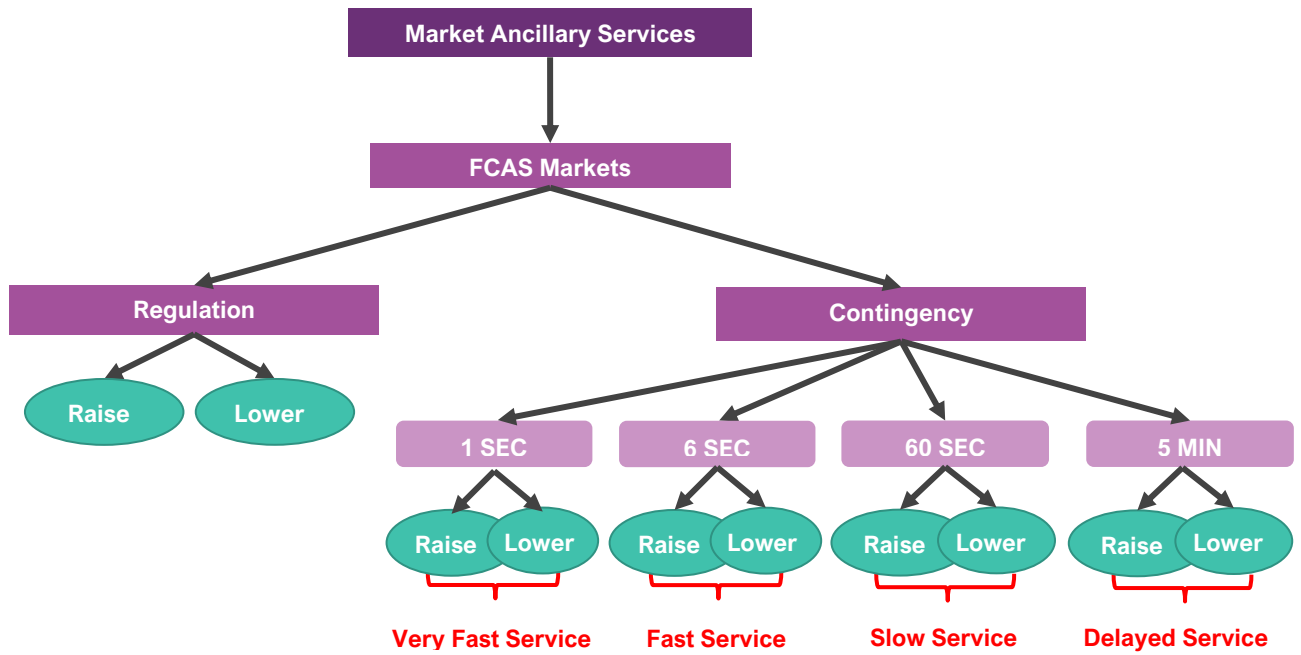
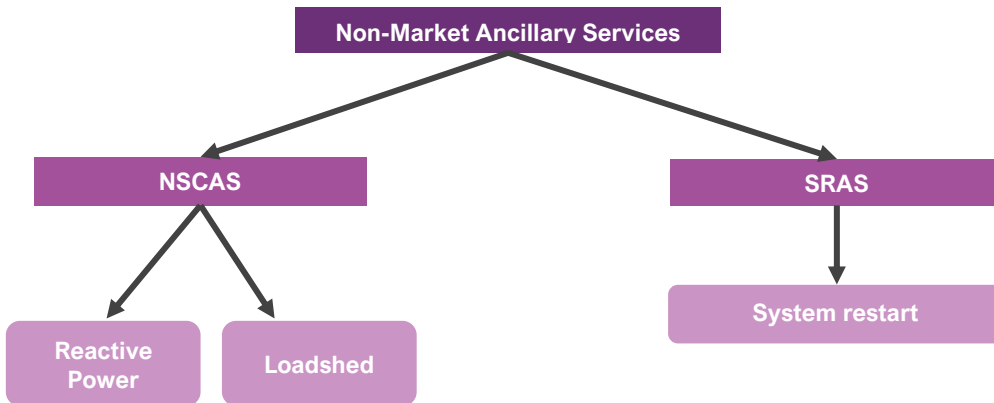


Figure 2 Non-market ancillary services summary



The following tables summarize the payment and recovery methods respectively for each of the *ancillary services*.

Table 1 Ancillary service payment summary

Ancillary Service Type	Payment Method	Paid To	Reference in this Guide
Contingency FCAS	Paid based on the relevant market clearing price and the quantity of service provided for each relevant dispatch interval	The relevant scheduled <u>aAncillary service unit Cost Recovery Market Participant</u> CRMP Market Generators/ Market Small Generation Aggregators/ Market Customers	Section 2.1, 2.3
Regulation FCAS	Paid based on the relevant market clearing price and the quantity of service provided for each relevant dispatch interval	The relevant scheduled <u>aAncillary service unit Cost Recovery Market Participant</u> Market Generators/ Market Customers	Section 2.2, 2.3
NSCAS	Paid based on terms and conditions in the relevant contractual agreements between AEMO and the contracted <i>Registered Participants</i>	The relevant contracted <i>Registered Participants</i>	Section 3.2
SRAS	Paid based on terms and conditions in the relevant contractual agreements between AEMO and the contracted <i>Registered Participants</i>	The relevant contracted <i>Registered Participants</i>	Section 3.4

Table 2 Ancillary service recovery summary

Ancillary Service Type	Recovery Method	Recovered from	Reference
Contingency FCAS	Recovered in proportion to the consumed energy / generation energy of the relevant <i>Market Participants</i> <u>Raise services are recovered from all participants based on ASOE from Energy Transactions and Lower services are recovered from all participants based on ACE from Energy Transactions</u>	Raise services are recovered from Market Generators or Market Small Generation Aggregators. Lower services are recovered from Market Customers <u>All</u> Applicable CRMPs	Section 2.4.1
Regulation FCAS	Causer pays basis or socialised <u>Causer pays basis or socialised</u>	Market Participants with individual MPFs or from Market Customers without individual MPFs <u>All</u> <u>a</u> Applicable CRMPs	Section 2.4.2
NSCAS	<u>CRMPs based on ACE</u> Recovered in proportion to the energy consumption of the relevant <i>Market Participants</i> in the relevant benefiting regions	Market Customers only <u>All</u> <u>a</u> Applicable CRMPs	Section 3.3
SRAS	<u>CRMPs based on ASOE (half) and based on ACE (half)</u> Recovered in proportion to energy consumption / generation of the relevant	Recovered in equal proportions (50/50) from <u>All</u> all CRMPs Market Customers and Market Generators	Section 3.4

Ancillary Service Type	Recovery Method	Recovered from	Reference
	<i>Market Participants</i> in the relevant benefiting regions		

2. Market ancillary services

FCAS are used by AEMO to maintain or rebalance the *frequency* on the *power system*, at any point in time, close to fifty cycles per second (50 Hz) as required by the NEM *frequency operating standards* set by the AEMC *Reliability Panel*.

FCAS is divided into Contingency FCAS and Regulation FCAS.

2.1. Contingency FCAS

Contingency FCAS correct the supply/demand balance in response to major *frequency* disturbances causing *frequency* to move outside the *normal operating frequency band*, which can occur after *contingency events* such as the loss of a *generating unit* or a major load.

There are eight types of Contingency FCAS:

i)	Very Fast Raise (1 second Raise)	Service provided within 1 second of a <i>contingency event</i>
ii)	Very Fast Lower (1 second Lower)	
iii)	Fast Raise (6 second Raise)	Service provided within 6 seconds of a <i>contingency event</i>
iv)	Fast Lower (6 second Lower)	
v)	Slow Raise (60 second Raise)	Service provided within 60 seconds of a <i>contingency event</i>
vi)	Slow Lower (60 second Lower)	
vii)	Delayed Raise (5 minute Raise)	Service provided within 5 minutes of a <i>contingency event</i>
viii)	Delayed Lower (5 minute Lower)	

2.2. Regulation FCAS

Regulation FCAS provide *frequency* correction in response to minor deviations in the demand/supply balance. There are two types of Regulation FCAS:

i)	Regulation Raise	Service provided to add MW to the system in order to raise the frequency closer to 50 Hz
ii)	Regulation Lower	Service provided to take MW out of the system in order to lower the frequency closer to 50 Hz

2.3. FCAS Payments

For each Dispatch Interval (DI), AEMO's dispatch engine (NEMDE) determines the FCAS *constraints*, including Global Requirements and Local Requirements, for each type of FCAS, the quantity of each FCAS to be *enabled* from FCAS providers based on their bids or offers, and a market clearing price (called an *ancillary service price*) for each of the above ten FCAS markets for each *region*.

The relevant FCAS providers will receive settlement payments for each Trading Interval (TI) calculated using the relevant *ancillary service price* and the amount of the *ancillary service* provided in each DI.

$$TA = \text{the aggregate of } \frac{EA \times ASP}{12}$$

Where:

<u>TA</u>	the trading amount to be determined
<u>EA</u>	the amount of the relevant market ancillary service which the ancillary service unit has been enabled to provide in the trading interval
<u>ASP</u>	the ancillary service price for the market ancillary service for the trading interval for the region in which the ancillary service unit has been enabled.

2.4. FCAS Recovery

FCAS payments are recovered from the relevant *Market Participants* (see Table 2). The recovery method for each type of FCAS is detailed in the following subsections.

2.4.1. Contingency FCAS Recovery

Global or Local Requirement

FCAS payments for services *enabled* to meet a Local Requirement are recovered from specified categories of *Market Participants* in the *region(s)* in which the relevant FCAS *constraint* was binding. FCAS payments for Global Requirements are recovered from specified categories of *Market Participants* across the entire NEM.

For more information on FCAS *constraints* please see the documents available on AEMO's [Congestion information resource](#) website.

Calculating Lower Contingency FCAS Recovery

Lower Contingency FCAS costs are recovered from *Market Customers CRMPs with ACE values* only, in the relevant Requirement *region(s)* (including all *regions* for a Global Requirement). The methodology described below is applied for all the relevant *regions'* Lower Contingency Requirements to calculate the service recovery from each relevant *Market Customer CRMP* over each TI.

$$(1) \quad \text{Lower Contingency Recovery} = \frac{\text{Total adjusted cost of LC Requirements [X]}}{\text{Total customer energy by participant in the requirement regions}} \times \frac{\text{Total customer energy in the Requirement regions}}$$

$$TA = LCR \times \left(\frac{ACE}{RATCE} \right) \times -1$$

Where:

LC Requirements [X] <u>TA</u>	=	The relevant binding <i>constraints</i> for Lower Contingency to be met in all Requirement <i>regions</i> for each DI in a TI (including Global Requirements and Local Requirements binding for those <i>regions</i>). <u>The trading amount payable by the Cost Recovery Market Participant CRMP CRMP in respect of the relevant region and trading interval.</u>
Lower Contingency Recovery <u>LCR</u>	=	The amount recovered from the relevant <i>Market Customer CRMPs</i> for the cost of meeting the LC Requirements [X] in the relevant Requirement <i>region(s)</i> in respect of the relevant TI. <u>the sum of:</u> <ol style="list-style-type: none"> 1. <u>the global market ancillary service requirement cost for that region, for the relevant trading interval; and</u> 1-2. <u>all local market ancillary service requirement costs for that region, for the relevant trading interval.</u>

Total adjusted cost of LC Requirements [X]ACE	=	The total cost for all regions associated with meeting the LC Requirements, being the relevant regions' total amounts to be paid by AEMO to all the FCAS providers who met the LC Requirements in each DI in the TI. This is the aggregate of the relevant global market ancillary service requirement costs and local market ancillary service requirement costs. The sum of the ACE, for all connection points of the Cost Recovery Market Participant CRMP located in the region of the CRMP, of the adjusted consumed energy amount for the connection point for the trading interval
Total customer energy by participant in the Requirement regions RATCE	=	Total energy consumed by the relevant Market Customer CRMP in the relevant TI in the Requirement regions. The sum of the ACE, for all connection points located in the region, of the adjusted consumed energy amounts for the trading interval all CRMPs.
Total customer energy in the Requirement regions	=	Total energy consumed by all Market Customers in the relevant TI in the Requirement regions

Calculating Raise Contingency FCAS Recovery

Raise Contingency FCAS costs are recovered from *Market Generators (MG) and Market Small Generation Aggregators (MSG) CRMPs with ASOE values only* in the relevant Requirement region(s) (including all regions for a Global Requirement). The methodology described below is applied for all the relevant regions' Raise Contingency Requirements to calculate the service recovery from each relevant MG and MSG CRMP over each TI.

(2) Raise Contingency Recovery

$$= \frac{\text{Total adjusted cost of RC Requirements [X]} \times (\text{Total generator energy by participant in the Requirement regions})}{(\text{Total generator energy in the Requirement regions})}$$

$$TA = RCR \times \left(\frac{TSOE}{ASOE} \right) \times -1$$

Where:

RC Requirements [X] TA	=	The trading amount payable by the CRMP CRMP in respect of the relevant region and trading interval. The relevant binding constraints for Raise Contingency to be met in all Requirement regions for each DI in a TI (including Global Requirement and Local Requirement binding for those regions).
Raise contingency recovery RCR	=	the sum of: 1. the global market ancillary service requirement cost for that region, for the relevant trading interval; and 1-2. All local market ancillary service requirement costs for that region, for the relevant trading interval. The amount recovered from the relevant MG or MSGA for the cost of meeting the RC Requirements [X] in the relevant Requirement region(s) in respect of the relevant TI.
Total adjusted cost of RC requirements [X] TSOE	=	the sum of the ASOE, for all connection points located in the region of the CRMP located in the region, of the adjusted sent out energy for the trading interval CRMP. The total cost for all regions associated with meeting the RC Requirements, being the relevant regions' total amounts to be paid by AEMO to all the relevant FCAS providers who met the RC Requirements in each DI in the TI. This is the aggregate of the relevant global market ancillary service requirement costs and local market ancillary service requirement costs.

Total generator energy by participant in the Requirement regions ASOE	=	the sum, for all connection points located in the region, of the ASOE for the trading interval Total generator energy by the relevant MG or MSGA in the relevant TI in the relevant Requirement regions.
Total generator energy in the Requirement regions	=	Total generator energy by all MG and MSGA for the relevant TI in the relevant Requirement regions.

2.4.2. Regulation FCAS recovery

Regulation FCAS recovery calculations recover the cost of meeting the binding Regulation FCAS constraints on a causer pays basis, i.e. the amount paid by AEMO for the Regulation FCAS service is recovered from *Market Participants* deemed to have ‘caused’ the need for the service, where this is possible to determine from metering. The residual amount of Regulation FCAS costs that cannot be allocated to metered ‘causers’ is smeared across all CRMPs Market Customers based on energy consumption.

Market participant factors

The Regulation FCAS cost recovery methodology incorporates two components:

- (a) Individual causer pays contributions – allocated to the following *Market Participants* with metering sufficient to identify frequency performance based on their calculated contribution factor or MPF.
 - Appropriately metered scheduled, semi-scheduled and non-scheduled CRMPs Market Generators.
 - Market Customers CRMPs with *scheduled loads* or non-scheduled loads with appropriate metering.
- (b) Residual – apportioned to CRMPs Market Customers based on their proportion of total consumed energy without appropriate metering.

For more information on Regulation FCAS Contribution Factors, please see the documents available on AEMO’s [Ancillary services contribution factors](#) website

Calculating Regulation FCAS recovery

For *Market Participants* with an individual MPF, the formula for calculating Regulation FCAS recovery can be expressed as:

$$(3) \quad \text{FCAS Regulation Recovery with MPF for Reg Requirement [X]} = \text{Total adjusted cost of Reg Requirement [X]} \times \left(\frac{\text{MPF}}{\text{Total}_{\text{MPF}} + \text{Residual}_{\text{MPF}} \times \text{CR}_{\text{MPF}}} \right)$$

$$(4) \quad \text{CR}_{\text{MPF}} = \frac{\text{Total customer energy in the requirement regions}}{\text{Total customer energy in the NEM}}$$

$$TA = \text{Aggregate of} \left(\text{REGR} \times \frac{\text{MPF}}{\text{AMPF}} \right)$$

Where:

Reg Requirement [X]TA	=	The trading amount payable by the CRMP in respect of the relevant region and trading interval. The binding constraint for Lower Regulation or Raise Regulation FCAS required to be met in each DI in the relevant TI.
FCAS Regulation recovery with MPFREGR	=	The total of all amounts calculated by AEMO under paragraph (h)(2) for the regulating raise service or the regulating lower service in respect of a trading interval. The amount recovered from the relevant Market Participant, for a given Regulation FCAS, for the cost of meeting Reg Requirement [X] in the relevant TI and for all the relevant Requirement regions
Total adjusted cost of Reg Requirement [X]MPF	=	The contribution factor last set by AEMO for the CRMP. The total costs associated with meeting Reg Requirement [X], in the relevant dispatch interval, paid by AEMO to all the relevant Regulation FCAS service providers.
MPFAMPF	=	The aggregate of the MPF figures for all CRMPs for the trading interval for the region or regions relevant to the regulating raise service or regulating lower service. The normalised Market Participant Factor for the relevant Market Participant
Total MPF	=	Sum of all the MPFs
Residual MPF	=	The normalised Residual NEM contribution factor (= 100 - Total MPF)
Residual MPF x CRMPF	=	Constraint Residual Contribution Factor
Total customer energy in the Requirement regions	=	Total energy consumed by all Market Customers in the relevant TI across the relevant Requirement region(s) in which Reg Requirement [X] was a Requirement
Total customer energy in the NEM	=	Total energy consumed by all Market Customers over the entire NEM in the relevant TI

Because not all regulation payments can be fully recovered from *Market Participants* with an MPF, the residual amounts are recovered from the remaining *Market Customers* CRMPs without an individual MPF, as follows:

(5) *FCAS Regulation Residual Recovery*

$$= \text{Total residual adjusted cost of Reg Requirement [X]} - \left(\frac{\text{Total customer energy by Market Customer in the Requirement regions}}{\text{Total customer energy by ALL Market Customers in the Requirement regions}} \right)$$

$$TA = \text{the aggregate of} \left(REGR \times \frac{MPF}{AMPF} \times \frac{TCE}{ATCE} \right)$$

Where:

FCAS Regulation Residual Recovery TA	=	The trading amount payable by the CRMP in respect of the relevant region and trading interval. The amount recovered from a Market Customer, for the residual cost of meeting Reg Requirement [X] in the relevant TI
REGR Total residual adjusted cost of Reg Requirement [X]	=	The total of all amounts calculated by AEMO under paragraph (h)(2) for the regulating raise service or the regulating lower service in respect of a trading interval. This is the remaining adjusted cost of the constraint that is still to be recovered. This is calculated after the recovery from all relevant Market Participants with individual MPFs has been accounted for.
Total customer energy by Market Customer in the Requirement regions MPF	=	The aggregate of the contribution factors for CRMPs, for whom the trading amount is not calculated in accordance with the regulation formula for the region or regions relevant to the regulating raise service or the regulating lower service. The normalised Residual NEM contribution factor (= 100 - Total MPF). Total energy consumed in the relevant TI by the relevant Market Customer for loads without appropriate metering across the regions in which Reg Requirement [X] applied
Total customer energy by ALL Market Customers in the Requirement regions AMPF	=	The aggregate of the MPF figures for all CRMPs for the trading interval for the region or regions relevant to the regulating raise service or regulating lower service. Total energy consumed in the relevant TI by all the Market Customers for loads without appropriate metering across all the relevant regions in which Reg Requirement [X] applied

<u>TCE</u>	<u>The adjusted consumed energy amountsACE for the CRMPsCRMP for the trading interval in the region or regions relevant to the regulating raise service or regulating lower service.;</u>
<u>RATCE</u>	<u>The aggregate of the adjusted consumed energy amountsACE for all CRMPsCRMPs for whom the trading amount is not calculated in accordance with the no residue regulation formula, for the trading interval for the region or regions relevant to that regulating raise service or regulating lower service.</u>

2.5. Co-optimisation

AEMO uses a process of co-optimisation between Delayed Contingency FCAS and Regulation FCAS for the purposes of efficient dispatch. As a result of this, the total amount recovered for Delayed Contingency FCAS and Regulation FCAS will equal the total payments for Delayed Contingency FCAS and Regulation FCAS.

i.e.:

$$\text{Total Payments (Delayed Contingency + Regulation)} = \text{Total Recovery (Delayed Contingency + Regulation)}$$

For more information on co-optimisation of delayed contingency FCAS and regulation FCAS please see the Constraint Implementation Guidelines document on AEMO's [Congestion information resource](#) website.

3. Non-market ancillary services

3.1. NSCAS and SRAS

NSCAS acquired by AEMO are typically used to control *voltage* at different points along the *network* to within prescribed standards and to keep power flow on the *networks* and *interconnectors* within operational limits. Generally, these services are provided by voluntary *load shedding* or the supply or absorption of *reactive power*.

SRAS enable *generation* to be restarted to energise the *transmission system* following a *major supply disruption*.

For more information on *non-market ancillary services*, please see the guidelines for NSCAS and SRAS on AEMO's website.

3.2. NSCAS Payments

AEMO procures NSCAS through contracts with *Registered Participants* on agreed terms and conditions. Some payment parameters in the existing contracts may relate to periods or events longer than one Trading Interval. Where this is the case, for cost recovery purposes they are allocated across all relevant Trading Intervals.

Types of payments made by AEMO to *NSCAS Providers* may include:

- (a) Availability payments for each Trading Interval that the service is available.
- (b) Enabling payments for Trading Intervals when the service is specifically enabled.
- (c) Compensation or usage payments made for the amount of the NSCAS actually provided.
- (d) Testing payments for each successfully conducted test.

3.3. NSCAS Cost Recovery

AEMO aggregates the relevant payments (excluding testing payments) for each trading interval and each type of NSCAS, and recovers them fully from Market Customers CRMPs with ACE values only in proportion to their energy consumption in that relevant Requirement region.

AEMO recovers NSCAS costs on a regional basis, from the benefiting region(s). This is done by applying Regional Benefit Factors (RBFs). For more information on RBF, please see the document on AEMO's Regional benefit ancillary services procedure website.

For each Trading Interval, the following regional recovery formulae are applied to the NSCAS costs as follows:

$$(6) \quad \text{NSCAS recovery per participant by region} = \text{Total NSCAS payments for NEM} \times \text{RBF} \\ \times \left(\frac{\text{Total customer energy consumed energy by CRMP customer in the Requirement region}}{\text{Total customer consumed energy in the Requirement region}} \right)$$

For each Trading Interval, the NSCAS recovery is then aggregated for all regions, by Market Participant, and then summed to give the total NSCAS recovery by Market Participant. i.e.,

$$(7) \quad \text{Total NSCAS recovery per participant} = \text{Total loadshed recovery per participant} + \text{Total reactive recovery per participant}$$

Where:

RBF	= Each region is assigned a regional benefit factor (RBF) for the relevant NSCAS type. = The RBF for each Requirement region is used to apportion the relevant total NSCAS costs to each relevant Requirement region.
NSCAS recovery per participant by region (\$)	= Recovery amount payable by the relevant Market Participant for the relevant TI for NSCAS in respect of the relevant Requirement region
Total NSCAS payments for NEM (\$)	= Total payments made by AEMO for the relevant NSCAS for the relevant TI for all the relevant NEM regions
Total customer-consumed energy by CRMP customer in the Requirement region (MWh)	= The sum, for all connection points of the CRMP <u>The sum, for all connection points of the CRMP located in the region, of the adjusted-consumed energy amount ACE for the connection point for the trading interval</u> The total customer energy for the relevant Market-Customer in the relevant Requirement region, for the relevant TI
Total customer-consumed energy in the Requirement region (MWh)	= The sum, for all connection points located in the region of the CRMPs, of the adjusted-consumed energy amount ACE for the connection point for the trading interval. <u>The total customer energy for all the relevant Market-Customers in that Requirement region for the relevant TI</u>

Note: The total NSCAS payment used in the above recovery calculations is only the total payment made for providing the relevant service. This does not include testing payments. For information on Testing Payment Recovery please see Section 3.6.

3.4. SRAS Payments

AEMO procures SRAS through contracts with Registered Participants on agreed terms and conditions. Some payment parameters in the existing contracts may relate to periods or events longer than one Trading Interval. Where this is the case, for cost recovery purposes they are allocated across all the relevant Trading Intervals.

Types of payments under SRAS contracts may include:

- (a) Availability payments, usually for every TI that the service is available.
- (b) Usage payments – made on each occasion when the service is successfully delivered in response to instructions from AEMO.
- (c) Testing payments – a payment for each successfully conducted test of the service.

3.5. SRAS Cost Recovery

AEMO aggregates the relevant payments for a SRAS event (excluding testing payments) for each trading interval and recovers the relevant costs on a 50/50 split basis from CRMPs based on ACE and ASOE values Market Customers and collectively from Market Generators and Market Small Generation Aggregators on a regional basis. The relevant SRAS payments are recovered in proportion to the energy consumption/generation of each relevant *Market Participant* within the respective benefiting *region*.

The formula applied for SRAS cost recovery in a Requirement *region*, for a given trading interval, is as follows:

Market Customer CRMP ACE based SRAS Recovery:

(8) *SRAS recovery per ~~CRMP customer~~ by region*

$$= \text{Total SRAS payments for NEM} \times \left(\frac{1}{2}\right) \times \text{RBF} \times \left(\frac{\text{Total ~~customer~~ ACE energy by Market Customer CRMP in the Requirement region}}{\text{Total ~~customer~~ consumed energy in the Requirement region}}\right)$$

Market Generator/ Market Small Generation Aggregator (MSG) CRMP ASOE based SRAS Recovery:

(9) *Total SRAS recovery per ~~generator~~ CRMP by region*

$$= \text{Total SRAS payments for NEM} \times \left(\frac{1}{2}\right) \times \text{RBF} \times \left(\frac{\text{Total ~~generator~~ SOE energy by generator CRMP or MSGA in the Requirement region}}{\text{Total ~~generator~~ Sent Out /SGA energy in the Requirement region}}\right)$$

Where:

SRAS recovery per customer/ generator by <i>region</i>	= SRAS recovery amount for the relevant TI payable from the relevant <i>Market Customer, Market Generator or Market Small Generation Aggregator CRMP</i> in the relevant Requirement <i>region</i> .
Total SRAS payment for NEM	= Total SRAS payments made by AEMO for the relevant TI to all the relevant SRAS providers in all the relevant Requirement <i>regions</i>
RBF	= The regional benefit factor. Each <i>region</i> is assigned an RBF. The RBF for each <i>region</i> is used in the recovery calculations for that <i>region</i> .
Total customer consumed energy by <u>Market Customer CRMP</u> in the Requirement <i>region</i> (MWh)	= <u>The sum, for all connection points of the CRMP located in the region, of the CRMP, of the adjusted consumed energy amount ACE for the connection point for the trading interval. Total Market customer energy for the relevant Market Customer in respect of the relevant TI and the relevant Requirement region.</u>

Total generator ASOE energy by generator or MSGACRMP in the Requirement region (MWh)	=	The sum, for all connection points of the CRMP -located in the region of the CRMP , of the adjusted sent out energy amount ASOE for the connection point for the trading interval. Total generator energy for the relevant Market Generator or MSGA in respect of the relevant TI and the relevant Requirement region.
Total customer consumed energy in the Requirement region (MWh)	=	The aggregate sum, for all connection points located in the region of the CRMPs , of the adjusted consumed energy amount ASOE for the connection point for the trading interval. Market customer energy of all the relevant Market Customers in respect of the relevant TI and the relevant Requirement region.
Total generator/MSGAA ASOE energy in the Requirement region (MWh)	=	The sum Aggregate , for all connection points located in the region of the CRMPs , of the adjusted sent out energy amount ASOE for the connection point for the trading interval. The aggregate of generator energy of all the relevant Market Generator and all the MSGA in respect of the relevant TI and the relevant Requirement region.

Note:

- The factor (1/2 = 0.5) in the above two formulae reflect the equal recovery of SRAS from *Market Customers and Market Generators/MSGA*.
- Energy for *Market Generators/MSGA* is floored to 0 MWh. This means these *Market Participants* will be exempted from SRAS recovery if their generator energy is negative.

3.6. Testing Payment Recovery

AEMO applies the same formulae to calculate testing payment recovery as for the respective ancillary service non-testing payment recovery, i.e.,

- (a) NSCAS testing payment recovery is calculated as per the formula in Section 3.3
- (b) SRAS testing payment recovery is calculated as per the formula in Section 3.4

However, where those equations refer to CRMPs *Market Customer, Market Generator or MSGA* energy for a given trading interval, the respective testing payment recovery calculations will use the aggregate of the relevant energy of the entire testing period for the respective *Market Participants*.

Testing payments are paid and recovered as a lump sum in the *billing period* in which the successful test is confirmed by AEMO. For billing purposes, non-testing recovery amounts are summed for all relevant trading intervals in a given *billing period* and added to the relevant testing recovery amounts to give rise to the final NSAS or SRAS recovery amounts for the relevant *billing period* for each *Market Participant*.

To find the settlement dates in a given settlement *billing period*, please see the [NEM Settlement Calendar](#).

4. Glossary of terms

TERM	DESCRIPTION
5MS	Five-minute settlement, to be implemented in the NEM from 1 July 2021 under the <i>National Electricity Amendment (Five minute settlement) Rule 2017</i> .
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator Limited
Contingency FCAS	FCAS provided when <i>power system frequency</i> is outside the <i>normal operating frequency band</i> , which can occur on the occurrence of a <i>contingency event</i> . Types of Contingency FCAS are Fast, Slow and Delayed.
Co-optimisation	The process of using Delayed Contingency FCAS and Regulation FCAS interchangeably to increase service efficiency.
Delayed Contingency (comprising Delayed Raise and Delayed Lower Service)	Contingency FCAS provided to either raise or lower <i>frequency</i> within five minutes after the locally-sensed <i>frequency</i> exits the <i>normal operating frequency band</i> .
Dispatch Interval (DI)	A five-minute period for which AEMO runs the <i>dispatch algorithm</i> (via NEMDE). On 5MS implementation, the definition of <i>dispatch interval</i> is deleted from the Rules and effectively replaced by a <i>trading interval</i> .
Fast Contingency (comprising Fast Raise and Fast Lower Service)	Contingency FCAS provided to either raise or lower <i>frequency</i> within six seconds after the locally-sensed <i>frequency</i> exits the <i>normal operating frequency band</i> .
FCAS	Frequency control <i>ancillary services</i>
Global Requirement	FCAS requirement for all <i>regions</i> in the NEM
Local Requirement	FCAS requirement for a single <i>region</i> or group of <i>regions</i> within the NEM.
Lower Contingency	Fast Lower, Slow Lower and Delayed Lower Services
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
NER	National Electricity Rules
NSCAS	<i>Network support and control ancillary services</i>
Raise Contingency	Fast Raise, Slow Raise and Delayed Raise Services
Regulation FCAS (comprising Regulation Raise and Regulation Lower Service)	FCAS provided in response to a central control system to maintain <i>power system frequency</i> , usually within the <i>normal operating frequency band</i> .
Regulation FCAS Contribution Factor/MPF	Contribution factors assigned to <i>Market Participants</i> as outlined in NER 3.15.6A. These factors are used to allocate Regulation FCAS costs to be recovered from <i>Market Participants</i> on a 'causer pays' basis.
Requirement	A requirement for a particular type of FCAS established by a binding <i>constraint</i> represented in NEMDE, which may be a Global Requirement or a Local Requirement.
Requirement regions	The <i>regions</i> for which a given FCAS requirement Constraint Equation is binding are known as the Requirement Regions for that constraint.
Rules	National Electricity Rules
Slow Contingency (comprising Slow Raise and Slow Lower Service)	Contingency FCAS provided to either raise or lower <i>frequency</i> within sixty seconds after the locally-sensed <i>frequency</i> exits the <i>normal operating frequency band</i> .
SRAS	<i>System restart ancillary services</i>
Trading Interval (TI)	A period for which AEMO settles <i>trading amounts</i> in the NEM. Until 5MS implementation, a <i>trading interval</i> is defined in the Rules as a 30-minute period. On 5MS implementation, the definition of <i>trading interval</i> changes to a 5 minute period.
ACE	Adjusted consumed energy

TERM	DESCRIPTION
ASOE	<u>Adjusted sent out energy</u>
CRMP	<u>Cost Recovery Market Participant</u>

Appendix A. Worked examples.

Note: All data used in these worked examples are for illustrating the calculation steps of the relevant *ancillary service* recovery methodology presented in section 2 and 3. They do not disclose *Market Participants'* confidential information. Unless specified otherwise, these calculations apply to a *Trading Interval* or a *Dispatch Interval*.

A.1 Contingency FCAS Recovery Calculations

This example illustrates Raise Contingency FCAS recovery for a binding constraint (FC_1) affecting Dispatch Interval DI1 in Trading Interval TI1, from 4 *Market Generators/CRMPs* in three Requirement regions. *Generator energy/Adjusted Sent-Out Energy ASOE* is used in this example. For Lower Contingency recovery, *Market Customer/CRMP energy/consumption energy* should be used. See Section 2.1 for the relevant formulae.

Table 3 shows the incurred adjusted costs for each Requirement region. Table 4 shows *Market Generator energy/ASEO* in each region for the relevant *Trading Interval*; and the relevant *Market Generators or MSGA*.

Table 3 Contingency Raise FCAS costs by region

Dispatch Interval in Trading Interval TI1	RC Requirement	Requirement Regions	Adjusted RC Costs (\$)
DI1	FC_1	NSW1; VIC1	\$45.00

Table 4 *Generator/CRMP Sent Out Energy by Market Generator/MSGAP*

Trading Interval	Requirement Region	RC Requirments	Market Generator/MSGACRMP	Generator Energy ASOE (MWh)
TI1	NSW1	FC_1	A	100
TI1	NSW1	FC_1	B	200
TI1	NSW1	FC_1	C	20
TI1	VIC1	FC_1	C	30

Note: This is the energy data for the relevant TI in which the relevant DI falls.

Calculating recovery for constraint FC_1

$$\begin{aligned}
 \text{Total Generator/CRMP Energy (FC_1, NSW1)} &= \text{Gen/CRMP Energy (A, NSW1)} + \text{Gen/CRMP Energy (B, NSW1)} + \text{Gen/CRMP Energy (C, NSW1)} \\
 &\quad + \text{Gen/CRMP Energy (C, VIC1)} \\
 &= 100 + 200 + 20 + 30 \\
 &= 350
 \end{aligned}$$

Therefore, the amount to be recovered from the relevant *Market Participant* for the given dispatch interval

$$\begin{aligned}
 \text{Recovery (A, FC_1, NSW1)} &= \$45.00 \times 100 / 350 \\
 &= \$12.86 \\
 \text{Recovery (B, FC_1, NSW1)} &= \$45.00 \times 200 / 350 \\
 &= \$25.71
 \end{aligned}$$

$$\begin{aligned}
 \text{Recovery (C, FC_1, NSW1)} &= \$45.00 \times 20 / 350 \\
 &= \$2.57 \\
 \text{Recovery (C, FC_1, VIC1)} &= \$45.00 \times 30 / 350 \\
 &= \$3.86
 \end{aligned}$$

A.2 Regulation FCAS Recovery Calculations

This example illustrates the step-by-step calculations for Regulation Raise FCAS recovery for a Global Requirement affecting *Dispatch Interval* D2 in *Trading Interval* TI2. These calculations apply equally to Regulation Lower FCAS recovery using the relevant data and follow the equations in section 2.4.2. These are outlined below.

Step 1: Obtain Regional Requirement Information

Table 5 shows the Regulation Raise FCAS constraint information for binding constraint FC_Reg_1, the constraint costs and the *regions* the constraint applies to.

Table 6 shows customer-consumption energy for each *Market-Customer-CRMP* in each Requirement *region*. The aggregated values by *region* have been populated in Table 7.

Market Participant Factors (MPF) for *Market Participants* with appropriate metering are shown in Table 8.

Table 5 Regulation Raise FCAS costs

Dispatch Interval in Trading Interval TI2	Regulation Raise Requirement	Requirement Region	Adjusted Regulation Raise Costs (\$)
D12	FC_Reg_1	NSW1	\$150
D12	FC_Reg_1	QLD1	\$150
D12	FC_Reg_1	VIC1	\$150
D12	FC_Reg_1	TAS1	\$150
D12	FC_Reg_1	SA1	\$150

Table 6 ~~Market-Customer Energy by Market-Customer~~Consumption Energy by CRMP

Trading Interval	Market Customer CRM P	Requirement Region	Market Customer Energy Consumed Energy (MWh)	Trading Interval	Market Customer CRM P	Requirement Region	Market Customer Energy Consumed Energy (MWh)
TI2	A	NSW1	100	TI2	I	TAS1	108
TI2	A	QLD1	200	TI2	I	SA1	68
TI2	A	VIC1	150	TI2	J	NSW1	201
TI2	B	NSW1	145	TI2	J	QLD1	252
TI2	B	TAS1	400	TI2	J	SA1	101
TI2	C	QLD1	650	TI2	K	TAS1	93

Trading Interval	Market Customer CRM P	Requirement Region	Market Customer Energy Consumed Energy (MWh)	Trading Interval	Market Customer CRM P	Requirement Region	Market Customer Energy Consumed Energy (MWh)
TI2	D	QLD1	225	TI2	L	QLD1	72
TI2	D	TAS1	230	TI2	L	VIC1	351
TI2	D	SA1	355	TI2	M	NSW1	637
TI2	E	NSW1	470	TI2	N	VIC1	45
TI2	F	NSW1	120	TI2	O	QLD1	8
TI2	F	TAS1	115	TI2	P	NSW1	155
TI2	G	VIC1	234	TI2	P	QLD1	217
TI2	H	SA1	56			Total	6,286
TI2	I	NSW1	98				

Note: This is the energy data for the relevant TI in which the relevant DI falls.

Table 7 Total Market Customer Energy CRM Consumed Energy by Requirement Region

Trading Interval	Requirement Region	NSW1	QLD1	VIC1	SA1	TAS1	TOTAL
TI2	Total Market Customer CRM Consumed Energy in Requirement Region (MWh)	1,926	2,005	1,059	580	946	6,286

Step 2: Calculate CR_{MPF}

The information from Table 7 can then be used to calculate the CR_{MPF} , as shown below:

$$\begin{aligned}
 CR_{MPF} &= \frac{\text{Total energy consumed in Requirement regions (NSW1, QLD1, VIC1, TAS1, SA1)}}{\text{Total energy consumed in the NEM}} \\
 &= \frac{(1,926 + 2,005 + 1,059 + 580 + 716)}{6,286} \\
 &= \frac{6,286}{6,286} = 1
 \end{aligned}$$

The CR_{MPF} equals 1 for a *Global Requirement* affecting all *regions* in NEM. It will be less than 1 for a *local requirement*.

Step 3: Calculate Regulation FCAS Recovery for Market Participants with individual MPFs.

After calculating the CR_{MPF} and obtaining the MPF data, we can calculate the Regulation FCAS recovery for *Market Participants* with MPFs (see Section 2.4.2 for formula). The data and calculations are shown in Table 8.

Table 8 MPF and Recovery Calculations

Trading Interval	Market Participant	MPF (%)	CR_{MPF}	ADJ COST (\$)	MPF Recovery (\$)
TI2	A	5.6	1	150	\$8.4

MPF recovery (A)

$$= \frac{\$150.00 \times 5.6}{65 + (1 \times 35)} = \$8.4$$

Trading Interval	Market Participant	MPF (%)	CRMPF	ADJ COST (\$)	MPF Recovery (\$)
TI2	B	8.9	1	150	\$13.35
TI2	D	1.5	1	150	\$2.25
TI2	E	11.2	1	150	\$16.80
TI2	G	6.4	1	150	\$9.60
TI2	I	5.25	1	150	\$7.88
TI2	J	7.35	1	150	\$11.03
TI2	K	9.8	1	150	\$14.70
TI2	L	9	1	150	\$13.50
Total MPF		65			
Total Residual MPF		35			
Total		100			\$97.5
				Residual Adjusted Costs	\$52.5

$$\begin{aligned}
 \text{Residual Adjusted Costs} &= \$150.00 - \$97.50 \\
 &= \$52.50
 \end{aligned}$$

Step 4: Calculate Regulation FCAS Residual Recovery

Table 9 shows the residual FCAS cost recovered from each *Market Customer* CRMP with no MPF in proportion to their share the total loads without MPFs from all *Market Participants* in the relevant Requirement regions.

Table 9 Residual MPF and Recovery Calculations

Trading Interval	Market Participant with no MPF	Total Customer Energy in Requirement Regions	RMPF Recovery
TI2	C	650	\$17.04
TI2	F	235	\$6.16
TI2	H	56	\$1.47
TI2	M	637	\$16.70
TI2	N	45	\$1.18
TI2	O	8	\$0.21
TI2	P	372	\$9.75
Total		2,003	\$52.5

$$\begin{aligned}
 R_{MPF} &= \$52.5 \times \left(\frac{650}{2,003} \right) \\
 &= \$17.04
 \end{aligned}$$

A.3 NSCAS Recovery Calculations

This section provides step-by-step instructions for calculating *Loadshed*, *Reactive Power* and total NSCAS recovery for a *CRMP with consumption Energy Market Customer* for a Trading Interval.

A.3.1 Calculate total loadshed recovery

Table 10 shows the required input data for *Loadshed* recovery calculations for **Market Customer CRMP with consumption energy (ACE) A** for the relevant *Trading Interval* in the relevant Requirement regions. The step-by-step calculations follow the equations in section 3.3.

Table 10 Input Data for Loadshed Recovery Calculations

	VIC1	NSW1	QLD1	TOTAL
CRMP Market Customer A Consumption Energy (ACE) (MWh)	200	150	350	700
Total Market Customer CRMP ACE energy (MWh)	500	600	800	1,900
RBF	0.1	0.75	0.15	1
Loadshed Payment (\$)				\$54,500

RBF allocated across all regions will sum to 1

Step 1: Calculate Loadshed recovery from **Market Customer CRMP A** in each Requirement region

$$\begin{aligned}
 \text{Loadshed recovery for Market Customer CRMP A (VIC1)} &= \$54,500.00 \times 0.1 \times 200 / 500 \\
 &= \$2,180.00 \\
 \text{Loadshed recovery for Market Customer CRMP A (NSW1)} &= \$54,500.00 \times 0.75 \times 150 / 600 \\
 &= \$10,219.00 \\
 \text{Loadshed recovery for Market Customer CRMP A (QLD1)} &= \$54,500.00 \times 0.15 \times 350 / 800 \\
 &= \$3,577.00
 \end{aligned}$$

Step 2: Sum all Loadshed recovery from **Market Customer CRMP A** by Requirement region

$$\begin{aligned}
 \text{Total Loadshed recovery for Market Customer CRMP A} &= \$2,180.00 + \$10,219.00 + \$3,577.00 \\
 &= \$15,976.00
 \end{aligned}$$

A.3.2 Calculate Total Reactive Power Recovery

Table 11 shows the input data required for *Reactive Power ancillary service (RPAS)* recovery calculations for **Market Customer CRMP with consumption energy (ACE) A** for the relevant *Trading Interval* in each Requirement region. The step-by-step calculations follow the equations in section 3.3.

Table 11 Information for Reactive Power Recovery Calculation

2013, Wk18	VIC1	NSW1	QLD1	TOTAL
Market Customer CRMP A ACE Energy (MWh)	300	425	250	975
Total Customer CRMP ACE Energy (MWh)	900	1,100	700	2,700
RBF	0.7	0.1	0.2	1

RBF allocated across all regions will sum to 1

2013, Wk18	VIC1	NSW1	QLD1	TOTAL
RPAS Payment (\$)				\$61,500

Step 1: Calculate the reactive power recovery from Market Customer CRMP A in each Requirement region

$$\begin{aligned}
 \text{Total RPAS recovery for } \underline{\text{CRMP}} \text{Market Customer A (VIC1)} &= \$61,500.00 \times 0.7 \times 300 / 900 \\
 &= \$14,350.00 \\
 \text{Total RPAS recovery for } \text{Market Customer } \underline{\text{CRMP}} \text{ A (NSW1)} &= \$61,500.00 \times 0.1 \times 425 / 1100 \\
 &= \$2,376.00 \\
 \text{Total RPAS recovery for } \text{Market Customer } \underline{\text{CRMP}} \text{ A (QLD1)} &= \$61,500.00 \times 0.2 \times 250 / 700 \\
 &= \$4,393.00
 \end{aligned}$$

Step 2: Sum the Reactive Power recovery from Market Customer CRMP A for all Requirement regions

$$\begin{aligned}
 \text{Total RPAS recovery for } \text{Market Customer } \underline{\text{CRMP}} \text{ A} &= \$14,350.00 + \$2,376.00 + \$4,393.00 \\
 &= \$21,119.00
 \end{aligned}$$

A.3.3 Calculate Total NSCAS Recovery

This step aggregates total Loadshed and RPAS recovery amounts for Market Customer CRMP A consumption energy (ACE) in respect of the relevant *Trading Interval*.

$$\begin{aligned}
 \text{Total NSCAS recovery for } \underline{\text{CRMP}} \text{Market Customer A} &= \text{Total Loadshed recovery} + \text{Total RPAS recovery} \\
 &= \$15,976.00 + \$21,119.00 \\
 &= \$37,095.00
 \end{aligned}$$

A.4 SRAS Recovery Calculations

This section provides calculation steps for SRAS recovery for a *Trading Interval* with respect to a *Market Customer and a Market Generator CRMP with consumed ACE or Sent out energy ASOE* in each *Requirement region*. The step-by-step calculations follow the equations in section 3.4.

A.4.1 Calculate SRAS recovery from a *Market Customer CRMP with ACE*

Table 12 shows the required input data for SRAS recovery calculations for a *Market Customer CRMP (A)* for the relevant *Trading Interval* in each *Requirement region*.

Table 12 Input data for *Market Customer CRMP with ACE values (A)* SRAS Recovery Calculations

	VIC1	NSW1	QLD1	TOTAL
Market Customer CRMP A ACE Energy (MWh)	100	200	300	600
Total Customer Energy ACE (MWh)	400	600	800	1,800
RBF	0.7	0.1	0.2	1.0
SRAS Payment (\$)				\$50,000
Market Customer CRMP Recovery Proportion				(1/2)

RBF allocated across all regions will sum to 1

SRAS is recovered equally from customers and generators

$$\begin{aligned}
 \text{Total SRAS recovery for Market Customer CRMP A (VIC1)} &= \$50,000.00 \times 0.5 \times 0.7 \times 100 / 400 \\
 &= \$4,375.00 \\
 \text{Total SRAS recovery for Market Customer CRMP A (NSW1)} &= \$50,000.00 \times 0.5 \times 0.1 \times 200 / 600 \\
 &= \$833.00 \\
 \text{Total SRAS recovery for Market Customer CRMP A (QLD1)} &= \$50,000.00 \times 0.5 \times 0.2 \times 300 / 800 \\
 &= \$1,875.00
 \end{aligned}$$

A.4.2 Calculate SRAS Recovery from a *Market Generator CRMP with ASOE*

Table 13 shows the required input data for SRAS recovery calculations for a *Market Generator CRMP with sent out energy (ASOE) (B)* for the relevant *Trading Interval* in each *Requirement region*.

Table 13 Input data for SRAS Generator Recovery Calculation

	VIC1	NSW1	QLD1	TOTAL
Market Generator CRMP B Energy ASOE (MWh)	200	500	400	1,100
Total Generator Energy ASOE (MWh)	500	900	900	2,300
RBF	0.7	0.1	0.2	1.0
SRAS Payment (\$)				\$75,000
Generator CRMP ASOE Recovery Proportion				(1/2)

RBF allocated across all regions will sum to 1

SRAS is recovered equally from customers and generators

	Total SRAS recovery for Market Generator CRMP B = \$75,000.00	x	0.5	x	0.7	x	200	/	500
	= \$10,500.00								
	Total SRAS recovery for Market Generator CRMP B = \$75,000.00	x	0.5	x	0.1	x	500	/	900
	(NSW1)								
	= \$2,083.00								
	Total SRAS recovery for Market Generator CRMP B = \$75,000.00	x	0.5	x	0.2	x	400	/	900
	(QLD1)								
	= \$3,333.00								

Appendix B. Data tables

This section lists confidential and public data tables currently available for use for settlement reconciliation purposes. These tables can be found in the EMMS data model available to *registered Market Participants*. Description of the contents of these tables can be found in the [MMS Data Model Report](#) published on AEMO website.

Table 14 Market Ancillary Service Payment by Service Type

Table Name	Description	Type
billingasrecovery	Shows participant charges for ancillary services for the billing period	Confidential
billing_nmas_tst_payments	Shows testing payment details for system restart services by period	Confidential
billing_nmas_tst_recovery	Shows testing recovery amounts for system restart services to be recovered from participants	Confidential
setcfg_participant_mpf	Shows the Market Participant Factors (MPF) for each connection point	Public
dispatch_fcas_req	Shows dispatch constraint tracking for regional Frequency Control Ancillary Services (FCAS) recovery	Public
setgendata	Shows settlement data (including generator energy) for each generating unit	Confidential
setcpdata	Shows settlement data for each customer connection point	Confidential
setpowerrecovery	Shows recovery amounts for reactive power ancillary services to be recovered from participants	Confidential
setshedrecovery	Shows recovery amounts for loadshed ancillary services to be recovered from participants	Confidential
setrestartrecovery	Shows recovery amounts for system restart ancillary services to be recovered from participants	Confidential
setshedpayment	Shows specific payment details for loadshed services by period	Confidential
setpowerpayment	Shows specific payment details for reactive power services by period	Confidential
setrestartpayment	Shows specific payment details for system restart services by period	Confidential
set_fcas_payment	Sets out enabling payment details for FCAS	Confidential
set_fcas_recovery	Shows recovery amounts for FCAS to be recovered from participants.	Confidential
set_nmas_recovery	Shows recovery amounts for system restart services to be recovered from participants	Confidential

Appendix C. Ancillary Service Reporting in the Settlement Report

Along with the weekly settlement statements, *Market Participants* receive a text document called the Settlement Report (SR). The SR contains a summary of the energy sold and purchased for the *billing period* and also contains a detailed summary of the *ancillary services* payments and recovery for the *billing period*. This section gives an example of what the *ancillary services* payment and recovery summary looks like in a typical settlement report received by a *Market Participant*.

Note that each *Market Participant* will not receive all of the *ancillary service* payment and recovery summaries shown below. For instance, *Market Participants* who are not providers of *ancillary services* will not see the *ancillary service* payment summaries. *while Market Participants who are Market Generators will not receive a breakdown of the NSCAS recovery as this ancillary service is not recovered from Market Generators.*

The data presented in the tables in this section are for illustration purposes and do not reflect any *Market Participants'* confidential information.

Note: The below SR examples are from a period prior to the implementation of the Very Fast services in October 2023.

C.1 Market Ancillary Service Payments

Table 15 shows the total amount paid by AEMO to all *Market Participants* broken down by service type. Table 16 presents the same information broken down further by *transmission node*. Note that the total payments by *transmission node* in Table 16 need to reconcile with the total amounts by service type in Table 15, as highlighted below.

Table 15 Market Ancillary Service Payment by Service Type

Ancillary Service Transactions	

Market Ancillary Service Transactions - Payments	

Service Provided	Amount (\$)

Very fast raise	\$0.00
Very fast lower	\$0.00
Fast raise	\$1,770.60
Fast lower	\$10,036.81
Slow raise	\$1,211.71
Slow lower	\$11,341.06
Delayed raise	\$961.54
Delayed lower	\$2,351.81
Regulation raise	\$15,054.66
Regulation lower	\$11,835.11

Total Payments By AEMO	\$54,563.30
=====	

Table 16 Market Ancillary Service Payment by Transmission Connection Point

Market Frequency Control Ancillary Services by Transmission Connection Point (Payments By AEMO)

Connection Point	Very fast raise	Very fast lower	Fast raise	Fast lower	Slow raise	Slow lower	Delayed raise	Delayed lower	Reg raise	Reg lower	Total
XXXX1	\$100.00	\$0.00	\$5,213.70	\$463.75	\$2,681.75	\$2,562.39	\$232.29	\$796.89	\$29,712.04	\$2,490.91	\$44,153.72
XXXX2	\$0.00	\$15.00	\$4,026.04	\$471.89	\$2,512.38	\$2,428.77	\$230.70	\$858.84	\$33,730.53	\$2,486.47	\$46,745.62
XXXX3	\$0.00	\$0.00	\$4,148.69	\$270.76	\$2,374.78	\$1,669.03	\$206.55	\$704.17	\$28,184.83	\$1,987.15	\$39,545.95
XXXX4	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
YYYY1	\$0.00	\$145.09	\$1,143.91	\$3,962.00	\$740.77	\$8,668.42	\$0.00	\$0.00	\$754.16	\$964.68	\$16,233.94
YYYY2	\$535.00	\$0.00	\$1,359.83	\$540.92	\$945.82	\$2,342.30	\$0.00	\$0.00	\$634.35	\$685.45	\$6,508.67
YYYY4	\$0.00	\$5.90	\$878.44	\$4,327.48	\$961.26	\$13,670.15	\$0.00	\$0.00	\$2,538.76	\$2,221.30	\$24,597.39
Total	\$635.00	\$165.99	\$16,770.60	\$10,036.81	\$10,216.77	\$31,341.06	\$669.54	\$2,359.89	\$95,554.66	\$10,835.97	\$177,785.29

C.2 Market Ancillary Service Recovery

Table 17 shows the amounts recovered by AEMO from a *Market Participant* by *market ancillary service* type and broken down by *Market Customer* and *Market Generator* categories. CRMP energy categories.

Table 17 Market Ancillary Service Recovery by Service Type

Market Ancillary Service Transactions - Recovery

Service Provided	MPF Amount (\$)	ACE Amount (\$)	ASOE Amount (\$)	Total Amount (\$)
Very Fast raise	\$0.00	\$0.00	-\$282.48	-\$282.48
Very Fast lower	\$0.00	-\$93.05	\$0.00	-\$93.05
Fast raise	\$0.00	\$0.00	-\$8,356.89	-\$8,356.89
Fast lower	\$0.00	-\$41.60	\$0.00	-\$41.60
Slow raise	\$0.00	\$0.00	-\$864.16	-\$864.16
Slow lower	\$0.00	-\$166.52	\$0.00	-\$166.52
Delayed raise	\$0.00	\$0.00	-\$252.80	-\$252.80
Delayed lower	\$0.00	-\$118.88	\$0.00	-\$118.88
Regulation raise	\$0.00	-\$0.05	\$0.00	-\$0.05
Regulation lower	\$0.00	-\$0.06	\$0.00	-\$0.06
Total Recovery(Payment to AEMO)	\$0.00	-\$420.18	-\$9,756.33	-\$10,176.51

Contingency raise services are not recovered from customers

Contingency lower services are not recovered from generators

Market Ancillary Service Transactions - Recovery

Service Provided	Customer Amount (\$)	Generator Amount (\$)	Total Amount (\$)
Fast raise	\$0.00	-\$54.28	-\$54.28
Fast lower	-\$20.53	\$0.00	-\$20.53
Slow raise	\$0.00	-\$34.98	-\$34.98
Slow lower	-\$96.88	\$0.00	-\$96.88
Delayed raise	\$0.00	-\$47.58	-\$47.58
Delayed lower	-\$54.23	\$0.00	-\$54.23
Regulation raise	-\$480.62	\$0.00	-\$480.62
Regulation lower	-\$532.89	\$0.00	-\$532.89
Total Recovery(Payment to AEMO)	-\$1,185.15	-\$136.84	-\$1,321.99

C.3 Non-Market Ancillary Service Payment

Table 18 shows *non-market ancillary service* payments by service type. While Table 19 captures the same information as Table 18, it is further broken down by contract id and payment component (i.e availability, enablement/ usage, compensation and testing).

Table 18 Non-Market Ancillary Service Payment by Service Type

Non Market Ancillary Service Transactions - Payments		
NMAS Type	Service Provided	Amount (\$)
SRAS	System Restart	\$53,432.00
NSCAS	Reactive	\$49,934.34
NSCAS	Loadshed	\$30,203.98
Total Payment From AEMO		\$133,570.32

Table 19 Non-Market Ancillary Service Payment by Contract ID

Compensation may be paid to market participant if AEMO makes a direction.

Test Payments are made to participants for testing their systems are capable of providing the non-market ancillary service. This payment is made when a successful test is confirmed.

Non Market Ancillary Service by Contract ID (Payments By AEMO)							
NMAS Type	Service	Contract ID	Availability	Enablement/Usage	Compensation	Testing	Total
SRAS	System Restart	AAAA12345	\$28,893.43	\$0.00	\$0.00	\$0.00	\$28,893.43
SRAS	System Restart	BBBB54321	\$24,538.57	\$0.00	\$0.00	\$0.00	\$24,538.57
NSCAS	Reactive Power	CCCC67890	\$49,934.34	\$0.00	\$0.00	\$0.00	\$49,934.34
NSCAS	Loadshed NSCAS	DDDD09876	\$30,203.98	\$0.00	\$0.00	\$0.00	\$30,203.98
Total Payments By AEMO							\$133,570.32

C.4 Non-Market Ancillary Service Recovery

Table 20 shows non-market ancillary service (NMAS) recovery by category (i.e., NSCAS, SRAS). Table 21 further breaks down the NMAS recovery by service type, region and payment type.

Table 20 Non-Market Ancillary Service Recovery by NMAS Type

Non Market Ancillary Service Transactions - Recovery			
NMAS Type	ACE Amount(\$)	ASOE Amount(\$)	Total Amount(\$)
SRAS	-\$94.96	-\$730.84	-\$825.79
Total Recovery (Payment To AEMO)		-\$94.96	-\$825.79

NSCAS is not recovered from generators.

Non Market Ancillary Service Transactions - Recovery			
NMAS Type	Customer Amount(\$)	Generator Amount(\$)	Total Amount(\$)
NSCAS	-\$353.42	\$0.00	-\$353.42
SRAS	-\$234.48	-\$3,944.05	-\$4,178.53
Total Recovery (Payment To AEMO)		-\$587.91	-\$4,531.96

Table 21 Non-Market Ancillary Service Recovery by Service Type

Non Market Ancillary Service Transactions by Region and Type - Recovery							
NMAS Type	Service	RegionId	Availability	Enablement/Usage	Compensation	Testing	Total
NSCAS	Reactive Power	NSW1	-\$67.34	\$0.00	\$0.00	\$0.00	-\$67.34
NSCAS	Reactive Power	QLD1	-\$56.78	\$0.00	\$0.00	\$0.00	-\$56.78
NSCAS	Reactive Power	SA1	-\$82.67	\$0.00	\$0.00	\$0.00	-\$82.67
NSCAS	Loadshed	NSW1	-\$146.63	\$0.00	\$0.00	\$0.00	-\$146.63
SRAS	System Restart	QLD1	-\$2,750.83	\$0.00	\$0.00	\$0.00	-\$2,750.83
SRAS	System Restart	TAS1	-\$1,427.70	\$0.00	\$0.00	\$0.00	-\$1,427.70
Total Recovery (Payment To AEMO)			-\$4,531.96	\$0.00	\$0.00	\$0.00	-\$4,531.96

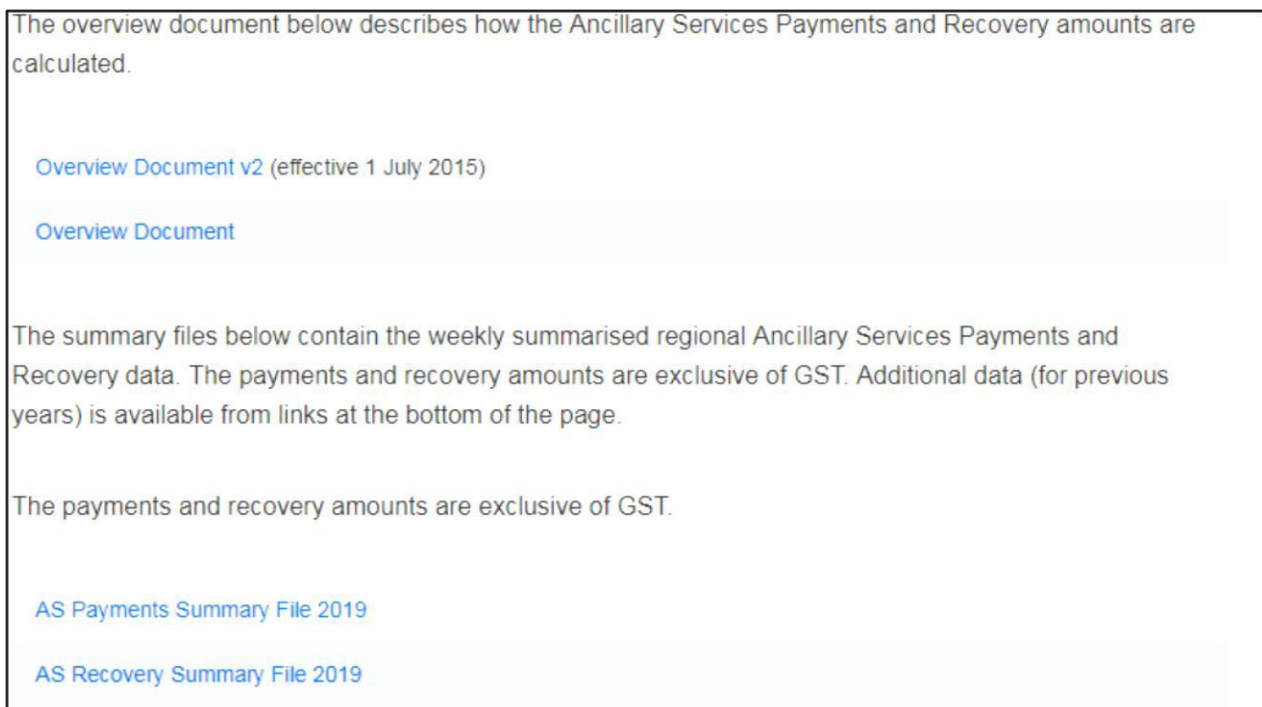
Appendix D. Ancillary Service Reports on AEMO's Website

AEMO publishes *Ancillary Service* payment and recovery reports on AEMO's website. These reports contain publicly available for *billing period* total payment and recovery amounts for each *ancillary service* category, broken down by *region*.

The data in the current year summary files (shown in Figure 3) are updated to capture information in the most recent posted settlement statements (*preliminary, final, or revised*). *Market participants* are also able to access and subscribe to receive these files by email, through Settlement Direct.

Note: the information below can be accessed on AEMO's [Ancillary services payments and recovery](https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data/Ancillary-Services/Ancillary-Services-Payments-and-Recovery) <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data/Ancillary-Services/Ancillary-Services-Payments-and-Recovery> website.

Figure 3 Current Ancillary Service Payment and Recovery Files



The overview document below describes how the Ancillary Services Payments and Recovery amounts are calculated.

[Overview Document v2 \(effective 1 July 2015\)](#)

[Overview Document](#)

The summary files below contain the weekly summarised regional Ancillary Services Payments and Recovery data. The payments and recovery amounts are exclusive of GST. Additional data (for previous years) is available from links at the bottom of the page.

The payments and recovery amounts are exclusive of GST.

[AS Payments Summary File 2019](#)

[AS Recovery Summary File 2019](#)

Historical *ancillary service* recovery and payment summary files are also available (see Figure 4). These are archived reports that are only updated at the start of the year if revised data is available. These historical files are available for the last two calendar years.

Figure 4 Historical AS Payment and Recovery Files

Historical files:

The payments and recovery amounts are exclusive of GST.

- [AS Payments Summary File 2019](#)
- [AS Recovery Summary File 2019](#)
- [AS Payments Summary File 2018](#)

Table 22 lists the contents of the published ancillary service recovery summary data table.

Table 22 Ancillary Service Recovery Summary Table Names

COLUMN NAME	DEFINITION
AS_RECOVERY_SUMMARY	This specifies the report type - Ancillary Services Recovery Summary Report
BILLING_WEEK	Specifies the year and billing week the ancillary services are recovered. The settlement dates within the billing week can be found from the settlement calendar
STATUS	This refers to the latest statement type for the billing week. The corresponding data is used in the recovery calculations
REGIONID	The <i>region</i> the ancillary services costs are recovered from
LOWER1SEC	Very Fast Contingency Lower FCAS Recovery (\$)
LOWER6SEC	Fast Contingency Lower FCAS Recovery (\$)
LOWER60SEC	Slow Contingency Lower FCAS Recovery (\$)
LOWER5MIN	Delayed Contingency Lower FCAS Recovery (\$)
LOWERREG	Lower Regulation FCAS Recovery (\$)
RAISE1SEC	Very Fast Contingency Raise FCAS Recovery (\$)
RAISE6SEC	Fast Contingency Raise FCAS Recovery (\$)
RAISE60SEC	Slow Contingency Raise FCAS Recovery (\$)
RAISE5MIN	Delayed Contingency Raise FCAS Recovery (\$)
RAISEREG	Raise Regulation FCAS Recovery (\$)
RESTART	Restart (SRAS) Recovery (\$)
REACTIVE	Reactive (NSCAS) Recovery (\$)
LOADSHED	Loadshed (NSCAS) Recovery (\$)
TOTAL_CUSTOMERACE_RECOVERY	Total ancillary service costs recovered from market customers CRMP with ACE (\$)
TOTAL_GENERATORASOE_RECOVERY	Total ancillary service costs recovered from market generators CRMP (\$) where generators include SGA with ASOE
ENERGY_CUSTOMERACE	Total customer CRMP ACE energy (MWh)
ENERGY_GENERATORASOE	Total generator CRMP energyASOE (MWh) where generators includes SGA
RECOVERY_RATE_CUSTOMERACE	The customer recovery rate is given in \$/MWh and is the TOTAL_CUSTOMER_RECOVERY divided by ENERGY_CUSTOMER

COLUMN NAME	DEFINITION
RECOVERY_RATE_GENERATORASOE	The generator recovery rate is given in \$/MWh and is the TOTAL_GENERATOR_RECOVERY divided by ENERGY_GENERATOR

Table 23 lists the contents of the published ancillary service payment summary data table.

Table 23 AS Payment Summary Table Names

ASPAYMENT_SUMMARY	This specifies the report type - Ancillary Services Payment Summary Report
BILLING_WEEK	Specifies the year and billing week the ancillary services are recovered. The settlement dates within the billing week can be found from the settlement calendar
STATUS	This refers to the latest statement type for the billing week. The corresponding data is used in the payment calculations
REGIONID	The <i>region</i> in which ancillary services payments are made
LOWER1SEC	Very Fast Contingency Lower FCAS Payment (\$)
LOWER6SEC	Fast Contingency Lower FCAS Payment (\$)
LOWER60SEC	Slow Contingency Lower FCAS Payment (\$)
LOWER5MIN	Delayed Contingency Lower FCAS Payment (\$)
LOWERREG	Lower Regulation FCAS Payment (\$)
RAISE1SEC	Very Fast Contingency Raise FCAS Payment (\$)
RAISE6SEC	Fast Contingency Raise FCAS Payment (\$)
RAISE60SEC	Slow Contingency Raise FCAS Payment (\$)
RAISE5MIN	Delayed Contingency Raise FCAS Payment (\$)
RAISEREG	Raise Regulation FCAS Payment (\$)
RESTART	Restart (SRAS) Payment (\$)
REACTIVE	Reactive (NSCAS) Payment (\$)
LOADSHED	Loadshed (NSCAS) Payment (\$)
TOTAL_AS_PAYMENT	Sum of all ancillary service payments (\$)

AEMO also publishes graphs showing rolling 12-month *Market Customer* and *Market Generator* recovery rates for each *region* (see Figure 5 and Figure 6). These charts are updated to reflect settlement outcomes in the latest *Preliminary, Final and Revised statements*.

Figure 5 – Customer Recovery Rates

Customer Recovery Rates from 17/06/2018 to 15/06/2019

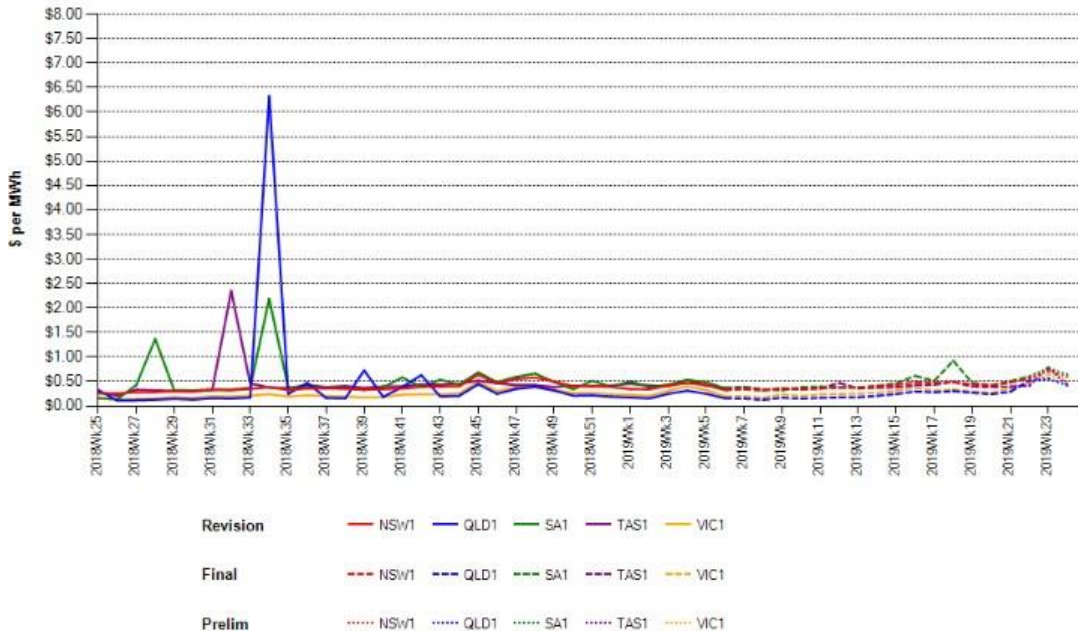
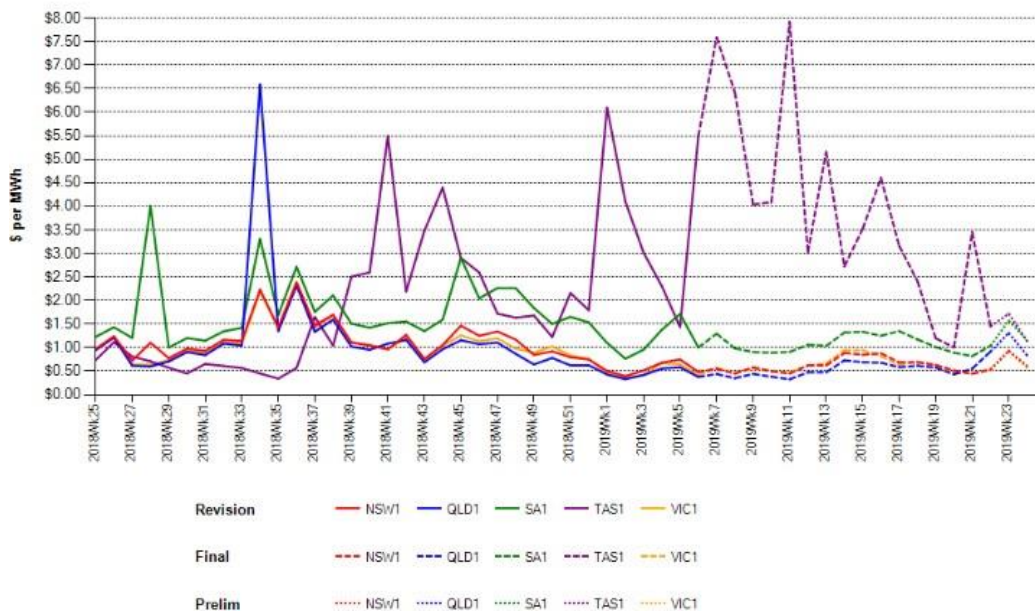


Figure 6 – Generator Recovery Rates

Generator Recovery Rates from 17/06/2018 to 15/06/2019



Version release history

Version	Effective Date	Summary of Changes
#1.0	04/03/2014	
#2.0	01/07/2015	Updated 3.5, Appendix A.4 and Appendix B based on changes to the SRAS cost recovery calculations commencing on 1 July 2015 – recovering SRAS costs on the basis of the regional benefits (rule change reference ERC0168).
#3.0	19/07/2019	Updated to AEMO new document template Updated Disclaimer Updated links to reference documents Updated worked examples in Appendix A to reflect changes arising from five- minute settlement rule changes Amended texts, re-arranged order of some sections to improve clarify and flow of the information
#4.0	14/02/2020	Amended section 2.4.1 (Contingency FCAS recovery) and appendix A1 Contingency FCAS recovery calculations) for clarity Update links to reference documents
#5.0	04/10/2023	Update for new Very Fast Contingency FCAS services Update links to reference documents Update document template for new branding