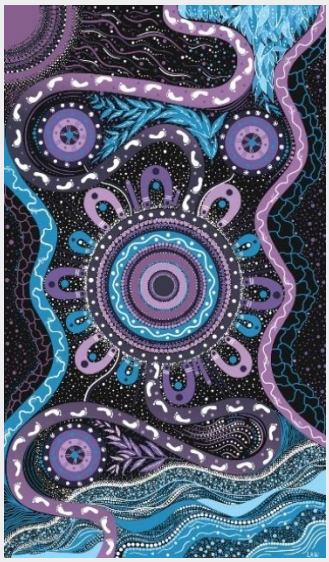
Guide to Analysing Constraint Outcomes for FCAS Cost Recovery

8 June 2025

A resource for NEM market participants and other stakeholders summarising the cost recovery approach for FCAS



We acknowledge the Traditional Custodians of the land, seas and waters across Australia. We honour the wisdom of Aboriginal and Torres Strait Islander Elders past and present and embrace future generations.

We acknowledge that, wherever we work, we do so on Aboriginal and Torres Strait Islander lands. We pay respect to the world's oldest continuing culture and First Nations peoples' deep and continuing connection to Country; and hope that our work can benefit both people and Country.

'Journey of unity: AEMO's Reconciliation Path' by Lani Balzan

AEMO Group is proud to have launched its first Reconciliation Action Plan in May 2024. 'Journey of unity: AEMO's Reconciliation Path' was created by Wiradjuri artist Lani Balzan to visually narrate our ongoing journey towards reconciliation - a collaborative endeavour that honours First Nations cultures, fosters mutual understanding, and paves the way for a brighter, more inclusive future.

Important notice

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Current version release details

Version	Effective date	Summary of changes
1.0	8 June 2025	First issue. Document reflects the National Electricity Amendment (Primary frequency response incentive arrangements) Rule 2022 No.8

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

1 Introduction

1.1 Purpose of this document

This document provides a broad explanation of payment and recovery for frequency control ancillary service(s) (FCAS) in the National Electricity Market (NEM), and explains how costs are calculated for *constraints* to enable AEMO's Settlements processes to allocate cost recovery for contingency and *regulation services*. This explanation is provided in a non-technical manner and is aimed at readers who have had little or no previous exposure to FCAS cost recovery.

Readers can also refer to AEMO's Settlements guide[1] for more details on how these costs are allocated to *Cost Recovery Market Participants* (CRMPs).

1.2 Key terms

Table 1 lists the different values that are used in the process, to determine and allocate both Frequency Performance Payments (FPP) and regulation FCAS recovery. To make this document as helpful as possible, the definitions below are more descriptive than those provided in the Glossary of the National Electricity Rules (NER).

In this document, AEMO aims to identify terms defined in the NER by italicising them, but failure to italicise a defined term does not affect its meaning.

Table 1 Key terms and elements of the FPP calculations and dispatch

Term	Definition
AEMO	Australian Energy Market Operator
AEMC	Australian Energy Market Commission
ACE	*Adjusted consumed energy*
Adjusted cost	Formerly known as the adjusted Requirement Payment, the adjusted cost (also known as TSFCAS in the NER) calculated for each constraint and service after accounting for regulation and contingency split. If no cost splitting occurs, adjusted cost is equal to base cost.
APC	*Administered price cap* – a price cap to apply to a regional reference price or *ancillary service* price as specified in NER 3.14.1
ASOE	*Adjusted sent out energy*
Base cost	Formerly known as Requirement Payment, the cost calculated for each *constraint* by looking at price adjustments
Constraint equation	The mathematical representation that AEMO uses to manage power system limitations and FCAS requirements in the NEM dispatch engine (NEMDE)
Contingency FCAS	*Very fast* (1 Second) *raise and lower services, fast* (6 Seconds) *raise and lower services*, *slow* (60 Seconds) *raise and lower services* and *delayed* (5 Minute) *raise and lower services*
Contribution Factor	The factor that represents the fraction of regulation FCAS costs for which a particular *Market Participant* is liable

[1] Available at https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/data-nem/ancillary-services-data/ancillary-services-payments-and-recovery

Term	Definition
CRMP	*Cost Recovery Market Participant*
5 Minute contingency services	*Contingency frequency control services* required to return the frequency to the normal operating band within five minutes of a contingency, also referred to as *delayed service*
FCAS	frequency control ancillary service/s
FPP	Frequency Performance Payments
LHS	Left Hand Side of a *constraint* equation. This consists of the variables that can be optimised by NEMDE. These terms include *scheduled* or *semi-scheduled generators*, *scheduled loads*, *ancillary service units, wholesale demand response units*, *scheduled bidirectional units*, *regulated interconnectors*, *Market Network Service Providers* or *regional FCAS enablement.*
Mainland	All regions of the NEM except Tasmania
Marginal value	Marginal cost of the constraint equation calculated by NEMDE. E.g. If there was a change in the FCAS constraint equation Right Hand Side (RHS) by 1 megawatt (MW), the marginal value (MV) represents the change in the total dispatch cost in the NEM.
MII	Manifestly Incorrect Input
MPC	*market price cap*
MPF	Market Participant Factor (contribution factor) for a Market Participant with appropriate metering (NER clause 3.15.6A(i)(1))
MSPS	*Market suspension pricing schedule* as specified in NER 3.14.5(e)(1)
MV	marginal value
MW	megawatt/s
NEM	National Electricity Market
NEMDE	National Electricity Market dispatch engine
NER	National Electricity Rules
OCD	Over Constrained Dispatch
P_Regulation	The marginal price of meeting the *global market ancillary service requirement* or *local market ancillary service requirement* for the *regulating raise service* or *regulating lower service* in that *trading interval*. Calculated in $ per MW per hour (NER 3.15.6AA(b)(1))
PFR	Primary Frequency Response
PFRR	*Primary Frequency Response Requirement*
Regulation FCAS	*Regulating lower service* and *regulating raise service* (the same meaning as *regulation services* in the NER)
Requirement Payment	*Constraint* cost of a contingency or regulation *constraint*, also known as ReqPayment
RHS	Right Hand Side of a *constraint* equation. The RHS is pre-calculated and presented to the solver as a constant; these terms cannot be optimised by NEMDE.
RRP	*regional reference price*
TI	*trading interval*

2 FCAS payment and recovery

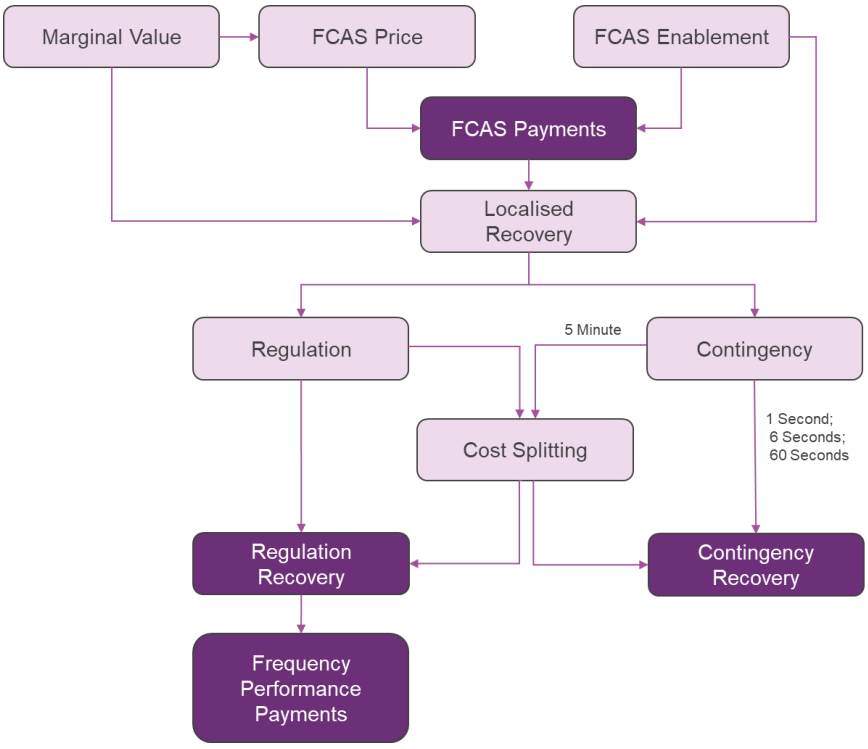
2.1 Introduction to FCAS payment and recovery

There are 10 FCAS markets in the NEM, eight contingency markets and two *regulation* markets. For each *trading interval*, AEMO makes payments to *Market Participants* that are enabled for their services within the *region*. These FCAS payments are then recovered from the relevant *Cost Recovery Market Participants*, based on the cost of the binding *constraint*[2] for the service used to meet *the market ancillary service requirement* for each *trading interval*[3].

These requirements can either be global or local. *Global market ancillary service requirements* ensure system-wide frequency stability across the entire NEM and may be sourced from any region within the NEM, while *local market ancillary service requirements* are required in abnormal circumstances where only local *Market Participants* can provide the FCAS. This is often, but not limited to, when a region becomes 'islanded' due to planned and/or forced outages of transmission elements or when there are specific local requirements.

Figure 1 illustrates the overall workflow of FCAS payment and recovery, which is detailed in this guide.

Figure 1 Flowchart of FCAS payment and recovery



[2] For FCAS *constraint* equations, binding indicates the *constraint* equation is setting the FCAS requirement for the service indicated for *regions* on the LHS.

[3] AEMO uses *constraint* equations to procure FCAS to ensure that when an event occurs on the power system, frequency is maintained within the frequency operating standards (FOS) as specified by the Reliability Panel. FCAS *constraint* equations specify the total FCAS enablement to be *dispatched* for each FCAS for one *region* or a group of *regions*. For more information on *constraint* formulation, refer to the latest Constraints Formulation Guidelines, at https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/congestion-information-resource.

2.1.1 FCAS payment

AEMO's NEM dispatch engine (NEMDE) determines a clearing price for each FCAS service in each *region* for each *trading interval*. This price is then used to determine the payments to relevant providers that was enabled for FCAS within a *region*[4]. The total of all these payments in a *region* is referred to as Regional Payment.

The formula to calculate Regional Payment is calculated for each service and region as follows:

$$Regional\ Payment\ =\ FCAS\ Price\ \times {}^{Regional\ Enablement}/_{nIntervals}$$

where:

- regional enablement (megawatts (MW)) = enablement amount for the service in the *region*. If there is an *AEMO intervention event*, enablement amount will be derived from the physical intervention run[5].
- FCAS price ($/megawatt hour (MWh)) = FCAS price for the service in the *region*. This value is calculated in NEMDE and the method of calculation is as specified in the NER (i.e. Regional FCAS price = Sum of marginal values of FCAS *constraints* encompassing that *region* and service). For example, the *regulation service* price will include the marginal value of 5 Minute requirement *constraints* encompassing the *regulation service* term of the same region on the Left Hand Side (LHS). If there is an *AEMO intervention event*, FCAS prices will be derived from the pricing run[6].
- nIntervals = number of intervals per hour (12 for *dispatch* and 2 for *pre-dispatch*).

For an example of a regional payment calculation in a standard case where both FCAS price and enablement are derived from the same run number and intervention run, refer to Appendix A1.2.1. For an edge case scenario where FCAS prices and enablement are derived from different run numbers and intervention runs, refer to Appendix A1.3.1.

2.1.2 FCAS recovery

The cost recovery processes for contingency and *regulation services* follow distinct methodologies. For contingency services, costs for raise services are recovered from CRMPs based on *adjusted sent out energy* (ASOE) while costs for lower services are recovered from *adjusted consumed energy* (ACE). In contrast, the cost of *regulation services* is recovered through the FPP process[7].

Despite these distinct differences, both processes use a localised recovery mechanism. This approach apportions FCAS costs to specific regions based on *constraint* outcomes, ensuring that costs associated with either global or local FCAS requirements are allocated accordingly per *trading interval*.

[4] For more detail on settlements *trading amount* calculation to FCAS providers, please refer to AEMO's Settlements guide, available at https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/data-nem/ancillary-services-data/ancillary-services-payments-and-recovery

[5] Also known as the dispatch or outturn run.

[6] Also known as the what-if run.

[7] FPP regulation cost recovery process was introduced under the AEMC's Primary frequency response (PFR) incentive arrangement rule change (see https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements) and is effective from 8 June 2025. Previously, recovery of payments for *regulation services* was based on the 'causer pays' methodology.

The recovery mechanism for contingency and regulation FCAS based on *constraint* outcomes is detailed in the following sections. For information on allocation of costs to CRMPs, refer to AEMO's settlement guide[8].

To determine regional recovery for regulation and contingency FCAS, total payments for each service in a *region* (as calculated in Section 2.1.1) must be pro-rated over the *constraint* requirements for that service that encompass that *region*[9]. These amounts, also known as the regional Base cost[10], are calculated on a *trading interval* basis and allocated based on the marginal value of each requirement *constraint*.

The formula to calculate regional Base cost for each service and *region* is as follows:

$$Regional\ Base\ cost = Regional\ Payment \times \frac{Requirement\ Marginal\ Value}{\sum_{region} Requirement\ Marginal\ Value}$$

When determining the appropriate marginal value (MV) to use for the calculation:

- A *constraint*'s MV should come from the physical run[11] instead of the pricing run[12], this reflects the intention of FCAS requirements in accordance with the NER. Refer to Appendix A1.1 to determine the appropriate run for extracting MV values, which includes a variety of scenarios.
- Capping is applied when the MV of a *constraint* is greater than *market price cap* (MPC). While the capped values are used for calculation, raw MVs will be stored as raw values within the data model (Section 2.4)
- In the rare occurrence where the MV of a *constraint* is negative (typically derived from <= *constraints*), it will be floored to zero for calculation purposes. This is consistent with the capping applied when MVs are greater than MPC. Similarly, while the floored values are used for calculation, negative MVs will be stored as raw values within the data model (Section 2.4).

Once the regional Base cost for each service and *region* is determined, costs are then aggregated for each requirement across all *regions* that are included in that requirement *constraint*. These costs, calculated per *constraint*, are also known as Base cost[13]:

$$Base\ cost = \sum_{\substack{Regions\ included \\ in\ requirement \\ constraint}} Regional\ Base\ cost$$

Contingency FCAS cost recovery

Contingency FCAS costs (as calculated in Section 2.1.1) are recovered per *trading interval*, where costs of each requirement for each contingency service are allocated to the regions included in the requirement, pro-rated as follows:

[8] Available at https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/data-nem/ancillary-services-data/ancillary-services-payments-and-recovery

[9] FCAS *constraint* requirement can include individual *regions*, mainland NEM or global (all NEM *regions*).

[10] Formerly known as the ReqPaymentAllocation.

[11] *Constraints* are imposed in dispatch to determine the quantity of *market ancillary service requirements* (NER 3.8.11(a1)). These FCAS requirements then set *dispatch* targets in the central *dispatch* run, which is known as the 'physical run'.

[12] Refers to the *central dispatch* run used to set prices during an *AEMO intervention event*. Also known as the "what-if" run.

[13] Formerly known as ReqPayment.

- lower contingency service costs are recovered from CRMPs with ACE values only, in the relevant requirement *region*(s);
- raise contingency service costs are recovered from CRMPs with ASOE values only, in the relevant requirement *region*(s).

Regulation FCAS cost recovery

The cost of *regulation services* are recovered per *trading interval* based on the FPP process, which is a double-sided system of incentive payments and penalties based on units' impact on *system frequency*. The FPP process, which is effective from 8 June 2025, replaces the previous 'causer pays' methodology for the allocation of regulation FCAS costs.

Regulation FCAS recovery calculations recover the cost of meeting the binding regulation FCAS *constraints* using five-minute contribution factors (a number between -1 and 1)[14]. Used and unused regulation FCAS costs will be recovered separately for both eligible units and residual deviation, with contribution factors being calculated for both:

- the cost for *regulation services* used in a *trading interval* will be allocated based on negative contribution factors (NCF) determined for the *trading interval* (NER 3.15.6AA(c)(1));
- the costs for *regulation services* not used in a *trading interval* will be allocated based on default contribution factors (DCF), which are intended to reflect the longer-term historical performance of a facility (NER 3.15.6AA(d)(1)).

The costs for *regulation services* used and unused in a *trading interval* are also calculated and allocated for eligible units that do not have appropriate metering (residual[15]).

In cases where additional *regulation service* is enabled to meet 5 Minute contingency service requirements, the Base cost of each 5 Minute contingency service *constraint* is split into the cost to be recovered through both regulation and 5 Minute contingency service recovery mechanisms. This is known as cost splitting and is discussed in Section 2.2. However, if additional *regulation services* are procured to meet contingency requirements and this leads to a zero marginal value for the regulation *constraint*, all costs are assigned to the 5 Minute contingency service, with none allocated to the non-binding *regulation service*.

[14] A negative contribution factor reflects the extent to which the unit contributed to the system frequency in an unhelpful manner, while a positive contribution factor reflects the extent to which the unit contributed to the *system frequency* control in a helpful manner. Participants that have a helpful impact on *system frequency* will receive payments, while those that have an unhelpful impact will pay penalties.

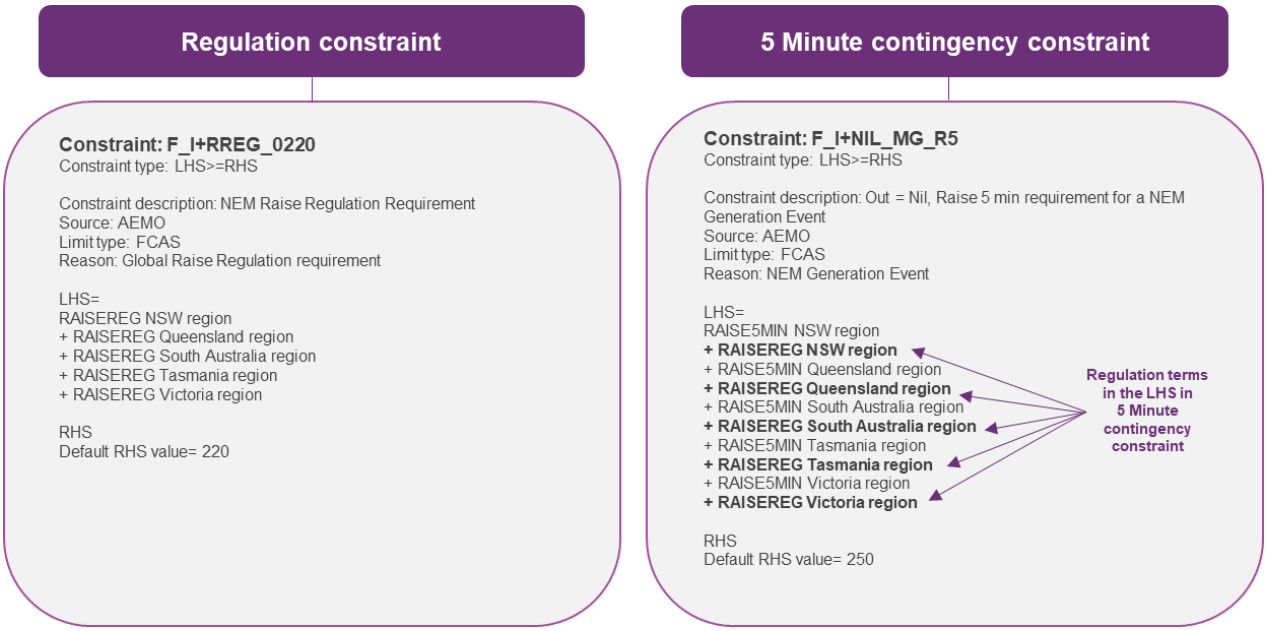
[15] Residual refers to all facilities connected to the grid without appropriate real-time telemetry (4-second SCADA measurements), including small consumers and distributed resources. Due to SCADA data not being available for these facilities to calculate their performance, a different approach is required. For more information, see Section 5.3.3 of the FPP factor calculation guide, at https://aemo.com.au/-/media/files/initiatives/frequency-performance-payments-project/aemo-nem-fpp-factor-calculation-guide.pdf?la=en.

2.2 FCAS recovery for cost splitting

2.2.1 Regulation and 5 Minute contingency FCAS co-optimisation

Regulation services (raise and lower) in the NEM can be used to deliver 5 Minute contingency response. As such, AEMO co-optimises the dispatch of these two services by including the regional regulation FCAS terms in the LHS of *constraint* formulation for 5 Minute contingency services[16] (Figure 2).

Figure 2 Example FCAS raise regulation and raise 5 Minute contingency *constraint* formulation



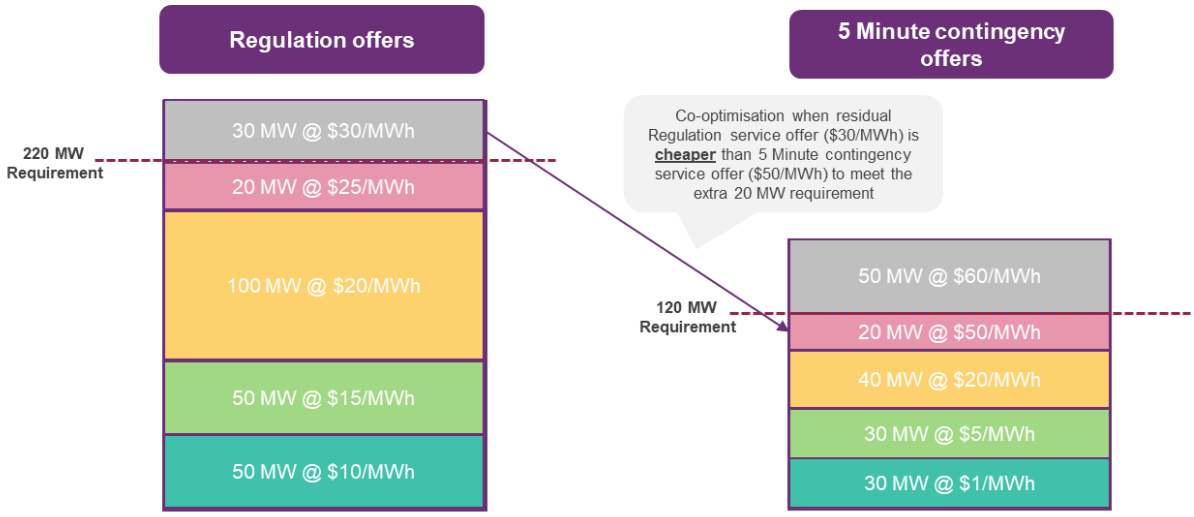
Co-optimisation between regulation and 5 Minute contingency services can occur either when:

- the residual regulation service offer is cheaper than the 5 Minute contingency service offer (Figure 3); or
- if there is insufficient supply of 5 Minute contingency service offer (Figure 4).

While *regulation services* can be used to deliver 5 Minute contingency response, the converse is not true (i.e. 5 Minute contingency services cannot be used to deliver *regulation services*). Therefore, regulation FCAS prices in all cases will always be greater than or equal to the price of 5 Minute contingency services in the same region. This reflects the inherently higher price of *regulation services*, as they can substitute for 5 Minute contingency services, whereas the reverse is not possible.

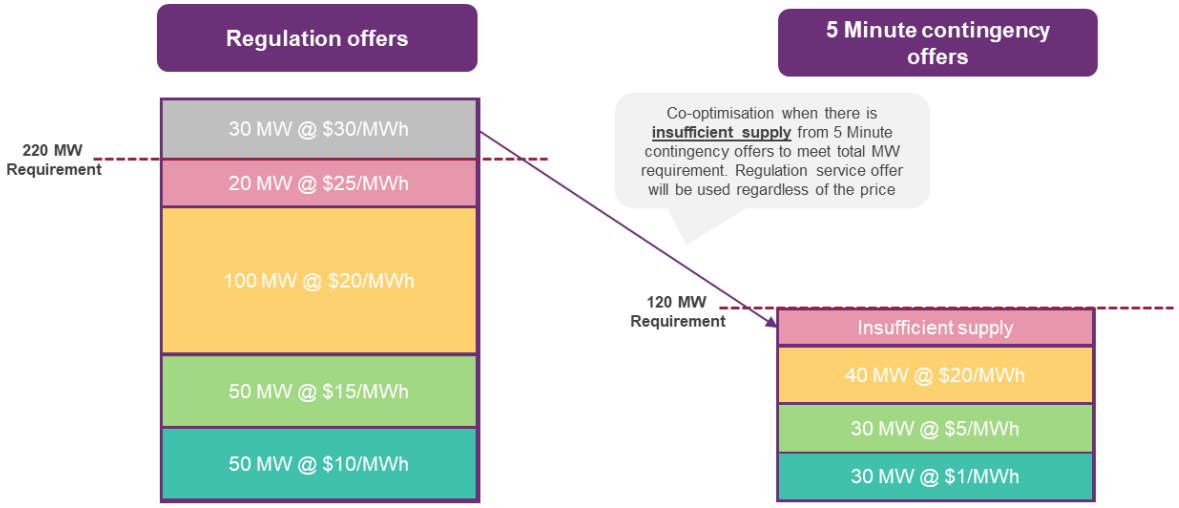
[16] See Section 5.4 of AEMO's Constraint Formulation Guideline, at https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2022/cfg-and-scvpf/final/constraint-formulation-guidelines-v12---final_.pdf?la=en.

Figure 3 Co-optimisation: residual regulation offers cheaper than 5 Minute contingency service



Note that diagram is not true to scale

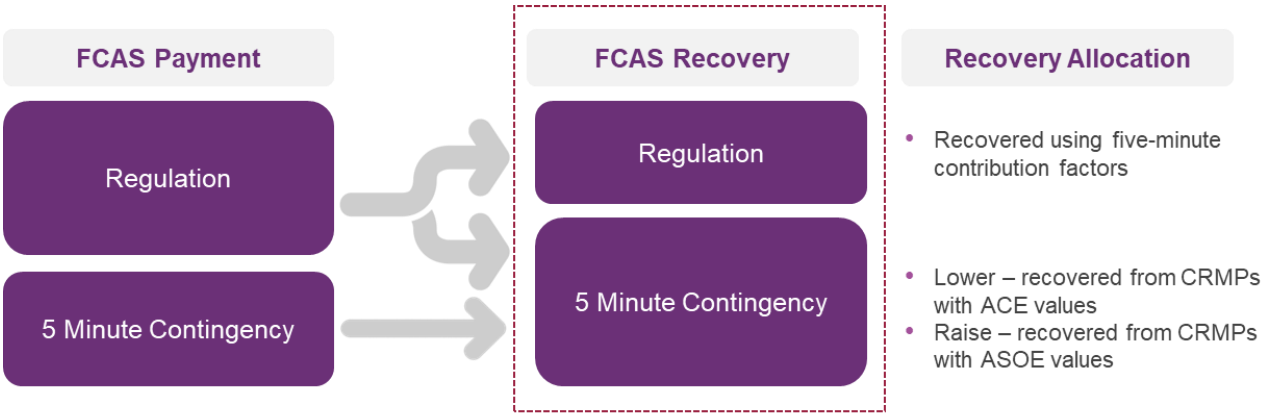
Figure 4 Co-optimisation: insufficient supply of 5 Minute contingency service offers



Note that diagram is not true to scale

While total payments will always be equal to total recovery, co-optimisation between regulation and 5 Minute contingency services requires that a portion of payments for *regulation service* to be recovered from 5 Minute contingency services. Recovery from contingency services is allocated to CRMPs' ACE or ASOE values, depending on whether it pertains to *raise* or *lower services* (Figure 5). Section 2.2.2 details the calculations used to allocate the costs between these two services.

Figure 5 FCAS payments and recovery for regulation and 5 Minute contingency services



2.2.2 Cost splitting between regulation and 5 Minute contingency FCAS recovery

When co-optimisation occurs between regulation and 5 Minute contingency services, AEMO implements a mechanism to allocate the *constraint* costs (Base cost as discussed in Section 2.1.2) arising from the co-optimised dispatch of both services. This recovery cost split is also known as the Adjusted cost.

Constraint grouping

Before calculating the Adjusted cost, any binding 5 Minute *constraint* (MV<>0) for each trading interval (TI) needs to be grouped with the respective regulation *constraint* to carry out the cost split. The regulation *constraint* must:

(a) be non-binding (MV=0 and LHS>Right Hand Side (RHS)[17]) which indicates excess regulation is used;

(b) have the same *region(s)* in the LHS as the 5 Minute *constraint regions*; and

(c) have the largest (most restrictive) RHS out of other *constraints* that satisfy a) and b).
When determining criteria c), non-regional terms will need to be accounted for in FCAS requirement calculation. LHS terms in FCAS *constraints* can include other non-regional terms such as interconnectors or specific units (hereafter referred to as 'other terms').

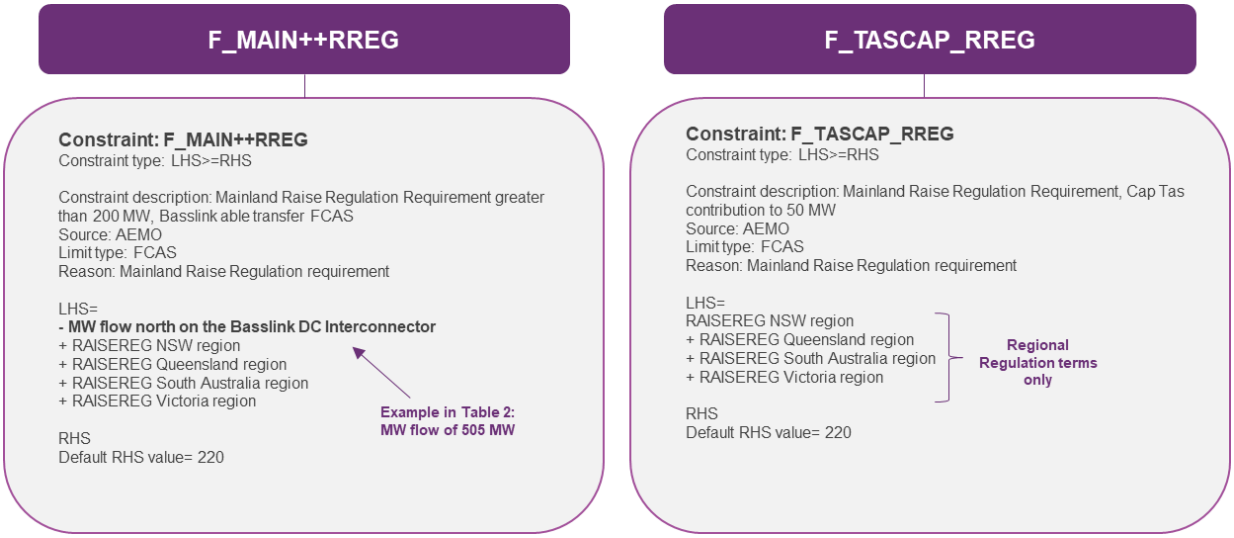
For interconnectors, this occurs most commonly with Basslink interconnector when its flows are co-optimised with mainland local requirements. In such instances, Basslink would be included in the LHS term of the *constraint* when used to transfer FCAS. To calculate the FCAS requirement, the RHS value will be corrected by first removing the impact of other LHS terms, such as interconnectors, unit *energy dispatch* or unit FCAS enablement. Where the actual calculated LHS and RHS terms remain negative, values will be floored to zero for the calculation. In the context of the data model, the original LHS and RHS (which may include negative values) will continue to be stored as their raw values.

[17] To address the interaction between local and global FCAS requirement *constraints* (where regulation *constraints* may inadvertently appear as non-binding when assessed independently), the methodology defines a regulation *constraint* as binding when LHS=RHS. This supports the logic that no additional regulation is enabled to satisfy the respective 5 Minute *constraint* when LHS is equal to RHS.

Example: *Constraint* grouping using most restrictive RHS value

Below is an example of a *constraint* grouping for a Mainland Raise 5 Minute *constraint* (F_MAIN++R5). Consider the following two non-binding Mainland Raise regulation *constraints* (F_MAIN++RREG and F_TASCAP_RREG) in the *constraint* group, and their respective LHS and RHS values (Figure 6).

Figure 6 Identifying interconnector terms in LHS of Regulation *constraint*



Before determining the correct Raise regulation *constraint* to group with, other terms (if any) will need to be accounted for. As shown in the below example (Table 2), other terms such as Basslink MW flow is added to the original LHS and RHS values for F_MAIN++RREG to determine the actual LHS and RHS. In this example, the Raise 5 Minute *constraint* will group with F_MAIN++RREG *constraint* instead of F_TASCAP_RREG as it has the most restrictive RHS value (235 MW) once Basslink transfers are accounted for.

Table 2 Calculated actual RHS becomes the most restrictive *constraint*

Regulation constraint	LHS (Original)	RHS (Original)	LHS (Actual)	RHS (Actual)	Most restrictive actual RHS
F_MAIN++RREG	-335	-270	170*	235*	✓
F_TASCAP_RREG	170	170	170	170	

Note: MW flow on Basslink interconnector is 505 MW (See Figure 6)
* To calculate actual LHS and RHS, add Basslink MW flow to original LHS and RHS values

In contrast, Table 3 shows an example where the Raise 5 Minute *constraint* will group with F_TASCAP_RREG *constraint* instead of F_MAIN++RREG as it has the most restrictive RHS value (170 MW) once Basslink transfers are accounted for in F_MAIN++RREG *constraint*.

Table 3 Calculated actual RHS becomes the least restrictive *constraint*

Regulation constraint	LHS (Original)	RHS (Original)	LHS (Actual)	RHS (Actual)	Most restrictive actual RHS
F_MAIN++RREG	335	270	170	105	
F_TASCAP_RREG	170	170	170*	170*	✓

Note: MW flow on Basslink interconnector is -165 MW.
* To calculate actual LHS and RHS, add Basslink MW flow to original LHS and RHS values

Adjusted cost

Once the regulation *constrain*t related to cost splitting is identified, Adjusted cost must be calculated to allocate the Base cost split for the regulation and 5 Minute contingency service recovery mechanism.

The Adjusted cost to be recovered for each 5 Minute contingency *constraint* through the *regulation service* recovery mechanism is calculated as follows on a *constraint* and service level:

$$Adjusted\ cost_r = Base\ cost_c \times [\frac{REG\_Calculated\_MW}{(REG\_Calculated\_MW + 5Min\_Calculated\_MW)}]$$

where:

- $Base\ cost_c$ = the *constraint* cost of a contingency *constraint* c
- REG_Calculated_MW = Constraint_Enablement (REG) – Extra_Regulation_MW[18]
- 5Min_Calculated_MW = Constraint_Enablement (5Min) + Extra_Regulation_MW

while the Adjusted cost to be recovered through the 5 Minute contingency service recovery mechanism is the difference between $Base\ cost_c$ and $Adjusted\ cost_r$, calculated as follows:

$$Adjusted\ cost_c = Base\ cost_c - Adjusted\ cost_r$$

Adjusted cost[19] of a *constraint* is used downstream in Settlements applications for cost recovery allocation to CRMP. Where there is no cost splitting, Base cost of a *constraint* in a *trading interval* is simply equal to Adjusted cost.

2.3 Introduction to frequency performance payments

The Mandatory Primary Frequency Response (PFR) rule introduced in 2020[20] requires all *scheduled* and *semi-scheduled generators* in the NEM to support the secure operation of the *power system* by responding automatically to small changes in *power system frequency*. A key aspect of this rule is that all *scheduled* and *semi-scheduled generators*, who have received a *dispatch instruction* to generate a volume greater than 0 MW, must operate their plant in accordance with the performance parameters set out in the *Primary Frequency Response Requirements* (PFRR)[21] as applicable to that plant.

Following this rule change, the AEMC published its final determination in September 2022 that mandatory PFR will continue beyond the initial sunset clause of June 2023, along with the introduction of a new double-sided FPP incentive payment for this service effective from 8 June 2025.

The new FPP incentive arrangements are intended to provide clear economic signals to participants about the value of good *frequency performance* (and the cost of poor performance). To value *frequency performance* and allocate amounts to individual generating units, AEMO will calculate contribution factors every five minutes. By

[18] Extra Regulation = total Regulation enablement – max(RHS Regulation requirement), where RHS Regulation requirement refers to the RHS value of the grouped non-binding Regulation constraint and this accounts for other terms.

[19] Also known as TSFCAS in the NER, this means each amount calculated by AEMO under NER 3.15.6A(h)(2) for the *regulating raise service* or the *regulating lower service* in respect of a *trading interval*.

[20] See https://www.aemc.gov.au/rule-changes/mandatory-primary-frequency-response.

[21] See https://aemo.com.au/initiatives/major-programs/nem-reform-program/nem-reform-program-initiatives/primary-frequency-response.

providing these outcomes to participants immediately, facility operators will have the opportunity to understand their *frequency performance* and potentially vary their behaviour in response to penalties and incentives.

2.3.1 Calculating frequency performance payment

All generation and load are exposed to PFR arrangements, with the specific application depending on whether a unit has appropriate metering, which allows for individual contributions to the deviation in the *frequency* of the *power system* to be assessed.

In accordance with NER 3.15.6AA(b)(1), for each eligible unit with appropriate metering, the calculation of *trading amount* for payment and recovery is as follows:

$$TA = CF \times \frac{P_{regulation}}{12} \times RCR$$

while *trading amount* calculation for an eligible unit which does not have appropriate metering is as follows:

$$TA = RCF \times \frac{P_{regulation}}{12} \times RCR \times \frac{TE}{ATE}$$

where:

- TA = the *trading amount* payable or receivable (in $) by the CRMP
- CF = the contribution factor (a number between -1 and 1) for the eligible unit determined by AEMO for the relevant *trading interval* and relevant to the *global market ancillary service requirement* or *local market ancillary service requirement* for *regulating raise service* or *regulating lower service.* A value between -1 and 1, where negative values show a unit's unhelpful frequency performance and positive values reflect a unit's helpful performance in frequency control.
- RCF = the residual contribution factor (a number between -1 and 1) for eligible units that do not have appropriate metering, for the relevant *trading interval* and relevant to the *global market ancillary service requirement* or *local market ancillary service requirement* for the *regulating raise service* or *regulating lower service*
- RCR = the requirement (MW) for corrective response determined by AEMO
- TE = the absolute value of ASOE + the absolute value of ACE before they are summed, for the CRMP for an eligible unit that does not have appropriate metering, for the *trading interval* in the *region* or *regions* relevant to the *global market ancillary service requirement* or *local market ancillary service requirement* for the *regulating raise service* or *regulating lower service*
- ATE = the aggregate of the absolute value of any *adjusted gross energy* amounts for all CRMP, for eligible units that do not have appropriate metering, for the *trading interval* for that *region* or *regions* relevant to the *global market ancillary service requirement* or *local market ancillary service requirement* for the *regulating raise service* or *regulating lower service.*

This guide will focus solely on the calculation of P_Regulation, while other components of the *trading amount* calculation (CF, RCR, TE and ATE) will be covered in the FPP Factor Calculation Guide[22] and Settlements guide[23]. The next section will provide a more detailed discussion of P_Regulation.

2.3.2 P_Regulation

P_Regulation, also referred to as adjusted marginal value, is a calculated value for regulation FCAS services that has been introduced by the FPP reform used in the calculation of FPP *trading amounts* for PFR. As defined in the NER, P_Regulation is the marginal price of meeting the *global market ancillary service requirement* for the *regulating raise service* or *regulating lower service* in a trading interval[24]. P_Regulation is calculated and stored in the Data Model and is ingested by both the FPP and Settlements applications.

The purpose of P_Regulation calculation is to ensure that marginal value (marginal cost of a *constraint*) accurately reflects price changes for cost recovery purposes. When there is no ex-post price change, the value of P_Regulation is equal to the marginal value. However, P_Regulation value will differ to marginal value when an ex-post price change event of price adjustment occurs.

P_Regulation is calculated per *constraint*, for *regulation services*. This can be for both regulation FCAS *constraints* and 5 Minute FCAS *constraints* (that have Regulation terms on the LHS). For all other FCAS services, P_Regulation will be zero. The respective P_Regulation formulas are illustrated in Table 4.

Table 4 P_Regulation formula

P_Regulation formula	
Regulation service	$Regulation = \frac{Base\ Cost}{\sum Regulation\ Enabled} \times nIntervals$
5 Minute contingency service	$5\ Minute = \frac{Base\ Cost}{\sum(Regulation\ Enabled + 5\ Minute\ Enabled)} \times nIntervals$

where:
- Base cost is the cost calculated for each *constraint*.
- nIntervals represents the number of intervals in an hour. For *Dispatch*, this would be 12. For *Pre-Dispatch*, this would be 2.

The examples below illustrate how P_Regulation is calculated in practice for a case with no ex-post price change and one with an ex-post price change.

P_Regulation example – no ex-post price change

Assume the values in Table 5 for the Tasmanian regulation and Raise 5 Minute *constraints*.

[22] Available at https://aemo.com.au/-/media/files/initiatives/frequency-performance-payments-project/aemo-nem-fpp-factor-calculation-guide.pdf?la=en.

[23] Available at https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/data-nem/ancillary-services-data/ancillary-services-payments-and-recovery

[24] P_Regulation is not calculated for contingency *constraints*, except for 5 Minute contingency *constraints* with cost splitting.

Table 5 No ex-post price change assumed values

ConstraintID	Region	Bidtype	MV	RRP	Enablement	Regional payment	Regional base cost	Base cost
F_T_RREG	Tasmania	Raise Regulation	3	5	50	20.83	12.5	12.5
F_T_R5	Tasmania	Raise 5 Minute	2	2	20	3.33	3.33	11.67
		Raise Regulation	2	5	50	20.83	8.33	

where:

Regional payment	Calculated by *constraint* and service: • Regional payment (F_T_RREG) = 5*(50/12) = 20.83 • Regional payment (F_T_R5 - R5MIN) = 2*(20/12) = 3.33 • Regional payment (F_T_R5 - RREG) = 5*(50/12) = 20.83
Regional Base cost	Calculated by *constraint* and service: • Regional Base cost (F_T_RREG) = (20.83*3)/(3+2) = 12.5 • Regional Base cost (F_T_R5 - R5MIN) = ((3.33*2)/2) = 3.33 • Regional Base cost (F_T_R5 - RREG) = ((20.83*2)/(3+2)) = 8.33
Base cost	Calculated on a *constraint* level: • Base cost (F_T_RREG) = 12.5 • Base cost (F_T_R5) = 3.33+8.33 = 11.67

As shown in Table 6 below, the calculated value of P_Regulation is equal to the MV of the constraint when there is no ex-post price change.

Table 6 P_Regulation calculation: no-ex post price change

P_Regulation calculation	
Regulation service	$P\_Regulation\ (Regulation) = \frac{12.5}{50} \times 12 = \mathbf{3}$
5 Minute contingency service	$P\_Regulation\ (5\ Minute) = \frac{11.67}{(50+20)} \times 12 = \mathbf{2}$

P_Regulation example – ex-post price change

Consider (as in Table 7) the same *constraints* as the above example, with the exception of a change in *regulation service* price from $5/MWh to $9/MWh due to an ex-post price change.

Table 7 Ex-post price change assumed values

ConstraintID	Region	Bidtype	MV	RRP	Enablement	Regional payment	Regional Base cost	Base cost
F_T_RREG	Tasmania	Raise Regulation	3	**9**	50	37.50	22.5	22.5
F_T_R5	Tasmania	Raise 5 Minute	2	2	20	3.33	3.33	18.33
		Raise Regulation	2	**9**	50	37.50	15	

where:

Regional payment	Calculated by *constraint* and service: • Regional payment (F_T_RREG) = 9*(50/12) = 37.5 • Regional payment (F_T_R5 - R5MIN) = 2*(20/12) = 3.33 • Regional payment (F_T_R5 - RREG) = 9*(50/12) = 37.5
Regional Base cost	Calculated by *constraint* and service: • Regional Base cost (F_T_RREG) = (37.5*3)/(3+2) = 22.5 • Regional Base cost (F_T_R5- R5MIN) = ((3.33*2)/2) = 3.33 • Regional Base cost (F_T_R5- RREG) = ((37.53*2)/(3+2)) = 15
Base cost	Calculated on a *constraint* level: • Base Cost (F_T_RREG) = 22.5 • Base Cost (F_T_R5) = 3.33+15 = 18.33

As shown in Table 8 below, the MV of the constraint remains the same from the physical run, however the P_Regulation (adjusted MV) now differs from the MV. Due to co-optimisation, a change in regulation price also impacts 5 Minute *constraint* costs.

Table 8 P_Regulation calculation: ex-post price change

	P_Regulation calculation
Regulation service	$P\_Regulation\ (Regulation) = \frac{22.5}{50} \times 12 = \mathbf{5.4}$
5 Minute contingency service	$P\_Regulation\ (5\ Minute) = \frac{18.33}{(50+20)} \times 12 = \mathbf{3.142}$

2.4 Data model

This section provides an overview of the relevant tables in AEMO's Market Management System (MMS) Data Model that are applicable to this guide[25]. Tables are available for dispatch, P5Min and Pre-dispatch (PD). For more information, see AEMO's MMS Data Model[26].

Table 9 FPP related tables

Table	Table names	Description
Run table	• DISPATCH_FCAS_REQ_RUN • P5MIN_FCAS_REQ_RUN • PD_FCAS_REQ_RUN	These tables store the run date and time of the case that triggers the processor run as well as the run number and the last time the processor was executed for the case run time. Note that the run number from this table is not used by the processor for calculations. MV, enablement, and price data are independent of the REQ_RUN number.
Constraint requirement table	• DISPATCH_FCAS_REQ_CONSTRAINT • P5MIN_FCAS_REQ_CONSTRAINT • PD_FCAS_REQ_CONSTRAINT	These tables store constraint level FCAS cost or price data for each run that will be ingested by both the FPP and Settlements applications. The tables will replace the FCAS_REQUIREMENT tables relevant for the causer pays framework that will be decommissioned.

[25] As part of the FPP reform, several updates have been implemented, including the introduction of new tables to support reform requirements and modifications to existing tables to improve data transparency and accessibility. The Data Model 5.4 was updated alongside the FPP non-financial go-live in December 2024, while Data Model 5.5 is effective April 2025 for FPP's financial go-live in June 2025.

[26] At https://visualisations.aemo.com.au/aemo/di-help/Content/Data_Model/MMS_Data_Model.htm?tocpath=_____15.

A1. Appendix

A1.1 Run number & intervention run selection

Figure 7 illustrates various scenarios that may result in multiple dispatch runs (runno) and intervention runs (intervention). It identifies the appropriate run from which to extract values for marginal value, FCAS price and enablement when calculating FCAS payments and recovery.

Figure 7 Runno and intervention run selection for MV, FCAS price and enablement values

		Runno	Intervention
OCD Rerun	MV	1	0
	Price	Max Runno	0
	Enablement	1	0
MII (accepted or rejected*)	MV	1	0
	Price	Max Runno	0
	Enablement	1	0
Intervention	MV	1	1
	Price	Max Runno	0
	Enablement	1	1
OCD Rerun & Intervention	MV	1	1
	Price	Max Runno	0
	Enablement	1	1
Manual suspension or Manual OCD Rerun	MV	1	0
	Price	Max Runno	0
	Enablement	1	0

A1.2 Cost recovery example – no cost splitting and no ex-post price change

This section outlines the steps to calculate cost recovery for Raise regulation and 5 Minute contingency services during a TI without cost splitting for the Raise 5 Minute contingency service. Consider a typical *trading interval* with only one dispatch run and no intervention. Table 10 lists all the binding Raise services *constraints* in this TI, along with their respective MVs.

Table 10 List of binding Raise regulation and Raise 5 Minute contingency services *constraints*

Run Datetime	RUNNO	Intervention	ConstraintID	LHS	RHS	MV
08/06/2025 00:05	1	0	F_I_R5	515.22	515.22	0.26
08/06/2025 00:05	1	0	F_T+RREG	50	50	83.17
08/06/2025 00:05	1	0	F_TASCAP_RREG	170	170	98.55

A1.2.1 FCAS payment calculation

As discussed in Section 2.1.1, regional FCAS payment requires FCAS prices to be derived from the pricing run, while regional enablement amounts must be obtained from the physical intervention run. Since this example involves a single dispatch run with no intervention, both FCAS price and regional enablement will be derived from runno=1 and intervention=0 (Table 11 and Table 12).

Table 11 FCAS prices

Run Datetime	Runno	Intervention	Region	RAISEREGRRP	RAISE5MINRRP
08/06/2025 00:05	1	0	NSW1	98.81	0.26
08/06/2025 00:05	1	0	QLD1	98.81	0.26
08/06/2025 00:05	1	0	SA1	98.81	0.26
08/06/2025 00:05	1	0	TAS1	83.43	0.26
08/06/2025 00:05	1	0	VIC1	98.81	0.26

Table 12 Regional FCAS enablement

Run Datetime	Runno	Intervention	Region	RAISEREG	RAISE5MIN
08/06/2025 00:05	1	0	NSW1	50.00	104.00
08/06/2025 00:05	1	0	QLD1	60.00	64.00
08/06/2025 00:05	1	0	SA1	0.00	36.00
08/06/2025 00:05	1	0	TAS1	50.00	5.00
08/06/2025 00:05	1	0	VIC1	60.00	86.22

Regional payment calculation for Raise regulation and 5 Minute contingency services using FCAS price and enablement values from the tables above is shown below in Table 13. Total FCAS payments to be recovered for Raise regulation and Raise 5 Minute contingency for the TI is $1,747.45 and $6.40, respectively.

$$Regional\ Payment\ =\ FCAS\ Price\ \times {}^{Regional\ Enablement}/_{nIntervals}$$

Table 13 Regional payment calculation

Region	RAISEREG	RAISE5MIN
NSW1	= 98.81*50/12 = $411.71	= 0.26*104/12 = $2.25
QLD1	= 98.81*60/12 = $494.05	= 0.26*64/12 = $1.39
SA1	= 98.81*0/12 = $0	= 0.26*36/12 = $0.78

Region	RAISEREG	RAISE5MIN
TAS1	= 83.43*50/12 = $347.64	= 0.26*5/12 = $0.11
VIC1	= 98.81*60/12 = $494.05	= 0.26 *86.22/12 = $1.87
Total	**$1,747.45**	**$6.40**

A1.2.2 FCAS recovery calculation

Base cost calculation

Using the marginal values for each binding *constraint* from runno=1 and intervention=0 in Table 14 and the regional payment values from Table 13, regional Base cost is calculated as shown in Table 15. Note that regulation portion of a 5 Minute contingency service *constraint* is shown in the tables below (highlighted in light purple) for the purpose of cost recovery. This is because regional regulation FCAS terms are incorporated into the LHS of constraint formulation for 5 Minute contingency services (see Section 2.2.1).

$$Regional\ Base\ cost = Regional\ Payment \times \frac{Requirement\ Marginal\ Value}{\sum_{region} Requirement\ Marginal\ Value}$$

Table 14 Marginal values for binding *constraints*

Run Datetime	Runno	Intervention	ConstraintID	Bidtype	MV
08/06/2025 00:05	1	0	F_I_R5	Raise 5 Minute	0.26
				Raise Regulation	0.26
08/06/2025 00:05	1	0	F_T+RREG	Raise Regulation	83.17
08/06/2025 00:05	1	0	F_TASCAP_RREG	Raise Regulation	98.55

Table 15 Regional Base cost calculation

ConstraintID	Bidtype	Region	Regional payment	Regional Base cost
F_I_R5	Raise 5 Minute	NSW1	$2.25	= $2.25*(0.26/0.26) = $2.25
		QLD1	$1.39	= $1.39*(0.26/0.26) = $1.39
		SA1	$0.78	= $0.78*(0.26/0.26) = $0.78
		TAS1	$0.11	= $0.11*(0.26/0.26) = $0.11
		VIC1	$1.87	= $1.87*(0.26/0.26) = $1.87
	Raise Regulation	NSW1	$411.71	= $411.71*(0.26/0.26+98.55) = $1.08
		QLD1	$494.05	= $494.05*(0.26/0.26+98.55) = $1.3
		SA1	$0	= $0*(0.26/0.26+98.55) = $0

ConstraintID	Bidtype	Region	Regional payment	Regional Base cost
		TAS1	$347.64	= $347.64*(0.26/0.26+98.55) = $1.08
		VIC1	$494.05	= $494.05*(0.26/0.26+98.55) = $1.3
F_T+RREG	Raise Regulation	TAS1	$347.64	= $347.64*[83.17/(83.17+0.26)] = $346.55
F_TASCAP_RREG	Raise Regulation	NSW1	$411.71	= $411.71*[98.55/(98.55+0.26)] = $410.625
		QLD1	$494.05	= $494.05*[98.55/(98.55+0.26)] = $492.75
		SA1	$0	= $0*[98.55/(98.55+0.26)] = $0
		VIC1	$494.05	= $494.05*[98.55/(98.55+0.26)] = $492.75

After determining the regional Base cost for each service and region (Table 15), costs are then aggregated for each requirement across all regions included in that requirement *constraint* (Base cost). The Base cost calculation, calculated on a *constraint* level, is shown in Table 16.

$$Base\ cost = \sum_{\substack{Regions\ included \\ in\ requirement \\ constraint}} Regional\ Base\ cost$$

Table 16 Base cost calculation

Constraint	Region	Bidtype	Base cost	Base cost (constraint level)
F_I_R5	Global (NSW1, QLD1, SA1, TAS1, VIC1)	Raise 5 Minute	= $2.25+$1.39+$0.78+$0.11+$1.87 = $6.40	= $6.40+$4.77 = $11.16
		Raise Regulation	= $1.08+$1.30+$0+$1.08+$1.30 = $4.77	
F_T+RREG	TAS1	Raise Regulation	= $346.55	$346.55
F_TASCAP_RREG	Mainland (NSW1, QLD1, SA1, VIC1)	Raise Regulation	= $410.625+492.75+$0+492.75 = $1,396.13	$1,396.13

To assess whether cost splitting is necessary for the binding global Raise 5 Minute *constraint* (F_I_R5), the relevant Regulation *constraint*(s) within the grouping must satisfy all the criteria outlined in Section 2.2.2. Upon applying these criteria, it was determined that none of the global Raise regulation *constraints* (Table 17) fulfilled criterion (a), which is required for the *constraints* to be non-binding. Consequently, co-optimisation did not take place for the binding Raise 5 Minute *constraint*, so cost splitting is not required.

Table 17 List of global raise regulation constraint(s) for potential constraint grouping

ConstraintID	Region	Bidtype	LHS	RHS	MV	Binding/ Non-binding
F_I+RREG	Global	Raise Regulation	220	220	0	Binding

Adjusted cost calculation

In this example, where there is no cost splitting, Base cost of a *constraint* in a TI is equal to Adjusted cost (Table 18). Total costs recovered for all three binding *constraints* is $1,753.84[27], of which $11.16 is recovered from F_I_R5 *constraint*, $346.55 from F_T+RREG *constraint* and $1,396.13 from F_TASCAP_RREG *constraint*. Adjusted cost values (TSFCAS) are used in Settlements application to calculate the cost recovery allocation from CRMPs.

Table 18 Adjusted cost calculation

ConstraintID	Region	Base cost	Adjusted cost
F_I_R5	Global	$11.16	$11.16
F_T+RREG	TAS1	$346.55	$346.55
F_TASCAP_RREG	Mainland	$1,396.13	$1,396.13
Total		$1,753.84	$1,753.84

A1.2.3 P_Regulation calculation

Using the same *constraints*, marginal values, enablement, and Base cost discussed in the previous section, Table 19 illustrates the calculation of P_Regulation for the three binding *constraints*.

$$Regulation = \frac{Base\ Cost}{\sum Regulation\ Enabled} \times nIntervals$$

$$5\ Minute = \frac{Base\ Cost}{\sum(Regulation\ Enabled + 5\ Minute\ Enabled)} \times nIntervals$$

Table 19 P_Regulation calculation

ConstraintID	Region	Bidtype	MV	Enablement	Base cost	P_Regulation
F_I_R5	Global	Raise 5 Minute	0.26	295.22	$11.16	$= \frac{11.16}{(295.22+220)} \times 12 = \mathbf{0.26}$
		Raise Regulation	0.26	220.00		
F_T+RREG	TAS1	Raise Regulation	83.17	50.00	$346.55	$= \frac{346.55}{(50)} \times 12 = \mathbf{83.17}$
F_TASCAP_RREG	Mainland	Raise Regulation	98.55	170.00	$1,396.13	$= \frac{1396.13}{(170)} \times 12 = \mathbf{98.55}$

Since there is no ex-post price change in this instance, the value of P_Regulation is equivalent to the marginal value of the *constraint*.

[27] Total FCAS costs recovered is equal to total FCAS payments.

A1.3 Cost recovery example – cost splitting and ex-post price change

This section outlines the steps to calculate cost recovery for Lower regulation and Lower 5 Minute contingency services during a TI that involves cost splitting for the Lower 5 Minute contingency service.

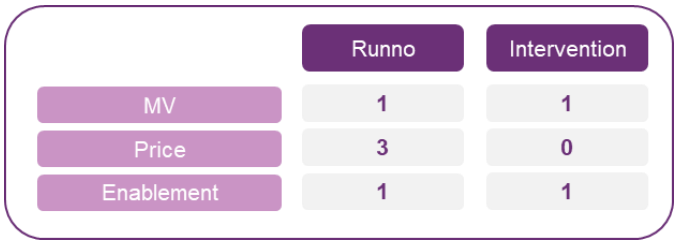
Consider a TI that involves an *Over Constrained Dispatch (OCD) re-run*, *intervention event* and rejected Manifestly Incorrect Input (MII)[28]. Such a scenario would trigger three dispatch runs (runs 1, 2 and 3) and two intervention runs (interventions 0 and 1). Table 20 displays all binding *constraints* for Lower regulation and Lower 5 Minute contingency services in the TI and their respective marginal values. The subsequent parts of this section will provide a comprehensive guide on the appropriate run numbers and intervention used.

Table 20 List of binding Lower regulation and Lower 5 Minute contingency services *constraints*

Run Datetime	Runno	Intervention	ConstraintID	LHS	RHS	MV
08/06/2025 00:05	1	0	F_MAIN_L5	767.88	767.88	39
08/06/2025 00:05	1	0	F_T_L5	51.66	51.66	0.38
08/06/2025 00:05	1	1	F_MAIN_L5	767.89	767.88	39
08/06/2025 00:05	1	1	F_T_L5	51.66	51.66	0.38
08/06/2025 00:05	2	0	F_MAIN_L5	767.88	767.88	39
08/06/2025 00:05	2	0	F_T_L5	51.66	51.66	0.38
08/06/2025 00:05	2	1	F_MAIN_L5	767.89	767.88	39
08/06/2025 00:05	2	1	F_T_L5	51.66	51.66	0.38
08/06/2025 00:05	3	0	F_MAIN_L5	771.41	771.41	49.99
08/06/2025 00:05	3	0	F_MAIN+LREG	210.00	210.00	18.82
08/06/2025 00:05	3	0	F_T+NIL_ML_L5	51.70	51.70	0.38
08/06/2025 00:05	3	1	F_MAIN_L5	771.41	771.41	49.99
08/06/2025 00:05	3	1	F_MAIN+LREG	210.00	210.00	18.82
08/06/2025 00:05	3	1	F_MAIN_L5	51.70	51.70	0.38

A1.3.1 FCAS payment calculation

As discussed in Section 2.1.1, regional FCAS payment requires FCAS prices to be derived from the pricing run, while regional enablement amount will be obtained from the physical intervention run.



[28] When AEMO rejects and automatically replace prices of the *trading interval* identified as subject to review with the prices from the last correct interval when an MII is found.

In this instance, FCAS prices are derived from the combination of runno=3, which is the maximum dispatch run number, and intervention=0, while regional FCAS enablement values are derived from the combination of runno=1 and intervention=1. Table 21 and Table 22 shows FCAS prices and regional FCAS enablement from the respective runs.

Table 21 FCAS prices

Run Datetime	Runno	Intervention	Region	LOWERREGRRP	LOWER5MINRRP
08/06/2025 00:05	3	0	NSW1	68.81	49.99
08/06/2025 00:05	3	0	QLD1	68.81	49.99
08/06/2025 00:05	3	0	SA1	68.81	49.99
08/06/2025 00:05	3	0	TAS1	0.38	0.38
08/06/2025 00:05	3	0	VIC1	68.81	49.99

Table 22 Regional FCAS enablement

Run Datetime	Runno	Intervention	Region	LOWERREG	LOWER5MIN
08/06/2025 00:05	1	1	NSW1	155.00	281.00
08/06/2025 00:05	1	1	QLD1	66.00	49.44
08/06/2025 00:05	1	1	SA1	0.00	9.00
08/06/2025 00:05	1	1	TAS1	51.66	0.00
08/06/2025 00:05	1	1	VIC1	0.47	206.98

Table 23 shows the regional payment calculation for Lower regulation and Lower 5 Minute contingency services, using FCAS price and enablement values from their respective runno and intervention run. Total FCAS payments to be recovered for Lower regulation and Lower 5 Minute contingency for the TI is $2,276.28 and $1,271.57, respectively.

$$Regional\ Payment\ =\ FCAS\ Price\ \times {}^{Regional\ Enablement}/_{nIntervals}$$

Table 23 Regional payment calculation

Region	LOWERREG	LOWER5MIN
NSW1	= 155*49.99/12 = $888.80	= 281*49.99/12 = $1170.60
QLD1	= 66*49.99/12 = $378.46	= 49.44*49.99/12 = $205.96
SA1	= 0*49.99/12 = $0.00	= 9*49.99/12 = $37.49
TAS1	= 51.66*0.38/12 = $1.64	= 0*0.38/12 = $0.00
VIC1	= 0.47*49.99/12 = $2.69	= 206.98 *49.99/12 = $862.23
Total	**$1,271.57**	**$2,276.28**

A1.3.2 FCAS recovery calculation

Base cost calculation

Using the marginal values for each binding *constraint* from runno=1 and intervention=1, along with the regional payment values from Table 23, the regional Base cost is calculated in Table 25. Note that regulation portion of a 5 Minute contingency service *constraint* is shown in the tables below (highlighted in light purple) for the purpose of cost recovery. This is because regional regulation FCAS terms are incorporated into the LHS of constraint formulation for 5 Minute contingency services (see Section 2.2.1).

$$Regional\ Base\ cost = Regional\ Payment \times \frac{Requirement\ Marginal\ Value}{\sum_{region} Requirement\ Marginal\ Value}$$

Table 24 Marginal values for binding *constraints*

Run Datetime	Runno	Intervention	Constraint	Bidtype	MV
08/06/2025 00:05	1	1	F_MAIN_L5	Lower 5 Minute	39
				Lower Regulation	39
08/06/2025 00:05	1	1	F_T_L5	Lower 5 Minute	0.38
				Lower Regulation	0.38

Table 25 Regional Base cost calculation

ConstraintID	Bidtype	Region	Regional payment	Regional Base Cost
F_MAIN_L5	Lower 5 Minute	NSW1	$1,171	= $1,171*(39/39) = $1,171.60
		QLD1	$205.96	= $205.96*(39/39) = $205.96
		SA1	$37.49	= $37.49*(39/39) = $37.49
		VIC1	$862.23	= $862.23*(39/39) = $862.23
	Lower Regulation	NSW1	$888.80	= $888.80*(39/39) = $888.80
		QLD1	$378.46	= $378.46*(39/39) = $378.46
		SA1	$0	= $0*(39/39) = $0
		VIC1	$2.69	= $2.69*(39/39) = $2.69
F_T_L5	Lower 5 Minute	TAS1	$0	= $0*(0.38/0.38) = $0
	Lower Regulation	TAS1	$1.64	= $1.64*(0.38/0.38) = $1.64

After determining the regional Base cost for each service and region, costs are then aggregated for each requirement across all regions included in that requirement constraint (Base cost). The Base cost calculation, calculated on a constraint level, is shown in Table 26.

$$Base\ cost = \sum_{\substack{Regions\ included \\ in\ requirement \\ constraint}} Regional\ Base\ cost$$

Table 26 Base cost calculation

ConstraintID	Region	Bidtype	Base cost	Base cost (constraint level)
F_MAIN_L5	Mainland (NSW1, QLD1, SA1, VIC1)	Lower 5 Minute	= $1,171.60+$205.96+$37.49+$862.23 = $2,276.28	= $2276.28+$1269.94 = $3,546.22
		Lower Regulation	= $888.80+378.46+0+2.69 = $1,269.94	
F_T_L5	TAS1	Lower 5 Minute	= $0	= $0+$1.64 = $1.64
		Lower Regulation	= $1.64	

Adjusted cost calculation

To assess whether cost splitting is necessary for the binding Lower 5 Minute *constraints* (F_MAIN_L5 and F_T_L5), the relevant regulation *constraint(s)* within the grouping must satisfy all the criteria outlined in Section 2.2.2.

As shown in Table 27, for the F_MAIN_L5 *constraint*, there are two mainland regulation *constraints* (F_MAIN+LREG and T_TASCAP_LREG) that meet criteria (a) and (b), meaning they are non-binding (indicating excess regulation is used) and share the same region(s) on the LHS as the 5 Minute *constraint*. However, only F_MAIN+LREG is selected to be grouped with F_MAIN_L5 for cost splitting purposes because it has the largest (most restrictive) RHS among *constraints* (criterion c).

Table 27 List of mainland lower regulation *constraint(s)* for potential *constraint* grouping with F_MAIN_L5

ConstraintID	Region	Bidtype	LHS	RHS	MV	Binding/ Non-binding	Most restrictive actual RHS
F_MAIN+LREG	Mainland	Lower Regulation	221.47	210.00	0	Non-binding	✓
F_TASCAP_LREG	Mainland	Lower Regulation	221.47	160.00	0	Non-binding	

Note: LHS, RHS and marginal values for *constraints* are derived from runno=1 and intervention=1.

Using the same methodology for *constraint* grouping, F_T_LREG meets criteria (a) and (b) for cost splitting with the F_T_L5 *constraint*. Since it is the only regulation *constraint*, it also meets criterion (c) by default, as it has the largest (most restrictive) RHS value (Table 28).

Table 28 List of Tasmanian lower regulation *constraint(s)* for potential *constraint* grouping with F_T_L5

ConstraintID	Region	Bidtype	LHS	RHS	MV*	Binding/ Non-binding	Most restrictive actual RHS
F_T_LREG	TAS1	Lower Regulation	51.70	50.00	0	Non-binding	✓

* Marginal values for *constraints* are derived from runno=1 and intervention=1.

Now that the regulation *constraint* related to cost splitting for both 5 Minute *constraints* is identified, Adjusted cost is calculated to allocate the Base cost split for the regulation and 5 Minute contingency service recovery mechanism.

$$Adjusted\ cost_r = Base\ cost_c \times [\frac{REG\_Calculated\_MW}{(REG\_Calculated\_MW + 5Min\_Calculated\_MW)}]$$

and

$$Adjusted\ cost_c = Base\ cost_c - Adjusted\ cost_r$$

where Extra_Regulation (the excess regulation to meet the 5 Minute *constraint* requirement) is as follows:

- Extra_Regulation (F_MAIN+LREG) = 11.5 MW (221.47 MW – 210 MW)
- Extra Regulation (F_T_LREG) = 1.70 MW (51.70 MW – 50 MW).

Table 29 Adjusted cost calculation

ConstraintID	Region	Bid type	Base cost	Adjusted cost
F_MAIN_L5	Mainland	Lower 5 Minute	$3,546.22	= $3,546.22 – $969.67 = **$2,576.55**
		Lower Regulation	= $3{,}546.22 \times \frac{221.47-11.5}{[(221.47-11.5)+(546.42+11.5)}$ = **$969.67**
F_T_L5	TAS1	Lower 5 Minute	$1.64	= $1.64-$1.58 = **$0.05**
		Lower Regulation	= $1.64 \times \frac{51.67-1.7}{[(51.67-1.7)+(0+1.7)}$ = **$1.58**
Total			**$3,547.85**	**$3,547.85**

Adjusted cost values (TSFCAS) are used in Settlements application to calculate the cost recovery allocation from CRMPs.

A1.3.3 P_Regulation calculation

Using the same *constraints*, marginal values, enablement, and Base cost discussed in the previous section, Table 30 illustrates the calculation of P_Regulation for the two binding *constraints*.

$$Regulation = \frac{Base\ Cost}{\sum Regulation\ Enabled} \times nIntervals$$

$$5\ Minute = \frac{Base\ Cost}{\sum(Regulation\ Enabled + 5\ Minute\ Enabled)} \times nIntervals$$

Table 30 P_Regulation calculation

ConstraintID	Region	Bidtype	MV	Enablement	Base cost	P_Regulation
F_MAIN_L5	Mainland	Raise 5 Minute	39	546.42	$3,546.22	$= \frac{3546.22}{(546.42+221.47)} \times 12 = \mathbf{55.42}$
		Raise Regulation	39	221.47		
F_T_L5	TAS1	Raise 5 Minute	0.38	0.00	$1.64	$= \frac{1.64}{(0+51.66)} \times 12 = \mathbf{0.38}$
		Raise Regulation	0.38	51.66		

In this example, where there is an ex-post price change due to the rejected MII, the marginal value of the *constraint* remains unchanged from the physical run, however the P_Regulation (adjusted marginal value) for F_MAIN_L5 (55.42) now differs from the marginal value (39).

Version release history

Version	Effective date	Summary of changes
1.0	8 June 2025	First issue. Document reflects the National Electricity Amendment (Primary frequency response incentive arrangements) Rule 2022 No.8