CAUSER PAYS PROCEDURE – FACTORS FOR ASYNCHRONOUS OPERATION

ISSUES PAPER

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

EXECUTIVE SUMMARY

The publication of this Issues Paper commences the first stage of the Rules consultation process conducted by AEMO to consider proposed amendments to the Procedure for Determining Contribution Factors (Causer Pays Procedure)[1] made under clause 3.15.6A(k) of the National Electricity Rules (NER).

AEMO has prepared this Issues Paper to invite Registered Participants to review and provide feedback on proposed options for amending the Causer Pays Procedure to include a description of how AEMO calculates contribution factors for periods when one or more National Electricity Market (NEM) regions have operated asynchronously, as contemplated by clause 3.15.6A(j)(2) of the NER.

The scope of this consultation is limited to the matters contemplated in clause 3.15.6A(j)(2) only, to comply with a determination by the Dispute Resolution Panel dated 3 October 2016 (DRP Determination). [2] The DRP Determination requires AEMO to complete this consultation and make the resulting procedures by 3 March 2017. AEMO intends to consult on a range of other aspects of the Causer Pays Procedure, but will do this as a separate exercise due to the time limit imposed by the DRP Determination.

Three options are discussed in this paper:

- A process that reflects the methodology currently used to determine contribution factors for recovery of the costs of all local ancillary service requirements, as currently set out in AEMO's Efficient Dispatch and Localised Recovery of Regulation Services Business Specification (Business Specification).[3]
- A process under which AEMO determines contribution factors for an asynchronous period ex post, based on individual unit performance during the asynchronous period itself. Those factors would be determined in the same way as they are during the historic reference period, to the extent possible in the circumstances. Under this option, Tasmania would be treated differently from other regions because it is permanently asynchronous.
- A process for substituting NEM-wide contribution factors with factors that use historical performance factors for appropriately metered facilities within the asynchronous region(s) only, and a recalculated residual factor.

For a range of reasons, AEMO's preliminary view is that only the first option is practical for the purposes of the current consultation. AEMO welcomes further feedback on the options, or any variations or alternatives that could meet the consultation criteria.

Stakeholders are invited to make written submissions on this Issues Paper by **5.00 pm (Melbourne time) on 5 December 2016**, in accordance with the Notice of First Stage of Consultation published with this paper.

[1] Available at: http://aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Ancillary-services/Ancillary-services-causer-pays-contribution-factors
[2] Final determination and reasons available at: http://www.resolveadvisors.com.au/dbpage.php?pg=wemdra
[3] Available at the same link as the Causer Pays Procedure above

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1. STAKEHOLDER CONSULTATION PROCESS

AEMO is consulting on proposed amendments to the Procedure for Determining Contribution Factors (Causer Pays Procedure or CPP) made under clause 3.15.6A(k) of the NER, in accordance with rule 8.9 of the NER.

AEMO's indicative timeline for this consultation is outlined below. Dates may be adjusted depending on the number and complexity of issues raised in submissions and any meetings with stakeholders.

Deliverable	Indicative date
Issues Paper published	28 October 2016
Submissions due on Issues Paper	5 December 2016
Draft Report published	4 January 2017
Submissions due on Draft Report	23 January 2017
Final Report and Procedures published	1 March 2017

Prior to the submissions due date, or in a submission on this Issues Paper, stakeholders can request a meeting with AEMO to discuss the proposed changes.

A glossary of terms used in this Issues Paper is at Appendix A.

2. BACKGROUND

2.1 NER requirements

AEMO prepared the Causer Pays Procedure under clause 3.15.6A(k) of the NER, to set out how AEMO determines contribution factors in accordance with clause 315.6A(j). These factors are used to calculate Market Participants' trading amounts under clause 3.15.6A(i), to recover the cost of regulating raise and regulating lower frequency control ancillary services (Regulation FCAS).

Clause 3.15.6A(j) provides:

(j) AEMO must determine for the purpose of paragraph (i):

(1) a contribution factor for each Market Participant; and

(2) notwithstanding the estimate provided in paragraph (nb), if a region has or regions have operated asynchronously during the relevant trading interval, the contribution factors relevant to the allocation of regulating raise service or regulating lower service to that region or regions,

in accordance with the procedure prepared under paragraph (k).

Clause 3.15.6A(k) provides:

(k) AEMO must prepare a procedure for determining contribution factors for use in paragraph (j) and, where AEMO considers it appropriate, for use in paragraph (nb), taking into account the following principles:

(1) the contribution factor for a Market Participant should reflect the extent to which the Market Participant contributed to the need for regulation services;

(2) the contribution factor for all Market Customers that do not have metering to allow their individual contribution to the aggregate need for regulation services to be assessed must be equal;

(3) for the purpose of paragraph (j)(2), the contribution factor determined for a group of regions for all Market Customers that do not have metering to allow the individual contribution of that Market Customer to the aggregate need for regulation services to be assessed, must be divided between regions in proportion to the total customer energy for the regions;

(4) the individual Market Participant's contribution to the aggregate need for regulation services will be determined over a period of time to be determined by AEMO;

(5) a Registered Participant which has classified a scheduled generating unit, scheduled load, ancillary service generating unit or ancillary service load (called a Scheduled Participant) will not be assessed as contributing to the deviation in the frequency of the power system if within a dispatch interval:

(i) the Scheduled Participant achieves its dispatch target at a uniform rate;

(ii) the Scheduled Participant is enabled to provide a market ancillary service and responds to a control signal from AEMO to AEMO's satisfaction; or

(iii) the Scheduled Participant is not enabled to provide a market ancillary service, but responds to a need for regulation services in a way which tends to reduce the aggregate deviation;

(6) where contributions are aggregated for regions that are operating asynchronously during the calculation period under paragraph (i), the contribution factors should be normalised so that the total contributions from any non-synchronised region or regions is in the same proportion as the total customer energy for that region or regions; and

(7) a Semi-Scheduled Generator will not be assessed as contributing to the deviation in the frequency of the power system if within a dispatch interval, the semi-scheduled generating unit:

(i) achieves its dispatch level at a uniform rate;

(ii) is enabled to provide a market ancillary service and responds to a control signal from AEMO to AEMO's satisfaction; or

(iii) is not enabled to provide a market ancillary service, but responds to a need for regulation services.

The CPP may be amended in accordance with the 'Rules consultation procedures' set out in NER rule 8.9. The release of this Issues Paper commences the first stage of that process.

2.2 Context for this consultation

2.2.1 Cost recovery of localised regulation services rule change

The last major revision of the CPP was done in 2008, following the *National Electricity Amendment (Cost Recovery of Localised Regulation Services) Rule 2007*. That Rule, and the revised CPP, took effect on 1 January 2009, and made the following key changes to the principles and process for recovering the cost of Regulation FCAS:

- Marginal prices for Regulation FCAS were to be calculated for each local market ancillary service requirement (local requirement) for those services, as well as for the global requirement.

- The costs of a local requirement for Regulation FCAS were to be recovered only from Market Participants in the region or regions affected.

2.2.2 DRP Determination

In October and November 2015, during a series of planned single line outages of the Heywood Interconnector between Victoria and South Australia, there was a local requirement for Regulation FCAS from within the South Australia region of the NEM, the costs of which were significant. AEMO's allocation of those costs under the NER and the CPP was subsequently disputed under rule 8.2 of the NER.

The DRP found that:

- AEMO's determination of contribution factors under the CPP and their application to the costs of local requirements for Regulation FCAS was consistent with the NER for periods when South Australia was synchronous with the rest of the NEM, but
- AEMO had not made a procedure that addressed the requirement in clause 3.15.6A(j)(2) for NEM regions operating asynchronously.

As noted in section 2.1 above, clause 3.15.6A(j)(2) requires AEMO to determine contribution factors relevant to allocating Regulation FCAS requirement costs when a region or regions operate asynchronously during a trading interval.

The DRP Determination required AEMO to make procedures, or amend the CPP, to address the circumstances in clause 3.15.6A(j)(2) within 5 months – by 3 March 2017.

2.2.3 Broader causer pays consultation

In November 2015, AEMO committed to a comprehensive review of the CPP in consultation with Market Participants, including the principles for allocating local requirement costs. A set of principles for this review was presented and discussed at AEMO's NEM Wholesale Consultative Forum on 27 January 2016. However, the review process was suspended when the dispute process was commenced.

AEMO noted at the time that the outcomes of the review could necessitate a rule change proposal. Following the DRP Determination, AEMO considers it is highly desirable for the NER to be amended in any event, to clarify some inconsistencies highlighted in the DRP process, including in relation to clause 3.15.6A(j)(2).

AEMO plans to recommence its review of the local Regulation FCAS recovery as soon as practicable, and intends to outline this process at the NEM Consultative Forum meeting on 30 November 2016. It is anticipated that development of a preferred option will take several months, after which it is likely that proposed NER and CPP changes will have to be consulted on. These broader consultations cannot be completed within the timeframe required by the DRP Determination for the clause 3.15.6A(j)(2) amendment.

In considering issues related to asynchronous operation, AEMO has also noted that neither the NER nor the CPP deal with synchronous separation (or indeed any other local requirement) other than at regional boundaries. An electrical island that straddles regional boundaries could result in parts of a region being in different Regulation FCAS constraints. This is not an issue that can be addressed in the current limited consultation due to the lack of supporting rules, and may have broader market implications. AEMO plans to explore this further in the broader causer pays consultation.

2.3 Limited consultation criteria

In view of the limited time for AEMO to make the changes required by the DRP determination, and the prospect of significant changes arising from the review described in section 2.2.3, AEMO considers that:

- This consultation must be limited in scope to the changes necessary to incorporate provisions in the CPP that address clause 3.15.6A(j)(2).
- The methodology for determining contribution factors for this purpose should not require any material change to systems or resourcing for AEMO or Market Participants.
- This consultation should preserve the flexibility to adopt a range of options in the broader causer pays consultation, without seeking to anticipate potential outcomes.

3. OPTIONS

In the final stage of the DRP proceedings, after the DRP had provided reasons for its determination, AEMO put forward three options for facilitating settlement of the disputed October and November 2015 billing periods in relation to a 35-minute period of asynchronous operation on 1 November 2015.

AEMO notes there is an important difference between a resolution to be applied on a 'once-off' basis to settle a period with known parameters, and an ongoing process that can be applied whenever any region becomes electrically separated. Nevertheless, all three options are presented in this Issues Paper and discussed by reference to the criteria in section 2.3 above, and the principles in clause 3.15.6A(k) of the NER.

NER principles relevant to assessment of options

AEMO considers that only principle (3) in clause 3.15.6A(k) is specifically relevant to paragraph (j)(2). For the purpose of that paragraph, it provides that the contribution factor determined for a group of regions for all Market Customers without appropriate metering, must be divided between regions in proportion to the total customer energy for the regions.

AEMO acknowledges that there may be some ambiguity in the formulation of principle (3). We interpret it to mean that the residual contribution factor,[4] as between the regions on either side of a synchronous separation, is to be proportionate to total customer energy in each group of regions. An alternative interpretation could be that the principle only applies where more than one region is operating as an island; and in those circumstances there is to be an asynchronous residual contribution factor across all those regions, which is then further divided between them in proportion to customer energy. However, there appears to be no logical rationale for this approach, since a group of regions within the same constraint would have to be synchronous with each other.

While principle (6) also refers to asynchronous operation, it relates only to the circumstance in which contributions for regions that are operating asynchronously are aggregated. From the second part of principle (6), this seems to refer to aggregation between asynchronous region(s) and the rest of the NEM, rather than between different asynchronous regions. As it would not be necessary to aggregate contributions to recover local requirement costs, AEMO concludes that this principle applies only to the recovery of global requirement costs. Currently, global requirements can only be recovered across asynchronous regions in the case of Tasmania, because of the frequency control capability of the Basslink interconnector. The CPP already provides for this normalisation and aggregation process in sections 5.9 and 5.10.

[4] The factor applied to calculate the recovery amount from Market Customers without appropriate metering for the purposes of clause 3.15.6A(i)(2)

3.1 Option 1: Use existing process for local requirements

3.1.1 Description

This process is substantially the same as that for determining contribution factors for recovering the costs of local ancillary service requirements, as currently set out in clause 4.2.2.4 of the Business Specification.

It is based on the historic contribution factors determined over the reference period relevant to the period of asynchronous operation, as follows:

- The contribution factor for each Market Participant in the affected region(s) with appropriate metering (MPF) is equal to the pre-determined portfolio MPF value for that Market Participant. The sum of the MPFs for all relevant Market Participants within the affected region(s) is the aggregate constraint MPF (CMPF).
- The residual contribution factor for Market Customers without appropriate metering in the affected region(s) (CRMPF) is calculated by multiplying the NEM residual contribution factor (RMPF) by a fraction, the numerator of which is the total customer energy in the affected region(s), and the denominator is the total customer energy in all NEM regions.

3.1.2 Worked example

A worked example using a simple hypothetical market scenario is presented in Appendix B.

3.1.3 Discussion

AEMO considers that the CRMPF is determined consistently with principle (3) using the existing process. It also means that local requirements arising from asynchronous operation or from any other cause will be treated consistently with each other, as at this stage there appears to be no logical reason to differentiate.

With reference to the consultation criteria, this Option 1:

- Addresses the requirement to describe how contribution factors are calculated for asynchronous operation, using a methodology already documented in the Business Specification.
- Requires no changes to systems or resourcing for AEMO or participants.
- By maintaining the status quo, preserves the flexibility to adopt a range of options in the broader causer pays consultation and does not anticipate potential outcomes.
- Permits AEMO to comply with the requirement in clause 3.15.6A(nb) of the NER to publish estimates of the factors to be applied, for information purposes, in the dispatch timeframe when regions are operating asynchronously.

3.2 Option 2: Substitute ex post factors using performance during asynchronous period

3.2.1 Description

This process sets out to determine new contribution factors after asynchronous operation, based on the frequency indicator (FI) for the islanded (asynchronous) region(s), by measuring and aggregating performance of appropriately metered generating units in the region(s) and demand in the region(s) during the asynchronous dispatch intervals (DIs).

The calculations would be done in the same way as the existing process in the CPP for calculating factors for the mainland NEM and Tasmania during the historical reference period. The asynchronous

factors would have to be calculated ex post on actual performance, since there will almost certainly be no historical periods with the same separation. The following input data would be used for each asynchronous DI:

- Frequency indicator (FI), calculated by reference to the Regulation FCAS deployed in the asynchronous region(s) using the 4-second control signals.
- 4-second SCADA data from units with appropriate metering in the region(s).
- Actual demand and demand forecast of the region(s).

For this option to remain consistent with principle (3), the contribution factors in the regions on both sides of the synchronous separation would require recalculation based on the method described above. For example, in the case of synchronous separation between South Australia and the rest of the NEM, new contribution factors would be determined for South Australia and for the rest of the NEM.

A worked example has not been provided for Option 2 because completely new contribution factors would have to be calculated and substituted for the pre-calculated NEM factors for each instance of asynchronous operation.

3.2.2 Discussion

This option has the advantage, in theory, of closely reflecting actual performance relative to the frequency requirements in electrically islanded regions. It also uses the same basic methodology as set out in the CPP when measuring performance over each reference period. However, it has a number of associated difficulties, which mean that Option 2 is unlikely to meet all consultation criteria and may be inconsistent with related NER or CPP provisions. In particular:

- It results in significant divergence between the treatment of local requirements for asynchronous operation and local requirements for other reasons, with no obvious rationale. This needs to be given more detailed consideration in the broader causer pays consultation.
- On the basis that system changes are not justified ahead of the broader consultation, Option 2 will be a labour intensive process. The calculation must be performed after the event by extracting available data from AEMO's systems, loading it into causer pays systems to substitute existing data, and selecting the data to be excluded from the calculations. This must be done for each region or set of regions on either side of the synchronous separation. Although unlikely to occur frequently, detailed process steps, training and testing will need to be developed and documented.
- Given that data from the asynchronous period will take some time (likely weeks) to collect, verify, load and then re-process, there is no method to provide a reasonable estimate of contribution factors in real time, meaning that AEMO will be unable to comply with clause 3.15.6A(nb) of the NER.
- Option 2 cannot be applied uniformly for all regions because it is impractical to treat Tasmania in the same way as regions that may be temporarily asynchronous. Tasmania is permanently asynchronous, but Basslink can transfer Regulation FCAS depending on operating conditions. The CPP already provides for calculation of contribution factors based on the separate FIs in Tasmania and the mainland NEM, which are then normalised. There are relatively frequent instances of local requirements in Tasmania which, under Option 2, would necessitate calculating new factors every time. To avoid an absurd outcome, Tasmania would need to be excluded from the Option 2 process. When a local requirement for Tasmania arises because Basslink is out of service or otherwise not transferring FCAS, Tasmanian historical performance (already used in the global contribution factor calculation process) would need to be used for settlement.
- There would be other occasions when the methodology simply could not be applied in practice because the asynchronous period is not long enough – noting that transition periods

immediately after separation have to be excluded from the calculation because there is delay in reconfiguring market systems and Automatic Generation Control (AGC) systems.

3.3 Option 3: Recalculate historical CMPFs using only facilities within asynchronous region(s)

3.3.1 Description

Under this option, AEMO would determine the individual CMPFs for dispatch intervals when a region(s) operated asynchronously using historical performance factors for the applicable reference period, but excluding the performance of appropriately metered facilities outside the asynchronous region(s). This would result in a new CMPF for each relevant Market Participant for that particular requirement, based only on the performance of its appropriately metered generation and load within the separated area.

Without material system changes, the new CMPF could only be determined after the event, because it is not feasible to determine CMPFs for each possible combination of separated regions manually in advance.

The CRMPF would then need to be calculated following the determination of new CMPFs, by multiplying the NEM-wide RMPF by the ratio of demand in the asynchronous region(s) to total NEM demand, then renormalising the constraint MPFs so that the aggregate of the CMPFs and the CRMPF for the asynchronous region(s) equals 100.

3.3.2 Worked example

A worked example using a simple hypothetical market scenario is presented in Appendix B.

3.3.3 Discussion

This option has the advantage (relative to Option 2) of using historical performance factors for the CMPF. This means the raw data necessary to determine these factors is already within AEMO systems, but without extensive system changes the individual performance factors must still be collated with manual intervention after any separation event.

Option 3 is also easier to reconcile with the treatment of Tasmania when local requirements apply to that region. However, as with Option 2, a number of other difficulties indicate that this option may not meet all consultation criteria. In particular:

- Like Option 2, Option 3 also results in significant divergence between the treatment of local requirements for asynchronous operation and other local requirements.
- On the basis that system changes are not justified ahead of the broader consultation, this option will also require material labour resources after any separation event, and documentation of detailed process steps.
- AEMO would again be unable to comply with the requirement to publish estimates of contribution factors in the dispatch timeframe under clause 3.15.6A(nb) of the NER.

4. PRELIMINARY VIEWS AND DRAFTING

For the reasons set out in the discussion of each option in section 3 of this Issues Paper, AEMO's preliminary view is that only Option 1 can reasonably be implemented ahead of the broader causer pays consultation, given the limitations of this consultation and the applicable NER provisions.

As AEMO is seeking further feedback on the options or any alternatives, amendments to the CPP have not been drafted at this stage of the consultation. However, AEMO envisages that:

- Additional provisions to address the circumstances in clause 3.15.6A(j)(2) would be included in section 5 of the CPP. It may be necessary to create a new section (e.g. 5A). For Option 1, the amendments would be based on section 4.2.2.4 of the Business Specification.
- The heading, and if necessary the text, of section 7 of the CPP would be amended to clarify that it only applies to electrical separations in a reference period for calculating the contribution factors to apply in a subsequent period. Performance data for the asynchronous period would continue to be excluded for these purposes.
- For clarity, the CPP should also address the determination of contributions for local requirements without asynchronous operation. In this respect there would be no change to the current process as described in the Business Specification.

5. SUMMARY OF MATTERS FOR CONSULTATION

AEMO seeks comment and feedback on the three options discussed in section 3 of this Issues Paper for the determination of contribution factors under clause 3.15.6A(j)(2) of the NER, namely:

- Option 1: Applying the current method used for all local Regulation FCAS requirements, using historic NEM contribution factors (both MPF and RMPF), apportioned to the asynchronous region(s).
- Option 2: Calculation after the event based on actual frequency requirements, and the actual contribution to those requirements of appropriately metered facilities and demand respectively, in the asynchronous region(s) during the period of separation - where the necessary data is available.
- Option 3: Calculation after the event based on historical performance factors for appropriately metered facilities within the asynchronous region(s) only, and a recalculated CRMPF to recover the residual portion not allocated using the new CMPFs.

At this initial stage, given the constraints of this consultation and the broader consultation to follow, AEMO also invites suggestions for proposed variations or alternatives that meet the requirements of clause 3.15.6A(j)(2) and all related provisions of the Rules, and that are consistent with the consultation criteria in section 2.3. Please include detailed steps and the reasons why you consider these would better meet the objectives of this consultation.

Submissions must be made in accordance with the Notice of First Stage of Consultation published with this paper by 5.00 pm (Melbourne time) on 5 December 2016.

APPENDIX A - GLOSSARY

Defined terms in the Glossary of the National Electricity Rules (Chapter 10) have the same meanings when used in this Issues Paper.

Term or acronym	Meaning
Appropriate metering	Metering (of generating plant or load) sufficient to allow the individual contribution of the relevant Market Participant to the aggregate deviation in frequency of the power system to be addressed.
Asynchronous	Not connected to another part of the NEM transmission grid by an operational alternating current link.
Business Specification	Efficient Dispatch and Localised Recovery of Regulation Services Business Specification.
Causer Pays Procedure or CPP	Causer Pays: Procedure for determining contribution factors under clause 3.15.6A(k) of the NER.
CMPF	Constraint Market Participant Factor – the sum of the MPFs applicable to the recovery of the costs of a local requirement from Market Participants with appropriate metering in the region(s) where that requirement applies.
CRMPF	Constraint Residual Market Participant factor - the RMPF applicable to the recovery of the costs of a local requirement from Market Customers without appropriate metering in the region(s) where that requirement applies.
DRP	Dispute Resolution Panel constituted for a decision under rule 8.2 of the NER.
DRP Determination	Determination of the DRP (PRD Gray QC, GH Thorpe and LM McMillan) dated 3 October 2016 and Reasons dated 2 September 2016 in relation to a dispute between Origin Energy Electricity Ltd, AEMO, a group of South Australian wind farm operators, and others.
FCAS	Frequency Control Ancillary Services
Global, global requirement	Global ancillary service requirement as defined in the NER
Local, local requirement	Local ancillary service requirement as defined in the NER (this arises from a constraint imposed by AEMO that requires FCAS to be sourced from an identified NEM region or regions)
MPF	Market Participant Factor (contribution factor) for a Market Participant with appropriate metering (NER clause 3.15.6A(i)(1)).
NEM	National Electricity Market
NER	National Electricity Rules
Regulation FCAS	A regulating raise service or regulating lower service as defined in the NER
RMPF	Residual Market Participant Factor (contribution factor) for Market Customers without appropriate metering (NER clause 3.15.6A(i)(2)).
SA	The South Australia region of the NEM.

APPENDIX B - WORKED EXAMPLES

Introduction

The worked examples in this Appendix show the calculation steps for Options 1 and 3 in the Issues Paper, in a case when South Australia (Non-SA) separates from the rest of the NEM. The examples use three fictitious Generator portfolios (P1, P2 and P3) owning generating units in South Australia (SA) or the rest of the NEM (Non-SA).

The demand of SA is assumed to be 5% of the NEM demand at the time of the calculation.

The metadata and published global MPFs for each generator are given in the table below.

Portfolio	Unit	Region	Global MPF %
P1	G1	SA	5
P1	G2	SA	
P2	G3	SA	10
P2	G4	Non-SA	
P3	G5	Non-SA	35
Residual		NEM	50

Option 1

This is the current method used for regional recovery. In this method, a portfolio with at least a single unit in the region is considered to be relevant to the region.

Therefore portfolio P2 is relevant to both SA and Non-SA, hence its full MPF is used for calculation in both sets of asynchronous regions.

CMPF is the sum of portfolio MPFs relevant to the region. Portfolios P1 and P2 are relevant to the SA asynchronous region and portfolios P2 and P3 are relevant to the Non-SA asynchronous regions.

	SA	Non-SA
CMPF	5 +10 = 15	10 + 35 = 45

The MPF of P2 is included in both calculations.

CRMPF is calculated by multiplying the global residual MPF (RMPF) by the demand ratio.

	SA	Non-SA
CRMPF	0.05*50 = 2.5	0.95*50 = 47.5

SA region demand is 5% of the NEM demand hence Non-SA is 95% of the NEM Demand.

The regional aggregate MPF (AMPF) for the constraint is the sum of the CMPFs and CRMPF.

	SA	Non-SA
Regional AMPF	15+2.5 = 17.5	45 + 47.5 = 92.5

The regional AMPF is then used to normalise the local portfolio factors and residual factor for the constraint.

As shown below, each portfolio factor is divided by the relevant regional AMPF to calculate the local factor.

Portfolio	Unit	Region	Global MPF %	SA local factor %	Non-SA local factor %
P1	G1	SA	5	100*5/17.5 = 28.57	0
P1	G2	SA			
P2	G3	SA	10	100*10/17.5 = 57.14	100*10/92.5 = 10.81
P2	G4	Non-SA			
P3	G5	Non-SA	35	0	100*35/92.5 = 37.84
Residual			50	100*2.5/17.5 = 14.29	100*47.5/92.5 = 51.35

Option 3

In this method, the factors are calculated using units in the region only. To achieve that, portfolio P2 with units in both SA and Non-SA is separated to two portfolios.

The indicative global MPFs after this change are given below.

Portfolio	Unit	Region	Indicative Global MPF %
P1	G1	SA	5
P1	G2	SA	
P2_SA	G3	SA	5
P2_Non-SA	G4	Non-SA	5
P3	G5	Non-SA	35
Residual		NEM	50

For simplicity, the same factors with equal factors for two sub-portfolios are used in this example. However, in reality all factors can change in this situation due to change in portfolio factors leading to region total changes.

CMPF is the sum of portfolio MPFs relevant to the region. Portfolios P1 and P2_SA are relevant to the SA asynchronous region and portfolios P2_Non-SA and P3 are relevant to the Non-SA asynchronous regions.

	SA	Non-SA
CMPF	5 +5 =10	5 + 35 =40

The MPF of P2 is included in both calculations.

CRMPF is calculated by multiplying the global NEM RMPF by the demand ratio.

	SA	Non-SA
CRMPF	0.05*50 =2.5	0.95*50 = 47.5

SA region demand is 5% of the NEM demand, hence Non-SA is 95% of the NEM Demand.

The regional aggregate MPF (AMPF) for the constraint is the sum of the CMPFs and CRMPF.

	SA	Non-SA
Regional AMPF	10+2.5 = 12.5	40 + 47.5 = 87.5

The regional AMPF is then used to normalise the local portfolio factors and residual factor for the constraint.

As shown below, the portfolio factor is divided by the regional AMPF to calculate the local factor.

Portfolio	Unit	Region	Global MPF %	SA local factor %	Non-SA local factor %
P1	G1	SA	5	100*5/12.5 = 40	0
P1	G2	SA			
P2_SA	G3	SA	5	100*5/12.5 = 40	100*5/87.5 = 5.71
P2_Non-SA	G4	Non-SA	5		
P3	G5	Non-SA	35	0	100*35/87.5 = 40
Residual			50	100*2.5/12.5 =20	100*47.5/87.5 = 54.29