Settlements Residue Auction and Modified Load Export Cost processes

Australian Energy Market Commission

24 May 2024

FINAL REPORT

Important notice

Contents

1. INTRODUCTION

The Australian Energy Market Commission (AEMC) engaged CEPA to provide assistance in the context of a rule change request seeking to change the cost allocation associated with interconnectors. The rule change would facilitate the inter-government agreements setting out an alternative pathway to the existing NER cost allocation framework.

The AEMC is seeking an understanding of the current regime and rationale, specifically with regard to the settlements residue auction (SRA) and inter-regional cost allocation processes, including the modified load export charges (MLEC).

This report is structured as follows:

- Section 2 offers a “plain English” explanation of current arrangements.
- Section 3 provides a more extensive and technical description of settlements residue and the SRA process.
- Section 4 provides a more extensive and technical description of the MLEC process.

2. PLAIN ENGLISH EXPLANATION

Why does settlements residue arise and how is it apportioned between inter- and intra-regional settlements residue?

Settlements residue is the difference between what load pays for energy and what generators are paid. Settlements residue arises because:

- generators produce more energy than loads consume in any trading interval, because energy is lost in transmission, mainly as heat; and
- market participants face different prices depending on their location, due to both network congestion and losses.

Settlements residue is divided into two categories:

- **inter-regional settlements residue**, arising from the difference in prices between regions and physical losses in transmitting electricity between regions; and
- **intra-regional settlements residue**, arising from the difference in prices within a region and physical losses in transmitting electricity within a region.

Inter- and intra-regional settlements residue are determined in each trading interval (i.e., every five minutes).

Intra-regional losses are determined for each region. Inter-regional settlements residue is determined for each 'directional interconnector'. There is only one directional interconnector in each direction between two regions, even if there are physically more than one set of interconnector assets between the regions. Where there are multiple physical interconnector assets, these are aggregated as one directional interconnector per direction (e.g. Murraylink and Heywood, both physical assets between Victoria and South Australia, are treated as a single directional interconnector in each direction).

There are currently six directional interconnectors in the National Electricity Market (NEM):[1]

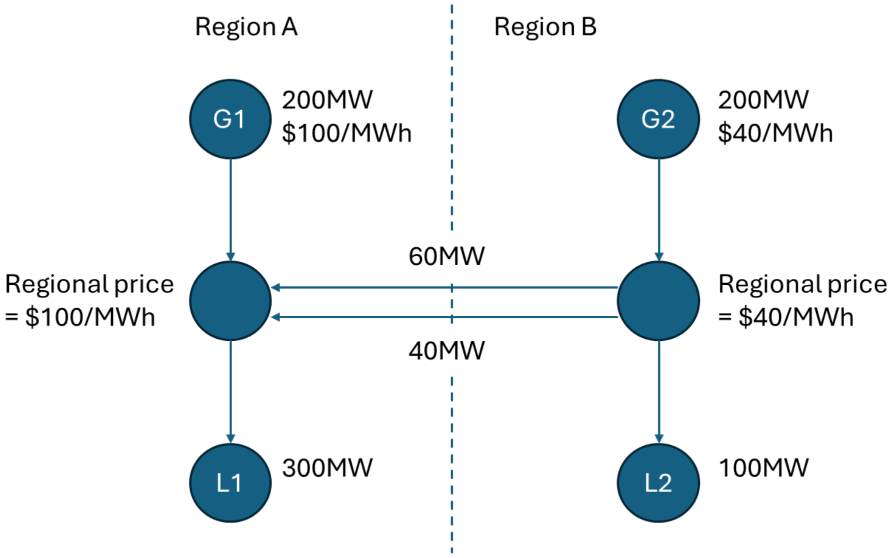
Flow direction A	Flow direction B	Interconnector assets
Queensland to NSW	NSW to Queensland	QNI, Terranora (Directlink)
NSW to Victoria	Victoria to NSW	VIC-NSW interconnector
Victoria to SA	SA to Victoria	Murraylink, Heywood

Basslink (the transmission asset between Tasmania and Victoria) is a market network service provider. Settlement residue still arises between these two regions, because Basslink is treated as a load in the region it imports from and a generator in the region it exports to. However, the settlements residue is retained by Basslink.

Example: inter-regional settlements residue

In the following example, we ignore losses and assume 1 hour trading intervals, for the sake of simplicity. There are two sets of interconnector assets making up one directional interconnector connecting regions A and B. There is a single generator (G1 and G2) and load (L1 and L2) in each region.

[1] AEMO (2024), Interconnector Capabilities, April.



In region B, the regional price is $40/MWh, set by the bid price of generator G2. Due to the physical limits of the interconnectors, only 100MW in total can flow between the regions – the interconnectors are congested. This congestion means that the regional price in region A is set by the bid of G1 ($100/MWh), rather than G2.[2]

Settlement of each generator and load is as follows:

Market participant	Quantity (MW)	Price ($/MW)	Settlement ($/h)
G1	-200	100	-20,000
L1	300	100	30,000
G2	-200	40	-8,000
L2	100	40	4,000
Total	**0**		**6,000**

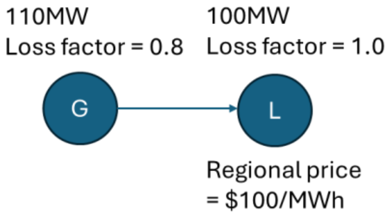
The settlements residue that arises on the directional interconnector between region B and region A is the difference between what load pays and what generators pay: $6,000/h.

Because we have ignored losses, the settlements residue is also equal to the sum of the flow on the directional interconnector (100MW), multiplied by the price difference between the regions ($100/MWh – $40/MWh).

Example: intra-regional settlements residue

In this example we again assume 1 hour trading intervals. We also assume there is only one region (and so no inter-regional settlements residue), for the sake of simplicity. By necessity, we include losses. This is because intra-regional settlements residue only arises because of losses, whereas inter-regional settlements residue arises due to both losses and congestion.

[2] RRPs are set equal to the marginal cost of meeting an incremental unit of demand at a pre-defined location in each region, known as the regional reference node (RRN). Due to the congestion on the interconnector, the next unit of demand at region A's regional reference node must be met by G1, at a cost of $100/MWh. In contrast, an incremental unit of demand at the regional reference node of region B can be met by G2, at a cost of $40/MWh. This is why there is a price difference between the regions.



The settlement of each market participant is the quantity they produce or consume, multiplied by the regional price, multiplied by their loss factor. Losses mean that the quantity of energy produced by generator and consumed by the load is different, and that the price they pay (regional price x loss factor) is different: both elements contribute to the intra-regional settlements residue

Market participant	Quantity (MW)	Regional price ($/MW)	Loss factor	Settlement ($/h)
G	-110	100	0.8	-8,800
L	100	100	1.0	10,000
Total	**-10**			**1,200**

The difference between what the load pays and what generators pay is the intra-regional settlements residue: $1,200/h.

A more comprehensive example, which combines intra- and inter-regional settlements residue, is provided in section 3.1.

Different processes are in place to distribute inter-regional and intra-regional settlements residue. Inter-regional settlements residue is the focus of this paper, and its allocation is discussed below and in more detail in Section 3. Intra-regional settlements residue is also briefly discussed in Section 3 for completeness.

Settlements Residue Auctions and the distribution of auction proceeds

The value of inter-regional settlements residue in each trading interval and for each directional interconnector can be either positive (when the price in the importing region is higher than the price in the exporting region) or negative (when the price in the importing region is lower than the price in the exporting region).[3] Positive and negative inter-regional settlements residues are treated differently, and we focus on each case in turn:

- **Positive inter-regional settlements residue** is sold at an auction. Every three months, AEMO holds Settlement Residue Auctions (SRAs), where market participants can buy a share of the positive inter-regional settlements residue that will arise on a directional interconnector (the shares are known as Settlements Residue Distribution (SRD) units). The SRAs were established because market participants who trade electricity across two regions of the NEM face the risk of not knowing how much prices will differ between the two regions in the future. Buying the settlements residue created by these price differences is a way for market participants to hedge this risk. The proceeds of the SRAs (i.e., what market participants pay to buy the SRD units) are initially distributed to the Transmission Network Service Provider (TNSP) responsible for the directional interconnector in the importing region, and ultimately are used to reduce transmission charges to consumers.

[3] Under the current network configuration, inter-regional settlements residue is typically positive. This is because the lowest cost combination of generation to meet demand typically requires interconnectors to transfer electricity from the lower priced region to the higher priced region. However, negative inter-regional settlements residue can occur in circumstances where the lowest cost combination of generation to meet demand flows ‘counter-price’ – from the higher priced region to the lower priced region. This is primarily due to intra-regional congestion.

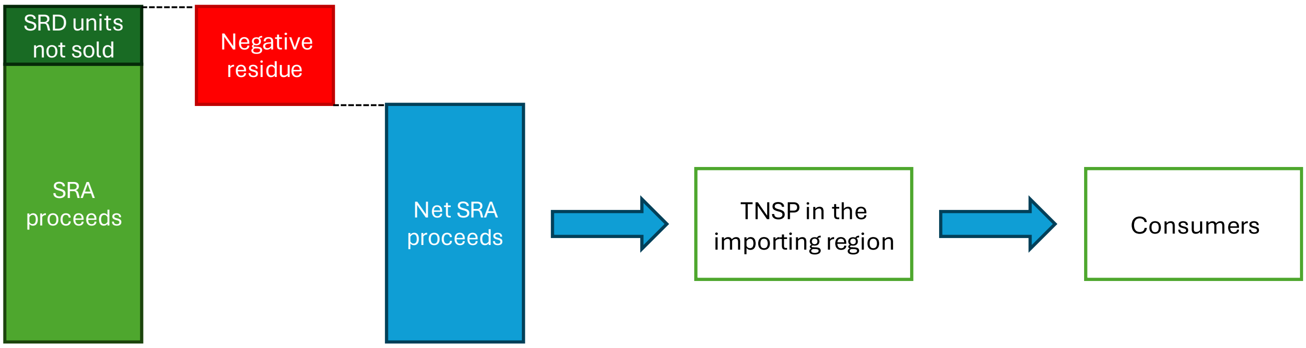
- **Negative inter-regional settlements residue** is initially distributed to the TNSP responsible for the directional interconnector in the importing region, and ultimately increases transmission charges to consumers. The decision not to auction both positive and negative residue together was based on an argument that this would have reduced SRD units' usefulness as hedges against regional price differences.

The result of this process is that SRA proceeds (plus inter-regional settlements residue not sold in the auctions, net of negative inter-regional settlements residue – from here on, for simplicity, "net SRA proceeds") are distributed to consumers through their TNSPs – as illustrated in Figure 2.1.

The rationale originally stated by the Australian Competition and Consumer Commission (ACCC) for this arrangement is that, in the first instance, the importing TNSP receives the inter-regional settlements residue for transporting electricity from a lower price region to a higher price region. However, the TNSP passes this benefit on to its consumers because they pay for the TNSP's assets.

In this way, consumers in the importing region receive a benefit from consuming electricity produced in a lower price region, but also pay for the transmission assets that enable this.

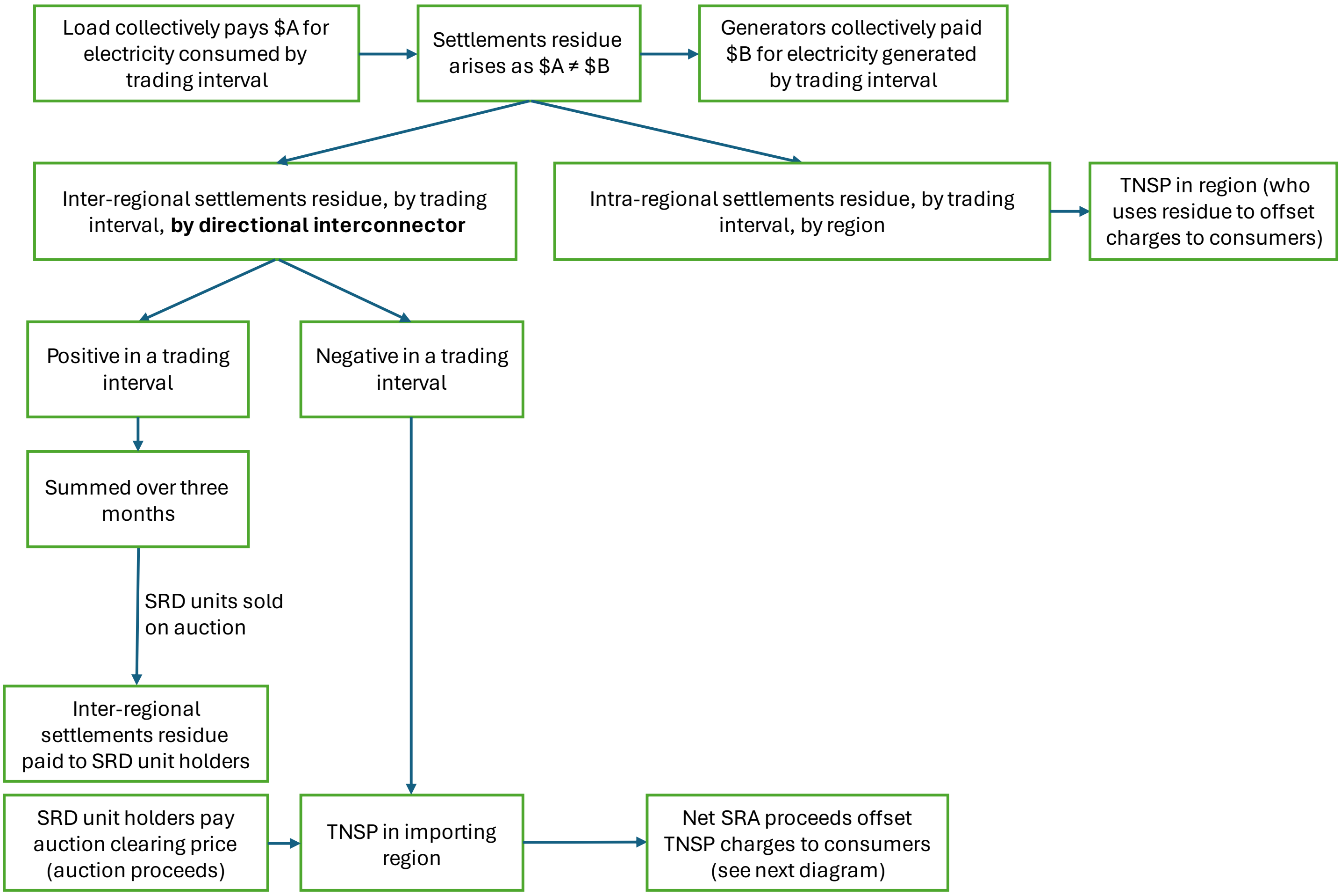
Figure 2.1: Illustration of net SRA proceeds



Another possible interpretation of the current arrangements is that consumers in the importing region face a (typically) higher price than in the exporting region, due to inter-regional network constraints. Therefore, consumers in the importing region should also receive the benefit of settlements residue that arises from those constraints.

The figure below illustrates how settlements residue arises, and how it is distributed, including through the SRA process. The way net SRA proceeds are used to offset transmission charges is discussed below, after introducing the Modified Load Export Charge process.

Figure 2.2: Flow chart of settlements residue and SRA process



Note: the figure reflects the simplified discussion of current arrangements provided in this section. Section 3 provides a more detailed description.

The Modified Load Export Charge process

Each TNSP must develop a pricing methodology in accordance with the requirements of the National Electricity Rules (NER). This describes how the TNSP will recover its regulated revenue allowance from customers. The AER approves this pricing methodology.

The pricing methodology includes the process for calculating a modified load export charge (MLEC). MLEC is the mechanism by which one region charges another region's customers for the use of their transmission assets.

When there are multiple TNSPs within a region, a single TNSP is appointed as the coordinating network service provider (CNSP) for the purposes of pricing. The CNSP in each region is responsible for calculating and levying MLECs. Where a TNSP is not a CNSP, they must appoint a CNSP who is responsible for collecting their required revenue on their behalf.

It is possible for a TNSP to appoint more than one CNSP and by extension have their costs initially allocated to more than one region. There are no clear requirements for how this should be done. Historically this has been done on the geographic split of the value of assets between regions.[4]

As shown in Figure 2.3, the CNSP for a region undertakes two separate processes for setting prices:

[4] For example, in the case of Murraylink 55% of costs are assigned to the CNSP in Victoria (AEMO) and 45% to the CNSP in South Australia (ElectraNet).

1. The first process calculates how much should be charged to neighbouring regions via the MLEC. The Rules require that all CNSPs use the same process for calculating MLECs. There are two broad steps:

   - **Step one:** The CNSP must calculate the share of network costs that will be used to calculate MLEC. This will then be used to allocate charges by location in step two.

   - **Step two:** The CNSP must use load flow modelling to calculate the contribution to peak utilisation of network assets by each connection point. Some of these connection points will be within the region and some will be at the boundary to a neighbouring region. The MLEC charge will be based on the proportionate contribution to peak utilisation of assets by those connections at the boundary to neighbouring regions.

   Simultaneously, the CNSPs in neighbouring regions also calculate how much they will charge via MLECs. The outcome of charging between CNSPs in the first process feeds into the second process.

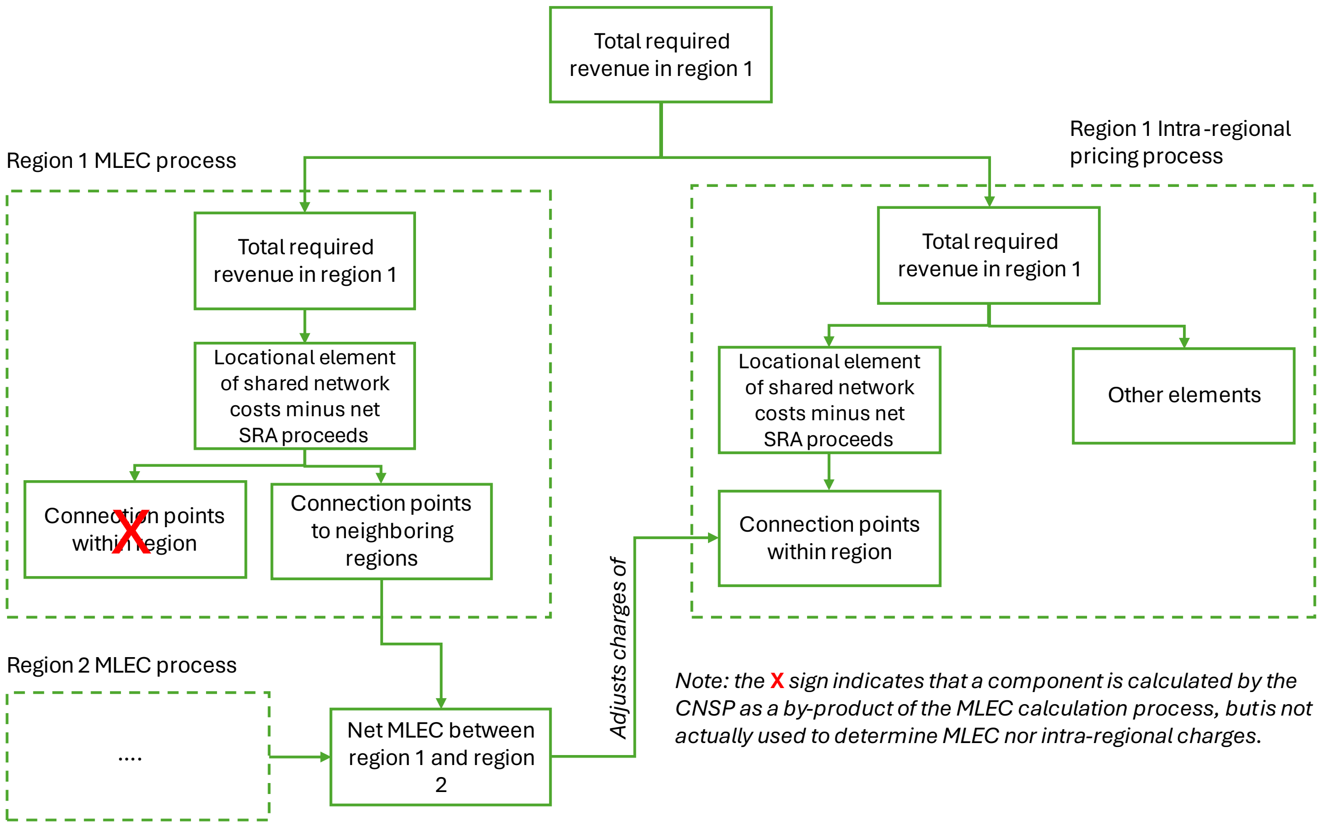
2. The second process sets prices for customers within their own region. CNSPs have a choice of methodologies for determining intra-regional prices.

Allocation of net SRA proceeds to consumers

Through the intra-regional pricing process, TNSPs distribute net SRA proceeds to their customers as a reduction to transmission network charges. In broad terms, the reduction is applied as an adjustment to the locational component of charges associated with shared network assets (see diagram below). There is some variability in the details of how TNSPs apply this adjustment and how proceeds are distributed to each connection point.

However, we note that, regardless of the approach that TNSPs adopt to allocate SRA proceeds to *connection points*, in practice SRA proceeds may not flow proportionally to all *individual electricity consumers* connected at those connection points (except perhaps transmission-connected customers). This is due to TNSP prices being passed on to end consumers only indirectly, via Distribution Network Service Providers (DNSPs) and retailers.

Figure 2.3: Simplified flow chart of MLEC process and interaction of net SRA proceeds with TNSP charges



Note: the figure reflects the simplified discussion of current arrangements provided in this section. Sections 3 and 4 provide a more detailed description.

3. INTER-REGIONAL SETTLEMENTS RESIDUE AND THE SETTLEMENTS RESIDUE AUCTION PROCESS

3.1. WHY DOES SETTLEMENTS RESIDUE ARISE AND HOW IS IT APPORTIONED BETWEEN INTER- AND INTRA-REGIONAL SETTLEMENTS RESIDUE?

Settlements residue arises because:

- generators produce more than loads consume in any trading interval, due to losses; and
- market participants face different prices depending on their location:
  - Within a region, the prices generators and loads face differ from one another to account for the impact of losses. Each market participant within a region faces the regional reference price (RRP) multiplied by a transmission loss factor – the latter of which differs by location.
  - Between regions, the prices differ due to both losses and the effects of congestion on the transmission lines between regions.

Energy settlement for each market participant is determined at each connection point for which the market participant is financially responsible on a trade interval by trading interval basis.

The settlement each trading interval is as follows:[5]

$$TA_{CP} = AGE_{CP} \times TLF_{CP} \times RRP_{CP}$$

Where:

- CP is a connection point
- TA_{CP} is the trading amount at the connection point for which the market participant is financially responsible, expressed in $.
- AGE_{CP} is the adjusted gross energy of the connection point in the trading interval, expressed in MWh, and is positive for load and negative for generation
- RRP_{CP} is the regional reference price of the region in which the connection point is located, in the trading interval, expressed in $/MWh.
- TLF_{CP} is the intra-regional loss factor for the connection point.

As the name implies, settlements residue is the difference between what generators collectively are paid and load collectively pays for energy. That is, settlements residue for a trading interval is the sum, across all connection points, of the trading amounts:

$$\text{Settlements residue} = \sum_{CP} TA = \sum_{CP} (AGE_{CP} \times TLF_{CP} \times RRP_{CP})$$

Settlements residue arises for two reasons:

1. The *quantity* generated and consumed across the market does not balance (ie, within a trading interval $\sum_{CP} AGE_{CP} \neq 0$). Generators collectively generate more than load collectively consumes due to losses.
2. The *price* that each market participant faces is not the same, for two reasons:

[5] NER 3.15.6.

a. Market participants in different regions have different RRPs. This is because the marginal cost of serving load at the different regions' RRNs differ due to losses and transmission congestion between the regions.
b. Even within the same region, the price is the region reference price multiplied by the transmission loss factor, the latter of which differs between connection points.

Settlements residue must be allocated to (or recovered from) someone. The first step on this allocation process is to split it between **inter-regional settlements residue** and **intra-regional settlements residue**.[6] The calculation of each is discussed in turn below, with an example. Inter-regional settlements residue is the focus of this paper; intra-regional settlements residue is briefly discussed for completeness and to demonstrate that all settlements residue is allocated to one or other of inter- or intra-regional settlements residue.

We understand that the reason for this split is to allocate the settlements residue appropriately. Notably, it enables inter-regional settlements residue (alone) to back inter-regional hedge instruments known as Settlement Residue Distribution (SRD) units, discussed in section 3.2. These units are intended to allow market participants to hedge the risk of price variations between the regions. Including intra-regional settlements residue – which arise from intra-regional price variations – to back these inter-regional price hedge instruments would diminish their effectiveness at managing inter-regional price risk.

Inter-regional settlements residue[7]

Inter-regional settlements residue is the residue arising from generation in one region, paid at that region's price, being consumed in another region, paid for at the other region's price.

Flows from the interconnectors are represented at the RRN of each region (as opposed to at the regional boundaries). For energy imported into a region, consumers pay the RRP in the importing region multiplied by the flow from an interconnector at the RRN in the importing region. For energy exported from a region, generators are paid the RRP in the exporting region multiplied by the flow to an interconnector at the RRN in the exporting region.

At each RRN, both the prices (RRPs) and flows into/out of the interconnectors differ. In the case of the latter, the flows into and out of the interconnectors at each RRN differ due to losses.

For each regulated interconnector, inter-regional settlements residue is calculated for each trading interval for each 'directional interconnector'.[8] That is, inter-regional settlements residues are separately calculated for flows from Region A to Region B and from Region B to Region A. The inter-regional settlements residue for a trading interval is always allocated to the directional interconnector in the importing direction in that trading interval.[9] The directional interconnector in the other direction is allocated zero in that trading interval. As the direction of flow can change between trading intervals, over time, both directional interconnectors can be allocated settlements residue.

Allocating inter-regional settlements residue by directional interconnector allows separate hedge instruments for each directional interconnector, which better suits the inter-regional price risk requirements of market participants.

Expressing the above discussion mathematically, the inter-regional settlements residue for a directional interconnector in the importing direction in a trading interval is:

$$\text{inter-regional settlements residue}_{IMP} = RRP_{IMP} \times Flow_{IMP} - RRP_{EXP} \times Flow_{EXP}$$

[6] NER 3.6.5(a)(2) and (3).

[7] Throughout this section, we have referenced the NER to the extent it constrains the approach taken by AEMO in determining inter- and intra-regional settlements residue. That said, the mathematical details of exactly how settlements residue is allocated between intra- and inter-regional settlements residue – as explained in this section – is determined under a AEMO methodology: AEMO, *Methodology for the Allocation and Distribution of Settlements Residue*, 22 July 2014, https://aemo.com.au/-/media/files/electricity/nem/settlements_and_payments/settlements/methodology_for_the_allocation_and_distribution_of_settlements_residue_july_14.pdf

[8] Rule 3.18.1(c)(2)

[9] NER 3.6.5(a)(4B)

$$\text{inter-regional settlements residue}_{EXP} = 0$$

Where:

- inter-regional settlements residue$_{IMP}$ is the inter-regional settlements residue on a directional interconnector that is importing.
- inter-regional settlements residue$_{EXP}$ is the inter-regional settlements residue on a directional interconnector that is exporting.
- Flow$_{IMP}$ is the flow out of the interconnector at the regional reference node of the importing region.
- Flow$_{EXP}$ is the flow into the interconnector at the regional reference node of the exporting region.
- RRP$_{IMP}$ is the RRP of the importing region.
- RRP$_{EXP}$ is the RRP of the exporting region.

Ignoring losses, the flow$_{IMP}$ is equal to flow$_{EXP}$ and so the equation collapses to the following:

$$\text{inter-regional settlements residue}_{IMP} = (RRP_{IMP} – RRP_{EXP}) \times \text{Flow}$$

Where 'flow' is the lossless flow between the regions. This illustrates that conceptually, the inter-regional settlement residue is the flow on the interconnector(s) between the regions, multiplied by the regional price difference. A simply numerical example of this is provided in section 2.

Where there is more than one regulated interconnector between the same two regions, all the regulated interconnectors between the two regions are deemed to constitute a single interconnector. In the calculation of inter-regional settlements residue, this deemed single interconnector is similarly treated as two directional interconnectors (from Region A to Region B and from Region B to Region A).[10] The inter-regional settlements residues for each individual regulated interconnector are aggregated and assigned to the deemed interconnector based on the direction of net energy flow between those regions.[11]

There are currently six directional interconnectors in the NEM: Queensland to NSW, NSW to Queensland, NSW to Victoria, Victoria to NSW, Victoria to SA, and SA to Victoria.

Basslink (the transmission asset between Tasmania and Victoria) is a market network service provider. Settlement residue still arises between these two regions, because Basslink is treated as a load in the region it imports from and a generator in the region it exports to. However, the settlements residue is retained by Basslink.[12]

The flows at each RRN into/out of each interconnector cannot be measured directly, as there is no physical interconnector at the RRN. The flows into the interconnector at the exporting RRN differs from the flows out of the interconnector at the importing RRN due to losses. The flows at each RRN are calculated as follows:

1. AEMO meters the flow at a defined point on the interconnector.
2. AEMO determines the losses across the entire interconnector between each RRN.

---

[10] Rule 3.18.1(c)(1).

[11] AEMO (2014), *Methodology for the allocation and distribution of settlements residue*, Version 2, 22 July, p. 10.

[12] The NER (rule 3.6.5(c)) also regulate the case where settlements residue accrues on "designated network assets", stating that "*the Primary Transmission Network Service Provider will calculate the relevant amounts to be distributed to or recovered from the owners of designated network assets in accordance with clause 3.6.2B(f)*." Designated network assets are defined in the NER (Chapter 10) as the assets that are: used from the boundary point to convey, and control the conveyance of, electricity, for an identified user group; and are for the exclusive use of the identified user group and may be owned by different persons within that identified user group. The AER publishes a register of existing dedicated networks assets. Currently, there are only three such assets (see https://www.aer.gov.au/connection-assets) and none of them is an interconnector, suggesting that the rule is only relevant to intra-regional settlements residue.

3. AEMO allocates the losses determined in step 2 to either side of the metering point in step 1 based on load flow analysis.
    a. It *adds to* the measured flow determined in step 1 the proportion of losses allocated to the exporting side of the metering point to determine the pre-loss flow at the exporting region RRN.
    b. It *removes from* the measured flow determined in step 1 the proportion of losses allocated to the import side of the metering point to determine the post-loss flow at the importing region RRN.

Inter-regional settlements residue on the importing interconnector is typically positive, at least under the current non-looped inter-regional network configuration. This is because typically, in determining the lowest cost combination of generation to meet demand, the dispatch engine will dispatch the interconnector from the lower priced region to the higher priced region. However, negative inter-regional settlements residue can occur. The lowest cost combination of generation to meet demand flows 'counter-price' – from the higher priced region to the lower priced region. This is primarily due to intra-regional congestion. In these circumstances, AEMO follows its procedures to intervene in the dispatch process to limit counter-price flows – something informally referred to as 'clamping'.[13]

Intra-regional settlements residue

If there were no flows on the interconnectors, there would still be intra-regional settlements residue due to the energy not balancing due to losses and market participants not settling at the same price due to different transmission loss factors.

Intra-regional settlements residue is the balance of settlement transactions within the region, *excluding* the interconnector component which is allocated to inter-regional settlements residue to avoid double counting.

A different intra-regional settlements residue is calculated for each region for each trading interval. That is:

RR_r = Market participant transactions in region + net interconnector exports paid at RRP

$$= \sum_{CP,r} (AGE_{CP,r} \times TLF_{CP,r} \times RRP_r) + \sum_i (NEXP_{i,r} \times RRP_r)$$

Where:

- RR_r is the intra-regional settlements residue in region r in a trading interval.
- $AGE_{CP,r}$ is the adjusted gross energy of a connection point in region r in the trading interval.
- RRP_r is the regional reference price of region r.
- $TLF_{CP,r}$ is the intra-regional loss factor for the connection point in region r.
- i is an interconnector.
- $NEXP_{i,r}$ is the net exports on interconnector i, using the convention that exports are positive and imports are negative.

Intra-regional settlements residue is determined on a region-by-region basis for the obvious reason that it can be allocated to the TNSPs (and ultimately consumers) of that region.

Example

Simple examples illustrating separately intra- and inter-regional settlements residue are provided in section 2. The following example is taken from AEMO and provides a holistic example of intra- and inter-regional settlements residue together.[14]

---

[13] NER 3.8.1(b)(11), 3.8.10(5).

[14] AEMO (2014), *Methodology for the allocation and distribution of settlements residue*, Version 2, 22 July.

Figure 3.1: Settlements residue example

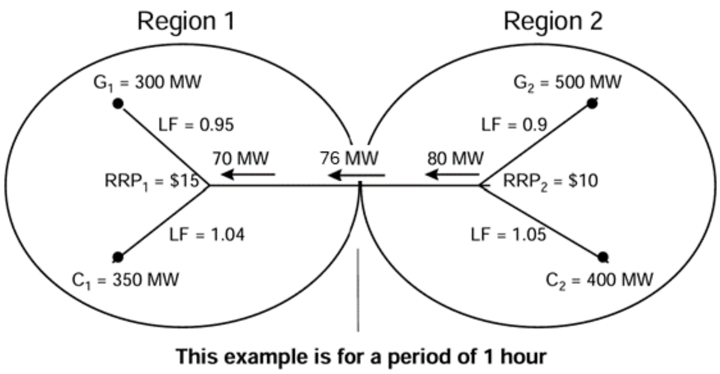


Table 3.1: Total settlements residue

Market participant	AGE × TLF × RRP	Total (TA)
Customer in region 1	350 x 1.04 x 15	$5,460
Customer in region 2	400 x 1.05 x 10	$4,200
Generator in region 1	- 300 x 0.95 x 15	-$4,275
Generator in region 2	- 500 x 0.9 x 10	-$4,500
Total settlements residue		$885

Table 3.2: Calculation of inter- and intra-regional settlements residue for each region and directional interconnector

<table>
<tr><th>Inter-regional settlements residue</th><th>Intra-regional settlements residue</th></tr>
<tr><td>To calculate the flows at each RRN we follow the three steps described above:
• Metered flow on the line at a point along the interconnector is 76MW
• AEMO determines the losses between the RRNs are 10MW
• AEMO allocates 60% of the losses to the importing side of the meter and 40% to the exporting side, resulting in the following flows at the RRNs:
  ○ RRN1 = 76 – 60% x 10 = 70MW
  ○ RRN2 = 76 + 40% x 10 = 80MW

Applying the inter-regional settlements residue formula we determine settlement residue for the importing directional interconnector as:

inter-regional settlements residue$_{IMP}$ = RRP$_{IMP}$ x Flow$_{IMP}$ – RRP$_{EXP}$ x Flow$_{EXP}$
inter-regional settlements residue$_{IMP}$ = 15 x 70 – 80 x 10
inter-regional settlements residue$_{IMP}$ = $250

Trivially, the inter-regional settlement residue in the exporting direction (from region 1 to region 2) is zero.</td><td>In region 1, the balance of the transactions is the revenue received from the consumer in region 1 less the revenue paid to the generator in region 1. From this we also add the net exports (which are negative as the region is importing) multiplied by the RRP:

RR1 = 5,460 - 4,275 + (15 x -70) = $135

Repeating for region 2, but in this case the net exports are positive:

RR1 = 4,200- 4,500 + (10 x +80) = $500

Note that these terms cancel, avoiding double counting.</td></tr>
<tr><td colspan="2">Check settlement balances
The sum of the two inter- and two intra-regional settlements residues is:

$250 + $0 + $135 + $500 = $885

Which is the same as the total settlements residue.</td></tr>
</table>

3.2. SETTLEMENTS RESIDUE AUCTIONS AND THE DISTRIBUTION OF AUCTION PROCEEDS

The treatment of inter-regional settlements residue is regulated in the NER and further detailed in AEMO guidance documents. The value of inter-regional settlements residue in each trading interval and for each directional interconnector is calculated by AEMO, as detailed in the previous section, and can be either positive or negative. Positive and negative inter-regional settlements residues are treated differently, and we focus on each case in turn.

Settlement Residue Auctions for positive inter-regional settlements residue

According to the NER, AEMO may conduct auctions, known as Settlement Residue Auctions (SRAs), where eligible participants (market customers, generators, or traders)[15] compete to buy settlements residue distributions units (SRD units).[16] Each unit is effectively a right to receive a portion of future positive inter-regional settlements residue associated with a directional interconnector.[17]

SRAs are governed by rules made by AEMO in accordance with Chapter 3.18 of the NER. A detailed description of auction rules is beyond the scope of this report. For the purposes of the present discussion, however, it is worth noting that currently AEMO holds quarterly auctions. In each quarter q, participants can bid for SRD units within 72 distinct "lots", since, for each of the six directional interconnectors, there are 12 tranches of SRD units on offer (referring to the inter-regional settlements residue that will arise in quarter q+1, q+2, …, q+12). The auction can, and in fact does, clear at a different price for each lot.[18]

Auction participants to whom AEMO issues SRD units must pay AEMO the relevant auction clearing price for the SRD units awarded.[19] These payments form the SRA proceeds, which AEMO must then distribute to the relevant TNSP,[20] i.e., the TNSP in the importing region.[21]

Any SRD units not sold are made available in subsequent auctions. Any SRD units not sold at the last relevant auction (i.e., the auction held in the quarter immediately preceding the one which the units refer to) remain unsold, and the associated inter-regional settlements residue is distributed directly to the relevant TNSP.[22]

As discussed in Section 2, and in more detail below, SRA proceeds (and inter-regional settlements residue associated with unsold SRD Units) must be used by the TNSP to offset customer charges.[23]

---

[15] Eligible persons must satisfy the following criteria: 1) being a Market Customer, a Generator or a Trader, or a person seeking to be eligible for registration as a Trader under rule 2.5A; and 2) satisfying any criteria specified in the auction rules made by AEMO. The auction rules must at a minimum exclude: persons who have not entered into an auction participation Agreement, TNSPs, any person whom AEMO considers is acting on behalf of, or in concert with, persons who have not entered into an auction participation agreement or TNSPs, and any person who would be a retail client as defined in section 761GA of the Corporations Act 2001 (Cth), if they entered into an SRD agreement with AEMO. Auction rules may also exclude persons who have previously defaulted on payment obligations under an auction participation agreement or a SRD agreement; or in relation to whom a default event has occurred. NER 3.18.2(b) and (g).

[16] NER 3.18.2(a)

[17] NER Chapter 10, definition of SRD unit.

[18] See for example AEMO's auction report for 2023 Quarter 4: https://aemo.com.au/-/media/files/electricity/nem/settlements_and_payments/settlements/auction-reports/2023/auction-report-2023-quarter-4.pdf?la=en.

[19] NER 3.18.1(b).

[20] NER 3.18.4(a)(1)

[21] AEMO (2014), p. 10.

[22] NER 3.18.4(a)(2) and AEMO (2019), *Guide to the Settlements Residue Auction*, 1 October, p. 15.

[23] NER 6A.24.1(b1)(4) indicates that, if there is more than one TNSP in the importing region, and therefore the TNSPs have appointed a CNSP to develop their pricing methodology, it is the CNSP's pricing methodology that determines how each TNSPs' charges are offset by SRA proceeds.

The costs and expenses incurred by AEMO in establishing and administering the auctions and in entering into SRD agreements[24] are recovered from the settlements residue by way of auction expense fees. Auction expense fees are ordinarily recovered from auction participants who are awarded the SRD units, based on a process set out in the auction rules. However, to the extent that inter-regional settlements residue is distributed directly to TNSPs as a result of SRD units remaining unsold, auction expense fees are recovered from the TNSPs in accordance with the auction rules – i.e., *as if* the relevant inter-regional settlements residue had been distributed to auction participants.[25]

AEMO may, with the approval of the settlement residue committee, suspend (or remove a suspension) on conducting auctions for one or more directional interconnectors for a specified period, if AEMO believes it is not practicable to conduct those auctions or those auctions are unlikely to lead to the SRD agreements in relation to all of the inter-regional settlements residue being auctioned. AEMO may also, after complying with the Rules consultation procedures, cease conducting auctions.[26]

Why is positive inter-regional settlements residue sold on auction?

As noted above, the purpose of the auction is to provide market participants the ability to hedge the impact on their cashflows of inter-regional congestion. For example, a vertically integrated gentailer with generation in region A and exactly matched load in region B faces ‘basis risk’ arising from price differences between the regions (i.e., the load in region B may be settled at a higher price than the price generation receives in region A). The settlements residue is correlated with the basis risk and so provides a hedge: the greater the price differences, the greater the basis risk, but also the greater the settlements residue that arises and is allocated through the auction.

Allocating inter-regional settlements residue by directional interconnector allows separate hedge instruments for each pair of interconnected region and direction of flow, which better suits the inter-regional price risk management requirements of market participants.

This rationale for the auctions is also stated in the 1999 ACCC determination that accepted the National Electricity Code Administrator’s (NECA’s, the AEMC’s precursor) application to change the National Electricity Code (NEC, the NER’s precursor) to enable the auctions:

> *“Power flowing over the interconnect will be sold at the exporting region’s (lower) price and purchased at the constrained importing region’s (higher) price, creating a settlements residue equal to the difference between the two prices times the amount of power flowing over the constrained interconnect. Such price differences can pose a significant financial risk to NEM participants undertaking inter-regional trades. The settlements residue can be used to hedge such price risks and hence facilitate interregional trade. […]*
>
> *Overall, the Commission is satisfied that significant public benefits will arise from the introduction of a settlements residue auction process. Implementation of the proposed arrangements should result in NEM participants being better able to manage financial risks inherent in inter-regional trading. Enhanced inter-regional trading will facilitate competition in the retail markets of each region and possibly contribute to lower energy prices for consumers.”*[27]

To expand on the arguments set out in the quote, the allocation of inter-regional settlements residue to market participants is intended to facilitate inter-regional trading and contracting. In turn, this should encourage efficient

[24] I.e., the agreement between AEMO and the eligible auction participant under which AEMO agrees to issue SRD units and the participant agrees to pay AEMO the auction clearing price for the SRD unit. NER 3.18.1(b)(1).

[25] NER 3.18.4(b) and (c)

[26] NER 3.18.2(d) and (e).

[27] ACCC (1999b), *Applications for Authorisation: National Electricity Code - Settlements Residue Auction Process*, 22 December, p. 3-4.

investment decisions by allowing generation (load) to site where it is most efficient for the whole system, rather than necessarily site in the same region as load (generation) due to risk in inter-regional trading. Efficient sharing of resource between the states was one the key reasons to implement the *National* Electricity Market. More efficient investment would be expected to contribute to lower electricity prices than would otherwise be the case.

Negative inter-regional settlements residue

The NER state that if the inter-regional settlements residue arising on a directional interconnector in respect of a trading interval is negative,[28] AEMO must recover the amount from the relevant TNSP,[29] at a time, interval, and by a method, determined by AEMO following consultation with TNSPs.[30]

In practice, this means that negative inter-regional settlements residue is not factored in the value of SRD Units (i.e., it does not reduce the value of positive inter-regional settlements residue being sold in the SRAs). Instead, AEMO recovers negative inter-regional settlements residue directly from the TNSP in the importing region on a weekly basis.[31]

Why is a different approach taken for positive and negative inter-regional settlements residue?

The rationale for not including negative inter-regional settlements residue in the value of the SRD units sold in the SRAs is summarised in two AEMC documents:

> *"[not including negative settlements residue] would mean that unit holders would retain the full [positive] value of residues …, which would thereby improve the inter-regional settlements residue as a risk management instrument. The value of inter-regional settlements residue units would no longer be diluted because of events resulting in negative settlement residues."*[32]

> *"The current Rules [which were changed] stipulate that for each directional interconnector, positive residues can be used (within the same billing week) to net off any negative residues that might occur as a result of counter-price flows. Other things being equal, this will reduce the funds paid out to inter-regional settlements residue holders and therefore reduce the firmness of the hedge."*[33]

The AEMC seemed to link higher revenue from SRA proceeds with better risk management properties of the instrument ("firmness"). Consistent with the advice Tom Walker gave the AEMC on his secondment last year as part of transmission access reform, our initial view is that this rationale is not strong.[34] The objective of a risk management instrument is to minimise profit volatility, not maximise revenue. To minimise profit variability, our initial view is that negative residue should offset positive residue and so be allocated to SRD unit holders.

---

[28] The NER also indicates that negative inter-regional settlements residue amounts should be adjusted to exclude negative inter-regional settlements residue arising as a result of an impact on central dispatch outcomes from an inter-network test. In this case:

- if the test proponent is not AEMO, the negative inter-regional settlements residue is to be borne by the test proponent (rule 5.7.7(aa)(3)); or
- if the test proponent is AEMO, the negative inter-regional settlements residue is adjusted to zero (rule 5.7.7(ab)), and AEMO must recover the cost under AEMO's budgeted revenue requirement process set out in NER 2.11.3.

[29] I.e., the TNSP in the importing region, or the Co-ordinating Network Service Provider, if there is more than one TNSP in the importing region. See NER 3.6.5(a)(4B)(i).

[30] NER 3.6.5(a)(4) and (4A). AEMO is also entitled to recover from the appropriate Network Service Provider any interest costs incurred in relation to unrecovered negative inter-regional settlements residue.

[31] AEMO (2019), p. 8.

[32] AEMC (2009), *Arrangements for Managing Risks associated with Transmission Network Congestion Rule*, p. 44.

[33] AEMC (2008), *Congestion management review*, p. 159.

[34] *PEC and negative settlements residue v2*, pp. 5-6, by email sent 14 December 2023.

How net SRA proceeds flow from TNSPs to consumers

The NER state that the SRA proceeds (plus inter-regional settlement residue not sold in the auctions, net of negative inter-regional settlements residue – from here on, for simplicity, "net SRA proceeds") distributed to a TNSP must be used to offset network service charges.[35] This process is described in Rule 6A.23.3, which states the principles for the allocation of the TNSPs' annual service revenue requirement (ASRR) for each prescribed transmission service to the relevant connection points.

In particular, the ASRR for prescribed Transmission Use of System (TUOS) services[36] is divided between a locational component and a non-locational component.[37] The locational component must be adjusted by subtracting net SRA proceeds (as well as net MLEC, as discussed in the next section).[38]

The adjusted locational component is allocated to the connection points of Transmission Customers (i.e., DNSPs, as well as customers connected directly to the transmission network, such as industrial loads) on the basis of their proportionate use of the network,[39] using either the cost reflective network pricing (CRNP) methodology or the modified CRNP methodology. The key difference between CRNP and modified CRNP is that:

- The CRNP assumes a 50:50 split between the locational and non-locational components of the TUOS ASRR. The locational component is allocated to each transmission system asset based on its replacement cost relative to the replacement cost of all relevant transmission system assets. For each asset, this 'locational network asset cost' is then allocated to connection points on a pro rata basis according to the maximum 'flow component' that each load has imposed on the asset.
    - CNSPs that adopt this approach (currently AEMO, in its capacity as the provider of shared transmission services in Victoria, and Powerlink) subtract net SRA proceeds from the locational component of TUOS, and then allocate this adjusted locational component to individual assets and connection points as explained above.[40] This approach effectively distributes net SRA proceeds to connection points in proportion to the share of *total* locational TUOS charges they bear.
- The modified CRNP does not assume a 50:50 split between the locational and non-locational components. Instead, it allocates the TUOS ASRR to each transmission system asset based on its replacement cost relative to the replacement cost of all relevant transmission system assets. For each asset, the amount derived in this way is multiplied by a factor between 0 and 1 reflecting the asset's level of utilisation. These utilisation-adjusted amounts form the locational component of TUOS,[41] and are allocated to connection

[35] NER 3.6.5(a)(6). This includes any such payments as adjusted by a routine revised statement or special revised statement issued as part of AEMO's settlements process under rule 3.15.

[36] TUOS services exclude entry and exit services, and common transmission services (i.e., those that provide equivalent benefits to transmission customers regardless of their location within the transmission system).

[37] NER 6A.23.3(a). The allocation can be either 50% to each component, or through an alternative allocation *"that is based on a reasonable estimate of future network utilisation and the likely need for future transmission investment, and that has the objective of providing more efficient locational signals to Market Participants, Intending Participants and end users"*.

[38] NER 6A.23.3(b)

[39] If the adjusted locational component is a negative amount, then the adjusted locational component will be deemed to be zero and the absolute value of that negative amount is to be subtracted from the non-locational component. NER 6A.23.3(c) and (d).

[40] AEMO (2021), Pricing Methodology for Prescribed Shared Transmission Services - 1 July 2022 To 30 June 2027, p. 17; PowerLink (2021), Pricing Methodology 1 July 2022 To 30 June 2027, Version 1.5, p. 11-12. Basslink is currently the only interconnector between Tasmania and the rest of the NEM. As Basslink is a market network service provider (MNSP), at the moment there is no requirement for TasNetworks to make an adjustment for net SRA proceeds – see TasNetworks (2023), Transmission Pricing Methodology: 2024-2029 Regulatory Control Period, p. 15.

[41] The remainder of the TUOS ASRR forms the non-locational component of TUOS.

points on a pro rata basis according to the maximum 'flow component' that each load has imposed on each network asset.[42]

- CNSPs that adopt this approach (currently ElectraNet and TransGrid) deduct net SRA proceeds specifically from the replacement costs of relevant interconnector network assets. Other things equal, this approach reduces the portion of the ASRR associated with these assets, and recovered from those who contribute to the assets' usage. In other words, these TNSPs allocate net SRA proceeds to connection points in proportion to the share of locational TUOS charges they bear *for relevant interconnector network assets*.[43] ElectraNet notes that in this way net SRA proceeds recover a portion of the revenue requirement allocated to shared network costs on a locational basis.

As a result, the precise way in which each TNSP adjusts locational TUOS charges to account for net SRA proceeds varies depending on whether the TNSP chooses to adopt the CRNP or modified CRNP approach.

Why are net SRA proceeds distributed to consumers?

The ACCC stated the original rationale for returning inter-regional settlements residue to consumers via TNSPs in their 1997 NEC authorisation:

> *"This mechanism was primarily chosen because the legitimate recipient of the settlements residue should be the relevant NSP.* [Note: this was written before the introduction of SRA auctions – hence the wording suggesting that inter-regional settlements residue is allocated directly to NSPs]. *The applicants state if interconnector owners were direct participants in the spot market competing to transport electricity between regional reference nodes, the settlements residue that arose would be paid to the interconnector owner in accordance with the transport services provided. However, because NSPs will receive a regulated income they relinquish their claim to retain the residue and instead it is to be passed through to network users via a reduction in network service charges."*[44]

This was expanded on in the 1999 ACCC decision introducing SRAs:

> *"Auction proceeds and unsold settlements residue is to be distributed to importing transmission network service providers, to be passed on to customers by using the money to reduce network charges (existing clause 3.6.5 and proposed clause 3.18.4). […] In this way, the commercial trading of the residue in the market will still result in a settlements residue distribution that is transparent as part of the TNSPs regulated income, can be universally applied, and is equitable, as consumers will receive a benefit via reduced transmission charges. This distribution is also efficient in its retention of the locational signals provided by marginal loss factors."*[45]

The quotes above indicate that the ACCC viewed inter-regional settlements residue as the benefit associated with the provision of a transmission service by the importing TNSP (transporting electricity from a lower price to a higher price region). However, the TNSP, who receives a regulated revenue stream for its services, is required to pass this

---

[42] NER Schedule 6A.3

[43] ElectraNet notes that the amount of the adjustment is "*converted to an equivalent asset replacement cost, which is offset against the asset replacement cost of the relevant interconnector network assets. If the equivalent asset replacement cost is greater than the interconnector network asset costs, then the interconnector network asset costs are set to zero and the outstanding portion of the estimated proceeds is offset against the non-locational prescribed TUOS service component. The reduced network costs are used as an input to the modified cost reflective network pricing methodology*". TransGrid uses words to the same effect. See ElectraNet (2022), *Revised Proposed Pricing Methodology - 1 July 2023 to 30 June 2028*, Version 4.1, 2 December, p. 18; and Transgrid (2021), *Pricing Methodology 2023/24 – 2027/28*, p. 14.

[44] ACCC (1997), Applications for Authorisation: National Electricity Code, 10 December, p. 91.

[45] ACCC (1999), *Applications for authorisation: National Electricity Code - Settlements Residue Auction Process*, Draft decision, 27 October, p. 7.

benefit on to the consumers in the importing region, who fund that revenue stream.[46] Put differently, through the distribution of SRA proceeds, it is as if consumers in the importing region received the benefit from consuming electricity produced in a lower price region, noting that the same consumers are also paying for the transmission assets that enable this inter-regional consumption.

Another possible interpretation of the current arrangements, in addition to the rationale stated by the ACCC, is that consumers in the importing region face a (typically) higher RRP than in the exporting region, due to inter-regional network constraints. If the constraints were removed (e.g., by investing in additional interconnector capacity), those consumers presumably would see a reduction in their RRP. Therefore, consumers in the importing region should be allocated the benefit associated with settlements residue that arises as a result of those constraints.

Finally, the ACCC considered that it was desirable to distribute SRA proceeds to consumers in a way that retains locational signals. However, we note that, even if net SRA proceeds are distributed to transmission *connection points* through locational charges, in practice they may not flow proportionally to all individual electricity consumers (except perhaps transmission-connected customers). This is due to TNSP prices being passed on to end consumers only indirectly, via Distribution Network Service Providers (DNSPs) and retailers.

Jurisdictional derogations

It is worth noting that, in the section that regulates the treatment of inter-regional settlements residue, the NER also state that *"full effect is to be given to the jurisdictional derogations contained in Chapter 9 relating to settlements residue"*.[47] However, currently Chapter 9 does not appear to include any explicit references to settlements residue, other than in rule 9.29.5 "Distribution Network Pricing – South Australia", which in practice does not appear to introduce any different arrangements for that region relative to other regions:

> *"(f) Any reduction in transmission network charges as a result of a regulatory reset (**excluding** reductions resulting from the distribution of settlements residue and settlements residue auction proceeds) must be paid to all customers."* [emphasis added]

Other jurisdictional derogations were present in the past, and subsequently cancelled. For example, in 1999 the South Australian government applied for a derogation – which was accepted by the ACCC as a transitional measure ending in 2002. The derogation set out that the settlements residue arising from the flows across the interconnector from Victoria into South Australia were to be distributed as follows:

- A maximum of 50% to be made available to hedge the exposure of retailers (ETSA Power) in SA to fluctuating electricity prices with respect to franchise (non-contestable) customers. The 50% figure was based on the maximum percentage of franchise customers to total load in South Australia – the actual percentage would decrease as the ratio of franchise to total customers declined.
- The remainder to be handed back to the National Electricity Market Management Company (NEMMCO, AEMO's predecessor) for *"an auction in support of inter-regional price hedging"* – i.e., the current SRA.[48]

[46] Consistent with the ACCC reasoning, MNSPs, who do not receive a regulated revenue stream and instead participate in the spot electricity market, retain the income that they obtain in the market by bidding as load in the lower price exporting region and selling as generation in the higher price importing region.

[47] NER 3.6.5(a)(1).

[48] ACCC (1999b).

4. MODIFIED LOAD EXPORT CHARGES

This section provides a technical explanation for how MLECs are calculated and levied on neighbouring regions. The explanation is split into three sub-sections.

- Aggregation of intra-regional required revenue.
- Determination of MLEC charges and their impact on intra-regional transmission charges.
- The rationale for current arrangements.

Aggregation of required revenue

The requirement for a coordinating network service provider (CNSP) arises when there are multiple TNSPs within a region. Each region has a single TNSP appointed as the CNSP. Where a TNSP is not a CNSP they must appoint a CNSP who is responsible for collecting that TNSP's required revenue on their behalf. The CNSP is:

- responsible for determining the structure of intra-regional and inter-regional (MLEC) charges.[49]
- responsible for charging CNSPs in neighbouring regions as well as customers intra-regionally to recover required revenue.[50]
- allocating revenues to TNSPs that are not the CNSP within their region.[51]

It is possible for a TNSP to appoint more than one CNSP. For example, Murraylink has appointed two CNSPs – AEMO (the CNSP in Victoria) and ElectraNet (the CNSP in South Australia).[52] Murraylink states provides transmission services in both Victoria and South Australia. Murraylink's previous pricing methodology explicitly allocates their costs 55% to AEMO and 45% to ElectraNet while their most recent pricing methodology makes no mention of the percentages.[53] The AER states that costs are allocated "*according to the value of Murraylink's assets in each State*".[54] We have not been able to identify a requirement in the Rules or the AER's pricing methodology guidelines that requires a regulated interconnector assign costs by geographic split.

Determination of MLEC charges and impacts

MLECs are the mechanism by which a CNSP in one region charges a CNSP in another region (and by extension, that CNSP's customers) for transmission services. MLEC charges are determined by the CNSP's pricing methodology. Transgrid is a CNSP and we use their pricing methodology to demonstrate current practice.[55]

Below we first explain how MLECs are calculated and then explain how intra-regional prices are adjusted.

MLEC calculation

The Rules set out how the CNSP must calculate MLECs.[56] MLECs are calculated for the following financial year and must use estimates.[57] The Rules set out four steps for calculating MLECs.

---

[49] In reference to MLECs: NER 6A.29A.2

[50] In reference to MLECs: NER 6A.29A.4

[51] NER 6A.29A.5

[52] Murraylink (2012), Pricing Methodology.

[53] Murraylink (2022), Pricing Methodology.

[54] AER (2023), Final decision – Murraylink transmission determination.

[55] Transgrid (2021), Transgrid pricing methodology.

[56] NER 6A.29A.2

[57] NER 6A.29A.2(a)

The first step takes the total annual cost of providing shared network services and multiplies it by 50%.[58] TNSPs provide a range of services and each TNSP's pricing methodology explains how prices will be determined for each of these services.[59] The Rules require that only costs associated with "*shared network services*" be charged inter-regionally.[60] The multiplication by 50% represents the locational component of shared network services.[61]

The second step adjusts the result of the first by subtracting any amount estimated to be receivable from the net SRA proceeds.[62]

The third and fourth steps allocate the amount produced in the second step to connection points.[63] These connection points can either be intra-regional or to neighbouring regions. Neighbouring region's connection points must be treated "*as if those connection points were also connection points of Transmission Customers*". The calculation must also be "*based on demand at times of greatest utilisation*" and "*for which network investment is most likely to be contemplated*". TNSPs must use "*MLEC CRNP [Cost Reflective Network Pricing] Methodology*" for this process.[64]

The aim of cost reflective pricing is to calculate the relative contribution of each connection point to the peak utilisation experienced by each transmission element. TNSPs use load flow modelling for this calculation. Our understanding of the required steps to implement the MLEC CRNP methodology are as follow:[65]

1. Firstly, the optimised replacement costs (ORC) of each transmission element are determined.
2. Secondly, load flow modelling measures the peak loading on each transmission element and determines the contribution of each 'customer connection' to peak loading. In the case of MLEC a 'customer connection' could be a neighbouring region.
3. Thirdly, the ORC of each element (1) is multiplied by the contribution of each connection to peak load (2). This represents each connection's contribution to that transmission element's cost.
4. Fourthly, the contribution calculated in (3) is summed cross all transmission elements. This represents a connection's contribution to the proportionate cost of every transmission element. The total annual locational charge is then assigned to each customer connection in this proportion.

The AER Guidelines require that the MLEC CRNP methodology use data from the previous financial year.[66]

The MLEC charge is the charge allocated by this process to inter-regional connection points. This process also calculates a charge for intra-regional connection points. However, this information is not used for actual charging.

Price adjustment for intra-regional prices

[58] NER 6A.29A.2(a)(1)

[59] NER 6A.23.4 requires the TNSPs have separate prices for "prescribed TUOS Services – adjusted locational component" and "prescribed TUOS services – adjusted non-locational component". We, like most TNSPs, refer to these two components as "shared network services". The other prices are "prescribed common transmission services", "prescribed entry services", "prescribed exit services" and "system strength services".

[60] The phrase "*shared network services*" does not appear in the Rules. However, it is commonly used by TNSPs to describe these services for example in Transgrid (2021). It is in our view clearer than the language that does appear in the Rules which is "*prescribed TUOS services*".

[61] In reference to MLECs, the Rules do not state that 50% * annual revenue requirement for shared network services results in the locational portion. However, this is the intention as stated in AEMC (2013), Rule Determination – National Electricity Amendment (inter-regional transmission charging) Rule 2013.

[62] NER 6A.29A.2(a)(2)

[63] NER 6A.29A.2(a)(3) and NER 6A.29A.2(a)(4)

[64] NER 6A.29A.2(b)

[65] This is based on Transgrid (2021), Transgrid Pricing Methodology and ROLIB Pty Ltd (2012), Modelling of Load Export Charges. It is possible the Rules allow for alternative implementations while still meeting the requirements of the Rules in relation to the MLEC CRNP Methodology.

[66] AER Pricing Methodology Guidelines 2.6(g).

MLECs will be calculated by all regions for each adjacent region and each region will then charge neighbouring regions. Region A therefore calculates an MLEC for region B and vice versa, and so on across all regions. The net of these charges is determined by each region which is used to adjust the locational prices for intra-regional charges,[67] as mentioned above in Section 3.2. As an example, we assume that there are just two regions – Region A and Region B. Region A charges Region B $100 for MLEC and Region B charges Region A $80 for MLEC then the net impact for Region A is $20. This means locational charges for Region A's customers will be reduced by $20.

If there is more than one TNSP within a single region the CNSP is responsible for allocating net MLEC to the other TNSPs.[68] This is done on the basis of ORC asset values.[69]

As discussed in this section, net SRA proceeds are subtracted from the locational component of shared network services costs prior to calculating MLEC. As discussed in Section 3.2 above, a similar adjustment also applies to the locational component of intra-regional charges. Despite the apparent duplication, when considered jointly the MLEC process and the intra-regional charging process do not double-count net SRA proceeds – in other words, for every $1 of net SRA proceeds distributed to a TNSP, there is only a $1 reduction to total TNSP charges.

This is because net MLEC is subtracted from intra-regional charges. Expanding on the example above, assume that Region A has $10 of net SRA proceeds. Further assume that, as a result of the SRA adjustment in the MLEC calculation, the MLEC charged by Region A to Region B is *reduced* by $1 (compared to a case where MLEC had not been adjusted). Net MLEC for Region A is now only $19. This means that locational charges for customers in Region A will be reduced by $19 (instead of $20), so they will now be $1 *higher* (compared to a case where MLEC had not been adjusted). The locational charges for Region A's customers are also adjusted for the full $10 of net SRA proceeds. The combined impact of these adjustments on Region A's total charges is exactly a $10 reduction, equal to the amount of net SRA proceeds.

Table 4.1: Illustrative example – Total impact of adjustments for net SRA proceeds

	Impact on Region A charges	$ impact in the example
MLEC adjusted for net SRA proceeds	MLEC charged by Region A to Region B is lower (compared to case where MLEC had not been adjusted)	-$1
Intra-regional charges adjusted for net MLEC	Intra-regional charges are higher (compared to case where MLEC had not been adjusted)	+$1
Intra-regional charges adjusted for net SRA proceeds	The SRA adjustment reduces intra-regional charges	-$10
Total impact	Total charges are reduced exactly by the amount of net SRA proceeds	-$10 (comprising a -$1 reduction to MLEC charged to Region B, and a net -$9 reduction to intra-regional charges)

More broadly, the MLEC process does not impact the total amount of revenue recovered collectively by the customers of all regions – it merely allocates the revenues between regions. Changing any step in determining MLEC does not affect the total revenue recovered.

[67] NER 6A.23.3(b)(2).

[68] NER 6A.29A.5.

[69] Transgrid (2021), Transgrid Pricing Methodology.

Rationale for current arrangements

The AEMC introduced MLEC's through a rule change in 2013.[70] We draw on the rationale set out in that document in our discussion here.

In 2013 a rule change request was put forward by the Ministerial Council on Energy (MCE). This requested that transmission businesses be required to levy a new charge – "*a load export charge*" – on transmission businesses in neighbouring regions. When this occurs consumers in the importing region will utilise the network in the exporting region. The charging arrangements prior to the 2013 rule change were such that consumers were not charged for utilising the network in the neighbouring region.

The Commission determined to make a more preferable rule than that initially proposed by the MCE instead adopting a "*modified load export charge*". The Commission accepted that inter-regional transmission charging would better promote the National Electricity Objective. There were three reasons put forward for this:

- TNSPs will have a greater incentive to pursue efficient transmission investments for which costs predominantly fall in their own regions and benefits fall in neighbouring regions. This is because they will now be able to recover some of the costs of the investment from neighbouring regions.
- Prices consumers face for transmission services will be more reflective of the actual costs incurred in providing those services.
- Credibility of, and confidence in, regulatory arrangements is improved as the costs of transmission capacity used for conveying electricity between regions is allocated to the regions that derive benefits from such capacity.

However, there were two key differences from the rule proposed by the MCE. The main differences and their justifications were as follows:

- Firstly, the adopted Rule required a consistent pricing methodology be applied by all TNSPs. This required a standard way to calculate the charge and an application of a 50/50 split to shared network services revenue to represent locational charges. The 50/50 split was consistent with the approach to locational charges that was adopted at the time by most but not all TNSPs. This was done to prevent MLECs being "*higher or lower for some regions purely based on the methodology for determining locational charges*".
- Secondly, the MLEC would be calculated separately from the calculation of intra-regional transmission charge. This was done to allow TNSPs to retain their intra-regional charging arrangements.

An alternative rule change for cost sharing was put forward by a group of generators was also rejected. Under this option, assets associated with inter-regional flows would be identified with costs then apportioned between regions. The cost-sharing allocation is determined in advance of the asset being constructed and fixed for the duration of the asset life. The cost allocation would be based on an estimate of market benefits of the new transmission asset. In their assessment of this proposal the Commission highlighted the following:

"while the group of generators' proposal for cost sharing prima facie also has merit in allocating costs on a regional beneficiary pays basis, the lack of stability of beneficiaries over time weakens the approach."

"The Commission considers that a key weakness of this approach is the significant uncertainty associated with modelling the spread of benefits before the assets are built. This would need to be done on forecast direction of flows, which could potentially change with each new investment in generation or load, as well as depending on the bidding behaviour of generators which is notoriously difficult to model.

Consequently, there would be a substantial risk for long lived transmission assets that costs of a long lived asset will become misallocated over time, given the likelihood that beneficiaries will change over time. Further, in light of such

---

70 AEMC (2013), Rule Determination – National Electricity Amendment (inter-regional transmission charging) Rule 2013.

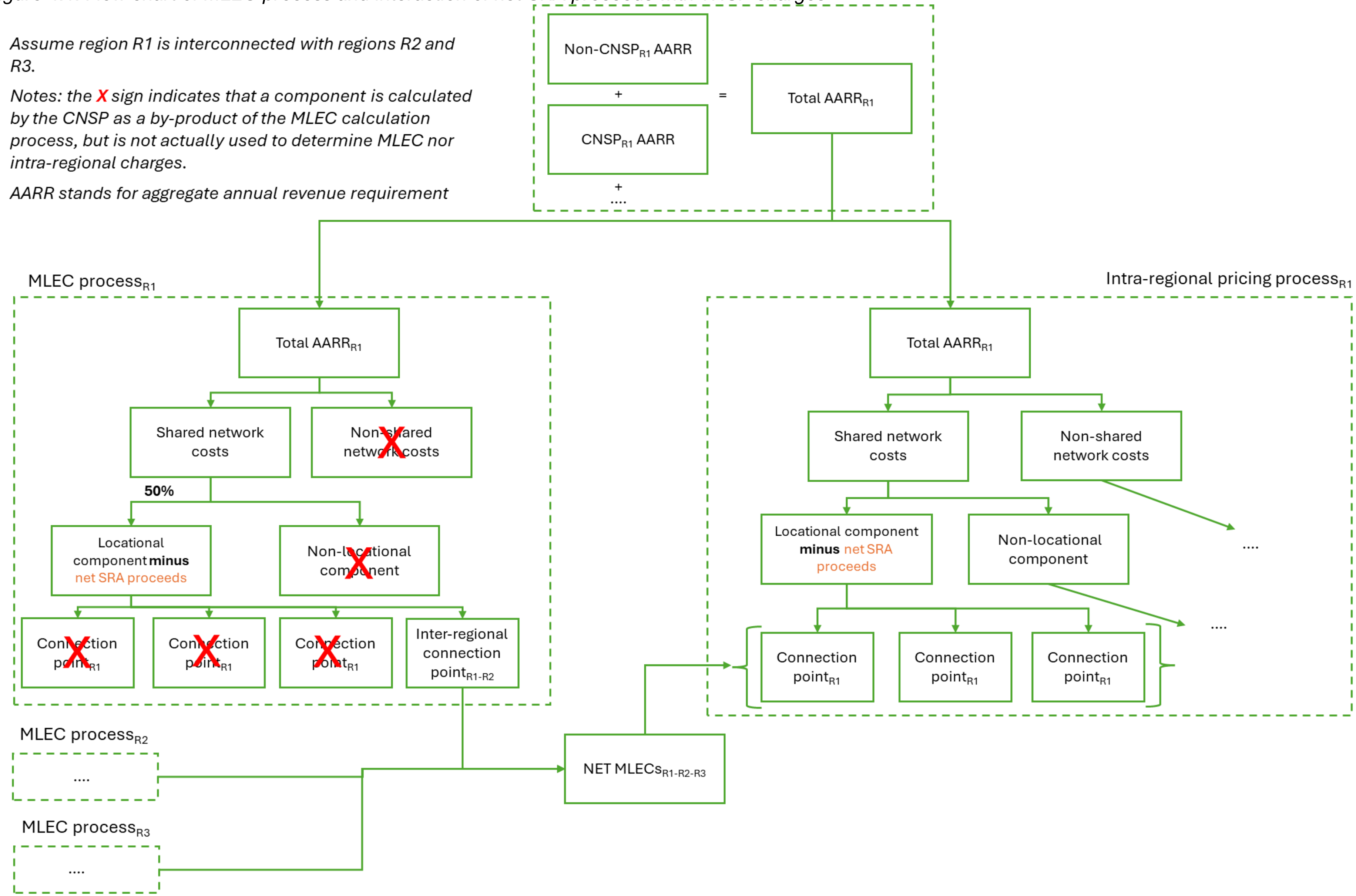
uncertainty surrounding calculating future benefits, obtaining agreement on cost sharing between different jurisdictions before such assets are built under the RIT-T process is likely to be challenging and could delay projects while disputes over benefit allocation are resolved."

Figure 4.1: Flow chart of MLEC process and interaction of net SRA proceeds with TNSP charges

Assume region R1 is interconnected with regions R2 and R3.

*Notes: the **X** sign indicates that a component is calculated by the CNSP as a by-product of the MLEC calculation process, but is not actually used to determine MLEC nor intra-regional charges.*

AARR stands for aggregate annual revenue requirement



Appendix A AN ALTERNATIVE WAY TO THINK ABOUT SETTLEMENTS RESIDUE

As noted throughout, it's typical (and correct) to consider settlements residue as the difference between what load collectively pays and generators are collectively paid for energy.

The 1997 ACCC decision quoted in Section 3 reveals an alternative – and equally correct – way to think about settlements residue. Under this conception, the current settlements arrangements work as if all generators and loads were settled at the *same price for energy* but also faced a separate charge to access the network. These network charges, net of the costs associated with losses, is the settlements residue. This is demonstrated mathematically in Box 1 below. In summary:

- Intra-regionally, it is as if generators and loads were settled for energy at the RRP (unadjusted for transmission loss factors) and then were *separately* charged for intra-regional access at an estimate of the marginal cost of losses.
- Inter-regionally, it is as if generators whose generation is consumed in an adjacent region were settled at the RRP of that *adjacent region* (i.e., the same price that the load consuming it pays), and then were *separately* charged for inter-regional access at the marginal cost of losses and congestion. This inter-regional access charge, net of costs associated with losses, is the inter-regional settlements residue. In its 1997 determination, the ACCC reasoned that, if TNSPs were market participants offering to transport electricity across regions, settlements residue would be paid to them, in accordance with the transmission service provided.[71]

Box 1: Settlements residue as a network access charge – mathematical illustration

We can rearrange the settlement equations to demonstrate this mathematically.

Recall the intra-regional settlements residue equation from above:

RR_r = Market participant transactions in region + net interconnector exports paid at RRP

$= \sum_{CP,r} (AGE_{CP,r} \times TLF_{CP,r} \times RRP_r) + \sum_i (NEXP_{i,r} \times RRP_r)$

This can be rearranged as follows:

$RR_r = \sum_{CP,r} [(TLF_{CP,r} - 1) \times RRP_r \times AGE_{CP,r}] + \sum_{CP,r} [(AGE_{CP,r} + \sum_i NEXP_{i,r})] \times RRPr$

In yellow is the intra-regional access charge for market participants. A TLF < 1 means that a generator pays (assuming the RRP is positive; recall that for generators, AGE is negative), and vice versa. A TLF of 1 means there is no intra-regional access charge. In blue is the short run cost imposed on the TNSP in running the network, relating to losses. The sum of AGE in a region plus net exports from the region is negative due to losses (i.e., generation exceeds load plus exports). Assuming the RRP is positive, the cost (in blue) is negative. The intra-regional residue within the region is simply the intra-regional access charges (in yellow) less the short run cost of operating the system (in blue).

Similarly, recall that the inter-regional settlement residue equation is:

inter-regional settlements $\text{residue}_{IMP} = RRP_{IMP} \times Flow_{IMP} - RRP_{EXP} \times Flow_{EXP}$

This can be rearranged as follows:

inter-regional settlements $\text{residue}_{IMP} = (RRP_{IMP} - RRP_{EXP}) \times Flow_{EXP} + RRP_{IMP} \times (Flow_{IMP} - Flow_{EXP})$

In pink is the inter-regional charge imposed on generators in the exporting region who export their generation to the importing region, *assuming the generator is paid the RRP in the importing region*. In green is the cost imposed on

[71] The ACCC also noted that in practice, because TNSPs have access to a regulated revenue stream funded by their consumers, they relinquish their claim to retain the settlements residue, and instead must pass the associated benefit through to network users via a reduction in network service charges.

the system due to losses, equal to the quantity of lost energy settled at the RRP in the importing region. The inter-regional residue across the interconnector is simply the charges (in pink) less the short run cost of losses (in green).

Finally, we can put together the total transactions faced by a generator:

Revenue (generator) = $AGE_{LOCAL} \times RRP_{LOCAL} + \sum_r(AGE_r \times RRP_r)$ + $[(TLF - 1) \times RRP_{LOCAL} \times AGE]$ - $\sum_r (RRP_r - RRP_{LOCAL}) \times AGE_r$

Where:

- AGE_{LOCAL} is the generator's adjusted gross energy that is consumed locally
- AGE_r is the generator's adjusted gross energy that is exported to an adjacent region, r
- $AGE_{LOCAL} + \sum AGE_r = AGE$, i.e, the sum the generator's AGE that is consumed locally and exported to other regions is the AGE of the generator
- RRP_{LOCAL} is the RRP in the generator's region
- RRP_r is the RRP in an adjacent region r

In red the generator gets paid the local RRP (i.e., the RRP in its region) for energy consumed in the region, plus the RRP in the adjacent region(s) for the energy consumed in the adjacent region(s). It then pays for intra-regional transmission services, in yellow, to transport all the energy to the local RRN, as well as inter-regional access for the energy transported between its local RRN and adjacent RRN(s) (in pink).

Note that in the equation above, many terms cancel, to become:

Revenue (generator) = $AGE \times RRP_{LOCAL} \times TLF$, i.e., the familiar settlement equation for a generator.

UK

Queens House

55-56 Lincoln’s Inn Fields

London WC2A 3LJ

T. **+44 (0)20 7269 0210**

E. **info@cepa.co.uk**

www.cepa.co.uk

Australia

Level 20, Tower 2 Darling Park

201 Sussex Street

Sydney NSW 2000

T. **+61 2 9006 1308**

E. **info@cepa.net.au**

www.cepa.net.au

Cepa-ltd

@cepaltd