Response to AER Information Request – Sydney CBD RIT-D Dispute

The issue in dispute and a summary of our response

The Energy Users' Association of Australia (EUAA) have submitted to the Australian Energy Regulator (AER) a notice of dispute relating to Ausgrid's Final Draft Assessment Project (FPAR) for the 'ensuring reliability requirements in the Sydney CBD' Regulatory Investment Test for Distribution (RIT-D) under clause 5.17.5 of the National Electricity Rules (NER).

The dispute is stated to be solely in relation to the Value of Customer Reliability (VCR) used in the assessment. In particular, the EUAA state that:[1]

> *'Ausgrid has used a VCR value of $170/kWh for Sydney CBD which is inconsistent with the agreed Sydney CBD value of $90/kWh used by TransGrid and Ausgrid as the basis for their Powering Sydney's Future project'*

Ausgrid wishes to clarify that there was never an "agreed Sydney CBD value of $90/kWh". Rather, as the discussion below and background materials make clear, VCR forecasts have been debated and analysed in a number of different contexts, and different forecasts have been used for different geographic areas, different customer groups, and different purposes.

The figure of $90/kWh is in fact an estimate of VCR for the Inner Sydney area (an area which includes, but is not limited to, the Sydney CBD). It is not an agreed estimate for the Sydney CBD.

It is important to understand the two different areas and sets of customers that the Powering Sydney's Future (PSF) Regulatory Investment Test for Transmission (RIT-T) and the Sydney CBD RIT-D each plan to avoid involuntary load shedding for. This is summarised in the table below.

Regulatory test	Relevant area(s)
PSF RIT-T	Sydney CBD and surrounding suburbs (An area collectively referred to as 'Inner Sydney')
Sydney CBD RIT-D	Sydney CBD

We include a map in our response to Information Request Item 1 below of how these two areas interact, as well as information regarding how they each serve a fundamentally different customer base and why they can reasonably be expected to value reliable electricity supply differently.

We note that the VCRs for the Sydney CBD area and the wider Inner Sydney area were discussed at length as part of the recent PSF RIT-T, that Ausgrid was party to, as well as the coincident TransGrid Revenue Proposal process. We consider it important that the chronology of these events is fully understood as it will help understand why a VCR of $170/kWh has been used for the Sydney CBD RIT-D.

We therefore present a summary of these events below:

- In early 2016, based on widespread recognition at the time that the standard AEMO VCR estimates are inappropriate for the types of outages contemplated under the PSF RIT-T,[2]

[1] See page one of the letter dated 2 July 2018 from the EUAA to Ms Paula Conboy regarding the Notice of a Dispute under Clause 5.17.5 of the NER.

TransGrid engaged the economic consultancy firm HoustonKemp to independently estimate appropriate VCR values for both customers in the Sydney CBD as well as the wider Inner Sydney area drawing on existing publicly available estimates.

- In July 2016, the final HoustonKemp VCR report recommended:[3]
  - a range of $150-192/kWh for the Sydney CBD area; and
  - $90/kWh for the wider Inner Sydney area.
- In December 2016, the Independent Pricing and Regulatory Tribunal (IPART) released its final report on the New South Wales electricity transmission reliability standards, which used:
  - a VCR of $90/kWh for the Inner Sydney area (which includes Sydney CBD) explicitly referencing the Inner Sydney value estimated by HoustonKemp;[4] and
  - did not comment on the higher VCR estimated by HoustonKemp for the Sydney CBD as the transmission reliability standards IPART determines do not distinguish between Sydney CBD and Inner Sydney.[5]
- In May 2017, the Project Assessment Draft Report (PADR) for the PSF RIT-T incorporated the HoustonKemp estimates – specifically, it used:
  - the mid-point of the HoustonKemp VCR range for the Sydney CBD, ie, $170/kWh; and
  - $90/kWh for the wider Inner Sydney area.
- In September 2017, the AER, in its Draft Decision on TransGrid's Revenue Proposal, queried the use of VCR estimates in the PSF PADR analysis for the Sydney CBD that were above those used by IPART in reviewing the reliability standard for Inner Sydney.
- In November 2017, the final report and economic analysis for the PSF RIT-T was published, which used a figure of $90/kWh for *both* customers in Inner Sydney and the Sydney CBD – however, at the time, TransGrid and Ausgrid stated that:[6]
  - they still consider that there are good reasons to believe that the VCR for customers in Sydney CBD would be higher than in Inner Sydney (as set out in the HoustonKemp report); and
  - as it was found that using the $170/kWh or $90/kWh figure for Sydney CBD customers was not material for the identification of the optimal timing for the PSF project, or for the outcome under the RIT-T analysis, it was decided to adopt the $90/kWh figure to avoid this continuing as a point of contention in the PSF RIT-T.

In late 2017, when the Sydney CBD RIT-D was commenced, it was still Ausgrid's view that any RIT-D economic assessment addressing unserved energy for customers in the Sydney CBD area (as opposed to the wider Inner Sydney area) should use a VCR of $170/kWh. This was, and still is, the only independent estimate of the VCR for customers in Sydney CBD for the types of outages that the Sydney CBD RIT-D is planning to avoid.

Since the VCR is inherently difficult to estimate and is used to inform investment decisions that have potentially significant ramifications in terms of electricity supply to customers, and the cost that outages impose on homes and businesses, we consider that adopting a $170/kWh VCR should be considered a prudent decision for the Sydney CBD RIT-D.

---

[2] A view that we note is also held by AEMO for these types of outages. Please refer to section 7.1.2 of the Powering Sydney's Future PADR for a detailed discussion of the inappropriateness applying the standard AEMO VCR values to the types of outages considered, including AEMO's view.

[3] HoustonKemp, *CBD and Inner Metro VCR estimates*, 28 July 2016, p. 2. The HoustonKemp report is provided as Appendix C to the Powering Sydney's Future PSCR.

[4] IPART, *Electricity Transmission Reliability Standards – Unserved Energy Allowances for Inner Sydney and Broken Hill, Molong, Mudgee, Munyang and Wellington Town*, Supplementary Final Report, November 2016 p. 22.

[5] In particular, IPART determines electricity transmission reliability standards for NSW as well as explicit unserved energy allowances for six regions – namely Inner Sydney, Broken Hill, Molong, Mudgee, Munyang and Wellington Town.

[6] TransGrid & Ausgrid, *Powering Sydney's Future Project Assessment Conclusions Report*, November 2017, p. 28.

In addition, we consider our approach for the Sydney CBD RIT-D to be consistent with principles broadly contained in earlier VCR guidance and reiterated in the draft RIT-D application guidelines released by the AER on 27 July 2018 (whilst noting that the new guidelines were not available when we undertook this RIT-D). In particular, the draft RIT-D guidelines state that, when considering what VCR to apply, the RIT-D proponent should:[7]

- consider the willingness to pay for a reliable supply of electricity, across a range of customers that the credible options in question will affect;
- have regard to the factors that cause the VCR to vary, including outage length, width of affected area, and customer type; and
- use estimates that are up-to-date, fit for purpose and based on a transparent methodology.

In addition, the draft guidelines state that the RIT–D proponent should clearly justify any excursion of VCR calculations away from accepted estimates. This was done in section 4.3 of both the DPAR and the FPAR for the Sydney CBD RIT-D.

Faced with the task of forecasting VCR for customers in the Sydney CBD for the purposes of the Sydney CBD RIT-D, Ausgrid asked itself two simple questions – namely:

1. Is it reasonable to assume that Sydney CBD customers place a higher value on electricity supply than the rest of the wider Inner Sydney customer base (i.e. is it likely that VCR in the Sydney CBD is higher than the value of $90/kWh, the value previously adopted for the wider Inner Sydney customer base)?
2. If so, then is the $170/kWh figure used for Sydney CBD a reasonable proxy for the value of reliable electricity supply for customers in the CBD?

Ausgrid considers that there is strong support for using a higher VCR for Sydney CBD customers for the reasons set out in the HoustonKemp report and that the use of the $170/kWh figure is reasonable given it represents the mid-point of the only independent estimates available for the VCR in the Sydney CBD. Ausgrid's use of this VCR forecast, including its reliance on independent analysis which supported that forecast, was entirely reasonable, in accordance with the Rules, and did not involve any manifest error.

To assist with hearing the dispute, the AER has requested Ausgrid provide additional information on eight items. The following eight sections do this in-turn in the following pages. Each section below first presents the item(s) requested, as they appear in the Information Request, in a box for reference.

[7] AER, *Draft Regulatory investment test for distribution application guidelines*, July 2018, p. 18.

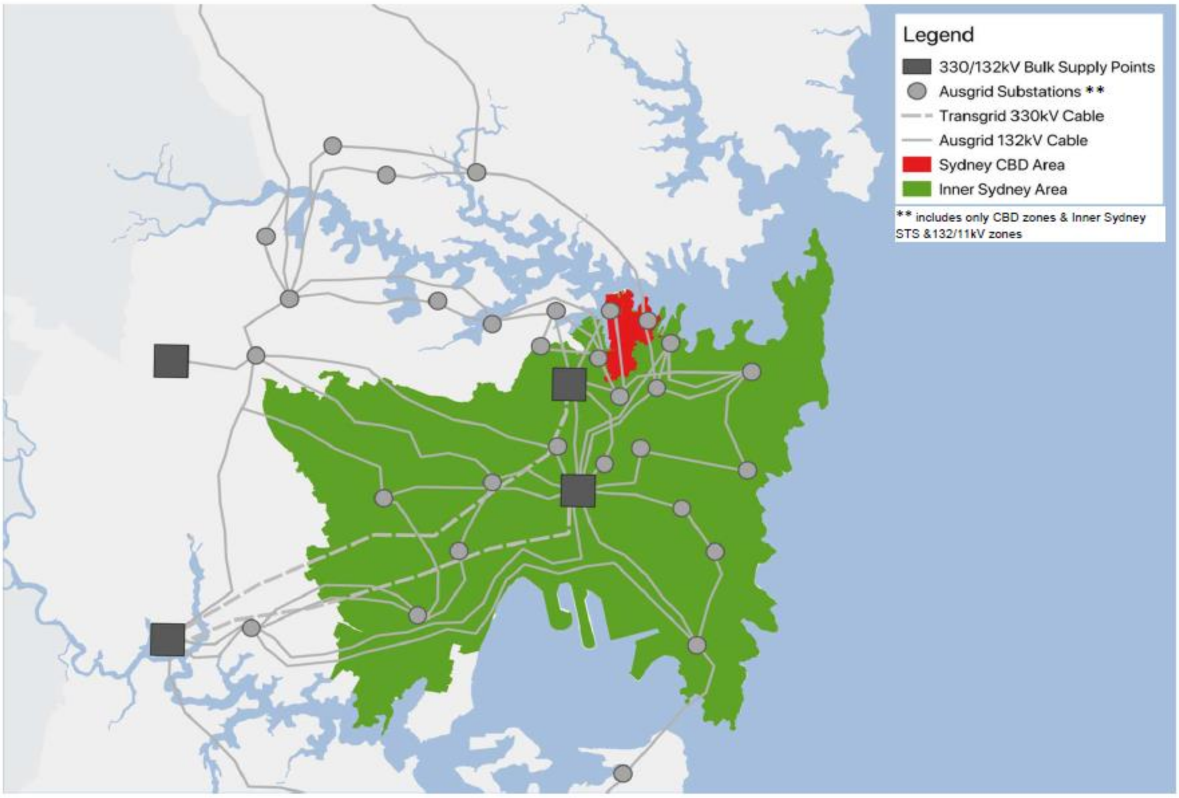
Item 1 – Underlying assessment of the $170/kWh figure

The underlying assessment and application to reach the $170/kWh VCR figure as the central scenario in the Sydney CBD RIT-D. This includes a breakdown of customer demographics, including the types of the customers supplied by the two zone substations, their load requirements and annual energy consumption, within the Sydney CBD network area as specified in Figure 1 of the FPAR.

As outlined above, Ausgrid has applied a central VCR estimate of $170/kWh based on the mid-point of a range of VCR for the Sydney CBD estimated by HoustonKemp.

The underlying assessment and application to reach the $170/kWh VCR figure is therefore contained in the HoustonKemp report, which is publicly available but also included in our response to this Information Request.[8]

The figure below illustrates how the Sydney CBD (shown in red) area sits within the wider Inner Sydney area (shown in green). The red area corresponds to the Sydney CBD network area as specified in Figure 1 of the FPAR.

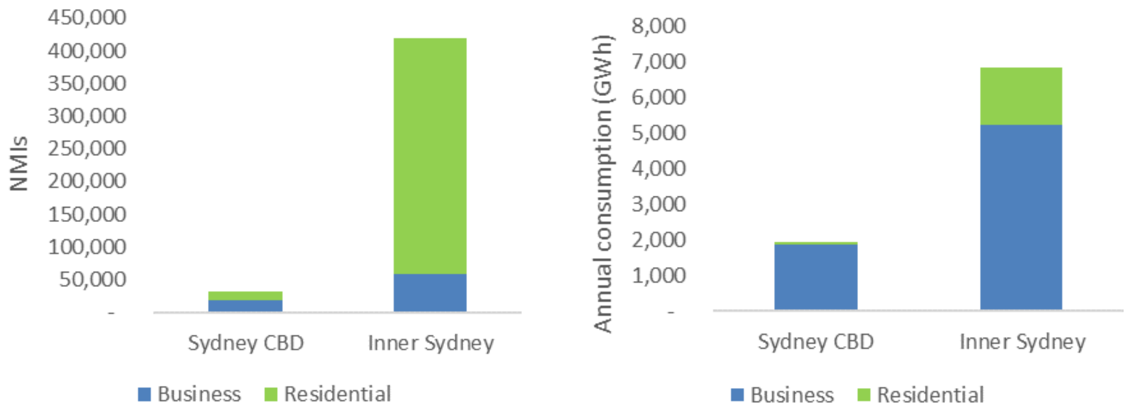


We note that the two areas serve fundamentally different customer bases – in particular:

- while there is a roughly even split between business and residential customer meters ('NMIs') in the CBD, business customers are responsible for approximately 97 per cent of the current annual electricity consumption (with residential customers making up the remaining 3 per cent); and
- in the wider Inner Sydney area, residential customers make up a far greater proportion of both NMIs (86 per cent compared to 44 per cent for the CBD) and annual consumption (24 per cent compared to 3 per cent for the CBD).

[8] HoustonKemp, CBD and Inner Metro VCR estimates, 28 July 2016, p. 2. The HoustonKemp report is provided as Appendix C to the Powering Sydney's Future PSCR.

The two figures below demonstrate these two fundamentally different customer bases.



We have also attached the full list of Sydney CBD NMIs, by customer, as additional supporting information. From reviewing the names of the individual customers, it is clear that these parties value reliable electricity supply highly (and consequently can be expected to have a high VCR).

Section 2 of the HoustonKemp VCR report discusses the demographics of customers in Sydney CBD further, both in terms of commercial customers and residential customers.

A breakdown of customer electricity usage and demand for the Sydney CBD zone substations namely City East and Dalley St considered in the RIT-D assessment is shown in the two tables below:

Dalley St Zone Substation

Customer Type	Number of Customers	Solar Customers	Annual Electricity Usage (MWh)	Annual Electricity Demand (MW) est.
Residential	1,262	0	6,324	2-3
Non-Residential Small to Med (<160 MWh pa)	3,226	12	83,501	4-5
Non-Residential Large (>160 MWh pa)	353	16	258,413	32
Total	4,841	28	348,238	39

City East Zone Substation

Customer Type	Number of Customers	Solar Customers	Annual Electricity Usage (MWh)	Annual Electricity Demand (MW) est.
Residential	193	0	1,433	5-10
Non-Residential Small to Med (<160 MWh pa)	925	5	23,832	21-26
Non-Residential Large (>160 MWh pa)	122	13	116,150	69
Total	1,240	18	141,415	100

Notes:
1. Electricity use data is for the 2016-17 financial year.
2. Electricity use data for all metered low voltage customers has been split into three categories:
i) 'Residential' refers to electricity used from the grid in residential properties including controlled load (off peak) hot water.
iii) 'Non-residential small-medium sites' refers to non-residential customers supplied at low voltage with annual usage from the grid typically less than 160 MWh per year.
iv) 'Non-residential large sites' refer to non-residential customers supplied at low voltage with annual usage from the grid typically greater than 160 MWh per year.
3. Customer numbers are the average number of customers over the financial year.
4. Number of solar customers are recorded as connected by Ausgrid as at 30 June 2017.

Item 2 – Cost benefit model and input assumptions

The cost benefit model for the input assumptions for the analysis of credible options and identification of the preferred option, including the separate cost and benefits for Stage 1, Stage 2 and Stage 3 of the project. Please also provide the capital value of zone substation capacities used to take load from the two substations. In addition, to include the modelling for the sensitivity analysis and the associated inputs used in the range of future scenarios referenced in section 5.4 of the FPAR for the Sydney CBD RIT-D. This should include the impact that each independent variable has on the identification and timing of the credible options, including sensitivity analysis of the $90/kWh VCR estimate.

The cost benefit model is included in the attached Excel spreadsheet named "Ausgrid RIT-D Sydney CBD model".

Benefits in Table 5.1 of the FPAR are derived from the benefit section in "R2 Charts" tab. The calculation of benefit figures for each option under each scenario is the sum of the three benefit categories (in brown cells, rows 9 to 14). The calculation of the weighted benefit figures for each option is the sum of the three benefit categories (in blue cells, rows 15 to 16).

Costs in Table 5.2 of the FPAR are derived from the costs section in "R2 Charts" tab. The calculation of the cost figures for each option under each scenario is the sum of the three cost categories (in brown cells, rows 32 to 37). The calculation of the weighted cost figures for each option is the sum of the three benefit categories (in blue cells, rows 38 to 39).

Expected net benefit figures in Table 5.3 of the FPAR are calculated from the weighted figures (in blue cells, rows 15-16 and 38-39) in the benefit and cost sections in "R2 Charts" tab.

The Present Value (PV) of capital costs are those from the capital cost category (in blue cells). The PV of operating costs are the sum of decommissioning cost and routine maintenance cost categories (in blue cells). The PV of gross weighted benefits are the sum of three benefit categories (in the blue cells). The weighted Net Present Value (NPV) of benefits is the difference between PV of costs and PV of benefits.

We note for transparency that the CBA sensitivity results contained in the attached Sydney CBD model spreadsheet have been marginally adjusted from those reported in section 5.4.2 of the FPAR . This is the result of minor refinements in cost estimates since those used for the DPAR/FPAR were prepared, along with correction of a data transposition error. The differences are not material, as shown in the tables below and do not change the conclusion that Option 2 is always preferred over Option 1.

Section 5.4.2 - Table 4 in DPAR/FPAR		
Sensitivity	Option 1	Option 2
Baseline	7.3	13.5
25 per cent higher capital costs	1.1	7.5
25 per cent lower capital costs	13.6	19.4
Unserved energy under POE10	10	16.3
Unserved energy under POE90	4.2	10.1
VCR $90/kWh	-2.6	2.5
4.19 per cent discount rate	18.9	26.3
8.07 per cent discount rate	-0.5	4.4

Corrected Values		
Sensitivity	Option 1	Option 2
Baseline	7.8	13.6
25 per cent higher capital costs	1.5	7.7
25 per cent lower capital costs	14	19.6
Unserved energy under POE10	10.4	16.5
Unserved energy under POE90	4.6	10.2
VCR $90/kWh	-2.2	2.7
4.19 per cent discount rate	19.4	26.4
8.07 per cent discount rate	0	4.5

Difference		
Sensitivity	Option 1	Option 2
Baseline	0.5	0.1
25 per cent higher capital costs	0.4	0.2
25 per cent lower capital costs	0.4	0.2
Unserved energy under POE10	0.4	0.2
Unserved energy under POE90	0.4	0.1
VCR $90/kWh	0.4	0.2
4.19 per cent discount rate	0.5	0.1
8.07 per cent discount rate	0.5	0.1

The results of the sensitivity analysis in the FPAR are derived from the NPV Results for Scenario 2 in "R1 Interface and results" tab (rows 96 to 101). The impact that each independent variable has on the PV Benefits, PV Costs and NPV is calculated by changing the parameters included in the User Interface in the same tab (rows 4 to 25). Each cell has a drop down list considering three input options: Low (for low benefit), Baseline and High (for high benefit). The corresponding values for each of the sensitivity inputs are defined in the "I2 CBA Inputs" tab, rows 8 to 22. In particular, row 16 has the input data for the VCR values.

For instance, if the user of the model wants to change the VCR value and measure the impact on the NPV results, the user must first change the values in the Base, Low and High input options in the "I2 CBA Inputs" tab (row 16). Then, the user must go to the "R1 Interface and results" tab and select Base, Low or High from the drop-down list in row 24, for Scenarios 1, 2 and 3. If the user wants to change the Scenario (i.e. Scenario 1 being 'low benefit', Scenario 2 being 'baseline' and Scenario 3 being 'high benefit'), this can be done by selecting the scenario from the drop-down list provided in cell D8.

The analysis presented in the cost benefit model only includes data relevant for Stage 2 and Stage 3 of the Sydney CBD area plan strategy. While the overall strategy consists of a three step process, Stage 1 of the area plan strategy is not included in the FPAR because it met the criteria for committed projects (i.e. Stage 1 did not need to be subject to this project assessment process). It should also be noted that Stage 1 of the Sydney CBD area plan strategy (i.e. transfer of 50MVA load from Dalley St zone substation to City North zone substation) was initiated separately because the construction of the CBD & South East Light Rail project along George Street started in 2016, and restricted underground cable work across George Street.

In relation to the capital value of zone substation capacities used to take load from the two substations, this refers to the cost of establishing Belmore Park zone substation, which was $124.2 million including the zone substation, 11kV distribution works and 132kV feeder connections. These works were initiated in 2009 and completed in 2015.

Item 3 – Further justification of the $170/kWh figure

The load weighted value of VCR based on the AEMO tables and escalated for inflation would yield a value of VCR of approximately $40-50/kWh. We note the notice of dispute refers to the 'agreed Sydney CBD value of $90/kWh'. Please provide an explanation and supporting argument:

a. Why the simple escalated load weighted value was not appropriate to this project;

b. Why the value of $90/kWh was not adopted, including specific reasons why Ausgrid did not agree the value was a reasonable basis for this analysis; and

c. Why Ausgrid adopted a load weighted value of VCR of $170/kWh for analysis of some elements of this project.

Please ensure to distinguish those parts of the analysis that relied on figures greater than the simple escalated load weighted value.

Before we respond to each of the three items requested we would first like to address the use of the word 'agreed' in the dispute notice. In particular, the EUAA state that:[9]

> *'Ausgrid has used a VCR value of $170/kWh for Sydney CBD which is inconsistent with the **agreed** Sydney CBD value of $90/kWh used by TransGrid and Ausgrid as the basis for their Powering Sydney's Future project' [emphasis added]*

We do not consider that the use of $90/kWh *for Sydney CBD customers' VCR* was ever agreed between any parties.

As outlined above, as well as in the PSF PACR, while a figure of $90/kWh was used for *both* customers in Inner Sydney and Sydney CBD in the final PSF assessment, TransGrid and Ausgrid stated at the time that:[10]

- they still consider that there are good reasons to believe that the VCR for customers in Sydney CBD would be higher than in the wider Inner Sydney, as the nature of the underlying end-use customers is different (as set out in the HoustonKemp report); and
- as it was found that using the $170/kWh or $90/kWh figure for Sydney CBD customers was not material for the identification of the optimal timing for the PSF project, or for the outcome under the RIT-T analysis, the $90/kWh figure was applied to avoid this continuing as a point of contention in the PSF RIT-T.

In addition, the EUAA dispute notice states that:[11]

> *'IPART did not accept the HoustonKemp analysis of $170/kWh but did conclude that the appropriate value for the CBD was $90/kWh'*

We do not consider this statement to be correct as the IPART review did not consider a specific VCR for the Sydney CBD area, rather only for the wider Inner Sydney area (which includes the CBD but is a lot broader, as shown above). IPART did not in fact comment on the applicability of the $170/kWh value. We therefore do not consider the statement above to be accurate.

We provide our explanation to each part of Item 3 in separate subsections below.

---

[9] See page one of the letter dated 2 July 2018 from the EUAA to Ms Paula Conboy regarding the Notice of a Dispute under Clause 5.17.5 of the NER.

[10] TransGrid & Ausgrid, *Powering Sydney's Future Project Assessment Conclusions Report*, November 2017, p. 28.

[11] See page four of the letter dated 2 July 2018 from the EUAA to Ms Paula Conboy regarding the Notice of a Dispute under Clause 5.17.5 of the NER.

Item 3a – Why the AEMO load weighted value was not appropriate to this project

Ausgrid considers that it is important that any VCR estimates used are fit for purpose and accurately reflect the costs that electricity supply interruptions impose on the end-use customers in question.

In the case of the Sydney CBD RIT-D, Ausgrid does not consider that the application of AEMO's standard VCR estimates, without modification, would be appropriate, for two reasons:

- the AEMO estimates are not broken down into different geographic areas beyond state-level values and therefore do not provide any insight into differences in VCR between customers in regions like Sydney CBD, and the rest of New South Wales; and
- the methodology used to calculate the AEMO estimates does not cater for prolonged outages (the longest outage considered was 12 hours) and so the 'low probability but high impact' supply interruptions contemplated in this RIT-D are not accurately captured.

In addition, the AEMO estimates do not include customers in Sydney CBD that could be reasonably expected to place a high value on the reliable supply of electricity, such as the Australian Securities Exchange, NSW Parliament, large financial institutions, public transport agencies etc. Please refer to our accompanying list of all Sydney CBD customers, by NMI, to see the specific type of customers we are referring to.

The inappropriateness of applying the standard AEMO VCR estimates to assessing the cost to customers of events that cause wide-spread, severe or prolonged supply shortages is noted by AEMO itself in its VCR Application Guide.[12] Specifically, the AEMO Guide notes that, because the VCR may not accurately estimate the impacts of widespread and/or prolonged outages, additional offsets to the VCR might be appropriate to estimate effects not captured through customer surveys. The guide notes that VCR survey respondents are not expected to have a good understanding of the social and safety impacts related to widespread and/or prolonged outages and so extrapolating survey results to cater for this kind of event might necessitate additional offsets due to the non-linear nature of a VCR over time and space.

An August 2016 consumer forum held by AEMO also suggested the possible use of multipliers to cater for outages of these types. Specifically, AEMO recommended that a sensitivity of doubling the VCR (as a proxy for capturing direct and indirect economic impacts) should be used as a proxy for the economic costs of widespread, prolonged outages when evaluating investment options that provide system security benefits.[13]

The recently released AER draft RIT-D application guidelines also appear to support the use of non-AEMO VCR values. In particular, the updated RIT application guidelines have been modified to suggest that, in considering the VCR(s) for a RIT-D, the RIT-T proponent should have regard to the factors that cause the VCR to vary, including outage length, width of affected area, and customer type.[14]

Overall, Ausgrid consider that the use of the standard AEMO estimates without modification would underestimate the costs that electricity supply interruptions impose on end-use customers in Sydney CBD.

We note that the EUAA themselves appear to agree that the AEMO VCR is likely to be an underestimate for Inner Sydney.[15] In particular, in submitting to the IPART review of transmission

[12] AEMO, *Value of Customer Reliability – Application Guide*, Final Report, December 2014, p. 20.

[13] AEMO*, Consumer Forum Meeting Pack 5 August 2016*, Handout 4: Regulatory Investment Test for Transmission (RIT-T) Improvements, p. 3

[14] AER, *Draft revisions of the application guidelines for the regulatory investment tests*, Explanatory statement, July 2018, pp. 35-36.

[15] IPART, *Electricity Transmission Reliability Standards – Unserved Energy Allowances for Inner Sydney and Broken Hill, Molong, Mudgee, Munyang and Wellington Town*, Supplementary Final Report, November 2016 p. 23.

reliability standards, they note that 'the HoustonKemp study raises some valid points suggesting that the AEMO methodological approach may mean the AEMO VCR estimates for inner metropolitan and CBD Sydney are under estimates'.[16]

In addition, IPART's final report states that, over the course of the review, they received feedback that the AEMO estimates are not an accurate representation of the VCR because they are calculated from a very small sample size, are overly dependent on the methodology used, and do not adequately capture low probability but high impact supply interruptions.[17]

While the Information Request for Item 3 requests that we ensure to distinguish those parts of the analysis that relied on figures greater than the simple escalated load weighted value, we note that none of the Sydney CBD analysis relied on these estimates directly. We consider that doing so would greatly underestimate the value that customers in this area place on reliable electricity supply (for the reasons outlined above).

Item 3b – Why the value of $90/kWh was not adopted in the Sydney CBD RIT-D

As explained above, the value of $90/kWh does not reflect an estimate or forecast of VCR for customers in the Sydney CBD specifically. Rather, this is an estimate of VCR for customers in Inner Sydney, which is a much broader geographic area encompassing the CBD and inner suburbs. As demonstrated in response to Item 1 above, the average customer profile for the Inner Sydney area is fundamentally different to that for the CBD area.

Ausgrid therefore did not consider it appropriate to simply adopt the value of $90/kWh as a forecast of VCR for the Sydney CBD. At the very least, it was necessary to consider whether the value placed on reliability in the Sydney CBD was likely to be in line with that in broader Inner Sydney customer base.

As outlined in the introduction to this memo, and in our response to Item 1 above, we believe that it is reasonable to assume that Sydney CBD customers place a higher value on electricity supply than the rest of the wider Inner Sydney customer base. Therefore it was not considered appropriate to simply adopt the VCR estimate for Inner Sydney customers as the forecast of VCR in the Sydney CBD.

Item 3c – Why a VCR of $170/kWh was used in the Sydney CBD RIT-D

As outlined in the introduction to this memo, and in our response to Item 1 above, we consider the use of the $170/kWh figure is reasonable given it represents the mid-point of the only independent estimates available of VCR for the Sydney CBD as determined by Houston Kemp.

Customers' expectations for reliable electricity supply are significantly different in the Sydney CBD compared with other network areas. This is consistent with NSW Ministerially imposed licence conditions which specify materially higher reliability standards in the Sydney CBD compared to feeders in urban areas. It is also reasonable to expect that the value that customers place on having a reliable electricity supply is different in the Sydney CBD than other network areas, given the nature of commercial business, the economic value added by these businesses and the impact on them of a disruption in their electricity supply (i.e. cases such as the financial sector, major retail facilities and/or hotels are examples of the industries subject to the significant impacts of an outage in the area).

[16] EUAA submission to IPART's Supplementary Report, 31 October 2016, p. 3.
[17] IPART, *Electricity Transmission Reliability Standards – Unserved Energy Allowances for Inner Sydney and Broken Hill, Molong, Mudgee, Munyang and Wellington Town*, Supplementary Final Report, November 2016 pp. 22-23.

Item 4 – Notice of screening for non-network options

How Ausgrid derived the values, as shown in Table 7 and section 4.2 of the Notice of Screening for Non-Network Options report , that set out the funding available to pay for demand management, and the costs expected to be charged by consumers to provide demand management services. In addition, please provide evidence that supports your assessment that a combination of DM options or DM and network options are not able to form a credible option with reduced cost.

The figures in Table 7, section 4.2 of the Notice on Screening for Non-Network Options report for reliability requirements in the Sydney CBD are based upon demand management analysis of the cost benefit models used to determine the investment need dates for the Dalley St and City East zone substations. This analysis determines the reduction in estimated unserved energy (EUE) for each MW of demand reduction achieved using demand management. Due to the scale of the energy shortfall, the demand reduction is not applied to the peak but to the base of the EUE requirement.

In this analysis, the demand reductions are progressively increased to derive the impact from a range of demand management outcomes. The reduced EUE, when assessed as part of an NPV assessment of the DM option, allows determination of the total available funds to finance the required demand management reductions. In each case, the assessment determines the NPV of the net benefit compared with the 'do nothing' scenario. The available DM funds are where the net benefit of the DM option is equal to the net benefit for the preferred network solution.

As noted in the Final Project Assessment Report, only a small portion of the risk is associated with failure modes leading to load shedding which might be addressed or mitigated using demand management. For example, removal of 42% of the load at risk using demand management would reduce the risk by only 13%. Without a material reduction in the risk, there is no change in the investment need date. For this reason, we have described in Table 7 a scenario where 100% of the load is removed with the resultant available funds and peak load and total volume of energy reductions in MWh required.

The MWh required was determined from an assessment of the 30 min interval data for both the Dalley St and City East zone substations. The unserved MWh is the 30 min load less the emergency transfer capacity. The resultant available $ per MWh is simply the total available funds divided by the total customer load in MWh in the year. This figure and the 'total available funds' are not 'costs expected to be charged by consumers to provide demand management services' but the total available funds available to pay for demand management services such that the demand management option is the least cost solution.

Please see the attached combined DM assessment in file 'AER response item 4 – DM assessment.xlsx' and load data analysis in files 'Peak days load profiles in City East-v2 Full year.xlsx' and 'Peak days load profiles in Dalley St-V2 Full year.xlsx'.

Our assessment that demand management cannot form part of a credible option is principally based upon two premises:

1. The principal failure modes require demand management to significantly or completely remove the EUE risk to offer a credible option; and
2. The available funds and the scale of demand reductions required result in a very modest budget to fund any demand reductions.

Our assessment of the available DM options reflects the very low funds available per MWh and per kW in comparison with the likely available DM solutions. Section 4.3 of the NNOR notes the typical costs associated with such solutions, which in each case is much higher than the available funds; and in some cases we note the likely available reductions from the options in comparison with the requirement. It is our opinion that viable demand management options cannot offer either the scale of reductions required or the price point required to be cost competitive.

We note that we received no submissions (or any other form of contact) on any of the RIT-D consultation documents from non-network proponents in relation to the Sydney CBD RIT-D.

Item 5 – Capital costs of the two network options

The two proposed options including the capital cost build up and further detail about how the new cables will connect to the consolidation cables or feeders. The costs should include: the proposed cable ducts, cables, consolidation cables, feeder reconfiguration costs, decommissioning costs and any other costs. The supporting information should include the assumptions used, quotes received or the other basis for the cost estimate. If expenditure from a past project was used, please provide an explanation and calculations for how those costs were used to derive the costs/rates for this project. Please provide the cost build up for the replacement of the substations as described in Table 3.4 of the FPAR.

The information about the capital cost build up is available in the attached Excel spreadsheet named "AER response item 5 – FPAR Sydney CBD – cost of credible options".

All existing live 11kV circuits that originate from City East zone substation pass through underground cable pits in Macquarie Street. As part of the 11kV load transfers for City East new ductlines and cables will be installed from Belmore Park to connect into these existing pits where the cables will be jointed onto the existing circuits and the electricity load will be subsequently transferred away from the City East zone substation onto Belmore Park zone substation. Following this the same process will be followed to connect the new Macquarie Street ductlines to existing pits nearby which contain the remaining circuits carrying load from Dalley St zone substation.

It should be noted that there are no quotes available for the installation of a non-standard arrangement of 2x10 ductlines, which is the core of the proposal made in the preferred Option 2. The unit rate is based on the advice of subject matter experts, based on the 11kV load transfer costing template used for planning estimates.

Item 6 – Assumed outages and modelled failures

Data relevant to the annual outage durations associated with asset failures and associated reliability standards applied to the project referenced in section 2.2 of the FPAR, alongside associated projects within the network areas. Furthermore, provide any potential studies on the market responses to high prices and congestion within the Ausgrid network area, if available. This may include any data on the extent of energy management and storage systems within the network areas.

The information about the data relevant to outages is available in the attached spreadsheet named “AER response item 6 – data for annual outage events”.

Three years of reliability data for City East and Dalley St zone substations are included in the spreadsheet.

Due to the scale of the energy reductions required and the resultant negative screening test outcome, a detailed assessment of the total demand management capability was not undertaken. This information is only identified, confirmed and contracted via the community consultation, detailed investigation and tendering process when a screening test indicates that demand management offers a potentially viable alternative.

In response to the two specific solutions listed, we note:

- the status, capability and customer willingness to contract for the use of existing energy management systems to reduce demand is not provided to Ausgrid by customers; and
- assessment of our connections application information show that as of March 2018 there were zero battery storage systems installed to the network served by Dalley St and City East zone substations.

In regards to market response to high prices and congestion within the Ausgrid network area, we would note that the network need is not related to network congestion or overload condition but to the need to retire aged assets and the associated risk of failure.

Item 7 – Demand forecasts

Details of the demand forecast for the Sydney CBD substations referenced in Table 2.1 of the FPAR (CBD Substations). This should include any models which will provide transparency regarding the methodology used to derive the demand forecast for the relevant substations, including whether any diversity factor between industrial/commercial and residential demand has been accounted for on the forecast.

a. Please also confirm how the Sydney energy master plan has been included in these forecasts. This should include details of any forecast spot loads comprised in these costs, forecast load transfers, and any other material Ausgrid believes is necessary to provide an understanding of each demand forecast. For clarity, spot load details should include at least the name of the expected spot load, the type of load (e.g. commercial, industrial, etc.), the load in MVA and the expected date of the load being applied to the network. Similar information should be provided for load transfers. This should include any analysis on the increased load constraints on Belmore Park following the load transfer.

b. If available, please provide the yearly demand profile for each of the CBD substations for the preceding 10 years, and forecasted demand profiles if available.

The details for the demand forecast as described in section 2.1 of the Final Project Assessment Report is as follows:

- Ausgrid has previously provided extensive information including input data, modelling results and models in spreadsheet and SAS format to the AER in response to ***AER Ausgrid information request IR#025 – peak demand forecast***. The information provided in IR#025 is supported by ***Attachment 5.07- Electricity Demand Forecasts Report***, which contains Ausgrid's maximum demand forecasting methodology,
- Section 4.1 of Attachment 5.07 describes the trending process for zone and subtransmission substations. This process is based on raw metered interval demand data measured at each zone and subtransmission substation transformer, and is net of downstream impacts including each substation's residential and non-residential customer mix.

Q7a

Energy efficiency

- As described in section 5.1 of Attachment 5.07, energy efficiency modelling in Ausgrid's maximum demand forecast is based on external advice and comprises the following three elements:
    - Section 5.1.1 – Equipment Energy Efficiency (E3) Program,
    - Section 5.1.2 – NSW Energy Savings Scheme (ESS) and Greenhouse Gas Abatement Scheme (GGAS),
    - Section 5.1.3 – Building Code of Australia (BCA) building shell improvements.
- We believe our energy efficiency is robust and that the above elements capture the major energy efficiency drivers. Further detail about how energy efficiency is modelled within the maximum demand forecast is described in section 5.1.4.

Sydney CBD spot loads

- The attached spreadsheet *CBD Spots and Transfers 2017.xlsx* provides detail of the Sydney CBD spot loads,

- We note that our forecast sheets for the Sydney CBD at present do not provide detail about spot loads, as opposed to other non-CBD substations. This is due to different spot load data management processes used in the 2017 max demand forecast,
- In the process of compiling the Sydney CBD spot loads information to meet this request, our review of this information has revealed that a number of the projects in this list have not been allocated to the correct CBD zone substation. Column E provides the corrected zone substation allocation,
- Also, we have also reviewed the load magnitudes due to discovery of a minor spreadsheet formula error, and we have also provided revised spot loads magnitudes by CBD zone substation and by year (see table T10:W16). In aggregate, the difference in the revised loads is around +97 amps at 11kV or roughly 4% of the aggregate Sydney CBD spot loads included in the 2017 forecast. We consider this difference to be minor.

Q7b

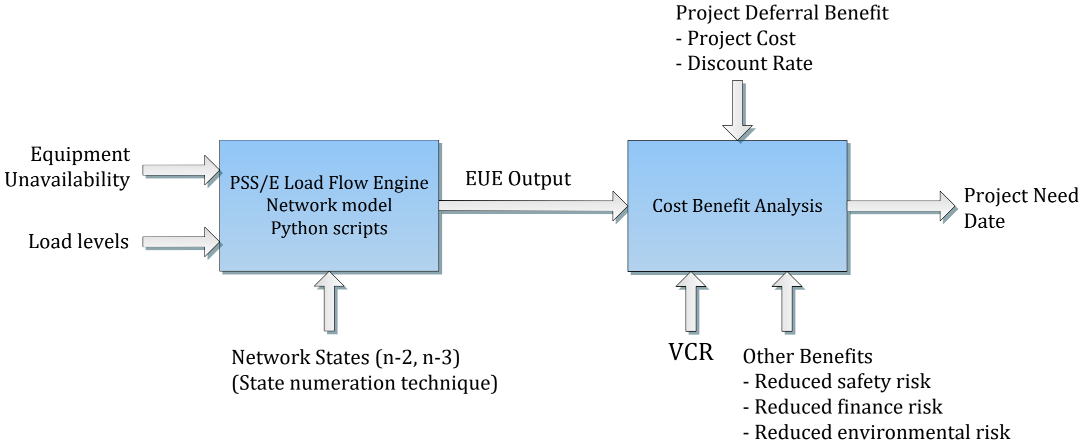
- 10 years of historical 15 min interval demand data for the Sydney CBD zone substations has been provided in the file: *interval data CBD zone subs.xlsx*

Item 8 – Assumed outages and modelled failures

The model for the calculation of the unserved energy (USE). Include the assumptions that cause the change in rate of increase of unserved energy in 2023/24, as shown in Figure 4, and why the USE flattens off after 2035.

Probabilistic planning approach is used to determine the requirement of capital investment by calculating the costs and benefits including expected unserved energy. This involves estimating the probability of an equipment outage and determining the amount of unserved energy as the result of this outage. The calculation of unserved energy uses the state enumeration technique which generates a number of states that represent the states of the network with different elements out of service. The probability of each state, the resulting load curtailment and the associated expected unserved energy (EUE) for each state is calculated. The total expected unserved energy is the sum of expected unserved energies of all states in the system.

The following diagram illustrates the cost benefit analysis methodology that we have undertaken, indicating the expected unserved energy as a key input.



The calculation of EUE involves a comprehensive and rigorous analysis as all the relevant network elements in the substation would be required to model in order to determine the load curtailment of each network state. Due to the complexity of the network, the modelling software is required for this type of assessment and we have used PSS/E load flow engine together with a number of python scripts to perform this analysis. It is not possible to reproduce the functionality of the PSSE using excel spreadsheets. The PSSE analysis can be demonstrated on request whether during a site visit, Skype meeting, tele-conference or other format.

City East Zone Substation (Stage 2):

City East is a 33/11kV zone substation, and is supplied by six 33kV cables from Surry Hills 132/33kV Subtransmission Substation. These six cables are directly connected to six 33/11kV transformers. City East zone was commissioned in 1964 and contains English Electric CV type compound insulated switchboard with oil filled circuit breakers. This is an orphan technology, not found elsewhere on the Ausgrid network.

The preferred solution is to progressively transfer the 11kV load currently supplied from City East to Belmore Park Zone Substation, which is located in the south of the CBD, near Central Station. This will require multiple 11kV cables to be laid from the Belmore Park service area to the vicinity of City East's service area. The plan also includes the decommissioning of City East Zone Substation and associated 33kV feeders and remediation of the site

The following network elements in City zone substation were modelled to determine the corresponding expected unserved energy.

- Twelve (12) 11kV switchboard sections
- Six (6) 33/11kV transformers
- Twelve (12) 11kV bus section breakers
- Twenty four (24) 11kV feeders (8 triplex feeders, two groups ABC and DEF)
- Six (6) 33kV feeders

The input data used in the analysis are summarised in the following tables.

Switchboard Type	**Weibull parameters**		**MTTR**
	η	**β**	
Compound Switchboard & bus section breakers	4.189	62.51	Contingency Plan 1 – 30 days Contingency Plan 2 – 90 days

Transformer Type	**Weibull parameters**		**Replace Time**	**Repairable failure rate**	**Repair Time**
	η	**β**			
33/11kV transformer w/endboxes	3.77	113.9	35 days	0.0014	10 days

Subtransmission Cables Type	**Failure**			**Third Party Damage**		
	η	**λ**	**Repair Time**	**η**	**λ**	**Repair Time**
HSL	4.6	2.6E10	10.5 days	3.0	7.0E-8	14 days

Distribution feeders	**Unavailability**
11kV feeder	0.7%

The following procedure was undertaken to calculate the reduced EUE benefit if the decommissioning of City East zone is undertaken.

The EUE is calculated for following two cases:

1. Existing City East
2. After the load transfer to Belmore Park (residual EUE)

Approximately 1000 network states (a combination N-2 and n-3) were modelled and performed the analysis for 11 load levels of the load duration curve at City East zone. The calculation is repeated for 20 years. Due to the complexity and the large amount of data, switchgear group ABC and DEF were separately analysed.

Further, the above analysis was performed for two scenarios based on different switchgear unavailabilities as given below.

1. Unavailability based on 30 day repair assumption
2. Unavailability based on 90 day repair assumption

To get the resultant unserved energy, the unserved energy calculated for above two scenarios is weighted based on a ‘MTTR Weighting Factor[18]”. The results are given in the attached excel output files as below:

Item 8 File 1 - Results_ABC_30 day

Item 8 File 2 - Results_DEF_30 day

Item 8 File 3 - Results_ABC_90 day

Item 8 File 4 - Results_DEF_90 day

The next step is to calculate the EUE from City East load if it were supplied by Belmore Park zone substation. For this case, switchgears at Belmore Park were not included because of the new equipment at this substation. Hence, only 11kV feeders with increased feeder length are assessed. The results are given in attached files (Item 8 File 5 - Results_ABC-LT to Belmore Park and Item 8 File 6 - Results_DEF-LT to Belmore Park).

The resultant EUE is the difference of above two scenarios which is then multiplied by VCR to get the reduced EUE benefit. Since the EUE after the load transfer to Belmore Park prior to 2020/21 is not available, they were calculated based off the exponential trend of years beyond 2020/21. The final EUE result is given in the attachment “Item 8 File 7 - Results_City East_EUE”.

EUE model output files:

1. Item 8 File 1 - Results_ABC_30 day.xlsm
2. Item 8 File 2 - Results_DEF_30 day.xlsm
3. Item 8 File 3 - Results_ABC_90 day.xlsm
4. Item 8 File 4 - Results_DEF_90 day.xlsm
5. Item 8 File 5 - Results_ABC-LT to Belmore Park.xlsm
6. Item 8 File 6 - Results_DEF-LT to Belmore Park .xlsm
7. Item 8 File 7 – Results_City East_EUE.xlsm

<u>Dalley St Zone Substation (Stage 3):</u>

Dalley St is a CBD type 132/11kV zone substation, and is supplied by four 132kV oil filled cables Surry Hills STS and Lane Cove STS. Dalley St Zone Substation was commissioned in 1969.

Dalley St Zone Substation comprises of both compound-insulated Email HQ type switchgear and air-insulated Reyrolle LMT type 11kV switchgear. The Email HQ switchgear is single busbar type, with compound insulation. There are oil-filled current transformer (CT) chambers and voltage transformers (VT) on the transformer incomer panels.

Similar input data and assumptions were used in the calculation of EUE for Dalley St. The resultant unserved energy is given in the attachment (File 8).

Attachments:

EUE model output files:

1. Item 8 File 8 – Results_Dalley St_EUE.xlsm

[18] MTTR weighting factor is the probability that spare boards are not available for the next failure. It is assumed that 6 out of 12 boards at City East zone are able to be transferred to emergency switchroom.

Comment on Figure 4 (FPAR):

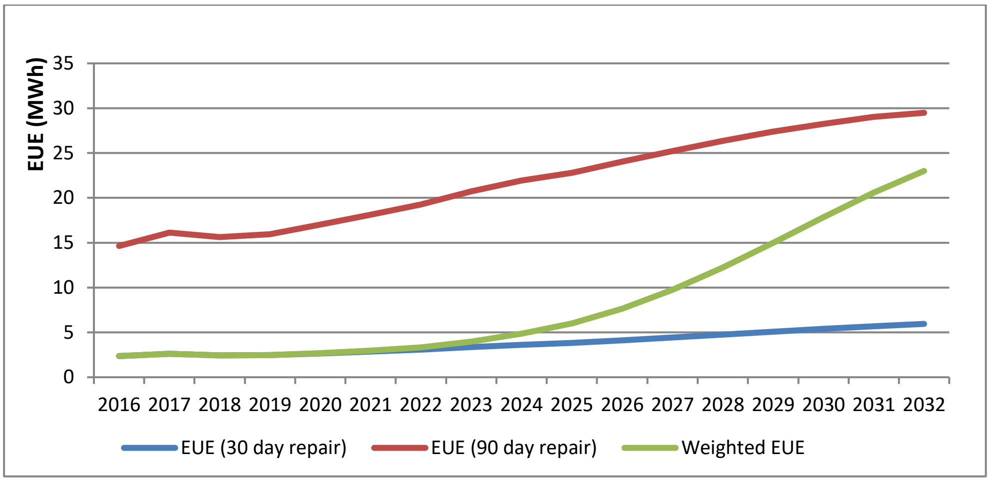
Change in rate:

As previously indicated, EUE is calculated for two scenarios that represents two contingency events as outlined below.

1. Contingency plan 1 (30 days): Ausgrid's emergency switchroom is deployed and load is transferred from the failed switchboard.
2. Contingency plan 2 (90 days): The failed switchboard is removed and replaced with new switchgear because the deployment of the emergency switchroom is not feasible due to prior failures.

To get the resultant unserved energy, the unserved energy calculated for above two scenarios is weighted based on a 'MTTR Weighting Factor", giving more weightage to the 90 day EUE due to the deployment of emergency switchroom being not feasible as a result of prior failures.

The above analysis of weightings results in the change in rate of increase of EUE around 2023/24. This can be illustrated as below.



USE flattens off after 2035:

The unserved energy data was extrapolated to smooth out the data and allow it to continue to increase. The extrapolation was done from 2029/30 for POE50 and 2025/26 for POE10. POE90 growth was not extended upwards and flattens considerably after 2035. This is to reflect the lower bound estimates of unserved energy.

This was explained underneath Figure 4 in FPAR as below.

"Ausgrid has elected to adopt a conservative estimate for POE90 (i.e. low USE) where it is assumed that growth in demand levels off in later years that reflects increases in efficiency and limited growth."