Attachment 23.14

SA Power Networks: Proposed amendment to STPIS Guideline

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Proposed amendment to STPIS Guideline

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SA Power Networks

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1. EXECUTIVE SUMMARY

The Australian Energy Regulator's (**AER**) Service Target Performance Incentive Scheme (**STPIS**) provides incentives for distributors to maintain or improve normalised reliability performance[1], by rewarding improvements and penalising declines from average historic levels. The STPIS measures normalised reliability by excluding[2] all interruptions that commence on Major Event Days (**MEDs**).

The STPIS utilises the 2003 version of the US Institute of Electrical and Electronic Engineers (**IEEE**) Standard 1366 (IEEE Std 1366™-2003) 2.5 Beta statistical method to determine if a day (midnight to midnight) is classified as a MED. The 2.5 Beta Method pre-determines an unplanned System Average Interruption Duration Index[3] (**USAIDI**) threshold ($\mathbf{T_{MED}}$), with any day where the daily USAIDI minutes accrued to that day from all interruptions commencing on that day exceed T_{MED}, are classified as a MED.

The IEEE has identified an issue with the 2.5 Beta method, in that extremely large daily USAIDI values (referred to as catastrophic days) can result for some utilities in a step uplift (ie decline) in normalised reliability as determined by the 2.5 Beta method for five years. The uplift results from the catastrophic day's USAIDI causing a step increase in the value of T_{MED}, which means that day(s) previously classified as MED(s) in past periods are no longer classified as MED(s) in future periods.

The current (2012) version of IEEE's Standard 1366 documents the known issue and recommends that each utility and their regulator agree on the method to exclude catastrophic days from the calculation of T_{MED}. The Standard now states in clause 5.3 titled 'Major Event Days and catastrophic days':

> *"…… Large daily SAIDI values caused by catastrophic events will exist in the data set for five years and could cause a relatively minor upward shift in the resulting reliability metric trends. ……."* and
>
> *"…. It is recommended that the identification and processing of catastrophic events for reliability purposes should be determined on an individual company basis by regulators and utilities since no objective method has been devised that can be applied universally to achieve acceptable results."*

The 'relatively minor upward shift' referred to above could result in a loss in annual revenue of 1.4% (or about $11M) in SA Power Networks' case due to the STPIS regime, where two days would no longer be classified as MEDs in a single year. This outcome would be inappropriate as SA Power Networks would be penalised due to event(s), which were excluded from the STPIS outcome in the year that they occurred (ie catastrophic day(s)).

SA Power Networks' proposes an amendment to the AER STPIS Guideline that permits a distributor, subject to AER approval, to exclude catastrophic days from the calculation of T_{MED}. This amendment would again align the STPIS Guideline with the IEEE Std 1366™, which is what occurred when the second version (ie v 1.01) of the Guideline was issued.

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1 Reliability is one of the components of a distributor's performance that is incentivised by the STPIS regime. The STPIS provides incentives for other components of a distributor's performance (eg customer service).

2 The STPIS also excludes other interruptions that are caused by generation or transmission failures as detailed in clause 3.3 of the STPIS Guideline.

3 USAIDI is the average number of minutes a customer is without electricity supply for a reporting period, normally one year.

SA Power Networks considers that the exclusion of catastrophic days from the calculation of T_{MED} would satisfy the National Electricity Rule (**NER**) 6.6.2(b)(2) requirement that the AER must when developing and implementing the STPIS:

> *"ensure that service standards and service targets (including guaranteed service levels) set by the scheme do not put at risk the Distribution Network Service Provider's ability to comply with relevant service standards and service targets (including guaranteed service levels) as specified in jurisdictional electricity legislation;*

As highlighted above the step uplift in reliability could result in a penalty in excess of one percent of revenue, which exceeds the materiality threshold for a positive pass through event. A penalty of this magnitude is unfair and could put at risk a distributor's ability to comply with relevant jurisdictional service standards and service targets, and is contrary to the NER requirement imposed on the STPIS.

Subject to the amendment of the STPIS Guideline detailed above, SA Power Networks proposes to exclude any day from the calculation of T_{MED} where the daily SAIDI exceeds a USAIDI threshold of 30 minutes. The 30 minute threshold was derived using the same methodology as that used in the 2.5 Beta method but using 3.7 instead of 2.5 as the multiplier of the standard deviation. The USAIDI threshold was determined by calculating the average (α) and the standard deviation (β) from five years of daily USAIDI data converted using the natural logarithm (LN) and the following equation:

$$T_{MED} = e^{(\alpha+3.7*\beta)}$$

As an indication of the extreme and abnormal nature of a 30 minute day it represents more than 18% of the annual normalised USAIDI since 1 July 2005, with only four days exceeding this threshold over the last nine years.

2. BACKGROUND

2.1 Accuracy of reliability data

SA Power Networks implemented an outage management system (**OMS**), at the request of the Essential Services Commission of South Australia (**ESCoSA**), to enable the accurate reporting of our distribution system's reliability performance and the automatic payment of reliability Guarantee Service Levels (**GSL**). The OMS commenced operation on 1 July 2005 and consequently accurate reliability data is not available prior to this date.

2.2 AER Service Target Performance Incentive Scheme

2.2.a *National Electricity Rule obligation – Rule 6.6.2*

The National Electricity Rules (**NER**) in particular Rule 6.6.2(a), required the Australian Energy Regulator (**AER**) in accordance with the distribution consultation procedures, to develop and publish an incentive scheme or schemes that provides incentives to distributors to maintain and improve performance. Rule 6.6.2(b)(2) states:

"(b) In developing and implementing a service target performance incentive scheme, the AER:

…

(2) must ensure that service standards and service targets (including guaranteed service levels) set by the scheme do not put at risk the Distribution Network Service Provider's ability to comply with relevant service standards and service targets (including guaranteed service levels) as specified in jurisdictional electricity legislation;

…"

As a consequence the AER developed its Service Target Performance Incentive Scheme (**STPIS**) Guideline (the **Guideline**), which details the incentive framework. The actual STPIS regime including measures and targets is specified in each distributor's Distribution Determination (**DD**) made by the AER for a specified Regulatory Control Period (**RCP**) - normally five years.

The Guideline contains a number of components which are the:

(1) 'reliability of supply' component;

(2) 'quality of supply' component;

(3) 'customer service' component; and

(4) 'guaranteed service level' (GSL) component.

The Guideline also includes for each of the components, parameters that may apply, and where applicable the maximum revenue increment or decrement that applies to that component.

The 'reliability of supply' component of the STPIS is normalised by excluding interruptions that:

- are beyond the control of the distributor (eg load shedding due to a generation shortfall) as detailed in section 3.3 of the Guideline; and
- commence on Major Event Days (**MEDs**).

A MED is a day where the daily Unplanned System Average Interruption Duration Index (**USAIDI**) exceeds a predetermined USAIDI threshold (referred to as $\mathbf{T_{MED}}$). The day's USAIDI is determined by accruing the USAIDI from every interruption that commences on that day (ie mid-night to mid-night). T_{MED} is determined in accordance with Appendix D of the Guideline, which permits a distributor to vary the 2.5 beta method within specified limits[4], subject to AER approval.

The 2.5 beta method was developed by the US Institute of Electrical and Electronic Engineers Inc (**IEEE**) and was documented in their Standard IEEE Std 1366™-2003, which was subsequently adopted by the AER in their Guideline. The AER made the following statement in its Final Decision[5] on the initial version if the STPIS, which states:

> *"The AER notes that the intention of allowing exclusions in the STPIS is to remove outlier performance (i.e. due to extreme weather or other events) that may distort the incentive properties of the scheme. For the purposes of the STPIS, the AER considers the IEEE standard to be a robust method for determining exclusions and notes its adoption by a number of Australian jurisdictions to measure the service reliability of DNSPs. The IEEE standard recognises the midnight to midnight timeframe limitation but accepts this in exchange for the simplicity and ease of calculation of the method."*

The AER fully aligned the Guideline with the IEEE Std 1366™-2003 in version 2 (ie v1.01 - May 2009).

2.2.b *STPIS Guideline*

The AER published the initial Guideline after consultation on 26 June 2008 (version 01.0). There has been two amendments to the Guideline, with the current version (v01.2) published on 24 November 2009. The following provides a summary of the amendments to the processes used to calculate T_{MED} in previous and current versions of the Guideline.

- Version 01.0 (June 2008) – T_{MED} was calculated using the IEEE's Beta Method except that the value of T_{MED} was fixed, with the same value being used to establish the STPIS targets and to measure the performance during RCP (ie value of T_{MED} not varied annually);
- Version 01.1 – T_{MED} was calculated using the unmodified IEEE's Beta Method (ie which meant that T_{MED} was calculated for each regulatory year based on the previous five years daily USAIDI data); and
- Version 01.2 – The default (or safe haven) method to calculate T_{MED} as per version 01.1 (ie IEEE's 2.5 Beta Method). In addition, the Guideline permitted subject to AER approval, a distributor to modify how the value of T_{MED} is calculated by:
    - varying the transformation used to convert the daily SAIDI values, where it was demonstrated that the natural logarithm (**LN**) transformation[6] does <u>not</u> and the DNSP's proposed transform does result in a Normal (or Gaussian) distribution; and/or
    - using a greater multiplier (ie > 2.5) for the standard deviation of the transformed values.

[4] The 2.5 beta method can be varied by using a different transform to convert the daily USAIDI values, where the default transform (ie natural logarithm) does not result in a normally distributed dataset. The other permitted variation is to use a higher multiplier than 2.5 for the standard deviation of the data set. T_{MED} is determined from converting back the average plus 2.5 times the standard deviation.

[5] Final Decision "Electricity distribution networks service providers, Service target performance incentive scheme – June 2008", see section 6.7.2 page 20.

[6] The natural logarithm is used to convert the daily USAIDI data in the IEEE Std 1366™ 2.5 Beta method and is the default or standard method used in the AER's STPIS Guideline.

The latest version of the Guideline reflects a recognition that the LN transformation does not result in a Gaussian distribution for some utilities/distributors.

2.3 SA Power Networks 2010-15 Distribution Determination

For the 2010-15 RCP, The AER approved SA Power Networks' proposal for the use of a different transformation (specifically the Box-Cox (**BC**) method) to convert the daily SAIDI values. The approval was on the basis that the BC conversion resulted in a Gaussian distribution whereas the specified conversion method (ie natural logarithm (**LN**)) did not. As this conversion method had not previously been used by a distributor, the AER reduced SA Power Networks STPIS regime's annual revenue at risk from five to three percent.

The Box-Cox method uses the following equation to convert the daily SAIDI values (X):

$$X^{(\lambda)} = \frac{X^{\lambda} - 1}{\lambda} for\ \lambda \neq 1, and\ X^{(\lambda)} = \ln X\ for\ \lambda = 0.$$

All other steps in the process to calculate T_{MED} remain unchanged (ie calculate the average (α) and the standard deviation (β) of the converted daily SAIDI ($X^{(\lambda)}$) data set), except that the following equations is used to determine the USAIDI threshold (ie reverse the transform):

$$T_{MED}{}^{(\lambda)} = \alpha + 2.5\beta \quad \text{and then}$$

$$T_{MED} = (\lambda T_{MED}{}^{(\lambda)} + 1)^{1/\lambda}.$$

SA Power Networks only had four years of daily USAIDI from the OMS to determine the value of T_{MED}. Consequently, a single value was used to calculate T_{MED} when establishing the STPIS targets specified in the 2010-15 DD. The value of T_{MED} was 4.37 USAIDI minutes and resulted in on average 5.0 MEDs pa during the four years used to establish the STPIS targets.

2.4 IEEE Std 1366™

As highlighted above, the AER's STPIS Guideline employs the IEEE Std 1366™-2003 2.5 Beta method to determine the USAIDI threshold, with any day with a USAIDI that exceeds the pre-determined threshold classified as a MED and excluded from the normalised reliability.

The IEEE established a Task Force to investigate a known issue with their 2.5 Beta method, which results in a step uplift (ie worsens) in normalised reliability. The step uplift occurs when catastrophic events (**CEs**), which have extremely large daily USAIDI values, are present in the dataset for determining T_{MED}. The step uplift does not occur in the year that the CE occurs, as it is classified as a MED but in subsequent years, as it is then included in the dataset for the calculation of T_{MED}.

The uplift is a result of the catastrophic day's USAIDI causing a step increase in the value of T_{MED}, which means that day(s) previously classified as a MED in past periods are no longer classified as MED(s) in future periods. This increase in T_{MED} lasts for five years, which is when the CE(s) are removed from the dataset.

The Task Force considered several methods to determine if a day should be classified as catastrophic, and then excluded from the dataset used to calculate T_{MED}. The recommended method was the 4.15 Beta Method, which is similar to the 2.5 Beta Method but uses a 4.15 instead of 2.5 as the standard deviation multiplier.

The Task Forces' recommendation was not adopted in the 2012 revision of the IEEE Standard 1366™ because for some utilities it resulted in:

- too many catastrophic event days (**CEDs**) to accept as reasonable; and/or

- a large increase in the number of days classified as MEDs once the CEDs were excluded from the dataset.

The IEEE Std 1366™-2012 section 5.3 titled "Major Event Days and catastrophic days" is reproduced below:

> *"When using daily SAIDI and the 2.5β method, there is an assumption that the distribution of the natural log values will most likely resemble a Gaussian distribution, namely a bell-shaped curve. As companies have used this method, a certain number of them have experienced large-scale events (such as hurricanes or ice storms) that result in unusually sizable daily SAIDI values. The events that give rise to these particular days, considered "catastrophic events," have a low probability of occurring. However, the extremely large daily SAIDI values may tend to skew the distribution of performance toward the right, causing a shift of the average of the data set and an increase in its standard deviation. Large daily SAIDI values caused by catastrophic events will exist in the data set for five years and could cause a relatively minor upward shift in the resulting reliability metric trends. While significant study was undertaken to develop objective methods for identifying and processing catastrophic events (in order to eliminate the noted effect on the reliability trend), the methods that were developed, in order to be universally applied, caused for many utilities, catastrophic events to occur far too often to accept as being reasonable. In addition, the elimination of catastrophic events from the calculation of the major event threshold caused, in some utilities, a rather large increase of days identified as MEDs in the following five years. It is recommended that the identification and processing of catastrophic events for reliability purposes should be determined on an individual company basis by regulators and utilities (emphasis added) since no objective method has been devised that can be applied universally to achieve acceptable results."*

It recommends the identification and processing of CEDs in the dataset is determined on an individual company basis by regulators and utilities. The simplest most pragmatic method is to exclude catastrophic days, once identified, from the data set.

3. IMPACT OF GREATER INTENSITY SEVERE WEATHER EVENTS

3.1 Introduction

The Bureau of Meteorology (**BoM**) reports on Severe Weather Events (**SWEs**) which are recorded in their monthly weather reports with, on average, about 10% of days pa covered by a BoM designated SWE. On average less than 10% of the BoM SWE days result in a MED (ie on average about one percent of days annually are classified as MEDs).

3.2 Step uplift in the MED USAIDI threshold

SA Power Networks has seen a significant increase in T_{MED} from 4.37 to 6.75 USAIDI minutes, with the former used to establish the historic reliability targets and the later applying to the 2014/15 regulatory year. If this higher value of T_{MED} was applied to each of nine regulatory years since 1 July 2005 then the number of MEDs reduces from 48 (using 4.37 minutes) to 23 (using 6.75 minutes), that is the number of MEDs halves. This reduction in MEDs leads to step uplift (ie worsens) in underlying reliability see Figure 1 below:

Figure 1 Normalised reliability (excludes MEDs using two different values)

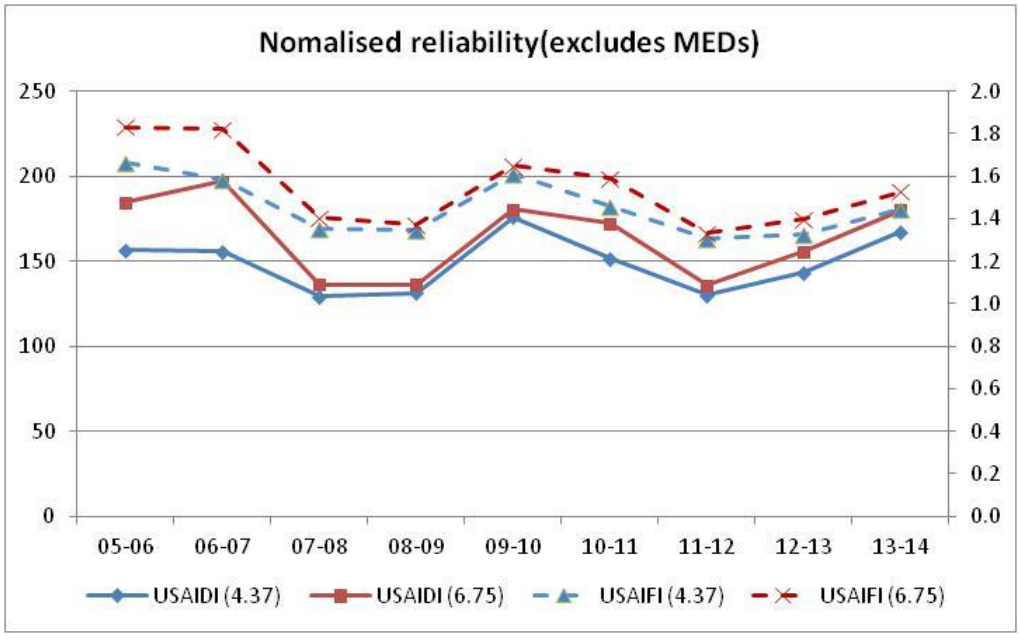
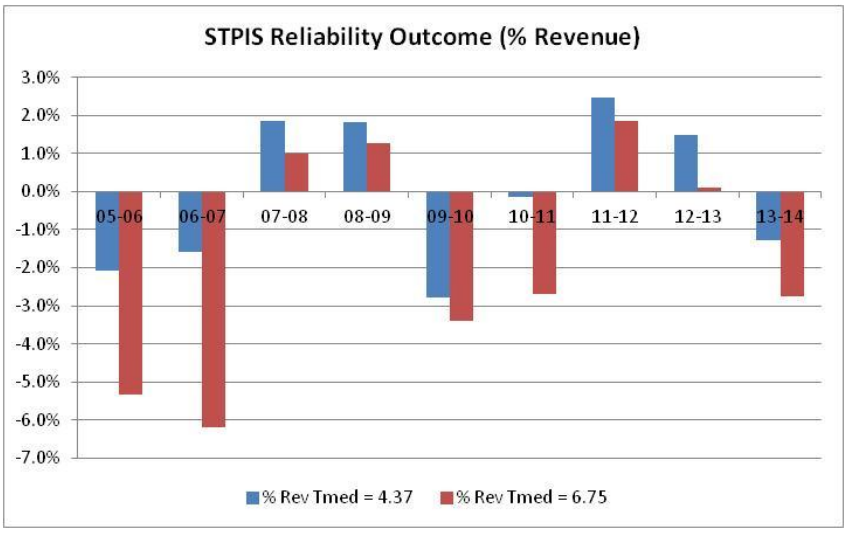


Figure 1 demonstrates that from an overall perspective (using the same value of T_{MED} for every year) the underlying USAIDI has been maintained and that USAIFI has been slightly improved. However, if the lower T_{MED} value was used to establish the STPIS reliability and the higher value used to measure the reliability performance, SA Power Networks would receive an average annual penalty by a reduction of 1.76% of revenue (or 1.51% for the 2010-15 RCP). The outcome for each individual year is shown in Figure 2 below.

Figure 2 Annual STPIS outcome penalty resulting from step uplift in T_{MED}.



This penalty (ie a reduction in revenue due to STPIS outcome) would have resulted from a change in the value of T_{MED} not a decline in underlying reliability as shown by Figure 1. This is contrary to the STPIS regime that was designed to reward or penalise a distributor based on their performance not factors beyond the distributor's reasonable control. SA Power Networks considers that the major driver of the step increase in T_{MED} is due to the greater severity of the Significant Weather Events[7] (**SWEs**), which have occurred in South Australia since 1 July 2010.

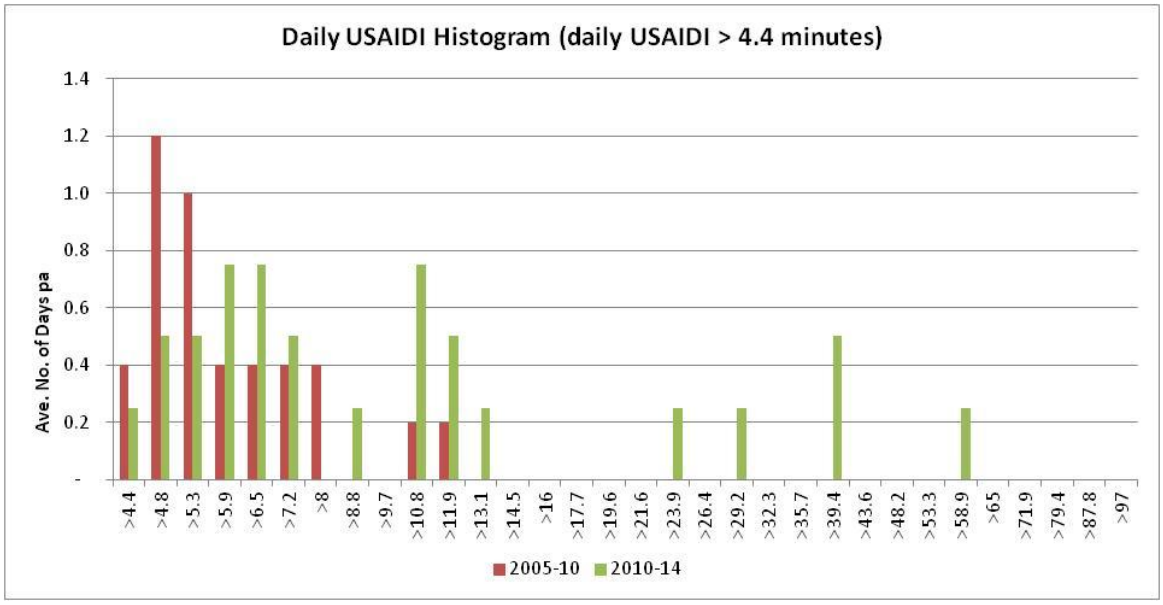
3.3 Emergence of Catastrophic Days

As highlighted in section 3.2 above, there has been an increase in the number and intensity of MEDs since 1 July 2010, with the number increasing from 4.6 during the 2005-10 RCP to 6.3 during the 2010-15 RCP. Simultaneously the average MED's daily USAIDI has more than doubled from 6.2 minutes to 14.6 minutes respectively. The vast majority of the USAIDI increase results from five MEDs which increased the average MED USAIDI by 8.1 minutes. The daily USAIDI for these five MEDs varied from 25 to 62 minutes compared to the previous maximum daily USAIDI during the 2005-10 RCP of 12 minutes.

Figure 3 below shows a histogram of the average number of days per annum, where the daily USAIDI exceeds 4.4 minutes, for the five years of the 2005-10 RCP and the four years of the 2010-15 RCP. It clearly highlights the five MEDs referred to above (ie the four columns at the right hand side of the Figure).

[7] SWE is a weather event that has been recognised and reported by the Bureau of Meteorology (**BoM**) as significant.

Figure 3 Histogram average number of days pa with daily USAIDI > 4.4 minutes.



The change in the distribution of the MEDs daily USAIDI has resulted in an increase in the average and standard deviation of the converted dataset. This has resulted in a higher T_{MED} value, which could lead to fewer MEDs. This is an example of the known issue with the IEEE Standard's 2.5 Beta method highlighted previously. The STPIS regime penalises any step uplift in reliability with a loss of revenue. The STPIS penalty associated with no longer excluding a single MED as a result of an increase in the value of T_{MED} from the inclusion of catastrophic days in the data set is about 0.7% (or $5-6M) of annual revenue.

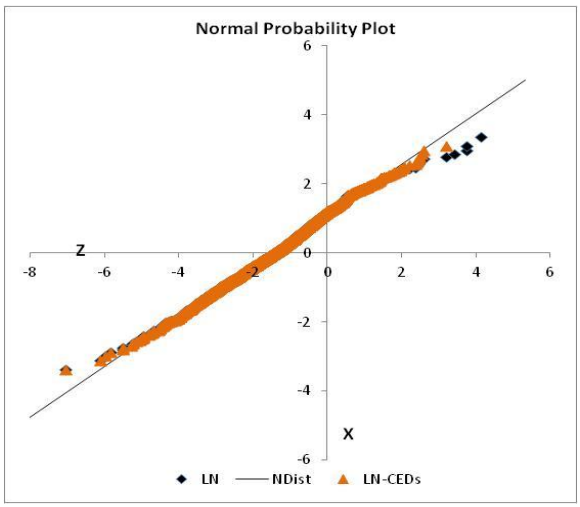
This STPIS penalty is contrary to the objectives of the incentive regime, as it is penalising a distributor for a day which is clearly beyond their control. In addition, that day is excluded from the STPIS outcome in the year that it occurs. However, that day's inclusion in the daily USAIDI dataset results in an increased value of T_{MED}, thereby penalising the distributor in the future.

3.4 Dataset not normally distributed

As detailed above, the AER approved the use of the Box-Cox method on the basis that it resulted in a dataset that was normally distributed unlike the natural logarithm (LN) dataset[8]. The Figures below compare the normality of the converted dataset's distribution by including and excluding days which are considered abnormal or catastrophic event days (**CEDs**). The plots compared the distribution with no days excluded (ie the darker colour) and between three and five of the days referred to above (ie daily USAIDI 25 minutes or more) excluded (ie the lighter colour). The plots on the left use the LN transform and on the right the BC transform. The exclusion of CEDs results in both datasets moving towards normality, but still not considered as normally distributed.

[8] The LN dataset is produced by converting the daily USAIDI using the natural logarithm.

Figure 4 - Normality plot (excls daily USAIDI > 40 mins ie three days excluded)



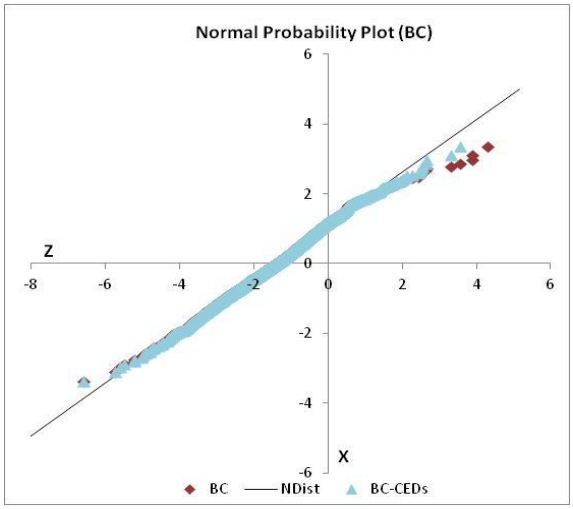
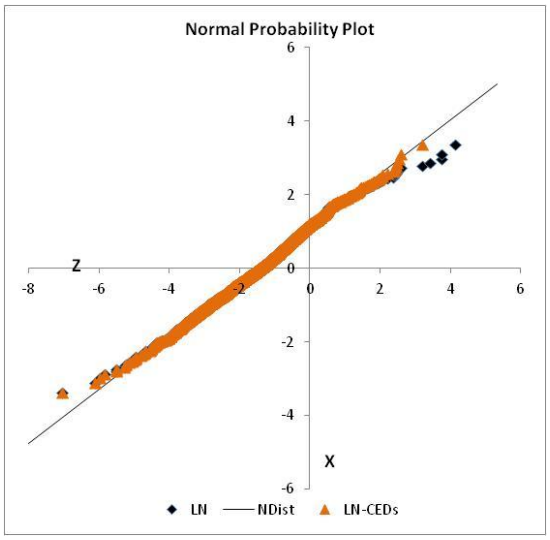


Figure 5 - Normality plot (excls days with daily USAIDI > 30 mins ie four days excluded)



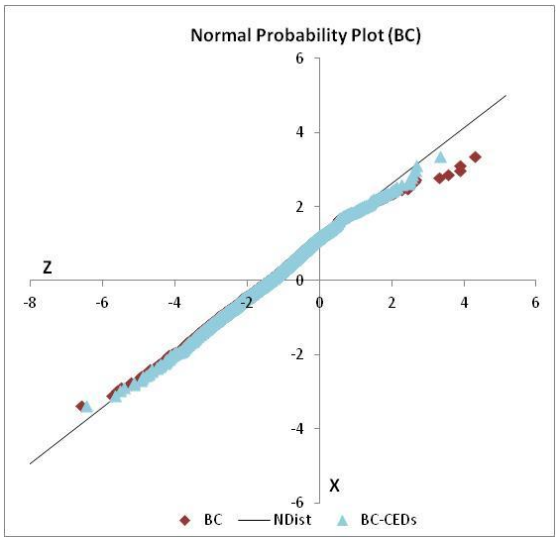
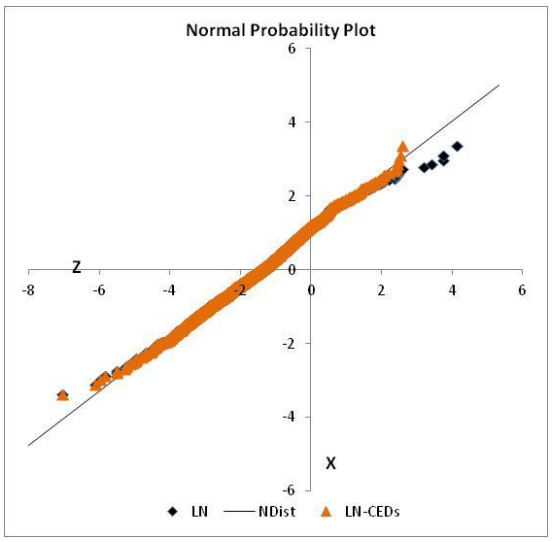
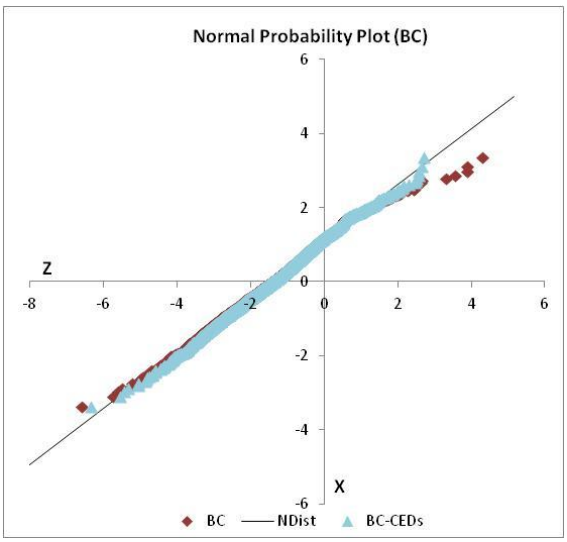


Figure 6 - Normality plot (excludes days with daily USAIDI > 24 minutes ie five days excluded)





The Figures show that the closest alignment to a normal distribution is when four days are excluded for the LN transform and five days from the BC transform.

The T_{MED} values both with and without CEDs (four for LN and Five for BC) are shown in the Table below:

	BC T_{MED}	BC T_{MED} (excl CEDs)	LN T_{MED}	LN T_{MED} (excl CEDs)
2009/10	4.369	4.369	6.006	6.006
2010/11	4.583	4.583	6.300	6.300
2011/12	5.282	4.578	6.598	6.299
2012/13	5.093	4.409	6.025	5.745
2013/14	5.628	4.918	6.190	5.905
2014/15	6.754	5.419	6.739	6.319

The IEEE's Task Force recommended method for determining the USAIDI threshold for a day to be classified as a CED using the 4.15 Beta methods is:

- 23.3 minutes for the BC method (ie excludes the five days); and
- 55.4 minutes for the LN method (ie excludes one of the five days).

The following Table details the total number of MEDs excluded using the thresholds calculated when CEDs are and are not excluded.

No of MEDs pa	BC T_{MED}	BC T_{MED} (excl CEDs)	LN T_{MED}	LN T_{MED} (excl CEDs)
Targets' T_{MED}	5.3	5.3	3.0	3.0
Max T_{MED}	2.6	4.0	2.7	2.8
Min T_{MED}	5.3	5.3	3.0	3.3

The 4.15 Beta method does not eliminate the step uplift in the value of T_{MED} using the Box-Cox method. Neither does the method eliminate the step uplift in T_{MED} using the LN transform, as the T_{MED} value for 2014/15 is reduced from 6.739 to 6.617 minutes by excluding one day. This compares to compares to 6.319 by excluding the four days. The limited effectiveness of the 4.15 Beta method in eliminating the step uplift in T_{MED} is likely to be the result of the SA Power Networks converted dataset not being normally distributed using the LN or BC conversion method.

SA Power Networks' conclusion is that the use of the BC method should cease, as the method is significantly affected by any shift in the dataset. This is because the dataset is used to determine lambda (λ) which is then used to convert the daily USAIDI data.

The LN conversion does not rely on the dataset to convert the data so is more stable than the BC method. However, it still requires that exclusion of catastrophic days to prevent step uplift in normalised reliability using the 2.5 Beta method. The threshold required to exclude four of the five

days is 30 minutes, which corresponds to applying a 3.7 Beta method (ie uses a 3.7 multiplier for the standard deviation of the converted dataset). This catastrophic day threshold excludes less than 0.15% of days or less than 15% of MEDs from the calculation of T_{MED}.

The removal of CEDs from the calculation of T_{MED} for the first four years of the 2010-15 RCP results in one additional MED using the LN method. Consequently, the adoption of 3.7 Beta method for determining catastrophic days does not result in a large increase in the number of MEDs neither does it result in too many catastrophic days being identified to be considered unreasonable (ie less than 0.15% of days). This is contrary to the two reasons the IEEE espoused for not including the 4.15 Beta method for the classification of catastrophic days in their revision to the Standard. The two reasons were that the exclusion of catastrophic days using the 4.15 Beta method resulted in:

- A large increase in MEDs once catastrophic days are excluded from the dataset; and/or
- too many catastrophic events identified to be reasonable.

The alternative would be to fix the T_{MED} value for a regulatory control period to the value used to establish the STPIS targets. This would eliminate the effects of catastrophic days but is likely to result in transitional issues from one RCP to the next. Using a fixed T_{MED} would align the STPIS with the initial version of the AER STPIS Guideline (ie v01 0).

4. AMENDMENT TO TMED CALCULATION

The following details SA Power Networks' proposed amendment to the AER's STPIS for the classification of MEDs.

The *major event day* boundary is calculated at the end of each reporting period (typically one *regulatory year*) for use during the next reporting period using the 2.5 beta method as follows:

1. Collect values of daily *unplanned SAIDI* over five sequential *regulatory years* ending on the last day of the last complete reporting period — these values should reflect any exclusions permitted under clause 3.3 and 5.4 of the *scheme*. If fewer than five *regulatory years* of historical data are available, the most recent data should be used.
2. Only those days where an *unplanned SAIDI*/day value > 0 are considered (do not include days that did not have any *interruptions*).
3. Calculate the natural logarithm (ln) of each daily unplanned SAIDI value in the data set.
4. Apply a commonly accepted statistical test to the data set and where application of the statistical test indicates:
   (a) the logarithms of the data set are not normally distributed:
      (1) Propose an alternative data transformation method which results in a more normally distributed data set in accordance with clause 2.2 of this *scheme*.
      (2) Apply the proposed alternative data transformation to calculate each *daily unplanned SAIDI* value in the transformed data set.
      (3) Find α (alpha) as the average of each daily *unplanned SAIDI* value to which the proposed alternative data transformation method has been applied.
      (4) Find β (beta) as the standard deviation of each daily *unplanned SAIDI* value to which the proposed alternative data transformation method has been applied.
      (5) Exclude any catastrophic days from the daily USAIDI dataset, as approved by the AER.
      (6) Re-calculate α (alpha) as the average of each daily *unplanned SAIDI* value to which the proposed alternative data transformation method has been applied, after excluding catastrophic days.
      (7) Re-calculate β (beta) as the standard deviation of each daily *unplanned SAIDI* value to which the proposed alternative data transformation method has been applied, after excluding catastrophic days.
      (8) The boundary for an extreme event or *major event day* (T_{MED}) is then calculated such that the transformed value is as follows:

      Transformed (T_{MED}) = α + 2.5β

      (where the value of 2.5β is adjusted to reflect any alternative amount permitted to be used in accordance with this *scheme*.)

   (b) the logarithms of the data set are normally distributed, or if the AER agrees with a DNSP that the use of an alternative data transformation method is not appropriate, despite the logarithms of the data set not being normally distributed, or where the AER determines that an alternative transformation method is not appropriate:
      (1) Find α (alpha), the average of the logarithms of the data set.
      (2) Find β (beta), the standard deviation of the logarithms of the data set.

(3) Exclude any catastrophic days from the daily USAIDI dataset, as approved by the AER.

(4) Re-calculate α (alpha), the average of the logarithms of the data set, after excluding catastrophic days.

(5) Re-calculate β (beta), the standard deviation of the logarithms of the data set, after excluding catastrophic days.

(6) The boundary for an extreme event or major event day (T_{MED}) is then calculated as follows:

$$T_{MED} = e^{(\alpha + 2.5 * \beta)}$$

(where the value of 2.5β is adjusted to reflect any alternative amount permitted to be used in accordance with this scheme.)

5. Any day in the new reporting period where the total unplanned SAIDI exceeds this value of T_{MED} is classified as a major event day.

6. Where 4(a) applies a DNSP must, in addition to the requirements of clause 2.2 of this scheme:

   (a) Demonstrate that the natural logarithm of the data set of each unplanned SAIDI value is not normally distributed.

   (b) Explain the proposed alternative data transformation method.

   (c) Provide the calculations that demonstrate the application of the alternative data transformation method to the unplanned SAIDI values.

   (d) Provide the data set resulting from applying the proposed alternative transformation method.

   (e) Demonstrate that the resulting data set is normally distributed or that the normality of the data set is improved.

5. GLOSSARY

Definitions of terms used in this submission:

Term	Definition
2010-15 RCP	2010-15 Regulatory control period, is the period from 1 July 2010 to 30 June 2015
2015-20 RCP	2015-20 Regulatory control period, is the period from 1 July 2015 to 30 June 2020.
AER	Australian Energy Regulator
BC	Box-Cox method to convert the daily SAIDI data to determine T_{MED}.
DNSP	Distribution Network Service Provider
EDC	South Australian Electricity Distribution Code
ESCoSA	The Essential Services Commission of South Australia
IEEE	US Institute of Electrical and Electronic Engineers Inc.
IEEE Std 1366™	IEEE Guide for Electric Power Distribution Reliability Indices[9] (the initial 2003 version has been superseded by the 2012 version).
LN	Natural logarithm used to convert the daily USAIDI data to determine T_{MED}.
MED	Major Event Day – a day which is excluded from the underlying reliability performance as reported in accordance with the AER's STPIS.
RCP	Regulatory Control Period means the period (normally five years) of a distribution determination for a DNSP by the AER.
STPIS	Service target performance incentive scheme
The Guideline	Means the AER's STPIS Guideline
The Standard	Means the IEEE Std:1366
T_{MED}	The MED SAIDI threshold which is calculated annually for each regulatory year, based on the daily SAIDI data from the previous five years. Any day that exceeds this threshold is classified as a MED.
TSP	STPIS Target Setting Period – the four year period (ie 1 July 2005 to 30 June 2009) used to establish the STPIS reliability targets for the 2010-15 RCP
USAIDI	Unplanned System Average Interruption Duration Index – total number of minutes, on average, that a customer is without electricity as a result of unplanned interruptions[10] in a year.
USAIFI	Unplanned System Average Interruption Frequency Index – average number of times a customer's supply is interrupted from unplanned interruptions[11] in a year

[9] The current version 1366:2012 was released on the 31 May 2012. It replaces the 1366:2003 version which is referenced in the AER's STPIS Guideline, for the determination of MEDs

[10] SAIDI excludes interruptions which last for less than one minute.

[11] SAIFI excludes interruptions which last for less than 0ne minute.