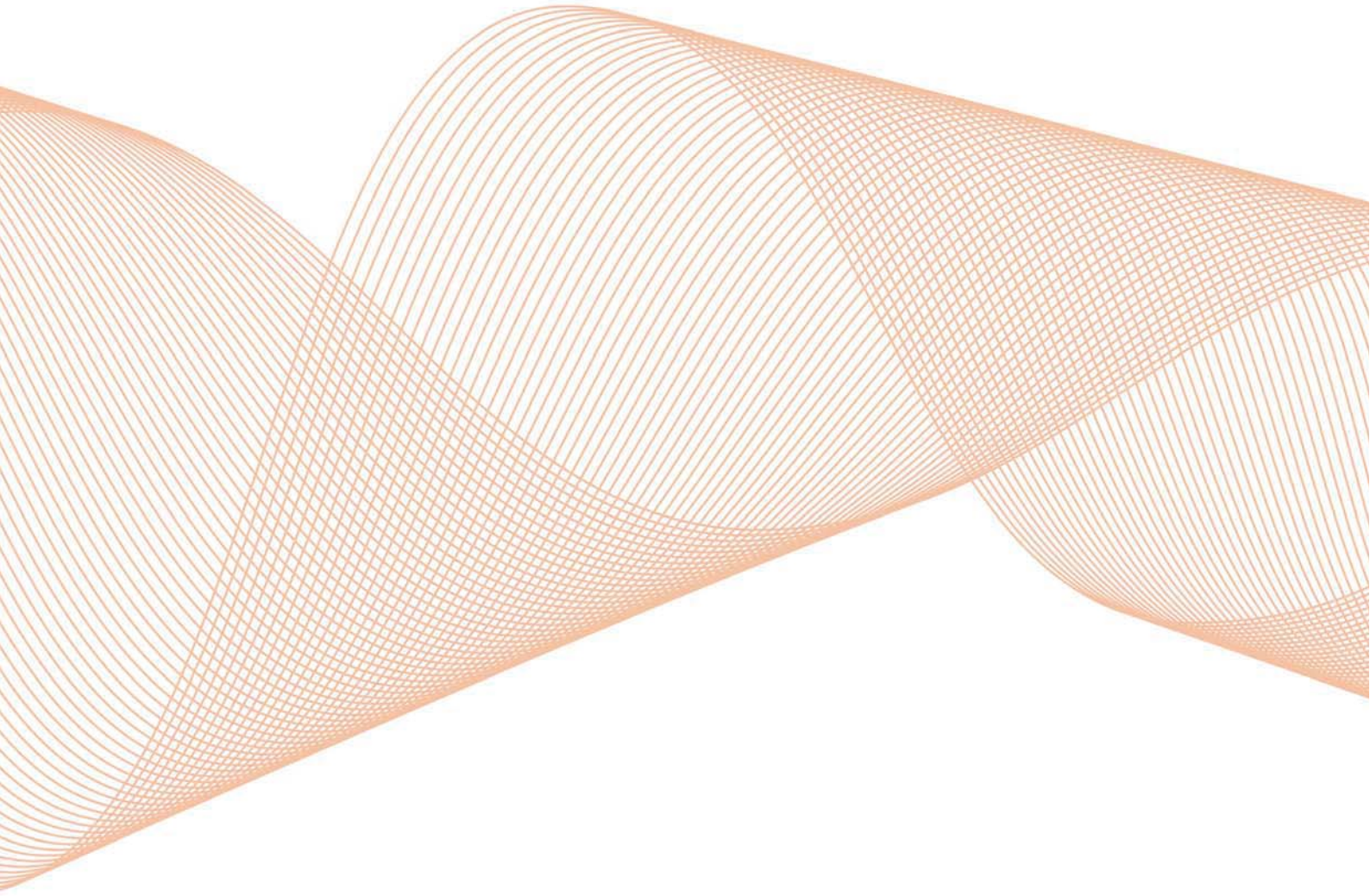
Appendix Y – KPMG Report – Customer Preferences for Supply Reliability Survey

September 2011



KPMG

ECONOMICS INFRASTRUCTURE AND POLICY

Western Power

Customer preferences for supply reliability – Calibrated to Normalised Feeder Data

March 2011

ADVISORY

AUDIT ▪ TAX ▪ ADVISORY

Disclaimer: About this report

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The findings in this presentation are based on a public research and the reported results reflect the responses from the survey respondents.

Any decisions made with regard to the results will need to be considered having regard to overall regulatory strategy, and other impacts such as the relevant codes and regulatory guidelines.

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KPMG

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Background and approach

This report outlines the response to a customer feedback survey which was developed to identify threshold levels of performance for Western Power customer service.

620 Western Power consumers answered the survey by telephone interview in late August 2010. These were equally divided between:

- 2 customer groups – Residential and Business; and
- 3 feeder categories – Urban, Rural short, and Rural long.

The sampling regime consisted of approximately equal numbers of business and residential customers equally distributed over the three feeder categories. This parameter was agreed in the start-up workshop with Western Power staff before the commencement of the survey process.

The process we adopted applied a methodology that had been used in a number of surveys to define customer preferences in other electricity distributors across Australia. We did not experience any difficulty in application of this methodology, and the survey process was conducted relatively quickly, achieving 620 responses as compared to the target of 600.

One key point about the survey is understanding the street address of the customer in the survey, and the distribution feeder to which they are attached. This allows calibration of the customer responses with the recorded feeder data to inform Western Power of the customer's experiences in terms of Western Power's current feeder data. The location data provided by Western Power was excellent and allowed the data collection to proceed quickly. It is recognised however, that the feeder data represents the performance data for the feeder on average, and not for a specific customer address. Customer data gathered through the survey represents their perception at their household or business. Differences with therefore exist between customer perception and feeder data depending on where the customer is located on the feeder. This difference is dealt with through the averaging and through calibration.

The data provided by the survey provides customers' perceptions about the frequency and duration of interruptions and other parameters which are presented in the report.

The objective is to define a set of thresholds of performance based on what the customers demand from Western Power. It is in effect, the customers view of what they demand.

Western Power can use this data to evaluate their performance against the customers' view of performance requirements.

Calibration and Thresholds

Calibration

Having established a customer perception of performance from the survey, we have calibrated this data against actual Western Power feeder data for the relevant customer. This uses customer ratings as a type of "meter" to estimate SAIDI and SAIFI. All meters need calibration and this was performed to convert this data back to information which is consistent with Western Power performance data in order for Western Power to respond to the feedback. Western Power was able to provide feeder data for measures of SAIDI and SAIFI to use in the calibration.

Our results have calibrated the customers' response to a set of data defined as "All Interruptions" and a set defined as "Normalised Unplanned Interruptions'. The second set is more closely aligned to Western Power's reporting requirements of SAIDI and SAIFI which removes planned outages and major interruption events.

Determination of threshold points

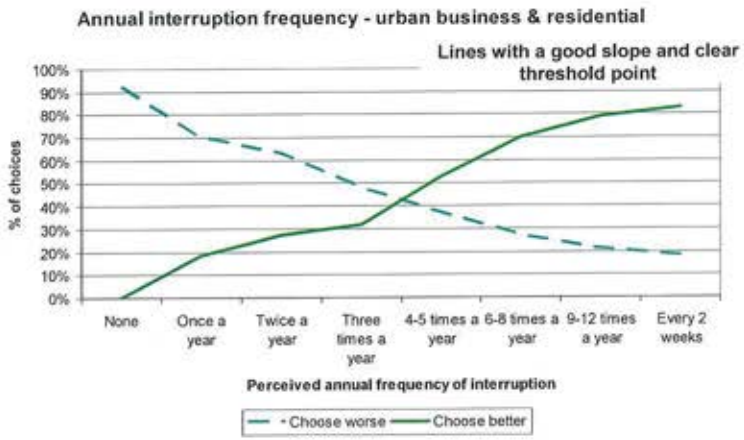
Our analysis produces graphs that identify threshold points that measure a customer's willingness to trade for improvements in a particular aspect of a service. The graphs presented in the body of the report plot two lines on a chart. The dashed line represents the proportion of customers who 'choose worse' (e.g. a level of reliability that is lower than their current level of reliability). The solid line represents the proportion of customers who 'choose better' (see example chart below).

The threshold point is where the lines intersect. At a level of performance better than that represented at the intersection point, the proportion of respondents willing to choose worse is higher than the proportion of respondents choosing better (and vice versa).

It is worth noting that in the discussion on the results, a "worse power supply" refers to a lower level of reliability or a higher frequency or duration of supply incidents. (Move to the right along the X axis). Conversely, a "better power supply" refers to a higher level of reliability or lower frequency or duration of quality of supply incidents. (Move left along X axis).

The threshold point is where customers are equally balanced in terms of the reliability they require. To set a reliability performance to the left of the threshold point would give them better reliability than they require and setting it to the right would give them reliability that was worse. It should be noted that in some cases there are two threshold points (see page 25 of the main report). This indicates that there is a zone of indifference between the thresholds and moving the reliability performance within that zone will make little difference to customer demands for reliability. In those cases, the reliability performance could be set anywhere between those two threshold points.

Example chart



Results

Major findings from the results of the survey are set out below

- Customers provided valid reliability estimates. We note that customers perceive they had fewer and shorter interruptions than actually measured by Western Power on their feeders. While this systematic perception bias is expected, as with all "meters" it needed to be calibrated out. The critical finding was not what customers estimated reliability to be according to network measures, but whether they perceived they needed more reliable power. Of course it is recognised that some customers may not have noticed interruptions if they were not present at the premises at the time.
- Calibration was carried out using actual network data based on "Normalised Unplanned Interruptions" data, and "All Interruptions" data. Western Power reports against the "Normalised Unplanned Interruptions" data, and this should continue to be Western Power's focus of its attention if this is consistent with how it communicates performance to its customer base and the regulator.
- The results of the survey translate to the following SAIDI measures. Where two points are provided for a customer feeder type, customers on average are satisfied for outages of fewer minutes than that stated, and on average dissatisfied for more minutes stated in the second measure, however they are indifferent to the measure in between those two points. Where only one intersection is provided, there is a clear delineation on where the threshold of satisfaction lies for the customer group on average. (For a single point example, "Rural Long 285 minutes" more customers were dissatisfied than satisfied at reliability levels greater than 285 minutes).

SAIDI Measures			Calibrated Results	
		Perceived data (From Survey Responses) Minutes pa	**Normalised unplanned interruptions** Minutes pa	**All network interruptions** Minutes pa
Urban	Customers satisfied below	9.5	181	230
	Customers not satisfied above	57	212	280
Rural short	Customers satisfied below	15	185	236
	Customers not satisfied above	169	285	396
Rural long	Customers satisfied below, and not satisfied above	169	285	396

"Perceived data" represents the results of the survey. The Calibrated results represent thresholds after calibration with Western Power feeder data. The Calibrated results provide the relevant data points for what customers demand, expressed in values consistent with Western Power's performance data

It is recognised that the data presented for rural long and rural short appears similar. This is a result of rounding and the result is coincidental.

Headlines continued

SAIFI Measures	Perceived data (From Survey Responses)	Calibrated Results	
		Normalised unplanned interruptions	All network interruptions
	Times pa	Times pa	Times pa
Urban	1.0	2.1	2.4
Rural short	2.0	2.3	2.8
Rural long	3.9	2.8	3.5

"Perceived data" represents the results of the survey. The Calibrated results represent thresholds after calibration with Western Power feeder data. The Calibrated results provide the relevant data points for what customers demand, expressed in values consistent with Western Power's performance data

- The SAIFI results above show the threshold points where customers are (on average) satisfied for a frequency of interruptions below the point reported and (on average) not satisfied for a frequency above that point.

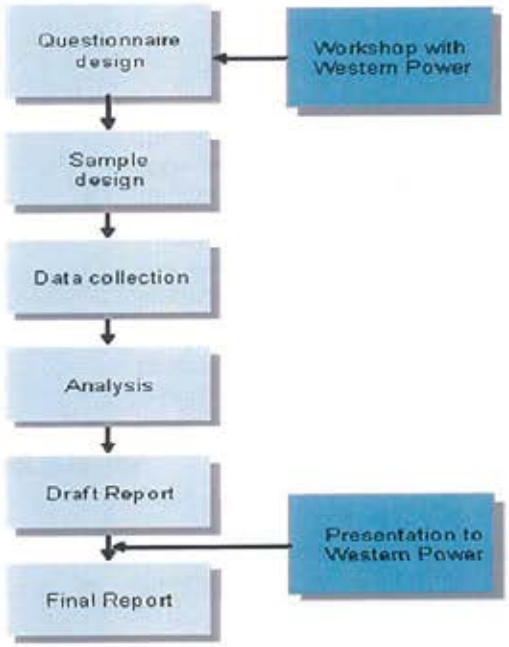
Other findings

- Thresholds for the measures of Longest duration interruption, MAIFI and Quality were also estimated and reported in the survey, but as there were limited corresponding network feeder data, the calibrated results were based on a calibration with appropriate SAIDI and SAIFI measures.
- The Call Centre response time and type, improved respondents attitudes towards Western Power's response to interruptions but had little impact on the threshold values reported. While Call Centre performance did not move the threshold values, there was clear evidence for Call Centre benefits outside those very specific points in the reliability spectrum.
- Separating residential and business customers produced results that are represented by samples of 100 (rather than combined which would represent 200 data points). This is reported for reference only. The separation of the data set indicated that:
  - Residential customers set generally less demanding reliability thresholds than business on the Urban and Rural short feeders while the reverse applied on the Rural long feeders
  - There was a large indifference zone for residential SAIDI on Urban and Rural short feeders, probably caused by a lack of homogeneity in the residential mix of customers on those feeder categories.

Approach

This section outlines the methodology used in the preparation of this report, to estimate the threshold points for the service standards identified.

Figure 1: Workplan diagram



Methodology

Consumer research was conducted to obtain estimates of threshold points for the reliability measures, including average duration (SAIDI), average frequency (SAIFI) and the Longest duration interruption. Questions regarding the customer Call Centres were also included. The threshold points are levels of a reliability index, above which customers would generally be seeking improvements in that reliability index and below which customers would generally not be seeking improvements.

The consumer research study consisted of the following stages:

- questionnaire design and customer feeder analysis;
- sample design and customer feeder analysis;
- data collection;
- analysis; and
- reporting.

Having applied this approach on seven previous occasions, our experience with other distributors has shown that the methodology is robust, producing stable results over time. That is, when the study is repeated for the same customer base, the results are consistent from year-to-year, with changes in findings due to external factors (e.g. changing rates of computer ownership).

Questionnaire design

A questionnaire was developed in consultation with Western Power.

In order to establish the threshold points, the questionnaire included questions to determine the respondents' perceptions about the reliability of their electricity supply. The respondents were then presented with a number of choice sets, which the respondents accepted or rejected.

The choice sets included trade-offs between the following attributes of electricity supply:

- duration of interruption;
- frequency of interruption;
- longest duration interruption;
- frequency of momentary interruptions;
- quality of supply; and
- Call Centre response times following an interruption and whether an operator was available.

The questionnaire included a number of demographic questions, as well as questions about electrical appliance ownership and attitudes towards electricity supply, the environment and Western Power's information programs.

Approach and calibration

Sample covered more than 600 customers on feeders described as:

- Urban
- Rural short
- Rural long

Service standards measured:

- SAIFI
- SAIDI
- Longest duration
- MAIFI
- Other, such as Quality and Call Centre

Sample design

A sample design is required to select the respondents to participate in the survey. Generally speaking, the objective of the sample design is to obtain the most statistically accurate (reliable) results with the resources available for this project.

The sample must be representative both of the population of interest and the range of service standards across the network. It needs to be sufficiently large to provide statistically reliable data. As a minimum, sample sizes of 200 respondents per major feeder category can be statistically justified.

Stratification regime

Discussions with Western Power settled on 600 respondents in total with 200 from each feeder category. The sample was controlled for residents and small business to ensure a representative sample within the feeder categories. This sampling regime reflects reality in that both groups are inseparable on the network. As agreed in the start up meeting, large organisations were excluded from the sample as they have different relationship with their distributor to small business and consumers. The feeder categories are classified in this report as:

- Urban
- Rural short
- Rural long

Data collection

All data was collected by telephone. The telephone interviews were conducted by computer aided interviewing (CATI) using a centralised, supervised control room. The telephone survey was conducted for a week and a half in late August 2010.

Western Power provided contact phone numbers for customers on feeders selected in the sample design phase (as well as the measured performance for the feeder, which was used in the Calibration phase – see below).

Analysis of data

The analysis stage included:

- understanding of qualitative assessment of the electricity network as identified by Western Power data;
- understanding the type of equipment respondents had within their homes or businesses;
- calibrating perceived network performance for the frequency and duration of interruptions to actual feeder performance as measured by Western Power; and
- determining the perceived threshold points for electricity performance measures including duration and frequency of interruptions for all customers segments.

The calibration against actual feeder data was carried out twice in the preparation of this report (refer pages 9, 17 and 18) using:

- "Normalised Unplanned Interruption" data consistent with Western Power's reporting of performance which excludes major events and planned interruptions from "All Interruptions" data; and
- "All Interruptions" data which would more closely match an indication of customer expectations however normalised data excludes events normally outside of the control of Western Power.

The use of "All interruptions" data is not consistent with the regulatory reporting framework applied by Western Power, and is therefore less relevant to the measures of service standards that are routinely applied and understood within Western Power.

All statistics are reported at the 95% confidence interval.

Service standards

Service standards for which threshold values were determined include:

- interruption frequency: refers to average number of interruptions a customer experiences per annum, and is measured by the System Average Interruption Frequency Index (SAIFI). This is represented by both a perceived and a network measure;
- interruption duration: refers to the average total duration of interruptions per customer per annum, and is measured by the System Average Interruption Duration Index (SAIDI). This is represented by both a perceived and a network measure;
- longest duration interruptions: which refers to a respondent's longest duration for a single interruption. This is represented by a perceived measure only;
- momentary interruptions: refers to the average number of times a customer experiences momentary interruptions per annum, and is measured by the Momentary Average Interruption Frequency Index (MAIFI). Momentary interruptions are defined as interruptions of one minute or shorter duration. This is represented by a perceived measure only;
- quality of supply: refers to a customer's average frequency of flickering or blinking lights, blown light bulbs, damaged electrical equipment and sustained low voltage. This is represented by a perceived measure only; and
- Call Centre: refers to the average response time for the Call Centre when a customer enquires about an service standard issue and whether a person can get through to an operator. This is a perceived measure only.

Only SAIFI and SAIDI has been calibrated because only these two have a network equivalent measure. The remaining measures are presented as perceived measures with an indicative network measure derived by assuming the SAIFI calibration curve for the frequency factors MAIFI and Quality and the SAIDI calibration curve for the duration factor Longest duration. Calibration obviously was not carried out but there is no reason to suspect that they are not similar.

Other results

In addition to the threshold points, the study also examined:

- electrical equipment used by residential and business customers; and
- customers' attitudes towards their electricity supply, and their perceptions about whether their reliability has improved over the last year and whether they want an improved supply.

Establishing threshold points

Satisfaction is not a useful measure. Collectively, customer perceptions are a reliable guide to system performance, but there are systematic distortions between perception and reality.

The calibration of customer responses with actual feeder data 'removes' systematic distortions. However:

- local variations can be extreme;
- perceptual measures have to be carefully formulated to provide useful indicators;
- reliability measures have to be moderately reliable; and
- this project is designed to understand consumers perception of their electricity supply, and calibrate it against actual feeder measures.

Choice or trade-off tasks establish threshold points

The threshold is the point at which respondents are equally balanced between choosing a better or worse level of a particular service attribute.

Calibration

We recognise that humans are 'imprecise' meters – in that they can estimate the frequency and duration of events but these estimates usually have systematic distortions. Customers may also not remember, or not be at the premises when the event occurs. The calibration process neutralises these distortions by comparing customers' perceptions regarding the reliability of the network with actual feeder performance data. It is recognised that the customers perception is representative of the service level at that customer point, which may be different to a customer on a different part of the same feeder. This will be compared to the Western Power feeder data which will represent an average for the feeder.

Calibration of reported or perceived data against Western Power's actual feeder performance data (both "Normalised Unplanned Interruptions", and "All Interruptions") therefore provides a mechanism by which perceived thresholds can be translated into network performance figures that Western Power can use. Naturally this can only be done for service levels where feeder performance figures exist at a network level.

The System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) as measured by Western Power were calibrated against average interruption duration and frequency as perceived by customers. The calibration translates the customer perception of frequency and duration of interruptions into the network measure of SAIFI and SAIDI but not the equivalent customer level interruptions (i.e. CAIDI). In this exercise we are using respondents as network 'meters' to measure the values we are interested in. This calibration maps the relationship between what the customer experiences and what Western Power measures in its feeder system.

Service standards thresholds

This section of the report presents the threshold points estimated for the six customer segments considered in this study. Service standard thresholds have been determined for the following reliability attributes:

1. frequency of interruptions;
2. duration of interruptions;
3. longest duration interruption;
4. frequency of momentary interruptions;
5. quality of supply interruptions; and
6. impact of Call Centre response times.

The choice or trade-off tasks

During the telephone interviews, customers were asked to make choices based on their preferences for defined outcomes relative to performance in the electricity network. In the first choice task, respondents were offered twelve "real" electricity options in which they were asked to trade-off variations in the six reliability and service standard attributes. In every choice they were offered combinations of options 1 to 3 above plus one of options 4 to 6. (Refer to page 12 for an example of the questions.)

In each case the offer varied around their present perceived reliability level for each attribute as previously advised in the telephone interview. The choice is therefore targeted to their perceived experience and therefore more relevant to their perceived values. In any one choice, any of the attributes may be better, the same or worse than what they are currently receiving. The respondents simply had to say whether they accepted or rejected the offer.

Overview of threshold points

Threshold points are points that measure customers' willingness to "trade" for improvements in a particular aspect of a product or service. The thresholds are determined by undertaking consumer research which asks customers to trade off different levels of attributes of their electricity supply (e.g. number versus duration of interruptions to supply).

These trade offs allow for "threshold" points to be estimated for the reliability measures. A threshold point is established when the proportion of respondents choosing a combination with poorer reliability equals the proportion of respondents choosing a supply with better reliability. At that point, the level of reliability may be considered balanced or of equal appeal to all. The threshold is determined where the 'choose worse' and 'choose better' lines intersect. (Refer page 10 for an example of a threshold charts, and page 25 for actual results).

The 'choose worse' line is calculated by taking the number of choices to choose a worse supply and dividing by the total number who have been made that offer. There is no equivalent line for those who rejected the worse supply as that provides no useful information. The 'choose better' line is calculated by dividing the number of responses where a better supply was offered and chosen and dividing by the total number who were made that offer. There is no equivalent line for those who rejected the better supply. In both cases the lines are made up of the proportion of people that chose the offer and the total number made that offer.

The lines are not the arithmetic sum of the responses to a particular offer so summing to 100% will be a coincidence especially as the responses for trade-offs, where the offer was the same supply, have been excluded.

Interpreting the threshold graphs

In the threshold graphs presented throughout this report, the y-axis represents the proportion of customers and the x-axis represents the perceived level of reliability.

The dashed line represents the proportion of customers who 'choose worse' (e.g. a level of reliability that is lower than their current level of reliability). The solid line represents the proportion of customers who 'choose better'. For example, in Figure 2 below, for those customers that currently have a perceived SAIFI of once a year, approximately 70% would accept a bundle of attributes that includes a higher frequency of interruptions, while approximately 20% would accept a bundle of attributes that includes a lower frequency of interruptions.

The threshold point is where the lines intersect. At SAIFI below this level, the proportion of respondents willing to choose worse is higher than the proportion of respondents choosing better (and vice versa).

In the discussion on the results, a "worse power supply" refers to a lower level of reliability / higher frequency or duration of supply incidents. Conversely, a "better power supply" refers to a higher level of reliability / lower frequency or duration of quality of supply incidents.

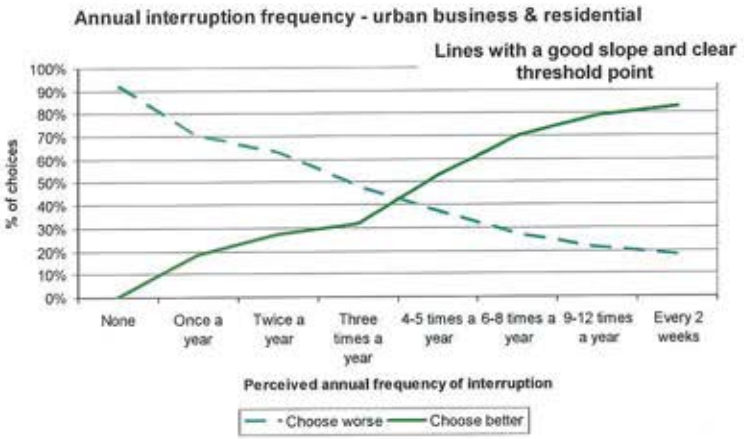
Establishing threshold points (2)

Ideally, the data will provide a clear threshold point, and therefore clear preferences for consumer standards. However, the data does not always provide an 'ideal' finding, with a single clear threshold point. Data may in fact provide multiple thresholds.

Ideal findings

The following figure illustrates an 'ideal' finding for a fictional threshold value analysis for SAIFI.

Figure 2: Ideal finding



Ideally, the aim is to establish a clear threshold point, indicating clear preferences in the market for particular service standards. The intercept is arithmetically interpolated in the spreadsheet and not estimated on the curves. The positioning on the curves is indicative only.

Trade offs

The accompanying table represents the trade-off process. In this table, the columns represent the range of the perceived variables of interest. Every respondent underwent a process that quantified these perceptions and these are indicated by the light grey shading (in this example, the respondent was on part of the network with a perceived SAIFI of 3 times a year and a SAIDI of 3-4 hours).

Each respondent was then given 12 trade-offs scenarios ranging plus or minus 2 increments from their perceived value (all the shading), except for the Call Centre which was a purely random selection.

As will be explained with examples on the next slide, every trade-off included combinations of perceived SAIFI, SAIDI and Longest duration so (620 respondents with 12 trade-offs = 7,440 combinations asked) as a main core while the momentary, quality and Call Centre performance was added to the main core one time in three (620 respondents with 4 trade-offs = 2,480 combinations asked). The latter three perceived values were only asked a third of the time to reduce respondent load.

Table 1: the trade off process and survey structure

Perceived SAIFI	Perceived SAIDI	Perceived Longest duration	Perceived momentaries	Perceived quality	Perceived Call Centre
					Randomly select 1
	Zero hours in a year				
	>1 minute and <30 mins pa		Zero in a year	Zero in a year	Hear a recorded message about the interruption
Zero in a year	30 minutes to an hour a year	Zero hours in	Once a year	Once a year	Hear a recorded message about the interruption and lets you speak to an operator
Once a year	1 - 2 hours a year	>1 minute and <30 mins	Twice a year	Twice a year	Talk to an operator within 30 seconds
Twice a year	2 - 3 hours a year	30 minutes to an hour	Three times a year	Three times a year	Take up to five minutes to talk to an operator
Three times a year	3 - 4 hours a year	1 - 2 hours	Four times a year	Four times a year	Take up to 10 minutes to talk to an operator
4-5 times a year	4 - 8 hours a year	2 - 3 hours	Monthly	Monthly	Cant get through to the Call Centre
6 - 8 times a year	8 - 12 hours a year	3 - 4 hours	Weekly	Weekly	
9 - 12 times a year	12 - 24 hours a year	4 - 8 hours	Twice weekly	Twice weekly	
2 weekly	1 - 2 days a year	8 - 12 hours	Daily	Daily	
Weekly	More than 2 days a year	12 - 24 hours			
Twice weekly		1 - 2 days			
Daily		More than 2 days			
Key					
	Present experience				
	Range of choice models				

Include in every trade-off = 7,440 choices

Include in every third trade-off = 2,480 choices

Trade offs – how the choice offer is put to the customer

The previous table defines parameters for choices that are presented to the customer in the telephone interview.

An example of how these are actually described in the interview is presented here.

Customers are asked to trade off one performance measure outcome for another.

The actual trade off is made with reference to the customers previously revealed perceived service levels (as shown on the previous slide). Using an example based on the previous page the trade off is initiated by confirming the perceived performance as follows:

"You have previously identified that in the last year you have experienced:

- **Three interruptions per year; with**
- **An average outage duration of 1 - 2 hours; and**
- **A longest duration of 3 - 4 hours; and**
- **Approximately 4 interruptions lasting less than a minute; and**
- **Voltage variations problems 4 times"**

The choice models are then constructed by combining randomly selected levels (the rows in the previous slide) for each relevant attribute (the columns in the previous slide). For all but the Call Centre attribute, to be realistic, the levels are chosen from within the shaded band and include the respondent's present service level.

Then, the customer is presented with 12 choice questions, constructed by combining the realistic attribute levels . Unfortunately there are six attributes which are too many to combine into one choice question over the telephone. In order to cut down respondents load, each choice question was made by combining the main attributes (perceived SAIFI, SAIDI and Longest duration) plus one other of the other attributes (momentary, quality and Call Centre). The questions proposed follow the following examples. In the mix of measures used some combinations are unreasonable and those that do not make sense are rejected. For example, a frequency of zero outages per year could not be matched with a an average annual duration of 3 – 4 hours.

Three of a possible 12 choice set questions that could be put to the respondent represented by the previous slide are as follows,. Note that only the levels vary for the first three main attributes, while for the last part of the question both the attribute and the level varies:

Choice question 1:

"Would you accept an average frequency of two interruptions per year with an average duration of 4 -8 hours and a longest duration of 3 – 4 hours with momentary interruptions weekly." (Yes/No)

Choice question 2:

"Would you accept an average frequency of three interruptions per year with an average duration of 1 - 2 hours and a longest duration of 3 – 4 hours and being able to talk to an Call Centre operator within 30 seconds if you call about an interruption" (Yes/No)

Choice question 3:

"Would you accept an average frequency of three interruptions per year with an average duration of 1 -2 hours and a longest duration of 3 – 4 hours with voltage variation problems twice a year." (Yes/No)

And so on for another 9 randomly generated combinations.

The choice sets offer alternatives varying around the service levels customer has revealed and therefore offers data points indicating their preference for choosing better or worse performance. Each yes/no response provides data on four attributes. By repeating the choice model 12 times, the sample has in effect been multiplied by the number of times an attribute was included in the choice model. 200 customers offered 12 options each, provides 2,400 data points for each of the main attributes and 800 data points for each of the other attributes per feeder so in effect, the sample responding about a feeder type is 2,400 or 800 depending on the attribute.

Respondents by network performance

The tables show summary results split by the three types of network and by performance. These results indicate nearly half Western Power customers want more reliable power.

Sampling over represented "poor" performing feeders because sufficient numbers of respondents were required at each service level to guarantee statistically significant results at each of those points. The oversampling merely allows us to find sufficient respondents with specific service levels to ask their preferences through the trade-off process. A very much larger and more costly sample would have to be used in order to achieve the same result with no over sampling.

Responses to the trade-offs were then plotted in the threshold charts. These established the level of tolerance of customers to interruptions which is an unbiased number that, once calibrated, can be applied to the network. The threshold number can then be used to calculate feeders above and below threshold and the over sampling issue becomes irrelevant.

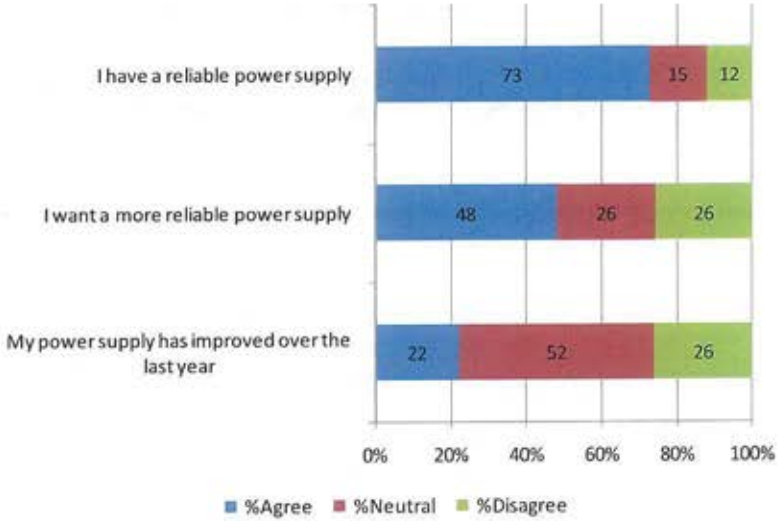
Table 2: network SAIDI results

Network SAIDI	Urban	Rural short	Rural long	Total
Zero	14	0	0	14
>1 to 30 mins	14	19	0	33
30 to 60 mins	16	20	0	36
60 to 120 mins	16	31	0	47
120 to 180 mins	22	19	14	55
180 to 240 mins	15	11	18	44
240 to 480 mins	27	24	29	80
480 to 720 mins	22	36	42	100
720 to 1440 mins	28	21	43	92
1440 to 2880 mins	39	5	37	81
>2880 mins	0	9	29	38
Total	**213**	**195**	**212**	**620**

Table 3: network SAIFI results

Network SAIFI	Urban	Rural short	Rural long	Total
Zero times pa	18	0	0	18
0.1-1.5 times pa	44	67	18	129
1.5-2.5 times pa	29	36	27	92
2.5-3.5 times pa	34	17	25	76
3.5-5.5 times pa	28	22	39	89
5.5-8.5 times pa	41	19	30	90
8.5-12.5 times pa	19	24	33	76
12.5-25 times pa	0	10	40	50
Total	**213**	**195**	**212**	**620**

Figure 3: Satisfaction with power supply



Satisfaction with power supply

Nearly three quarters of customer respondents agree that they have reliable power but nearly a half want more reliable power. This result is in accordance with the threshold analysis which indicates low tolerance for interruptions. There is no agreement on the power supply improving in the last year. If anything, respondents feel supply has declined slightly.

More detail is provided on the next page which breaks this satisfaction data down into the feeder types sampled.

Satisfaction with Power supply by feeder category

The figures demonstrate the satisfaction with power supply segregated into feeder type.

Figure 3a: Satisfaction with power supply - Urban

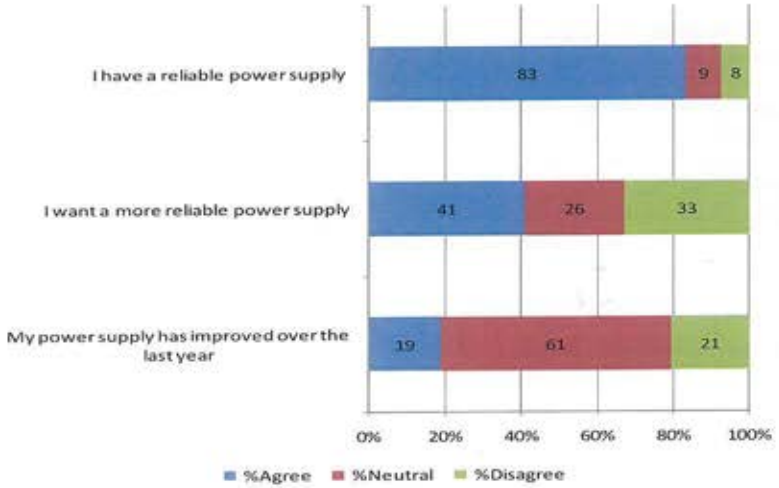


Figure 3b: Satisfaction with power supply – Rural short

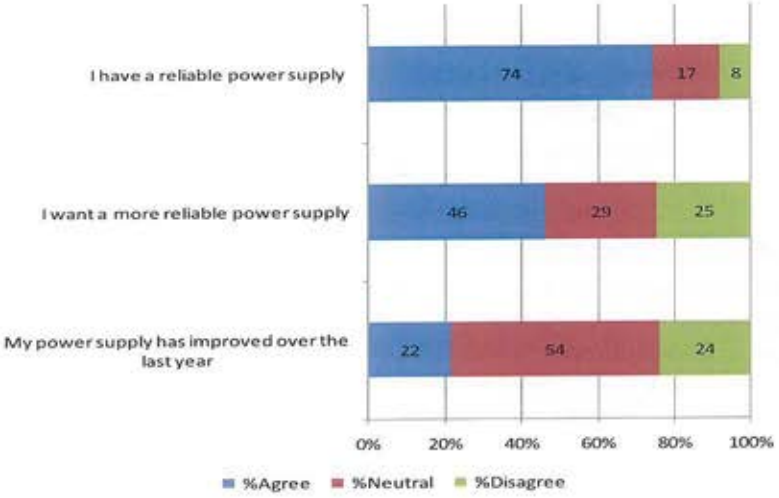
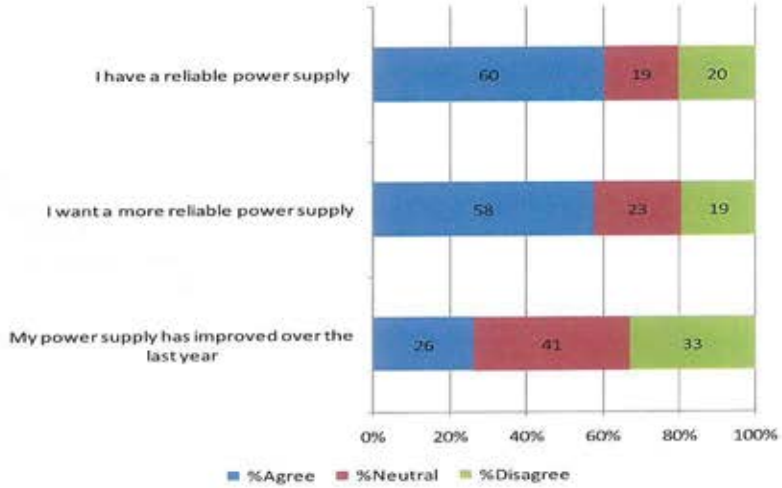


Figure 3c: Satisfaction with power supply – Rural long



Overall 73% of respondents agree that they have reliable power. (see Figure 3) This figure is maximised on Urban feeders with the proportion agreeing that they have reliable power being:

- 83% respondents on Urban feeders
- 74% on Rural Short feeders
- 60% on Rural Long feeders

Despite having a 'high' level of satisfaction with their reliability, 48% of respondents want a more reliable power supply. While indicative, the apparent contradiction between this and the first score underlines the problem 'measuring' reliability demands using simple attitudinal ratings scales. The desire for more reliable power is maximised on Long Rural feeders with the proportion that want more reliable power being:

- 41% respondents on Urban feeders
- 46% on Rural Short feeders
- 58% on Rural Long feeders

Overall, respondents are neutral to slightly negative when asked if their power supply had improved in the last year. The responses typically had a large neutral zone with a slightly smaller "agree" than "disagree" zone . This effect was greatest for Rural Long feeders.

Calibration – SAIDI (All Interruptions)

At the low SAIDI level, Western Power is measuring interruptions customers perceive they are not having (see top figure – where 20% of respondents believe they are not having interruptions while this is only 2% on the network measure).

This phenomenon switches over at network SAIDI between 120 to 180 minutes off per annum. Above this level respondents believe they are having more time off the network than the network measure indicates.

Figure 4: All Interruptions - network vs. perceived SAIDI

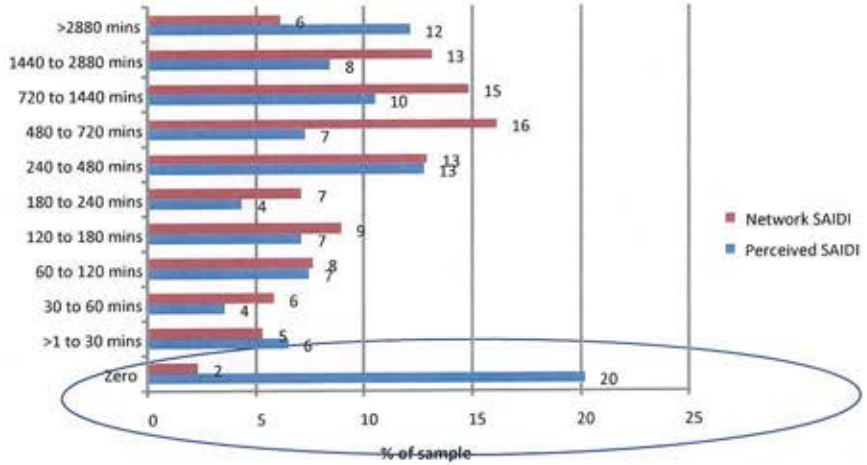
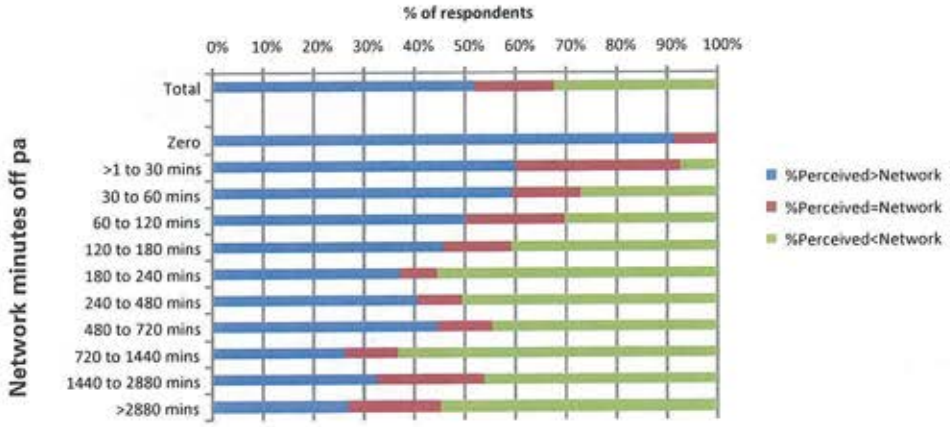


Figure 5: All Interruptions - perceived SAIDI vs. network



Calibration – SAIDI (All Interruptions)

This under-estimation by customers of interruptions is persistent for all feeder categories.

Figure 6: All Interruptions - network vs. perceived SAIDI - Urban

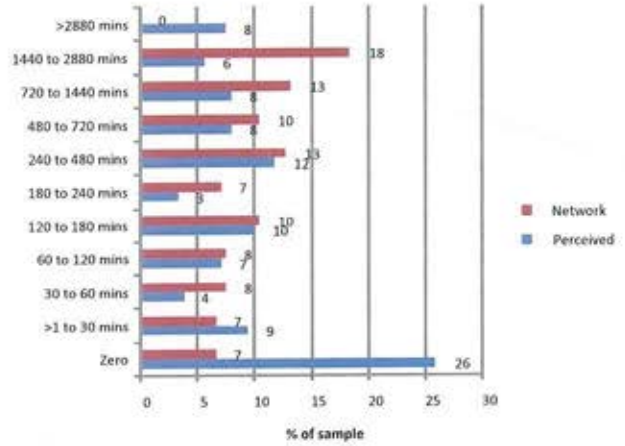


Figure 7: All Interruptions - network vs. perceived SAIDI – Rural short

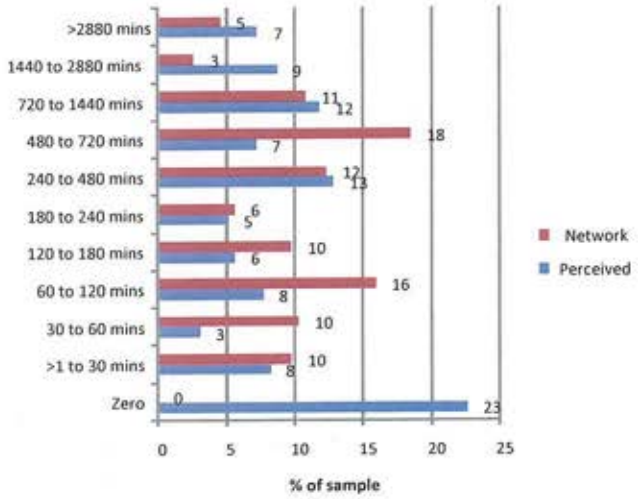
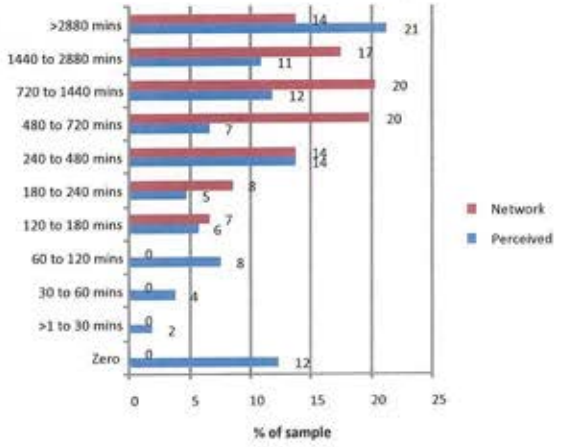


Figure 8: All Interruptions - network vs. perceived SAIDI – Rural long



Calibration – SAIDI (All Interruptions)

There is a systematic relationship between perceived and network SAIDI

- The calibration of perceived to network SAIDI was mainly carried out with reference to this low range curve as the majority of the perceived thresholds were in this range.
- Calibration of perceived performance against "All Interruptions" feeder data provides a measure of what customers actually receive at least at the high voltage level. This calibration and the calibration against Normalised Unplanned Interruption data is provided for completeness.

Figure 9 B : calibration SAIDI – full range All Interruptions
(between 0 and 6,000)

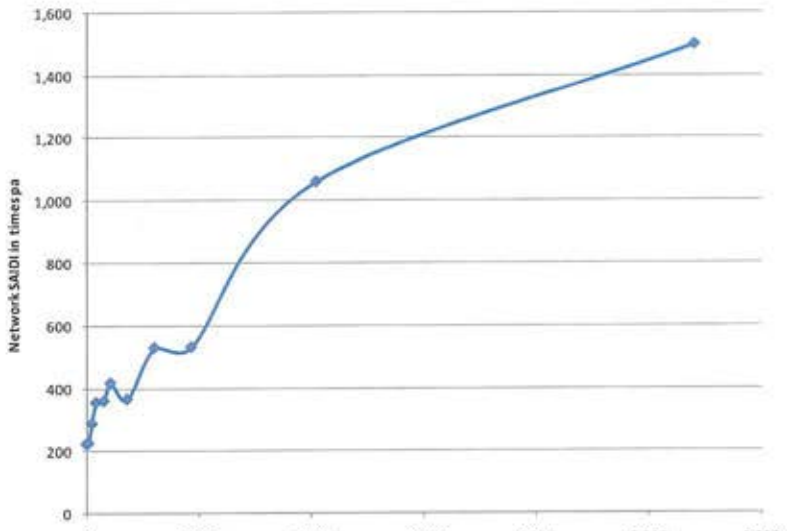
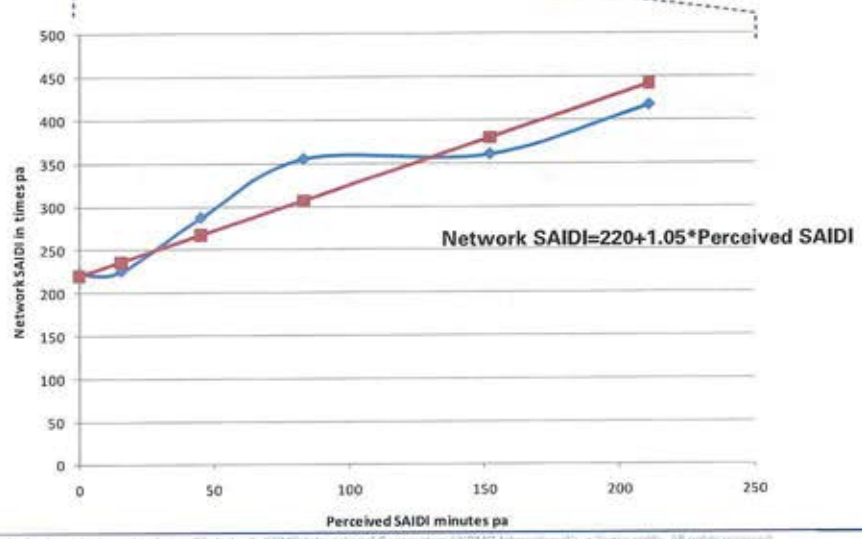


Figure 10 B : calibration SAIDI – low range All Interruptions
(between 0 and 250, representing the lower end of the chart above)



Calibration – SAIDI (Normalised Unplanned Interruptions)

There is a systematic relationship between perceived and network SAIDI

- The calibration of perceived to network SAIDI was mainly carried out with reference to this low range curve as the majority of the perceived thresholds were in this range.
- Calibration against "Normalised Unplanned Interruptions" feeder data provides a measure against data which is consistent with Western Power's existing reporting.

Figure 9 A : calibration SAIDI – full range Normalised Unplanned Interruptions (between 0 and 6,000)

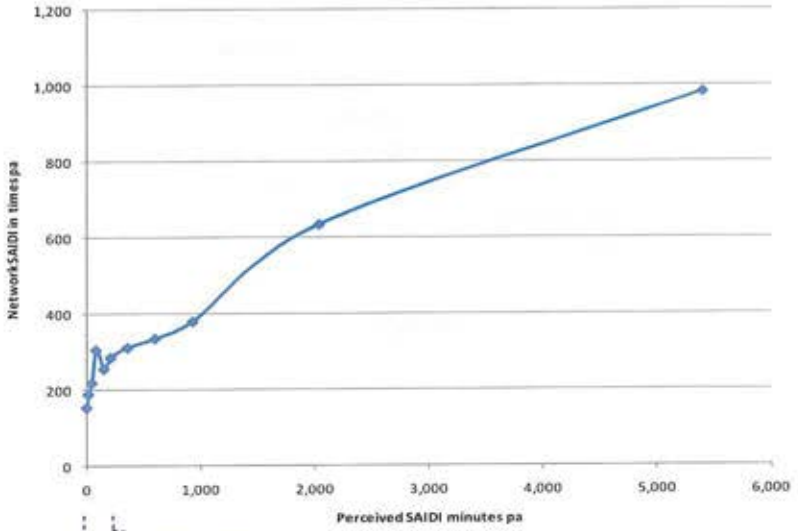
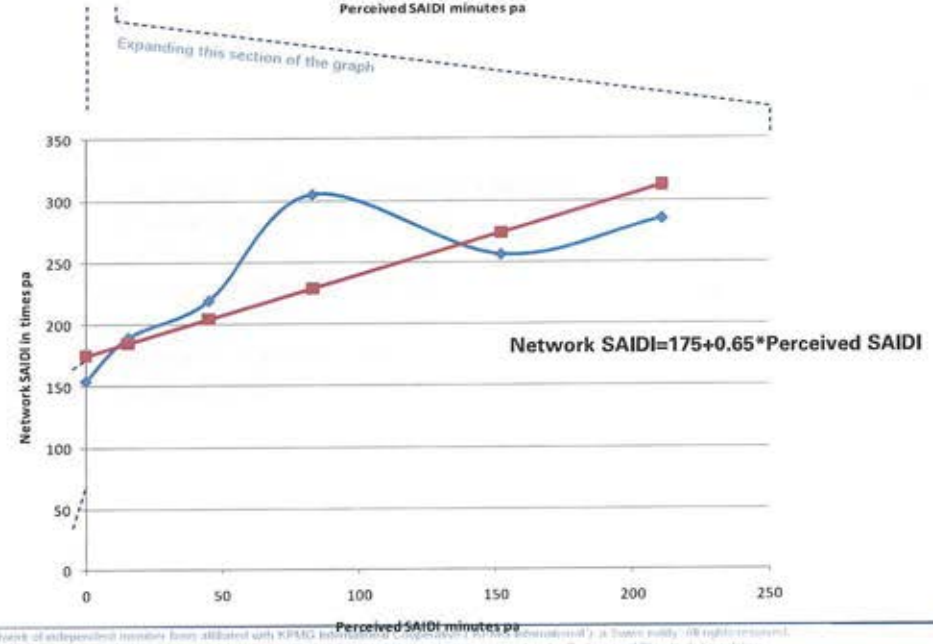


Figure 10 A : calibration SAIDI – low range Normalised Unplanned Interruptions (between 0 and 250, representing the lower end of the chart above)



Calibration – SAIFI (based on All Interruptions)

As with SAIDI, Western Power is recording interruptions at a level above that which the customers perceive they are experiencing. (Refer to the "measured" vs. "perceived" zero frequency.)

This phenomenon switches over on network SAIDI at around three to four interruptions per annum. Above this level, respondents believe they are having more frequent interruptions than is measured in the network.

Figure 11: All Interruptions - network vs. perceived SAIFI

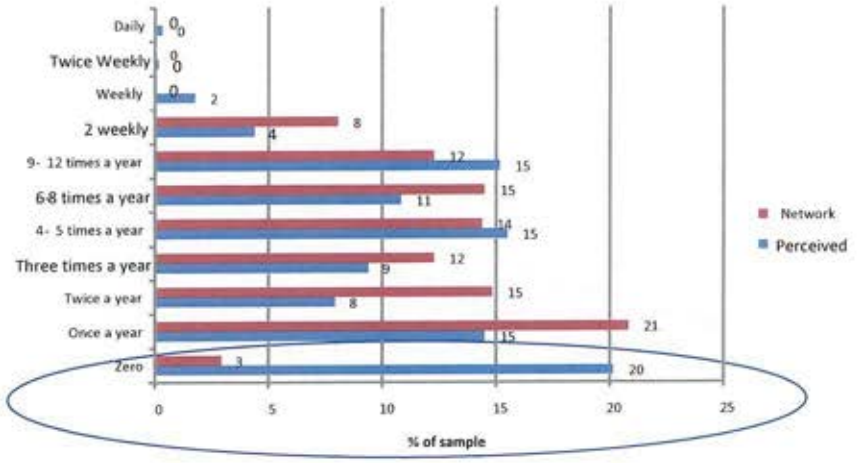
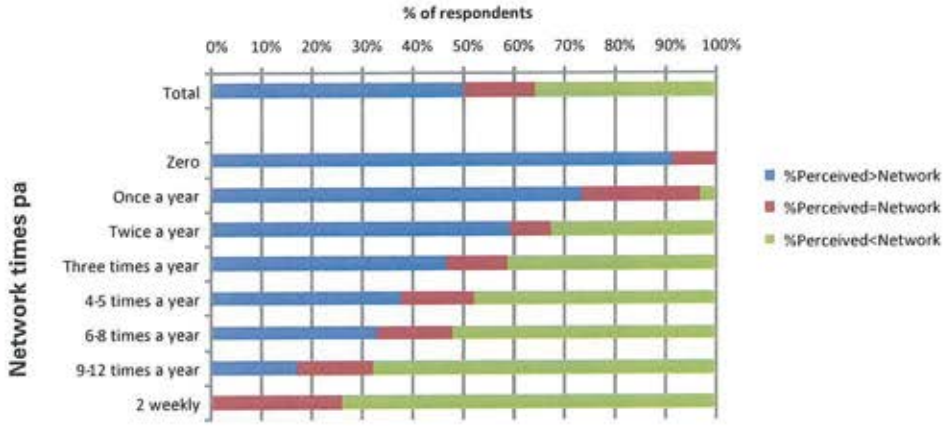


Figure 12: All Interruptions – network vs. perceived SAIFI



Calibration – SAIFI (based on All Interruptions)

As with SAIDI, people in the low network SAIFI group tend to under estimate their minutes off – this effect is persistent for all feeder categories

Figure 13: All Interruptions - network vs. perceived SAIFI - Urban

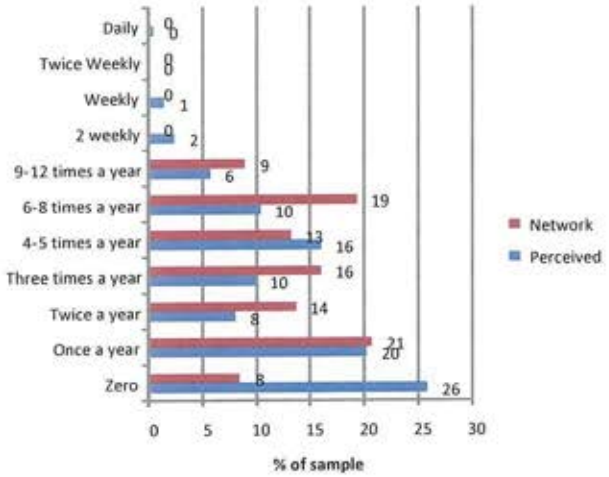


Figure 14: All Interruptions - network vs. perceived SAIFI – Rural short

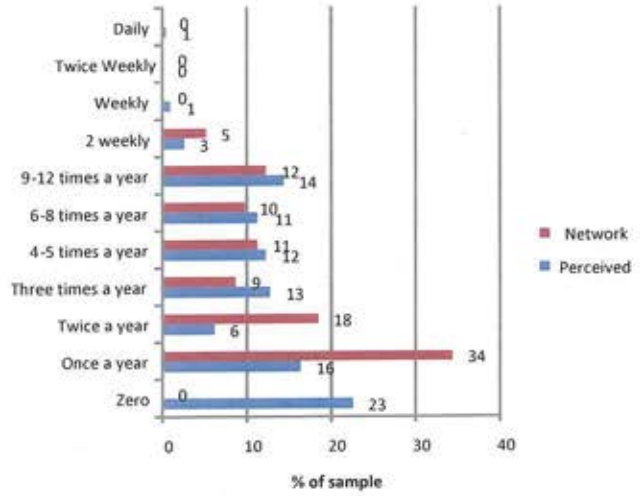
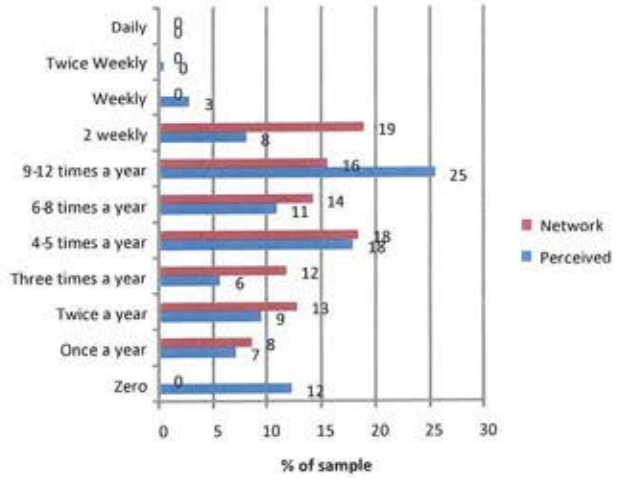


Figure 15: All Interruptions - network vs. perceived SAIFI – Rural long



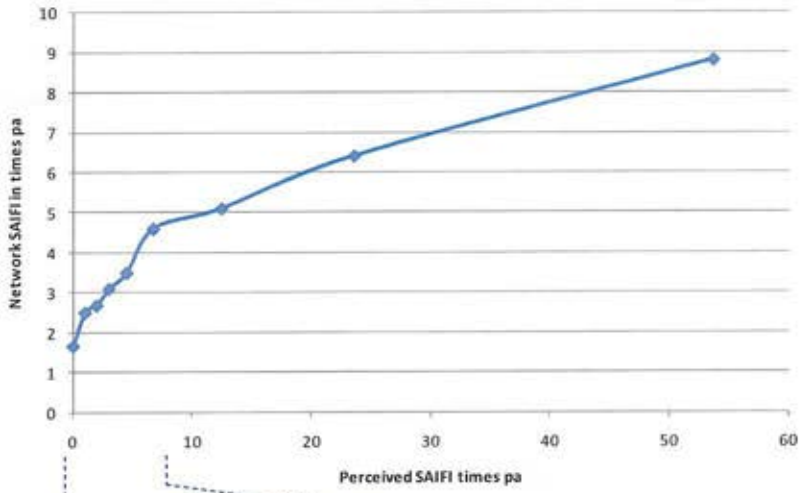
Calibration – SAIFI (All Interruptions)

There is a systematic relationship between perceived and network SAIFI:

- This relationship demonstrates an 'instability' above 4 interruptions per annum on network measure as indicated by the data presented on slide 18;
- Despite this instability the SAIFI calibration curve again approximates a straight line in the low range; and
- The translation of perceived to network SAIFI was mainly carried out with reference to this low range curve as the majority of the perceived thresholds were in this range.

Figure 16: calibration SAIFI – full range All Interruptions

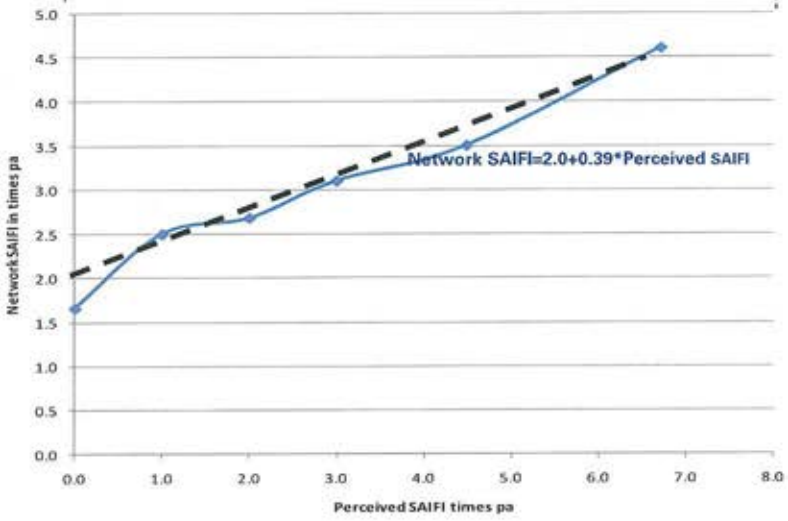
(between 0 and 60)



Expanding this section of the graph

Figure 16: calibration SAIFI – low range All Interruptions

(between 0 and 8, representing the lower end of the chart above)



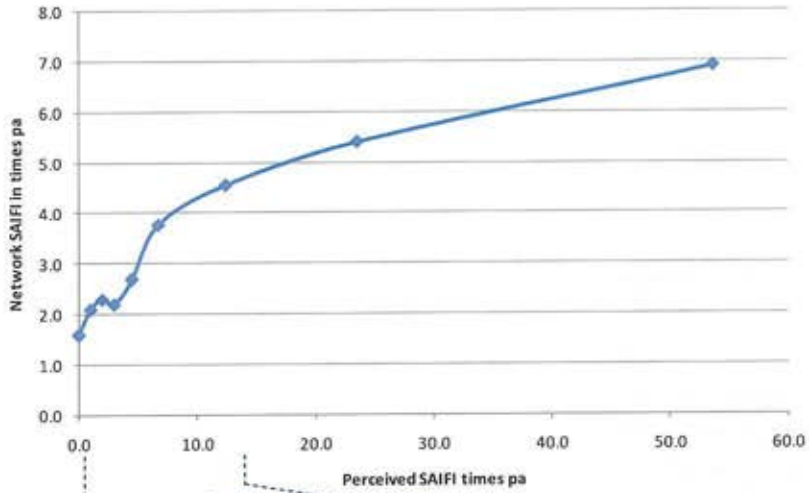
Calibration – SAIFI (Normalised Unplanned Interruptions)

There is a systematic relationship between perceived and network SAIFI:

- This relationship demonstrates an 'instability' above 4 interruptions per annum on network measure as indicated by the previous slide;
- Despite this instability the SAIFI calibration curve approximates a straight line in the low range; and
- The translation of perceived to network SAIFI was mainly carried out with reference to this low range curve as the majority of the perceived thresholds were in this range.

Figure 16: calibration SAIFI – full range Normalised Unplanned Interruptions

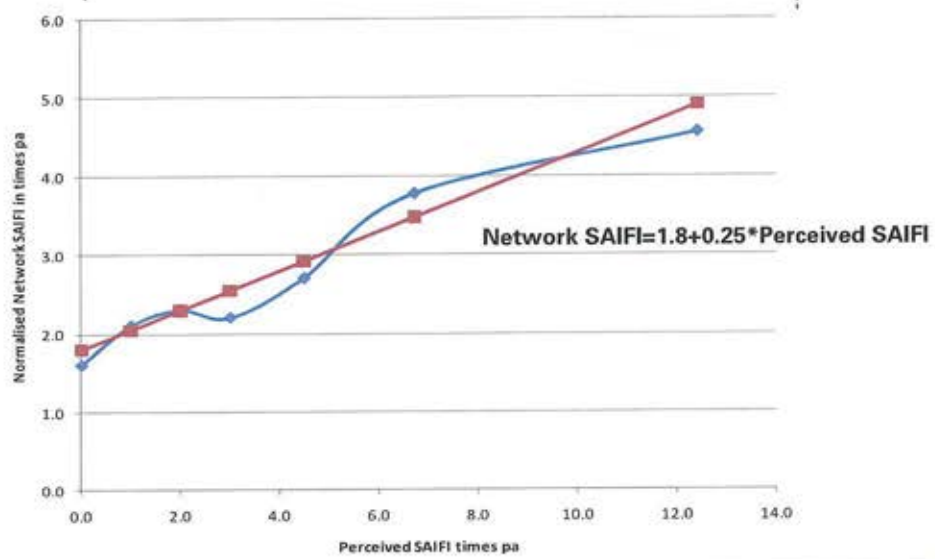
(between 0 and 60)



Expanding this section of the graph

Figure 16: calibration SAIFI – low range Normalised Unplanned Interruptions

(between 0 and 12, representing the lower end of the chart above)



Longest duration, MAIFI and Quality

As with SAIFI and SAIDI, the perceived values of MAIFI, Quality and Longest duration have a disproportionate number of respondents who indicate they have experienced zero events. This is unlikely but since there are no network measures available for these reliability factors it cannot be confirmed.

Figure 17: perceived MAIFI

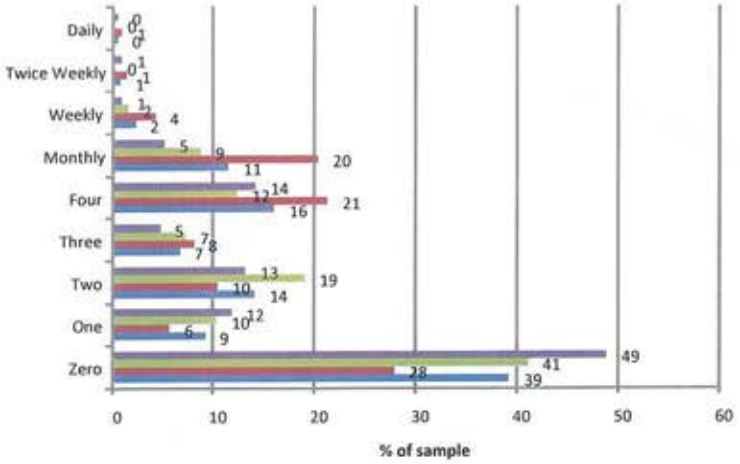


Figure 18: perceived Quality

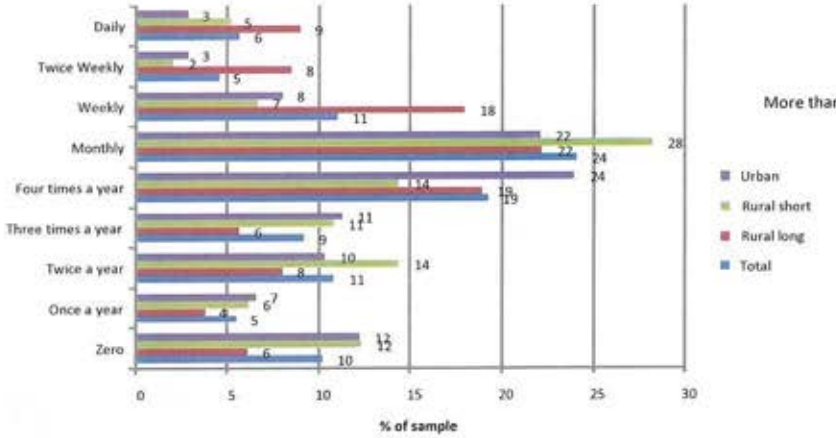
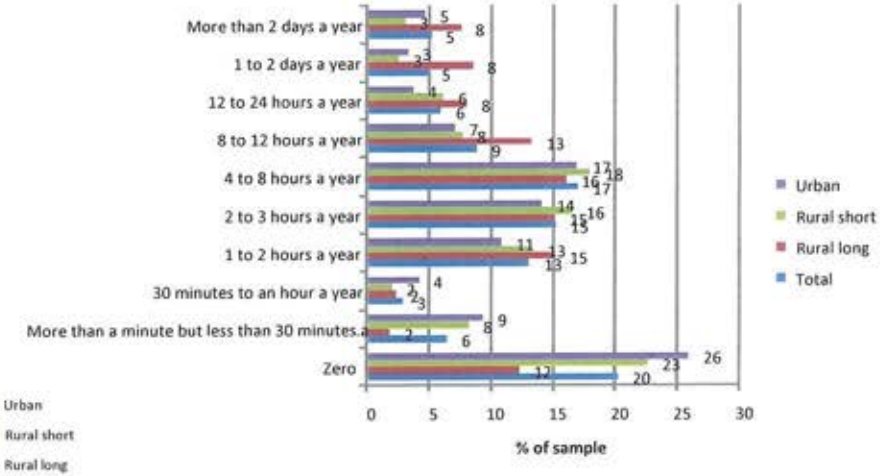


Figure 19: perceived Longest duration



Perceived SAIDI & SAIFI – summary of findings

The tables on this page summarise the calibrated results of the trade-offs for SAIDI and SAIFI.

In all cases the perceived threshold level has been translated into a network measure by calibration.

Once this calibration is carried out, Western Power can identify which feeders have reliability levels above the threshold. This may assist Western Power consider actions on these feeders, in light of overall corporate strategy.

A shortest and longest classification exists where the threshold curve gives more than one crossing. The shortest is the first place it crosses and the longest is the last.

Such 'confusion' of thresholds arises from indifference within the underlying population most likely caused by lack of homogeneity possibly caused by movement of more progressive residents from urban and rural short into rural long for example and, more conservative areas as this effect is more pronounced for residential than business.

Table 4: perceived SAIDI

SAIDI Feeder Type	Sub Category	Perceived Minutes pa	All network interruptions Minutes pa	Normalised unplanned interruptions Minutes pa
Urban	Customers satisfied below	9.5	230	181
	Customers not satisfied above	57	280	212
Rural short	Customers satisfied below	15	236	185
	Customers not satisfied above	169	396	285
Rural long	Customers satisfied below and not satisfied above	169	396	285

It is recognised that the data presented for rural long and rural short appears similar. This is a result of rounding and the result is coincident.

Table 5: perceived SAIFI

SAIFI Feeder Type	Perceived Times pa	All network interruptions Times pa	Normalised unplanned interruptions Times pa
Urban	1.0	2.4	2.1
Rural short	2.0	2.8	2.3
Rural long	3.9	3.5	2.8

In respect to SAIFI, customers are satisfied with frequencies below that identified in the above table, and not satisfied with frequencies above the thresholds identified.

Perceptual SAIDI

This page summarises perceived SAIDI tradeoff results for the three feeder categories:

Urban

- Consumers are indifferent between 9.5 and 57 minutes off per annum, and
- Consumers want better supply than 57 minutes per annum.

Rural short

- Consumers are indifferent between 15 and 169 minutes off per annum, and
- Consumers want better supply than 169 minutes off per annum.

Rural long

- Consumers want better supply than 169 minutes off per annum.

Figure 20: perceived SAIDI service standard threshold - Urban

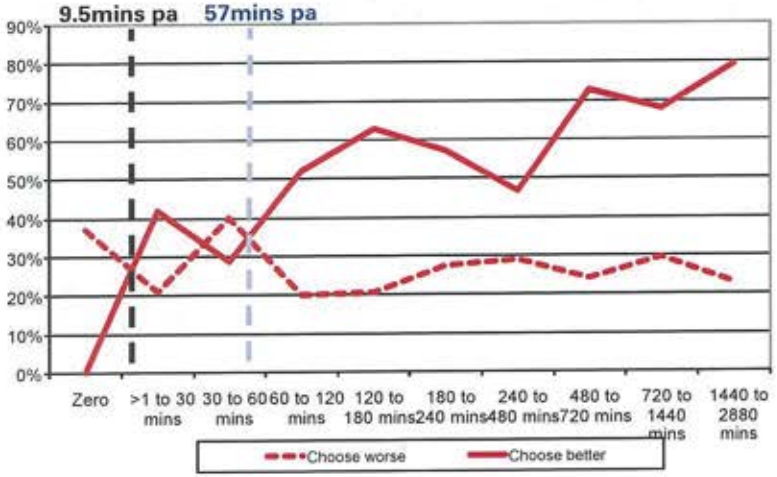


Figure 21: perceived SAIDI service standard threshold – Rural short

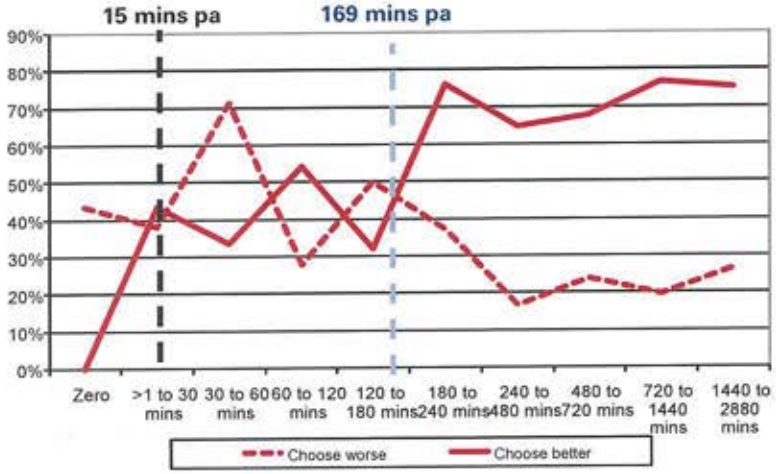
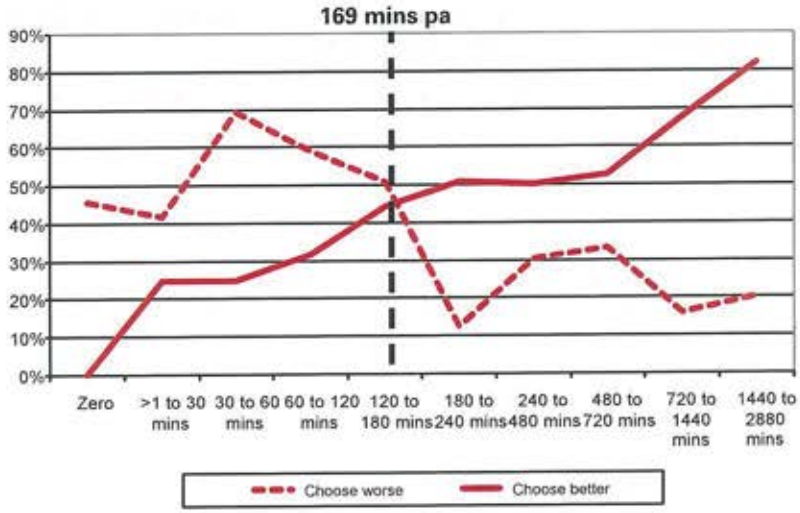


Figure 22: perceived SAIDI service standard threshold – Rural long



Note: The intercept is arithmetically interpolated in the spreadsheet and not estimated on the curves. The positioning of the curves is indicative only.

Perceptual SAIFI

This page summarises perceived SAIFI tradeoff results for the three feeder categories:

Urban

- Consumers want no more than one interruption per annum.

Rural short

- Consumers want no more than two interruptions per annum.

Rural long

- Consumers want no more than 3.9 interruptions per annum.

Figure 23: perceived SAIFI service standard threshold - Urban

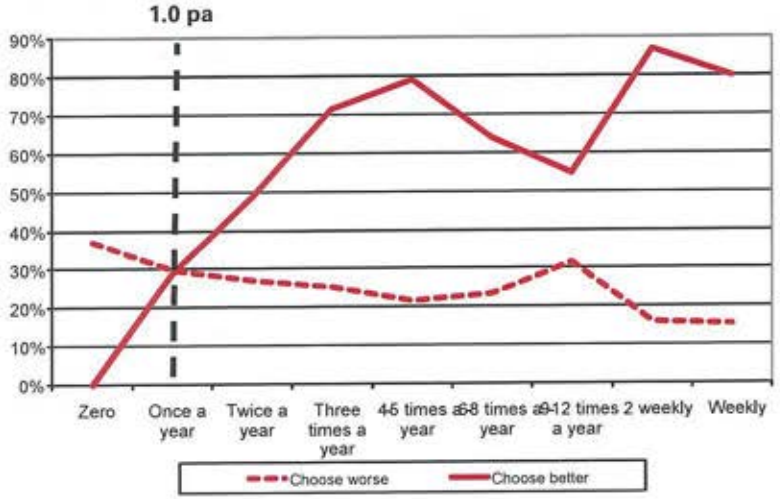


Figure 24: perceived SAIFI service standard threshold – Rural short

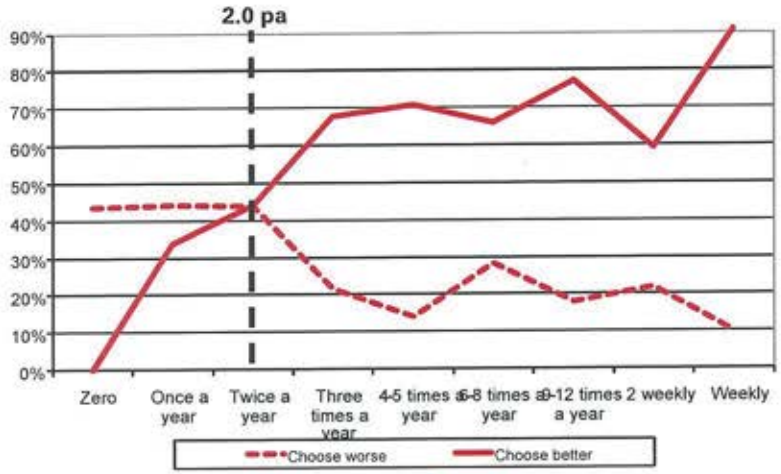
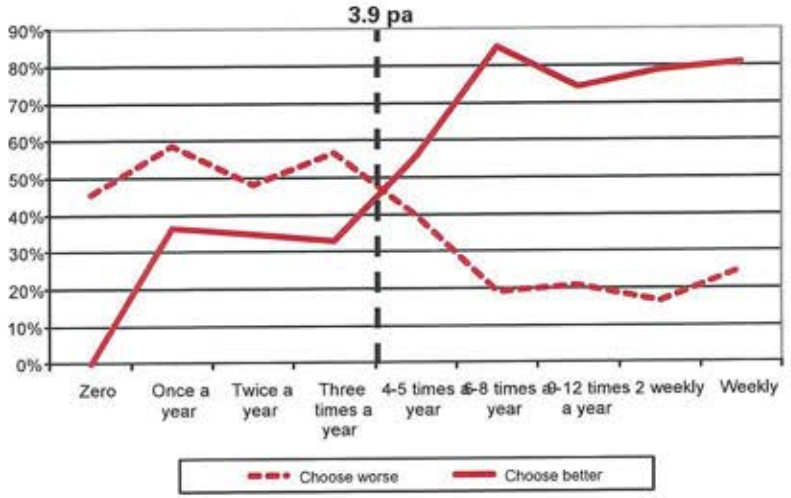


Figure 25: perceived SAIFI service standard threshold – Rural long



Longest duration, MAIFI and Quality thresholds

The tables on this page summarise the calibrated results of the trade-offs for Longest duration, MAIFI and Quality.

- The perceived threshold level for MAIFI, Quality and Longest duration has been translated into a network measure using the calibration curves for SAIFI and SAIDI. This has been done for indicative purposes as direct calibration curves could not be produced for these reliability factors;
- Since there is no equivalent network measure for these three reliability factors, it has been assumed that their SAIDI and SAIFI equivalents apply;
- The Longest duration thresholds are understandably shorter than the SAIDI thresholds; and
- There is clearly a heightened sensitivity to MAIFI and Quality over SAIFI as the number of the former events the respondents will tolerate is lower than the latter.

Table 6: Longest duration

Feeder Type	Sub category	Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest (Customers satisfied below)	13.0	199	183
	Longest (Customer not satisfied above)	51.0	292	208
Rural short		15.0	216	185
Rural long		35.0	261	198

Table 7: MAIFI

Feeder Type	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	0.5	2.2	1.9
Rural short	1.2	2.5	2.1
Rural long	0.8	2.3	2.0

Table 8: Quality thresholds

Feeder Type	Sub category	Perceived	All network interruptions	Normalised unplanned interruptions
		Times pa	Times pa	Times pa
Urban		0.5	2.2	1.9
Rural short		1.8	2.7	2.3
Rural long	Lower (Customers satisfied below)	0.7	2.3	2.0
	Upper (Customer not satisfied above)	2.5	3.0	2.4

The trade-off task was to determine what levels of each reliability measure respondents would accept. Their answers do not combine in the pure arithmetic in the way that the network measures are derived – there will be inconsistencies when measures such as SAIDI and Longest duration are compared. This doesn't make then wrong, it simply makes them what the respondents say they will tolerate. In addition, as MAIFI is less than SAIDI (see table 5 on page 24) it indicates that respondents are more sensitive to shorter duration interruptions than a smaller number of long ones.

The data does not provide the reason why this is the case. This could be determined through discussion with customers through customer focus groups for example.

Perceived Longest duration

This page summarises perceived Longest duration (per annum) tradeoff results for the three feeder categories:

Urban

- Consumers are indifferent between 13 and 51 minutes off for the longest interruption, and
- Consumers want better supply than 57 minutes off for the longest interruption.

Rural short

- Consumers want better supply than 15 minutes off for the longest interruption.

Rural long

- Consumers want better supply than 35 minutes off for the longest interruption.

Figure 26: perceived Longest duration service standard threshold - Urban

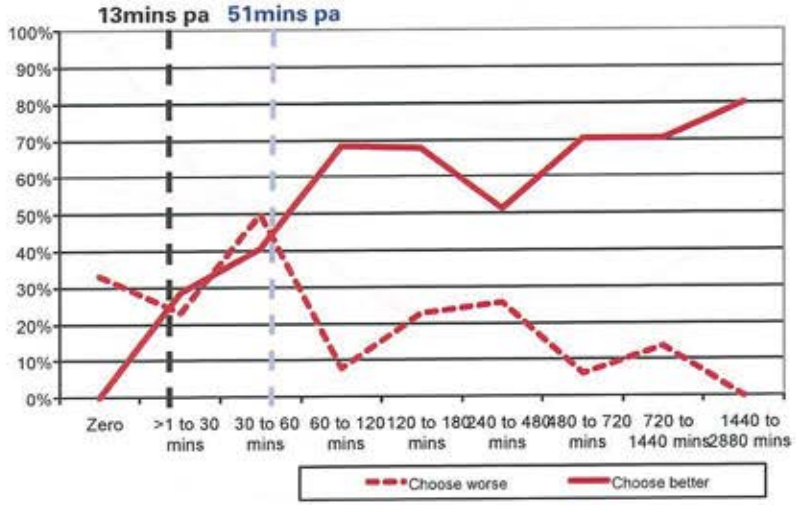


Figure 27: perceived Longest duration service standard threshold – Rural short

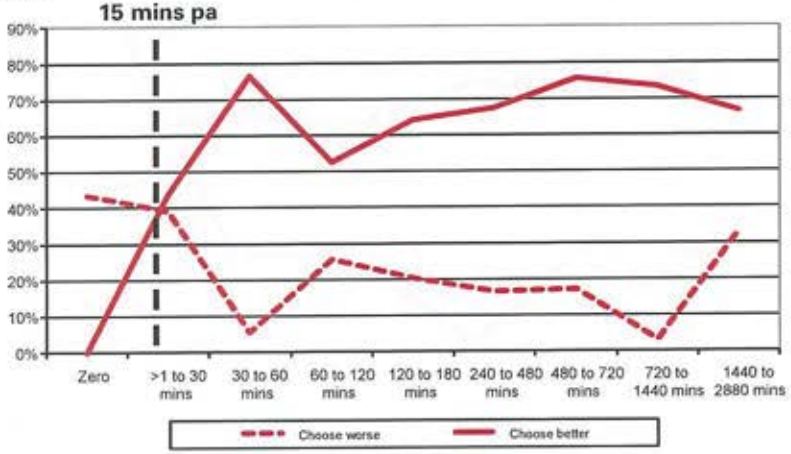
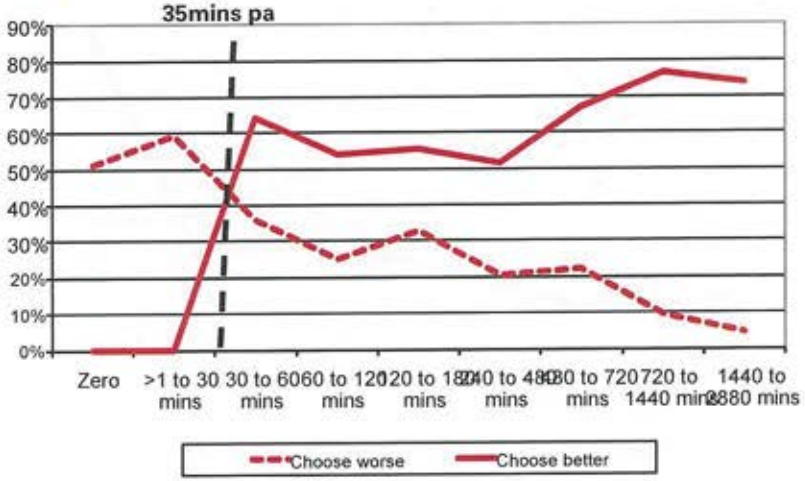


Figure 28: perceived Longest duration service standard threshold – Rural long



Perceptual MAIFI

This page summarises perceived MAIFI tradeoff results for the three feeder categories:

Urban

- Consumers want better supply than 0.5 momentary interruptions per annum.

Rural short

- Consumers want better supply than 1.2 momentary interruptions per annum

Rural long

- Consumers want better supply than 0.8 momentary interruptions per annum

Figure 29: perceived MAIFI service standard threshold - Urban

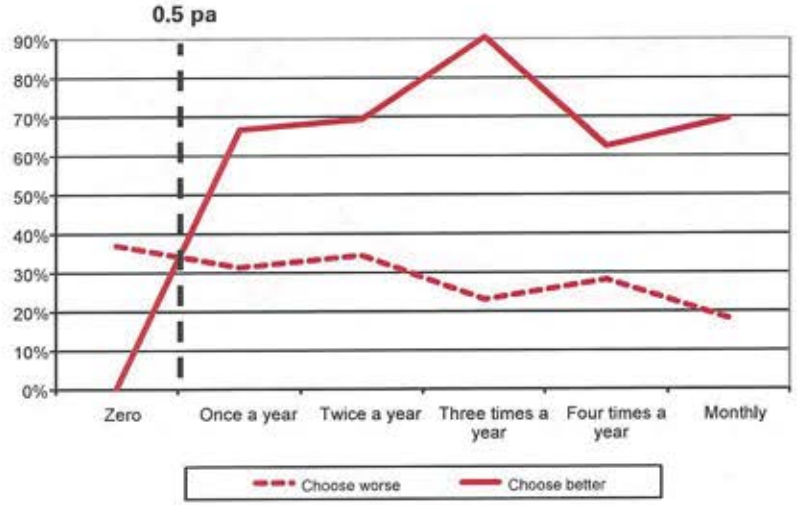


Figure 30: perceived MAIFI service standard threshold – Rural short

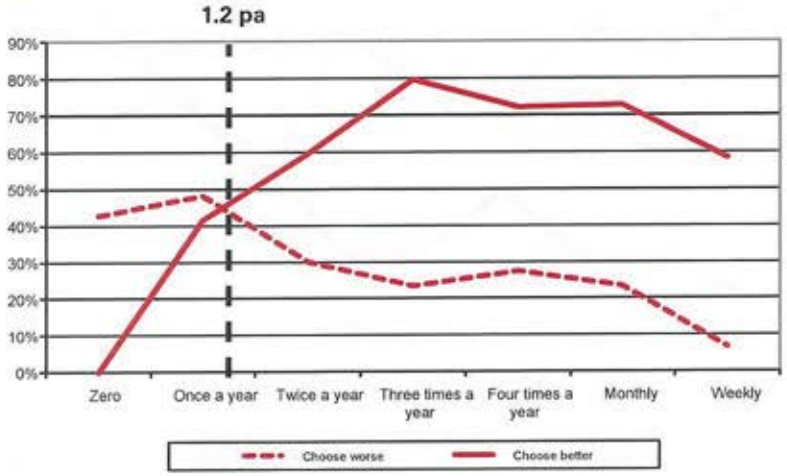
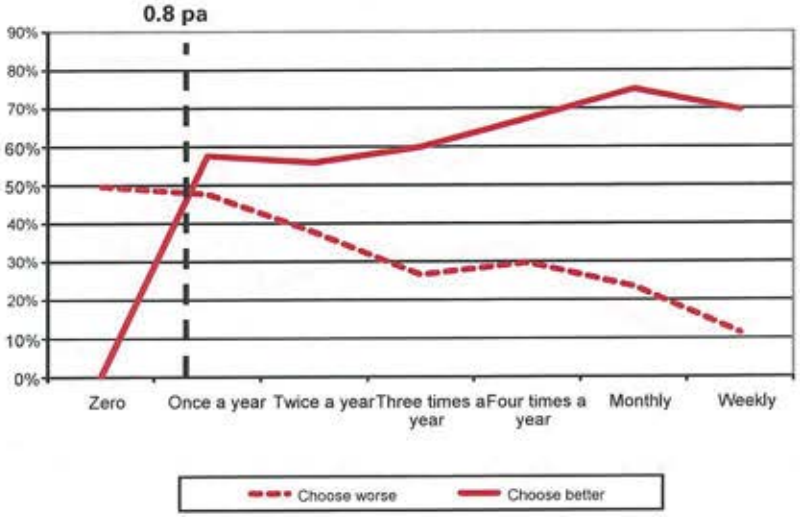


Figure 31: perceived MAIFI service standard threshold – Rural long



Perceived Quality

This page summarises perceived Quality tradeoff results for the three feeder categories:

Urban

- Consumers want better supply than 0.5 episodes of poor quality supply per annum.

Rural short

- Consumers want better supply than 1.8 episodes of poor quality supply per annum.

Rural long

- Consumers are indifferent between 0.7 and 4.0 episodes of poor quality supply per annum, and
- Consumers want better supply than 4.0 episodes of poor quality supply per annum.

Figure 32: perceived Quality service standard threshold - Urban

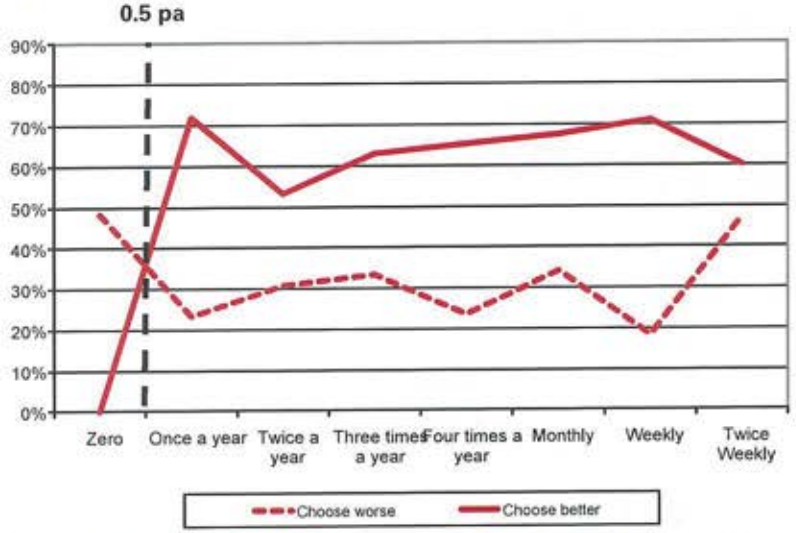


Figure 33: perceived Quality service standard threshold – Rural short

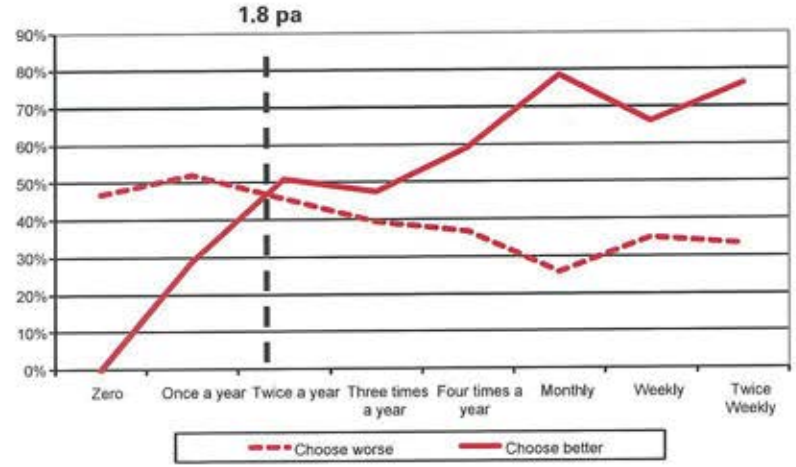
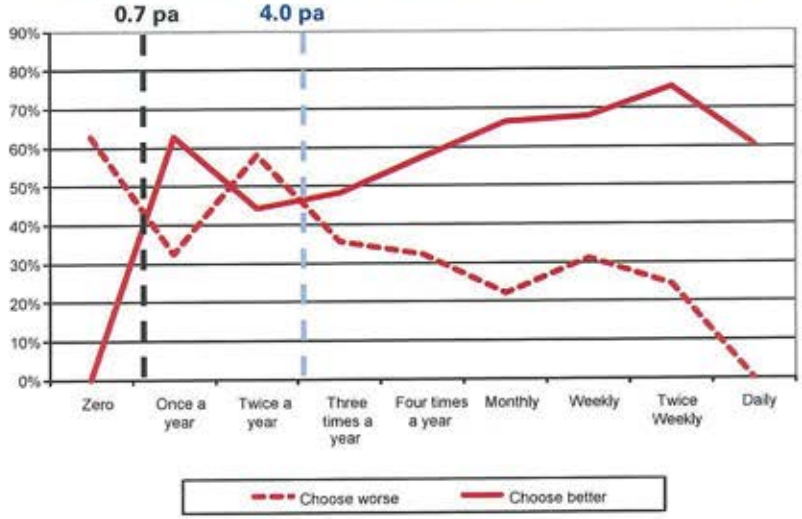


Figure 34: perceived Quality service standard threshold – Rural long



Perceived Call Centre performance

A surprisingly high number (40%) of respondents called a Call Centre about an interruption in the last year

- 89% of those got through;
- Most of those listened to a recorded message and nearly half also spoke to an operator; and
- For those that spoke to an operator, 14% got through within 30 seconds while nearly half waited up to 5 minutes.

For the people who connected to the Call Centre, 63% were satisfied with the answer. Only 12% were unhappy with the experience while 11% didn't get through.

Figure 35: contact with Call Centre

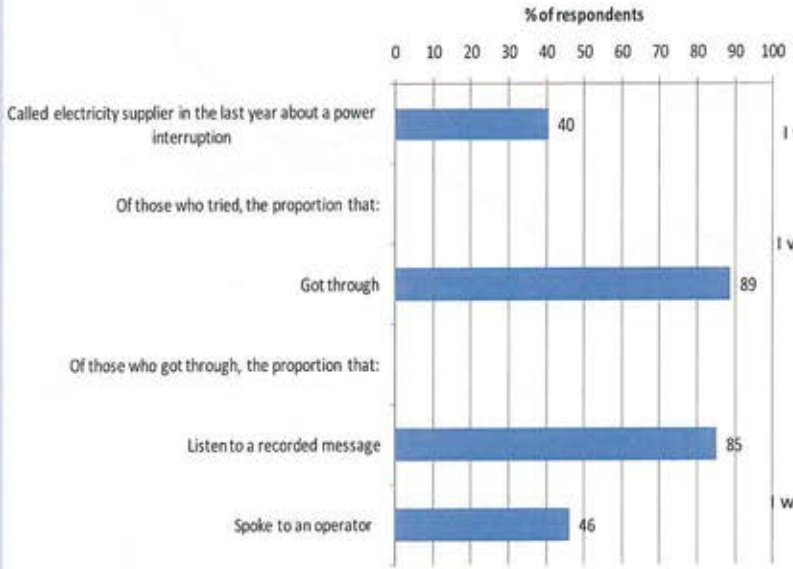


Figure 36: of those who spoke to an operator

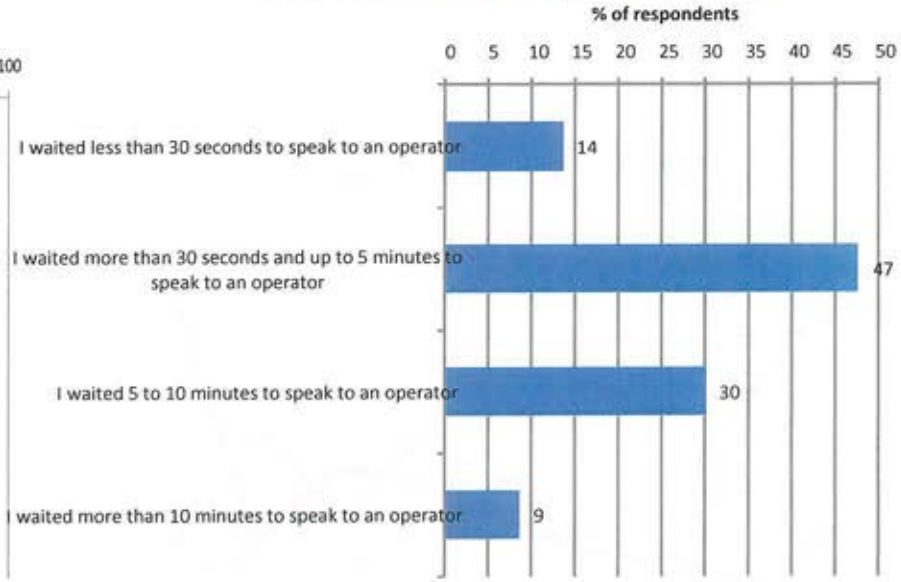
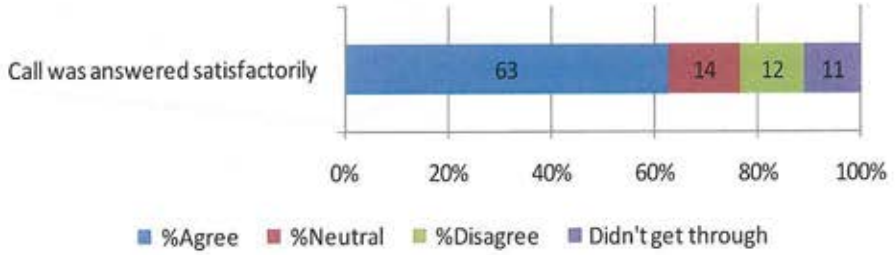


Figure 37: Call Centre satisfaction

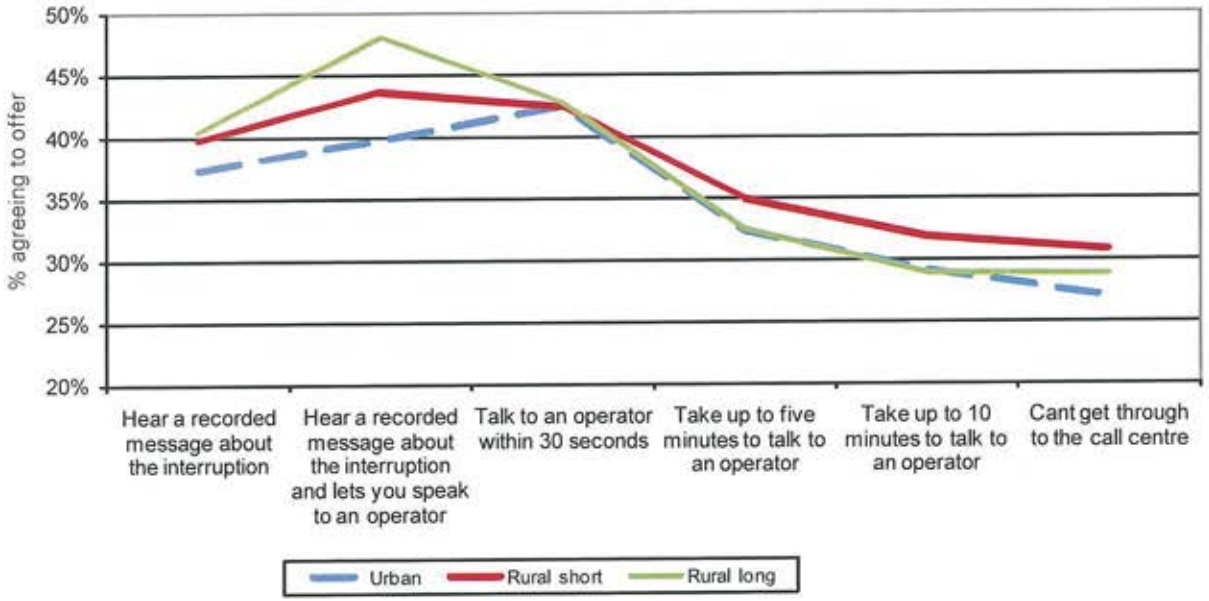


Call Centre

Overall the impact of the Call Centre is to increase the probability of any trade-off in service performance if it takes 30 seconds or less to get through to a Call Centre operator. As for the options, a customer can:

- Hear a recorded message about the interruption;
- Hear a recorded message about the interruption and lets them speak to an operator; and
- Talk to an operator within 30 seconds.

Figure 38: Call Centre agreeability and time taken to respond



SAIDI & SAIFI adjusted for Call Centre effects

However, further analysis on the impact "Call Centre performance" makes on the thresholds indicates it has a relatively minor effect. For example, the thresholds for performance change little for prompt Call Centre response except for the SAIDI of Rural Long feeders.

The conclusion is that while customers perceive considerable benefits from Call Centre response as demonstrated on the previous slide, these benefits do not play out with a substantial shift in demand for reliability.

This information has been collected for information only. It will be most valuable for later rounds to help explain any shifts in the thresholds as it is the experience of this consultant that changes in customer's equipment can lead to changes in demands for reliability.

Table 9: Call Centre performance by feeder categories

Average

		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	9.5	230	181
	Longest	57	280	212
Rural short	Shortest	15	236	185
	Longest	169	396	285
Rural long	All	169	396	285

Call Centre high service <=30 second response

		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	11.5	232	182
	Longest	58	281	213
Rural short	Shortest	15	236	185
	Longest	172	401	287
Rural long	All	177	406	290

Call Centre low service 5 min or worse response

		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	7.5	228	180
	Longest	55	278	211
Rural short	Shortest	0.1	220	175
	Longest	168	396	284
Rural long	Shortest	9.4	230	181
	Longest	122	348	254

Table 10: Call Centre and SAIFI

Average

	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	1.0	2.4	2.1
Rural short	2.0	2.8	2.3
Rural long	3.9	3.5	2.8

Call Centre high service <=30 second response

	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	1.4	2.5	2.2
Rural short	2.3	2.9	2.4
Rural long	4.7	3.8	3.0

Call Centre low service 5 min or worse response

	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	0.8	2.3	2.0
Rural short	1.2	2.5	2.1
Rural long	3.3	3.3	2.6

Longest duration outage and MAIFI adjusted for Call Centre effects

Once again "Call Centre performance" makes little difference to the measure of the longest duration except for Rural Long.

It also makes little difference on the MAIFI measures.

This information has been collected for information only. It will be most valuable for later rounds to help explain any shifts in the thresholds as it is the experience of this consultant that changes in customer's equipment can lead to changes in demands for reliability.

Table 11: Call Centre and longest duration outage

Average		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	13.0	234	183
	Longest	51.0	274	208
Rural short		15.0	236	185
Rural long		35.0	257	198
Call Centre high service <=30 second response				
		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	8.7	229	181
	Longest	65.0	288	217
Rural short		15.0	236	185
Rural long	Shortest	47.0	269	206
	Longest	158.0	386	278
Call Centre low service 5 min or worse response				
		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	N/A	N/A	N/A
	Longest	17.7	239	187
Rural short		0.0	220	175
Rural long	Shortest	30.0	252	195
	Longest	N/A	N/A	N/A

Table 12: Call Centre and MAIFI

Average	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	0.5	2.2	1.9
Rural short	1.2	2.5	2.1
Rural long	0.8	2.3	2.0
Call Centre high service <=30 second response			
	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	0.6	2.2	2.0
Rural short	1.3	2.5	2.1
Rural long	1.9	2.7	2.3
Call Centre low service 5 min or worse response			
	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	0.4	2.2	1.9
Rural short	1.1	2.4	2.1
Rural long	0.6	2.2	2.0

Quality adjusted for Call Centre effect

Once again "Call Centre performance" makes little difference to the measure of quality (as defined by the average frequency of flickering or blinking lights, blown light bulbs, damaged electrical equipment and sustained low voltage).

Table 13: Call Centre and quality impacts

Average		Perceived	All network interruptions	Normalised unplanned interruptions
		Times pa	Times pa	Times pa
Urban		0.5	2.2	1.9
Rural short		1.8	2.7	2.3
Rural long	Lower	0.7	2.3	2.0
	Upper	2.5	3.0	2.4

Call Centre high service <=30 second response		Perceived	All network interruptions	Normalised unplanned interruptions
		Times pa	Times pa	Times pa
Urban		0.5	2.2	1.9
Rural short		1.7	2.7	2.2
Rural long	Lower	0.6	2.2	2.0
	Upper	2.1	2.8	2.3

Call Centre low service 5 min or worse response		Perceived	All network interruptions	Normalised unplanned interruptions
		Times pa	Times pa	Times pa
Urban		0.5	2.2	1.9
Rural short		1.9	2.7	2.3
Rural long	Lower	1.0	2.4	2.1
	Upper	2.9	3.1	2.5

Residential and business equipment survey results

Residential and business equipment surveys

As part of the survey, the respondents were also asked about the equipment and appliances that they have installed in their homes and businesses.

Understanding a little about what the customers are using power for, and how they manage their own interruptions experience may be useful for Western Power to interpret these results.

Understanding this data at this point in time, will also enable a comparison with similar questionnaires in the future to gauge how customers are changing their power needs.

Residential equipment

The questionnaire also established what electrical equipment and appliances consumers had installed in their homes and businesses.

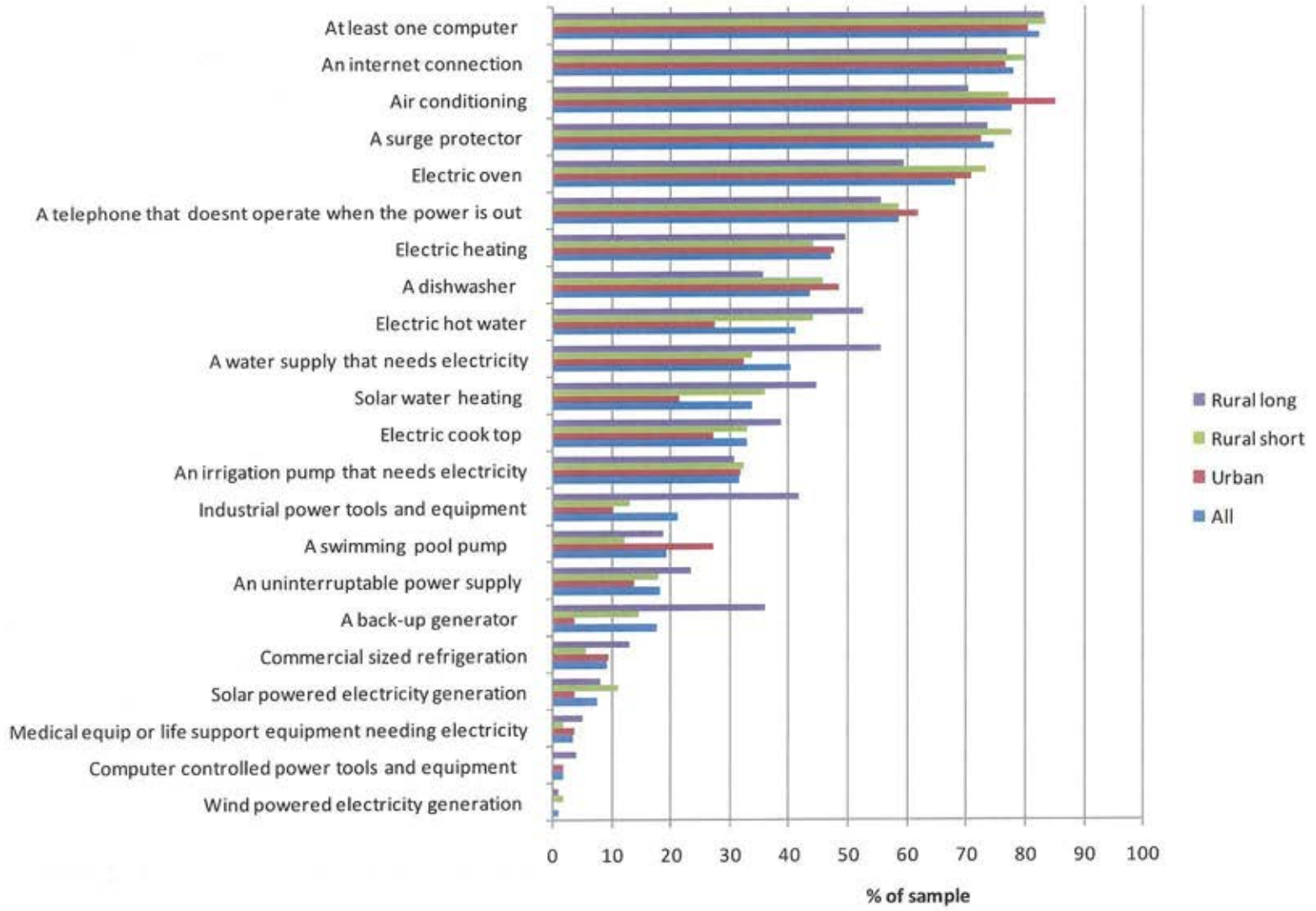
Penetration rates indicate

- A high level of computers and internet connections and surge protectors with little variation across feeder categories, and
- A large number of households with air conditioning.

There is little variation across the networks except that:

- Urban rely less on electricity for cooking and hot water, and
- Rural respondents tend to have fewer dishwashers, but have more electric cook tops, back up generators, industrial power tools and a water supply that needs electricity.

Figure 39: residential equipment survey results



Residential air conditioning

The questionnaire also collected data on air conditioning. Penetration rates of air conditioners is high across all networks:

- Two thirds have reverse cycle air conditioning
- 13% expect to install more air conditioning

Figure 40: residential equipment survey results – air conditioning

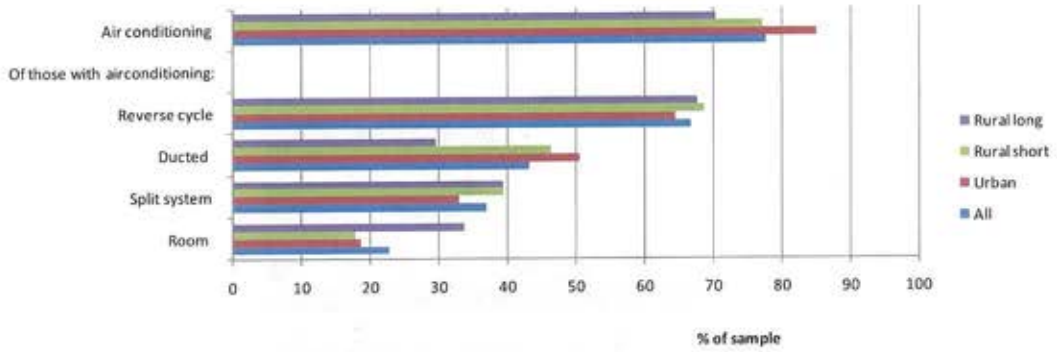
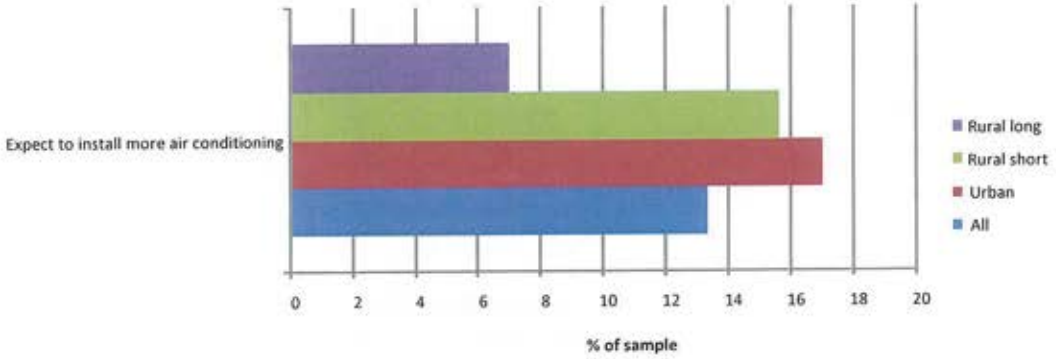


Figure 41: residential equipment survey results – air conditioning



Residential other

The average household:

- Has two refrigerators or freezers and televisions. More than half of the TVs are flat screen
- Has 1.7 working computers
- Spends 11.3 hours on the internet and 6.7 hours interacting through email in the last week

Figure 42: residential equipment survey results – selected equipment

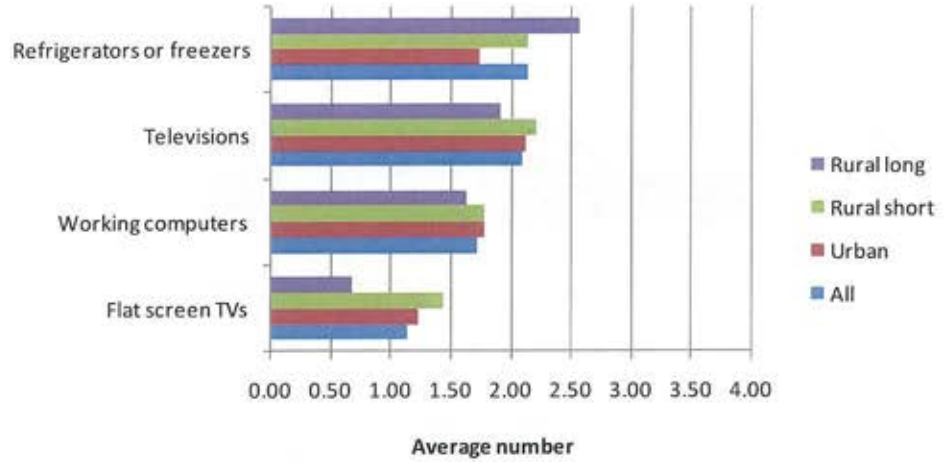
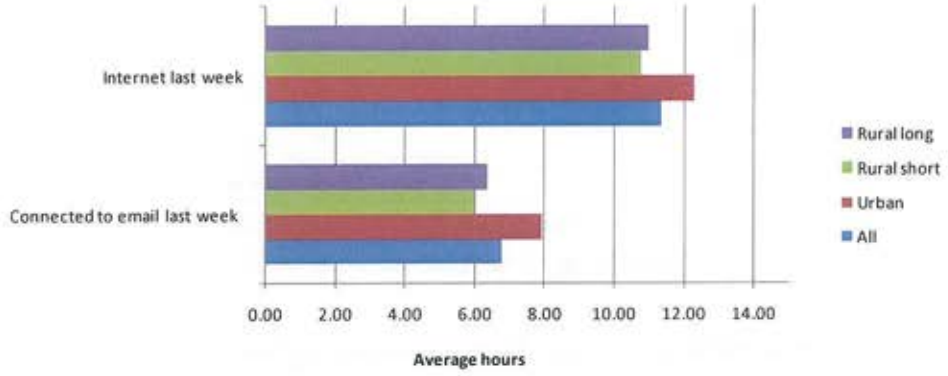


Figure 43: residential equipment survey results – email and internet

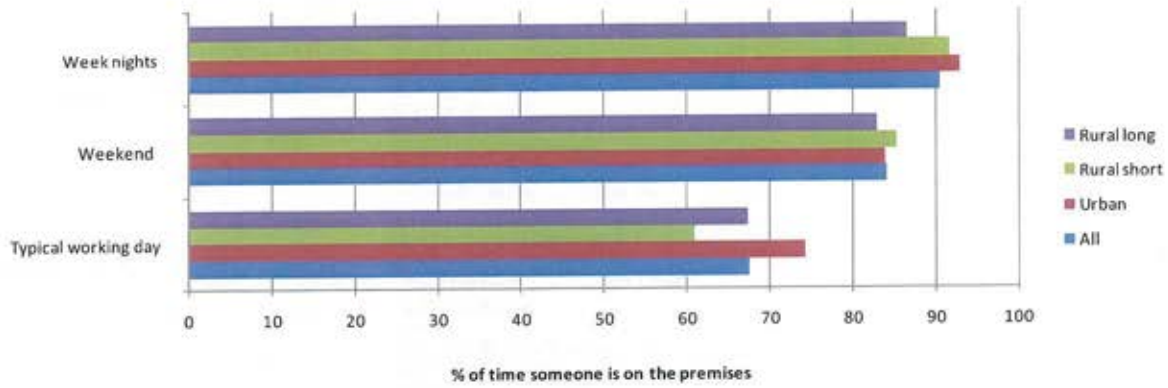


Residential – proportion of time on premises

The average household:

- Has someone at home a minimum of two thirds of the time during a working day, and
- The proportion of time increases for the weekend and week nights to 84% and 90% respectively.

Figure 44: residential equipment survey results – per cent of time on premises



Business equipment

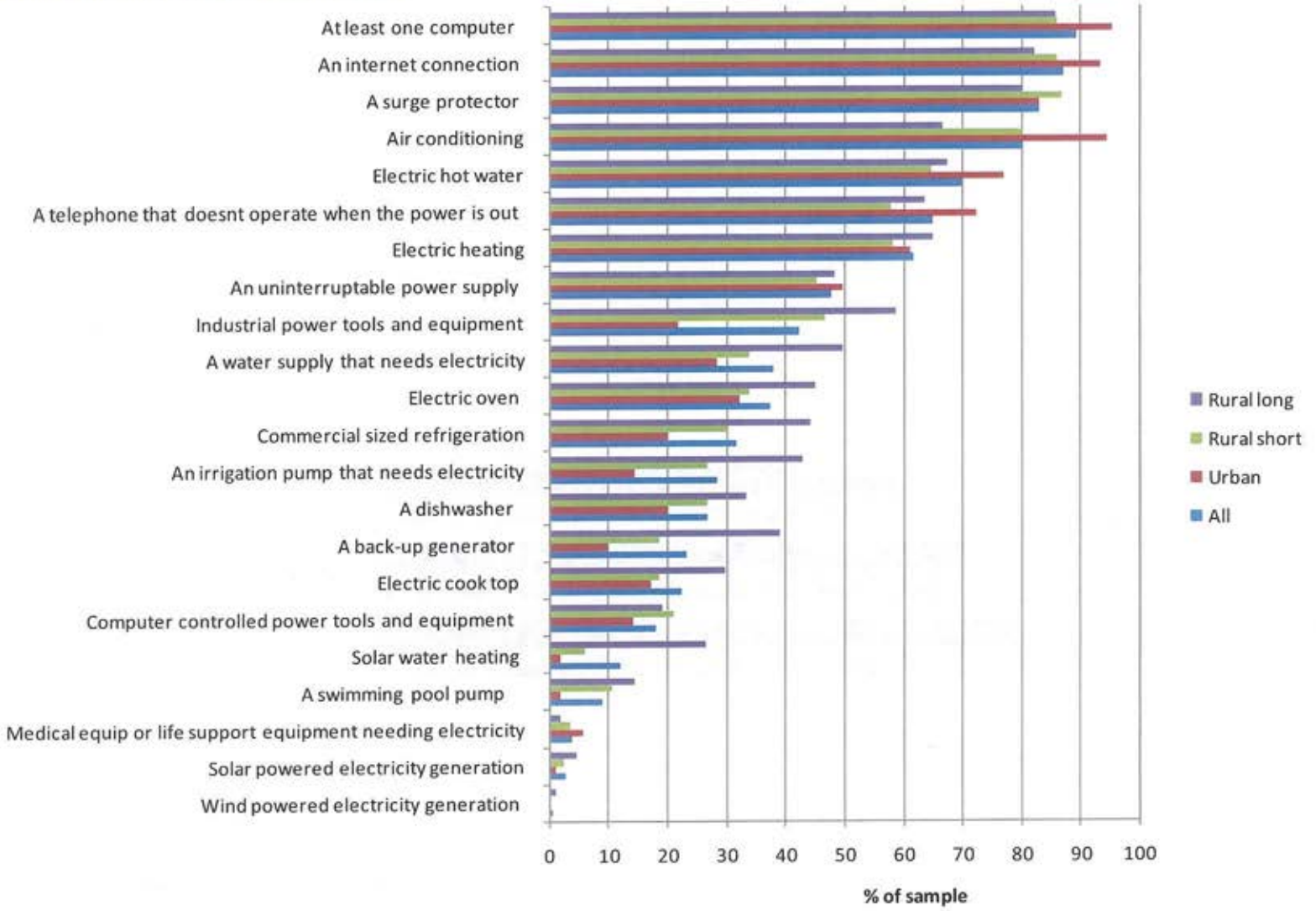
Penetration rates indicate

- A high level of computers and internet connections and surge protectors with little variation across feeder categories,
- A large number of businesses with air conditioning, and
- Half have an uninterruptable power supply and nearly three quarters have a telephone that doesn't need electricity.

There is little variation across the networks except that:

- Rural respondents have fewer air conditioners, and
- Rural respondents tend to have more back up generators, industrial power tools and a water supply that needs electricity.
- A large number of respondents indicated they own surge protectors. This may or may not be due to misunderstanding on behalf of survey respondents.

Figure 45: business equipment survey results



Business air conditioning

Penetration rates of air conditioners is high across all networks:

- Over three quarters have reverse cycle air conditioning, and
- 12% expect to install more air conditioning.

Figure 46: business equipment survey results – air conditioning

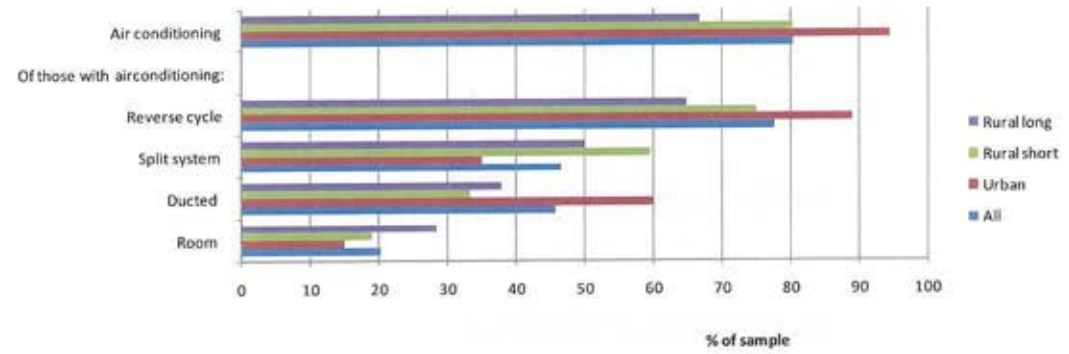
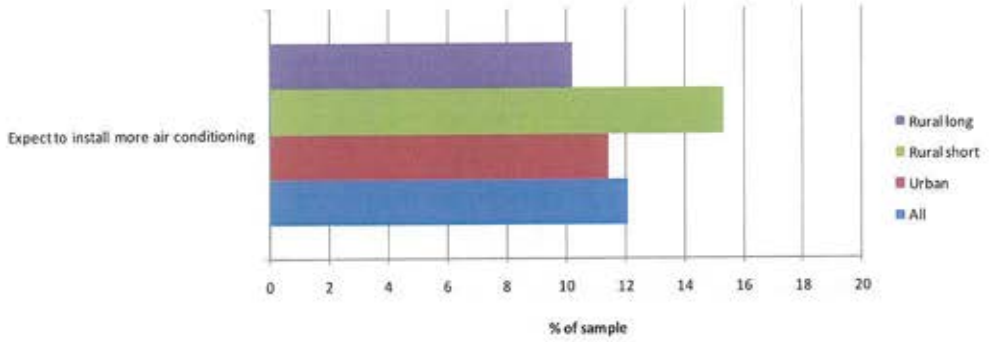


Figure 47: business equipment survey results – air conditioning



Business other

The average business:

- The average business has12.5 working computers, 3.8 refrigerators, 2.4 TVs, the majority of which are flat screen, and
- Spends 15.6 hours on the internet and 14.5 hours interacting through email in the last week.

Figure 48: business equipment survey results – selected equipment

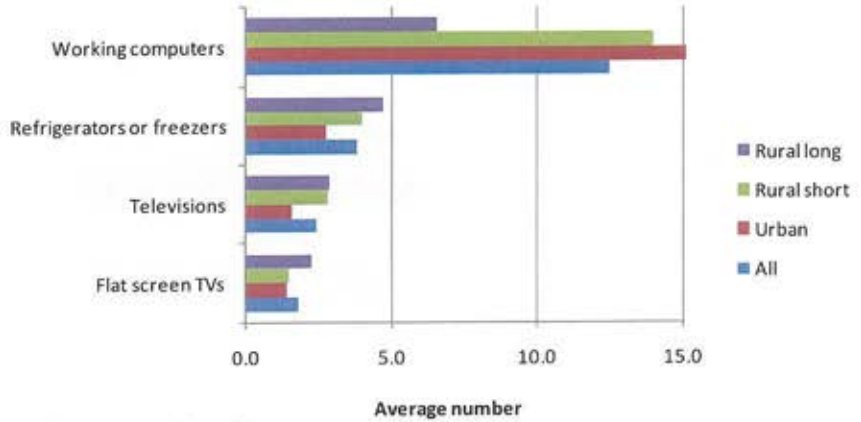
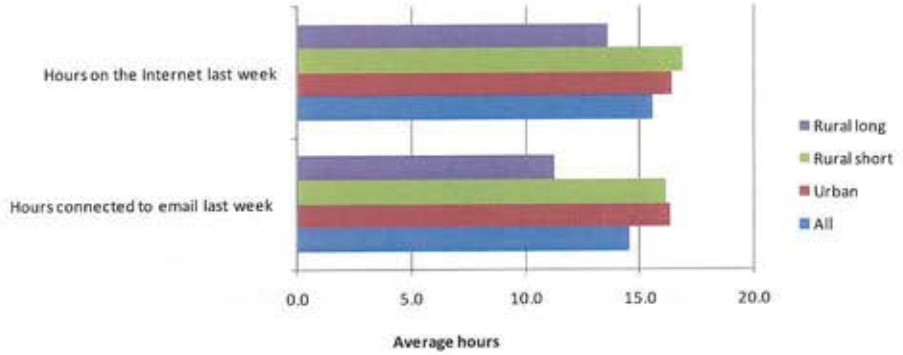


Figure 49: business equipment survey results – email and internet

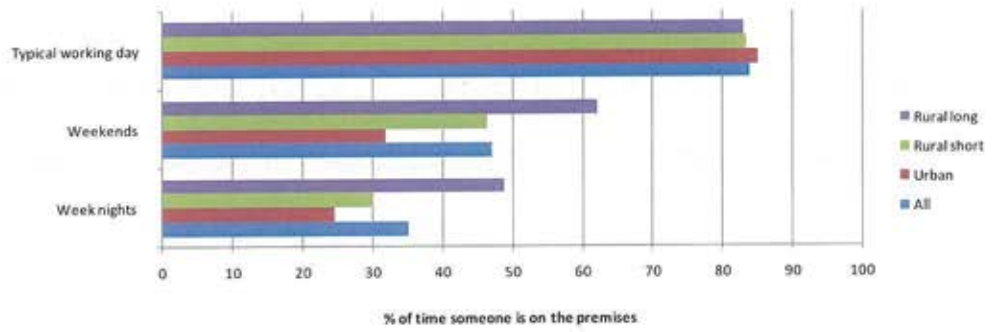


Business – proportion of time on premises

The average business:

- Has someone on the premises 84% of the time during a working day, and
- The proportion of time decreases for the weekend and week nights to 48% and 35% respectively.

Figure 50: business equipment survey results – per cent of time on premises



Appendices

Appendix A: feeders by region

Appendix B: feeders by suburb

Appendix C: perceived to network results, businesses and residential results

Appendix D: demographics for businesses and residential consumers

Feeders by region

The respondents were selected from the feeder by region as indicated on this table

Table 14: feeders by region

Feeder category	Region	Respondents
Urban	Metro	195
	North Country	8
	South Country	10
	Total	***213***
Rural short	Goldfields	17
	Metro	90
	North Country	31
	South Country	57
	Total	***195***
Rural long	Metro	6
	North Country	94
	South Country	112
	Total	***212***
Total		**620**

Feeders by suburb

Table B1: feeder categories by region - Urban

Urban Feeders - Suburb/location	Respondents
BALGA (54%) DIANELLA (23%) MIRRABOOKA (17%)	4
BALGA (82%) BALCATTA (10%) HAMERSLEY (7%)	4
BEECHBORO (89%) MORLEY (8%) WEST SWAN (3%)	7
BELDON (100%)	4
BLUFF POINT (33%) BERESFORD (29%) SUNSET BEACH (17%)	5
BOORAGOON (39%) BATEMAN (29%) BRENTWOOD (21%)	5
BUNBURY (100%)	3
BUNBURY (67%) DALYELLUP (28%) CAREY PARK (3%)	7
CANNING VALE (100%)	13
DALKEITH (79%) NEDLANDS (19%) CLAREMONT (2%)	5
DUNCRAIG (83%) CARINE (17%)	7
EAST PERTH (100%)	5
EAST PERTH (54%) PERTH (46%)	5
EAST PERTH (84%) PERTH (16%)	5
FLOREAT (53%) WEMBLEY (30%) CHURCHLANDS (17%)	5
FLOREAT (76%) CHURCHLANDS (24%)	2
GERALDTON (100%)	3
GWELUP (54%) KARRINYUP (26%) BALCATTA (10%)	4
JOONDALUP (~100%)	7
KARRINYUP (100%)	5
LAKELANDS (58%) STAKE HILL (13%) GREENFIELDS (11%)	3
LEEDERVILLE (63%) NORTH PERTH (23%) WEST PERTH (13%)	5
MALAGA (100%)	5
MAYLANDS (75%) MOUNT LAWLEY (19%) EAST PERTH (6%)	6
MIDLAND (100%)	5
MORLEY (66%) BAYSWATER (17%) BASSENDEAN (16%)	11
NEDLANDS (73%) CLAREMONT (27%)	4
PARKWOOD (41%) FERNDALE (31%) LYNWOOD (23%)	5
SCARBOROUGH (100%)	6
SUBIACO (100%)	4
SUBIACO (62%) SHENTON PARK (20%) WEST PERTH (17%)	5
SUBIACO (86%) WEST PERTH (13%)	5
SUBIACO (94%) SHENTON PARK (6%)	6
VICTORIA PARK (68%) EAST VICTORIA PARK (31%)	16
WATERFORD (40%) KARAWARA (30%) BENTLEY (28%)	4
WELLARD (93%) LEDA (5%) BALDIVIS (1%)	1
WELSHPOOL (43%) CARLISLE (37%) KEWDALE (19%)	5
WELSHPOOL (93%) QUEENS PARK (7%)	1
WEMBLEY (72%) SUBIACO (28%)	4
WOODLANDS (29%) INNALOO (29%) STIRLING (24%)	7
Total	213

Table B2: feeder categories by region – Rural short

Rural short Feeders - Suburb/location	Respondents
ALBANY (25%) MCKAIL (17%) MOUNT MELVILLE (14%)	5
AUSTRALIND (65%) EATON (26%) MILLBRIDGE (8%)	5
BALDIVIS (56%) WARNBRO (39%) PORT KENNEDY (5%)	10
BERTRAM (34%) MEDINA (32%) CALISTA (26%)	5
BINNINGUP (54%) MYALUP (24%) HARVEY (11%)	6
BOULDER (86%) KALGOORLIE (8%) SOMERVILLE (5%)	5
BUSSELTON (85%) WEST BUSSELTON (9%) BROADWATER (5%)	20
BYFORD (53%) JARRAHDALE (44%) CARDUP (1%)	5
CANNING VALE (97%) BANJUP (3%)	2
COOGEE (34%) BEELIAR (25%) MUNSTER (22%)	3
COOLGARDIE (98%)	8
DAWESVILLE (48%) ERSKINE (27%) WANNANUP (11%)	14
ELLENBROOK (~100%) AVELEY (1%)	5
ELLENBROOK (88%) HENLEY BROOK (11%)	1
GINGIN (35%) BULLSBROOK (27%) BEERMULLAH (21%)	7
GREENFIELDS (89%) MANDURAH (9%) PARKLANDS (2%)	7
HILTON (38%) BEACONSFIELD (35%) WHITE GUM VALLEY (14%)	2
KAMBALDA EAST (95%) KAMBALDA (4%)	4
KELMSCOTT (55%) WESTFIELD (25%) GOSNELLS (10%)	3
LITTLE GROVE (24%) ALBANY (18%) LOCKYER (16%)	6
MELVILLE (72%) ATTADALE (16%) WILLAGEE (9%)	4
MERREDIN (100%)	4
NARROGIN (~100%) MINIGIN (1%)	6
NORTHAM (~100%)	5
PARMELIA (46%) ORELIA (36%) BERTRAM (9%)	6
PINJARRA (95%) WEST PINJARRA (4%) FAIRBRIDGE (0%)	1
PORT KENNEDY (29%) WAIKIKI (27%) WARNBRO (27%)	3
ROCKINGHAM (76%) LEDA (12%) EAST ROCKINGHAM (8%)	5
SEVILLE GROVE (43%) ARMADALE (30%) OAKFORD (17%)	5
SEVILLE GROVE (57%) ARMADALE (25%) KELMSCOTT (6%)	3
SOUTHERN CROSS (100%)	6
SPENCER PARK (25%) YAKAMIA (20%) MIRA MAR (20%)	4
THREE SPRINGS (~100%)	4
WAGIN (100%)	5
WUNDOWIE (54%) MORANGUP (43%) TOODYAY (2%)	5
YANCHEP (64%) TWO ROCKS (35%) EGLINTON (0%)	6
Total	195

Feeders by suburb (2)

Table B3: feeder categories by region – Rural long

Rural long Feeder - Suburb/location	Respondents
AUGUSTA (58%) MOLLOY ISLAND (10%) KARRIDALE (9%)	7
BAKERS HILL (58%) CLACKLINE (22%) MOKINE (9%)	4
BOYUP BROOK (55%) BRIDGETOWN (27%) HESTER (3%)	12
BREMER BAY (21%) KALGAN (16%) LOWER KING (9%)	8
BULLSBROOK (88%) MUCHEA (9%) CHITTERING (1%)	6
BUSSELTON (62%) YALYALUP (10%) GEOGRAPHE (5%)	5
CAPEL (39%) BOYANUP (22%) PEPPERMINT GROVE BEACH (18%)	5
CARNAMAH (55%) COOROW (25%) EGANU (6%)	5
COLLIE (76%) MUMBALLUP (4%) CARDIFF (4%)	4
COOLUP (56%) PINJARRA (10%)	5
CORRIGIN (70%) BULLARING (6%) BABAKIN (4%)	5
DALWALLINU (52%) MILING (13%) PITHARA (10%)	6
DANDARAGAN (56%) BADGINGARRA (19%) MOORA (11%)	8
DONGARA (18%) WALKAWAY (17%) DEEPDALE (12%)	6
ENEABBA (75%) ARROWSMITH EAST (9%) KADATHINNI (6%)	5
GABBADAH (52%) SEABIRD (17%) WANERIE (13%)	5
GNOWANGERUP (36%) TAMBELLUP (24%) BROOMEHILL (11%)	5
HARVEY (58%) YARLOOP (26%) COOKERNUP (14%)	5
HIGHBURY (31%) TINCURRIN (11%) HARRISMITH (9%)	4
LAKE GRACE (44%) NEWDEGATE (18%) PINGARING (6%)	4
LANCELIN (56%) LEDGE POINT (24%) KARAKIN (8%)	4
MARGARET RIVER (68%) PREVELLY (11%) WITCHCLIFFE (5%)	14
MERREDIN (68%) BURRACOPPIN (13%) WALGOOLAN (6%)	5
MORAWA (51%) PERENJORI (22%) CANNA (5%)	5
MOUNT BARKER (40%) KENDENUP (17%) CRANBROOK (9%)	5
MULLEWA (35%) WOORREE (20%) MOONYOONOOKA (12%)	5
MURADUP (25%) KULIKUP (24%) MOODIARRUP (19%)	5
NORTHAMPTON (34%) MORESBY (10%)	7
NYABING (27%) PINGRUP (24%) JERRAMUNGUP (24%)	5
PINGELLY (25%) BROOKTON (22%) CUBALLING (10%)	5
QUAIRADING (63%) CUNDERDIN (6%) DULBELLING (4%)	5
RAVENSTHORPE (14%) BORDEN (9%)	5
ROCKY GULLY (34%) PERILLUP (15%) DENBARKER (13%)	3
TAMMIN (58%) CUNDERDIN (14%) YORKRAKINE (12%)	5
WILLIAMS (55%) QUINDANNING (12%) NARROGIN (9%)	4
WYALKATCHEM (38%) KOORDA (24%) KORRELOCKING (4%)	5
YALLINGUP (40%) QUINDALUP (11%) QUEDJINUP (8%)	6
YORK (52%) BEVERLEY (28%) TALBOT (2%)	5
Total	212

Reliability for feeder categories by business/residential

Comparing business and residential SAIDI and SAIFI

- Note that as there are only approximately 100 respondents in each of the business and residential categories for each feeder categories there will be some instability in the following results. They should be used for information only, as they do not represent a statistically significant sample in their own right.

The separation of business and residential:

- SAIDI - Separating residential and business users on Urban and Rural short feeders has the effect of lengthening the indifference zones for perceived SAIDI of residential users and shortening them for business while it has the reverse effect on Rural long feeders. This would tend to support the hypothesis that there is low residential homogeneity in the Urban and Short Rural areas than in Rural long areas as they are less able to reach a conclusion about the SAIDI threshold they require. There are indications that business is less homogeneous in their SAIDI needs on Rural long feeders than they are on the other feeder categories. SAIFI and MAIFI – On Urban and Rural short feeders, residential consumers have relaxed their thresholds slightly and business tightened them. The reverse is true for Rural long feeders.
- Longest duration - On Urban and Rural short feeders, residential consumers have eliminated their indifference zone and relaxed their upper thresholds slightly and while business has lengthened its indifference zone tightened shortest limit. It has had the perverse effect of slightly lengthening the limit for both business and residential on Rural long feeders. This effect is due to the quite different nature of the curves for both cohorts and when combined come up with this effect
- Quality – On Urban feeders, residential consumers remained the same and tightened their levels on both Rural short and Rural long feeders. Business is the reverse of this and has extended the upper limit of their tolerance across all networks

Perceived to network SAIDI & SAIFI

Comparing business and residential SAIDI

- On Urban and Rural short feeders, residential consumers have relaxed their thresholds slightly and business tightened them. The reverse is true for Rural long feeders.

Comparing business and residential SAIFI

- On Urban and Rural short feeders, residential consumers have relaxed their thresholds slightly and business tightened them. The reverse is true for Rural long feeders. The differences are not significant.

Table C1: perceived to network SAIDI

All		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	9.5	230	181
	Longest	57	280	212
Rural short	Shortest	15.0	236	185
	Longest	169	396	285
Rural long	All	169	396	285

Residential		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	8.4	229	180
	Longest	342	579	332
Rural short	Shortest	8.4	229	180
	Longest	195	425	302
Rural long	All	159	387	278

Business		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	11.8	232	183
	Longest	48	270	206
Rural Short	Shortest	45	267	204
	Longest	166	394	283
Rural Long	Shortest	12	233	183
	Longest	520	512	359

Table C2: perceived to network SAIFI

All	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	1.0	2.4	2.1
Rural short	2.0	2.8	2.3
Rural long	3.9	3.5	2.8

Residential	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	2.3	2.9	2.4
Rural short	2.5	3.0	2.4
Rural long	3.5	3.4	2.7

Business	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	1.0	2.4	2.1
Rural short	1.8	2.7	2.3
Rural long	4.5	3.8	2.9

Perceived SAIDI

Comparing business and residential SAIDI

- Residential thresholds are generally extended for Urban and Rural short feeders; while
- they are extended for Rural long business.

Note: This analysis was carried out because there were zones in the interaction diagrams where the 'choose worse' and 'choose better' lines crossed each other a number of times (indifference zones). This exploratory analysis was carried out to see if the impacts were due to a difference between residential and business responses particularly on the rural short feeders as it was hypothesised that urban migration to these areas made the residential responses less homogeneous.

The original sample was not designed to split residential and business responses so as there are only approximately 100 respondents in each of the business and residential categories for each feeder categories there will be some instability in the following results. They should be used for information only, as they do not represent a statistically significant sample in their own right.

Figure C1a: perceived SAIDI – Urban residential

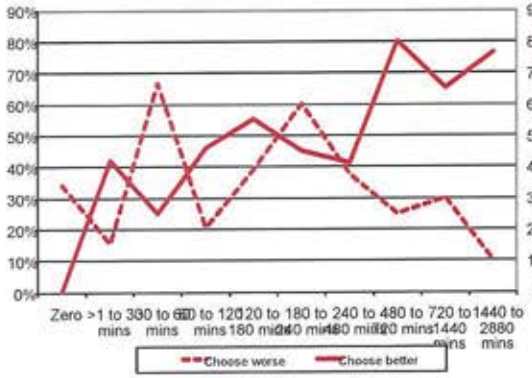


Figure C1b: perceived SAIDI – Rural short residential

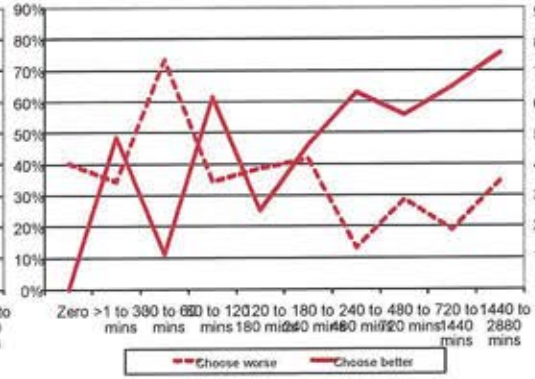


Figure C1c: perceived SAIDI – Rural long residential

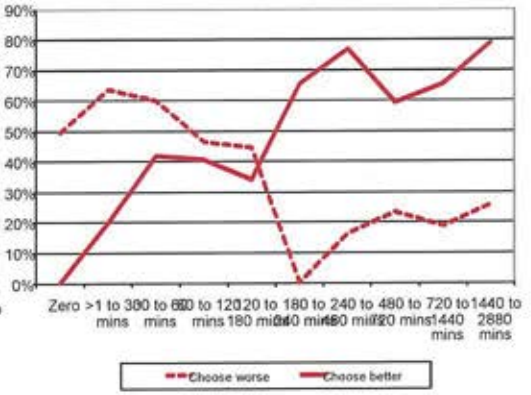


Figure C1d: perceived SAIDI – Urban businesses

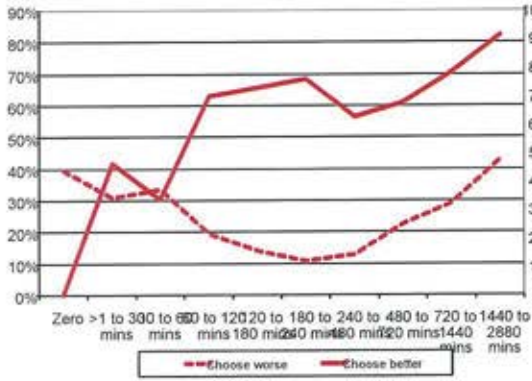


Figure C1e: perceived SAIDI – Rural short businesses

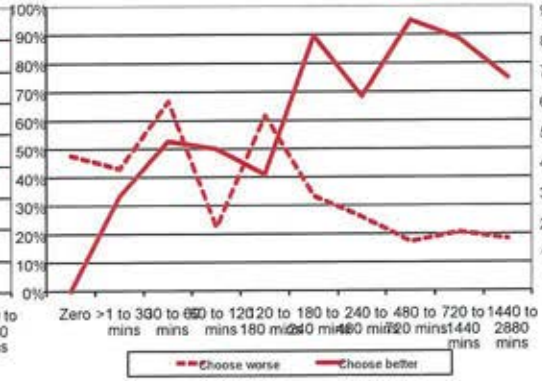
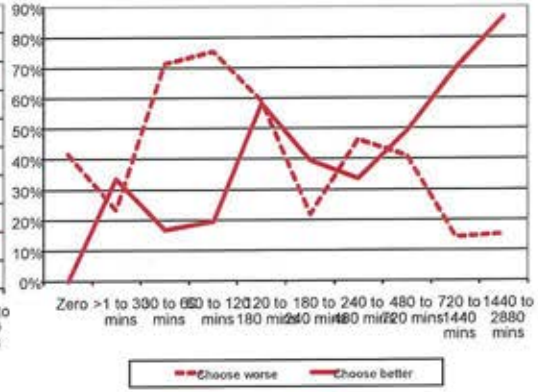


Figure C1f: perceived SAIDI – Rural long businesses



Cross over points for these charts is provided on the previous page (Refer tables C1)

Perceived SAIFI

Comparing business and residential SAIFI

- On Urban and Rural short feeders, residential consumers have relaxed their thresholds slightly and business tightened them. The reverse is true for Rural long feeders.

Figure C2a: perceived SAIFI – Urban residential

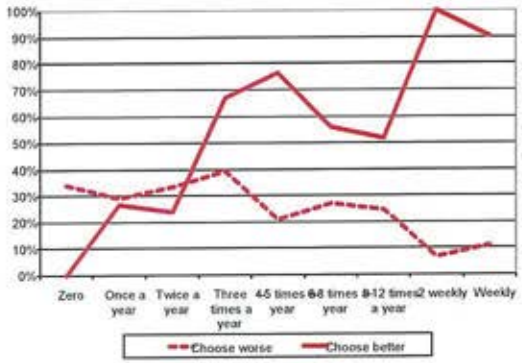


Figure C2b: perceived SAIFI – Rural short residential

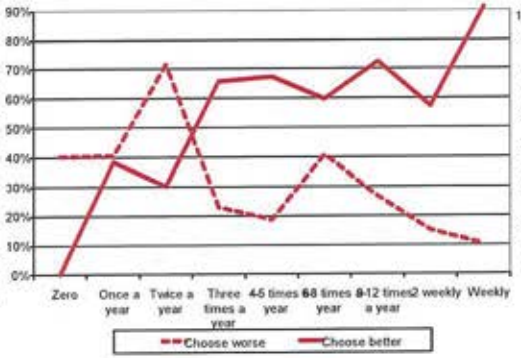


Figure C2c: perceived SAIFI – Rural long residential

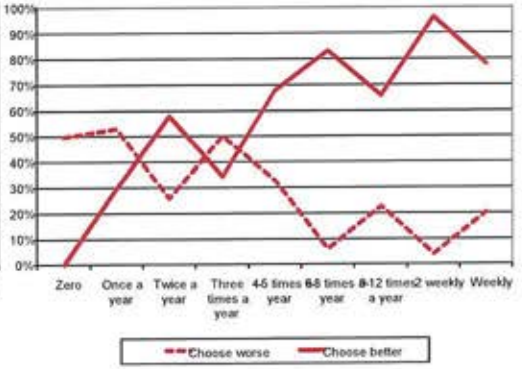


Figure C2d: perceived SAIFI – Urban businesses

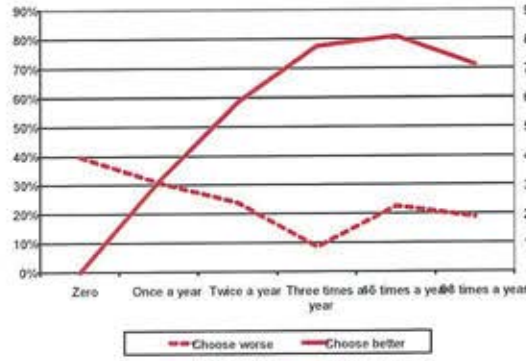


Figure C2e: perceived SAIFI – Rural short businesses

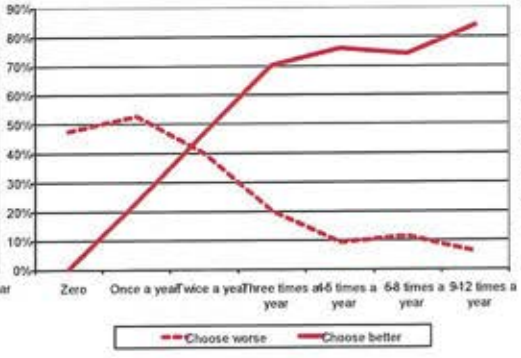
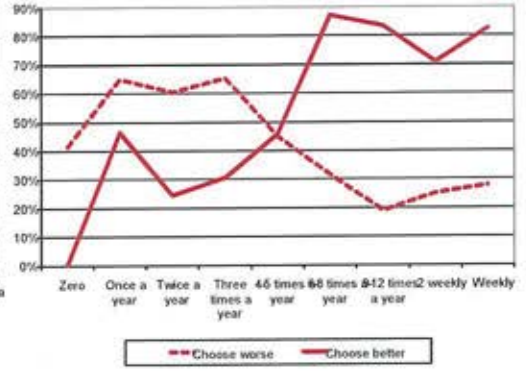


Figure C2f: perceived SAIFI – Rural long businesses



Cross over points for these charts is provided on page 51 (Refer tables C2)

Perceived to network Longest interruption & network MAIFI

Comparing business and residential Longest duration

- On Urban and Rural short feeders, residential consumers have eliminated their indifference zone and relaxed their upper thresholds slightly and while business has lengthened its indifference zone and tightened the shortest limit. It has had the perverse effect of slightly lengthening the limit for both business and residential on Rural long feeders. This effect is due to the quite different nature of the curves for both cohorts and when combined come up with this effect.

Comparing business and residential MAIFI

- On Urban and Rural short feeders, residential consumers have relaxed their thresholds slightly and business tightened them. Again, the reverse is true for Rural long feeders.

Table C3: perceived to network Longest duration

All		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	13.0	234	183
	Longest	51.0	274	208
Rural short		15.0	236	185
Rural long		35.0	257	198

Residential		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	50.4	273	208
	Longest	50.4	273	208
Rural short		15.0	236	185
Rural long		45.0	267	204

Business		Perceived	All network interruptions	Normalised unplanned interruptions
		Minutes pa	Minutes pa	Minutes pa
Urban	Shortest	8.9	229	181
	Longest	51.0	274	208
Rural short		15.0	236	185
Rural long		50.0	273	208

Table C4: perceived to network MAIFI

All	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	0.5	2.2	1.9
Rural short	1.2	2.5	2.1
Rural long	0.8	2.3	2.0

Residential	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	0.5	2.2	1.9
Rural short	1.3	2.5	2.1
Rural long	0.7	2.3	2.0

Business	Perceived	All network interruptions	Normalised unplanned interruptions
	Times pa	Times pa	Times pa
Urban	0.5	2.2	1.9
Rural short	1.1	2.4	2.1
Rural long	1.0	2.4	2.1

Perceived Longest duration

Comparing business and residential Longest duration

- On Urban and Rural short feeders, residential consumers have eliminated their indifference zone and relaxed their upper thresholds slightly and while business has lengthened its indifference zone tightened shortest limit. It has had the perverse effect of slightly lengthening the limit for both business and residential on Rural long feeders. This effect is due to the quite different nature of the curves for both cohorts and when combined come up with this effect.

Figure C3a: perceived Longest duration – Urban residential

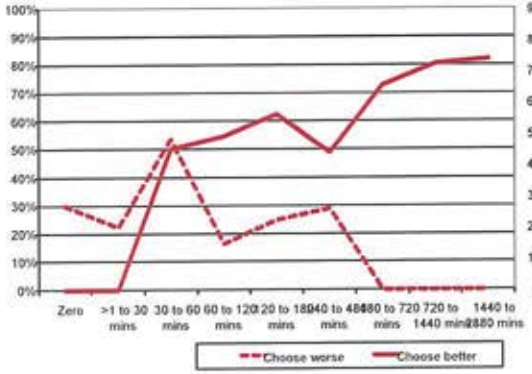


Figure C3b: perceived Longest duration – Rural short residential

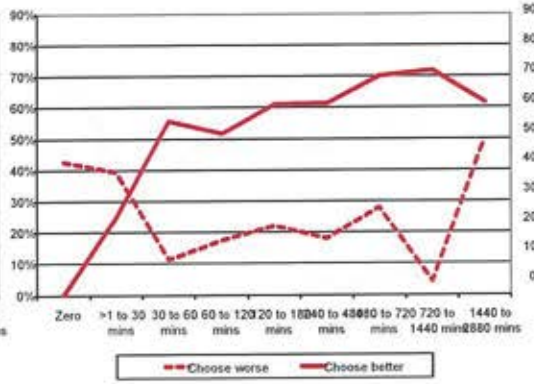


Figure C3c: perceived Longest duration – Rural long residential

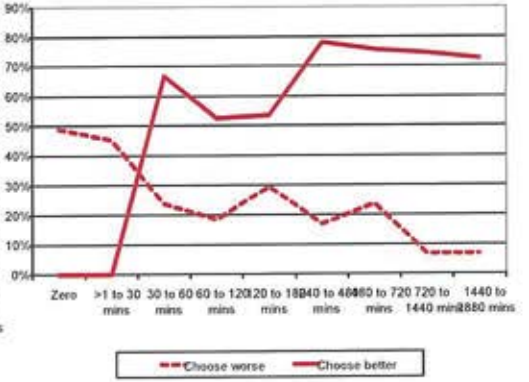


Figure C3d: perceived Longest duration – Urban businesses

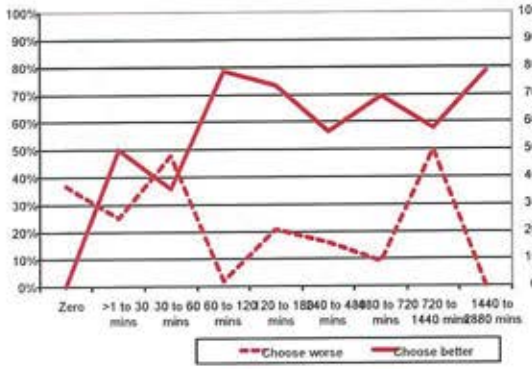


Figure C3e: perceived Longest duration – Rural short businesses

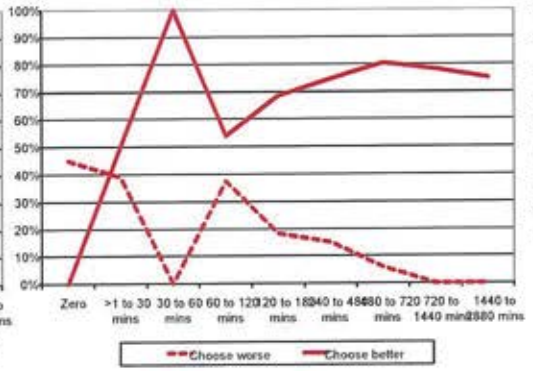
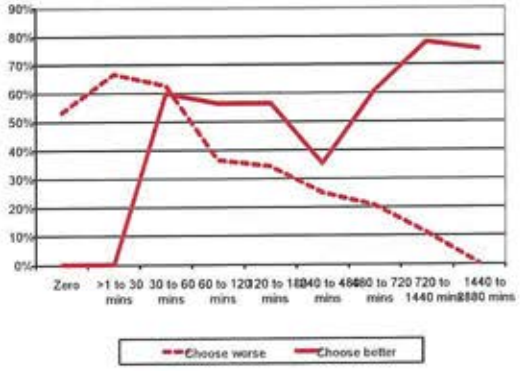


Figure C3f: perceived Longest duration – Rural long businesses



Cross over points for these charts is provided on page 53 (Refer tables C3)

Perceived MAIFI

Comparing business and residential MAIFI

- On Urban and Rural short feeders, residential consumers have relaxed their thresholds slightly and business tightened them. The reverse is true for Rural long feeders

Figure C4a: perceived MAIFI – Urban residential

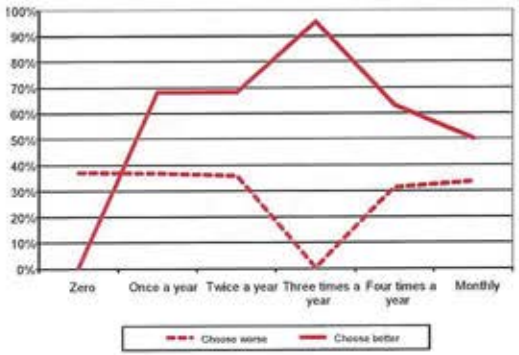


Figure C4b: perceived MAIFI – Rural short residential

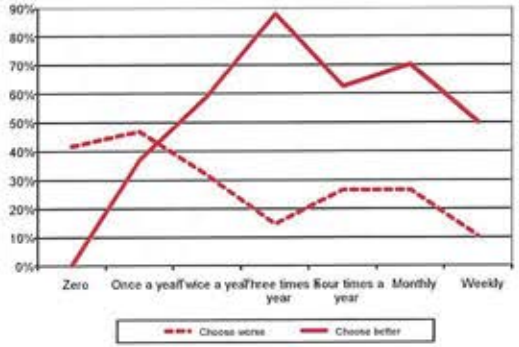


Figure C4c: perceived MAIFI – Rural long residential

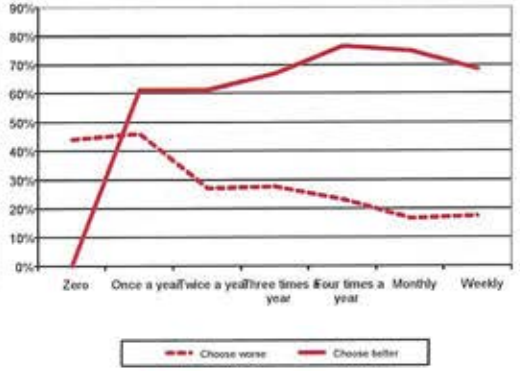


Figure C4d: perceived MAIFI – Urban businesses

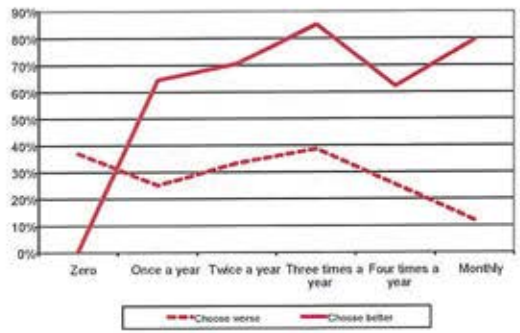


Figure C4e: perceived MAIFI – Rural short businesses

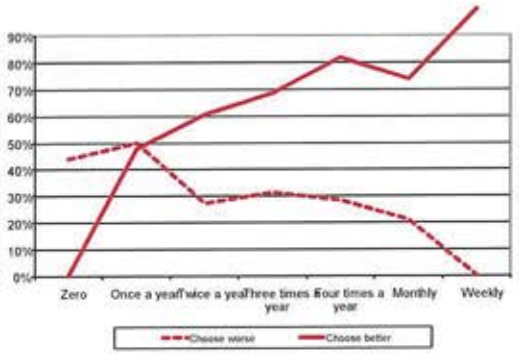
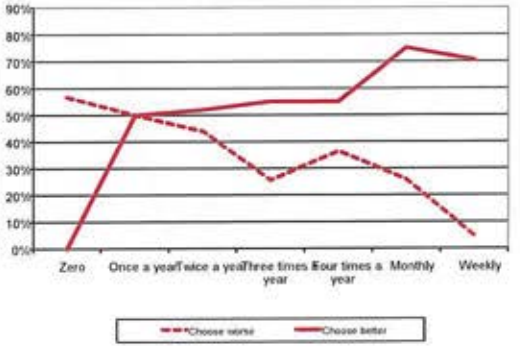


Figure C4f: perceived MAIFI – Rural long businesses



Cross over points for these charts is provided on page 53 (Refer tables C4)

Perceived to network Quality

Comparing business and residential Quality

- On Urban feeders, residential consumers remained the same and tightened their levels on both Rural short and Rural long feeders
- Business is the reverse of this and has extended the upper limit of their tolerance across all networks

Table C5: perceived to network quality

All		Perceived	All network interruptions	Normalised unplanned interruptions
		Times pa	Times pa	Times pa
Urban		0.5	2.2	1.9
Rural short		1.8	2.7	2.3
Rural long	Lower	0.7	2.3	2.0
	Upper	2.5	3.0	2.4

Residential		Perceived	All network interruptions	Normalised unplanned interruptions
		Times pa	Times pa	Times pa
Urban		0.5	2.2	1.9
Rural short		1.1	2.4	2.1
Rural long	Lower	0.7	2.3	2.0
	Upper	2.2	2.9	2.4

Business		Perceived	All network interruptions	Normalised unplanned interruptions
		Times pa	Times pa	Times pa
Urban	Lower	0.5	2.2	1.9
	Upper	2.1	2.8	2.3
Rural short		2.6	3.0	2.5
Rural long	Lower	0.6	2.2	2.0
	Upper	3.9	3.5	2.8

Perceived Quality

Comparing business and residential Quality

- On Urban feeders, residential consumers remained the same and tightened their levels on both Rural short and Rural long feeders.
- Business is the reverse of this and has extended the upper limit of their tolerance across all networks.

Figure C5a: perceived Quality – Urban residential

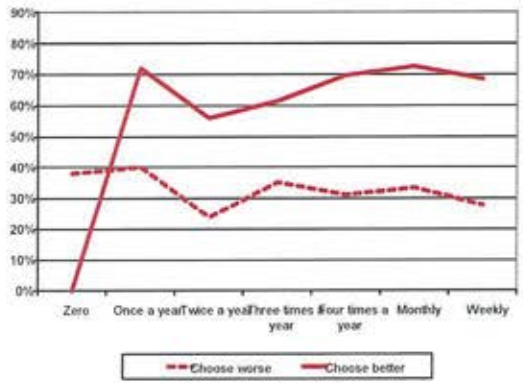


Figure C5b: perceived Quality – Rural short residential

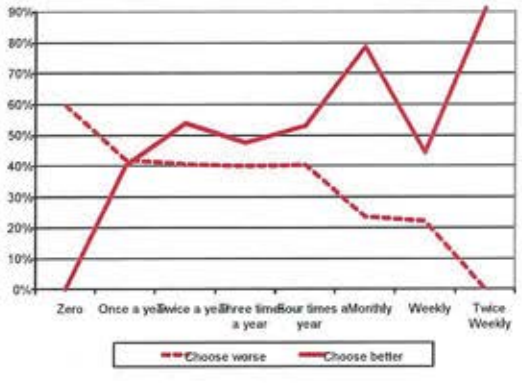


Figure C5c: perceived Quality – Rural long residential

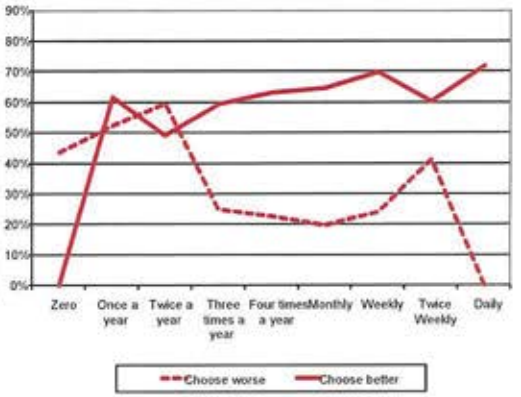


Figure C5d: perceived Quality – Urban businesses

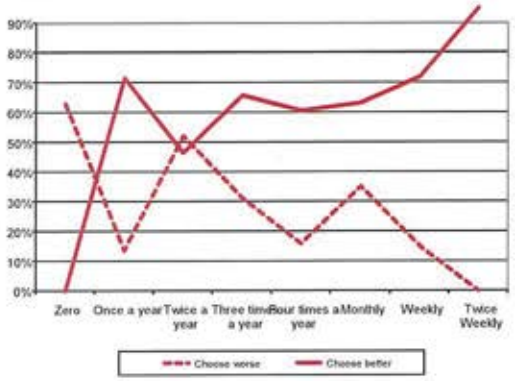


Figure C5e: perceived Quality – Rural short businesses

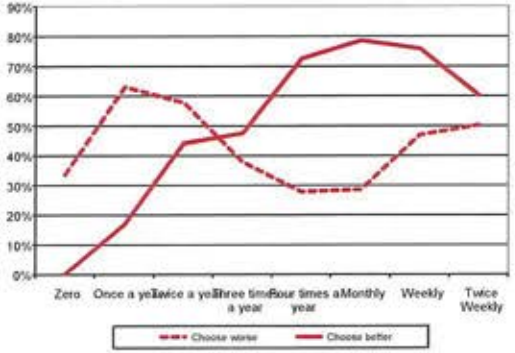
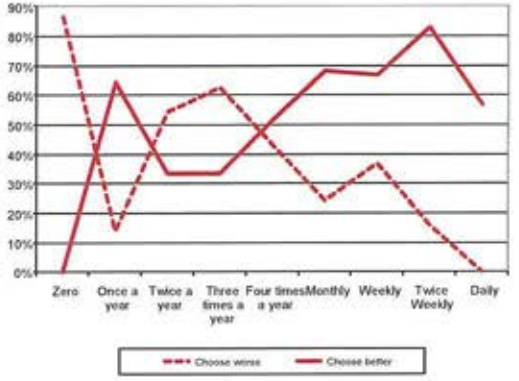


Figure C5f: perceived Quality – Rural long businesses



Cross over points for these charts is provided on page 57 (Refer tables C5)

Demographics – residential sample

Sample demographics are shown here for completeness

Figure D1: age

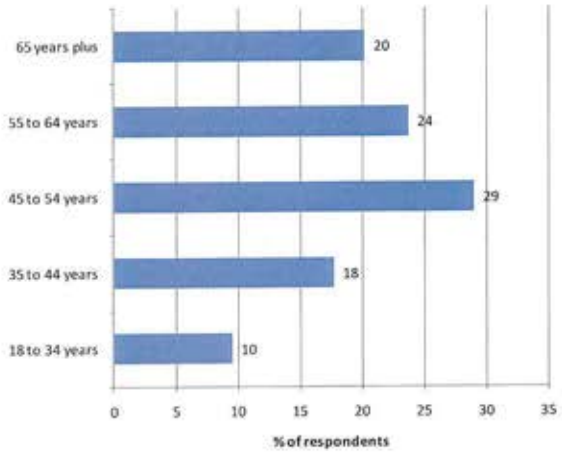


Figure D2: income

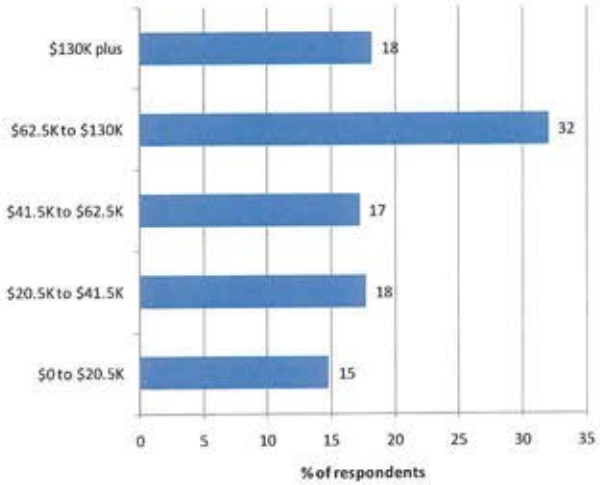
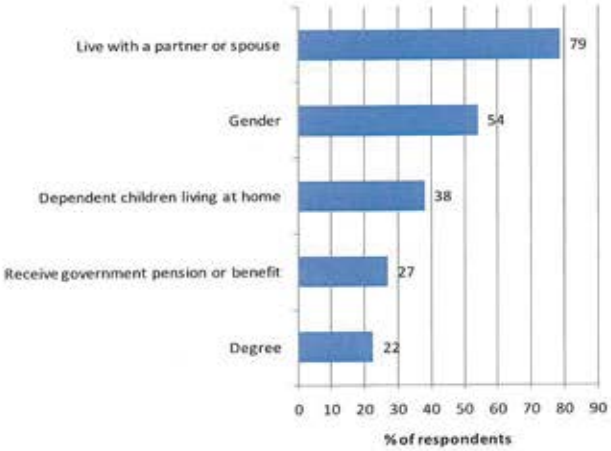
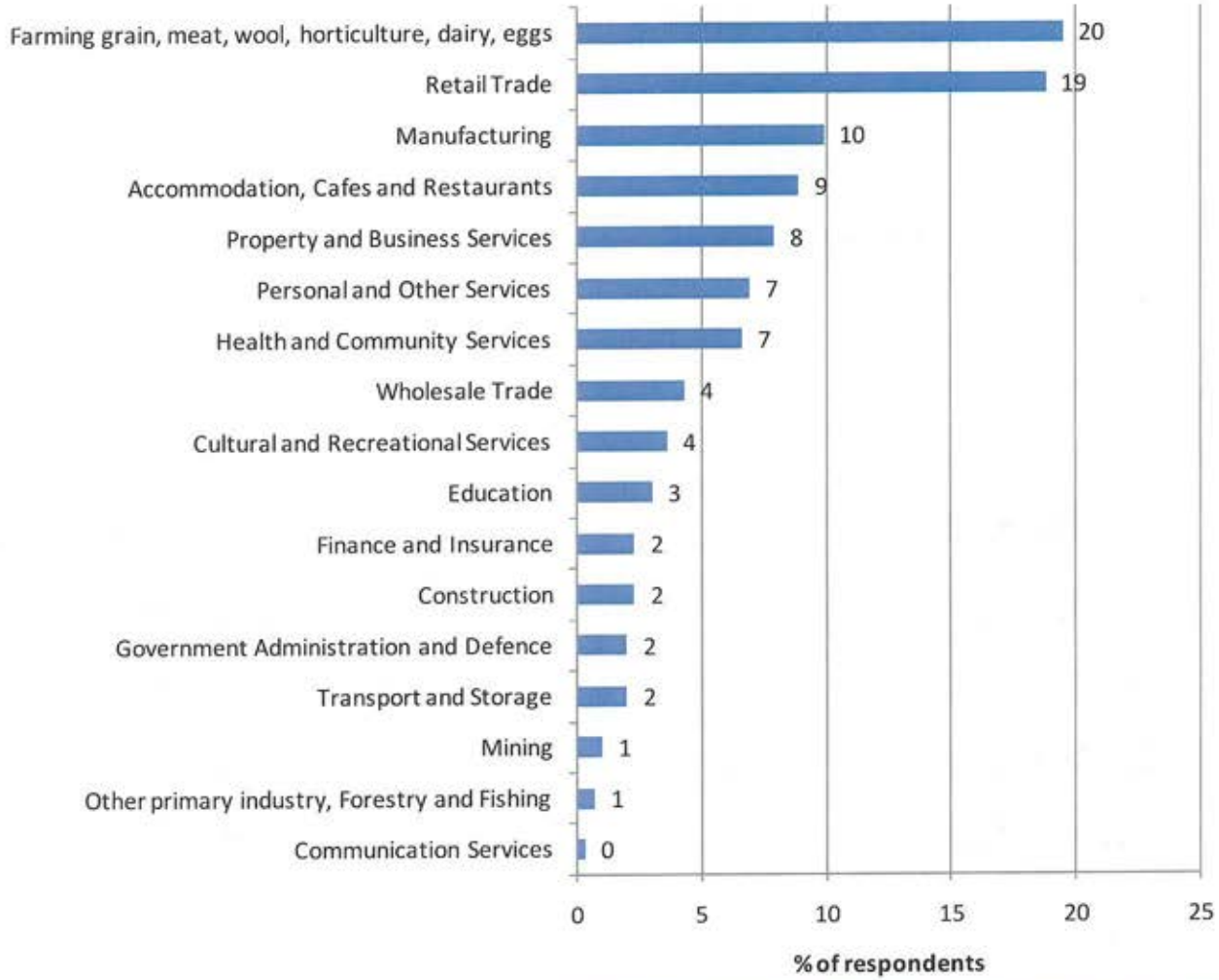


Figure D3: other factors



Demographics – Business Sample

Figure D4: industry



Demographics – Business Sample

Figure D5: number of employees

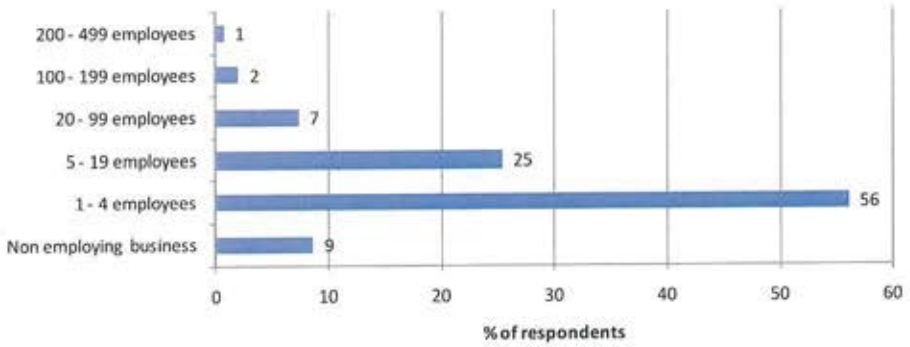
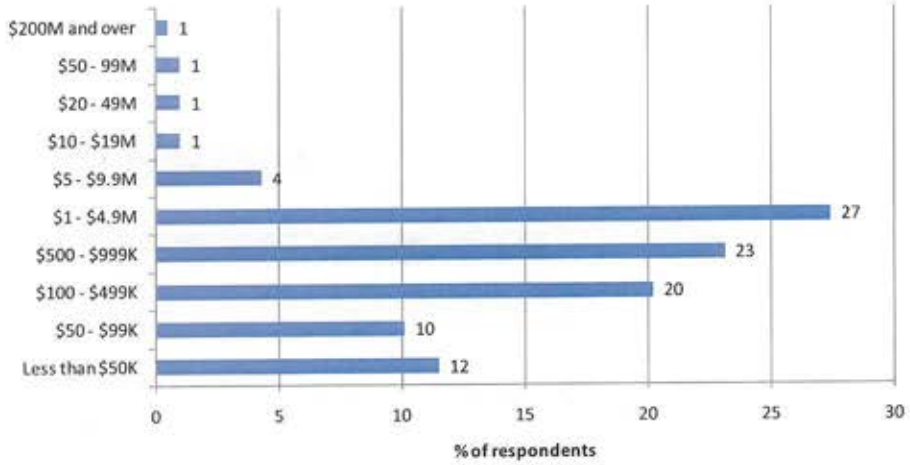


Figure D6: annual turnover



Demographics – Business Sample

45% of respondents were female, 55% were male

24% of respondents had a tertiary education degree

Figure D7: gender and education of respondent