Attachment 5.13

2014 Reliability Investment Plan for 2014-15 to 2018-19

January 2015

Ausgrid revised regulatory proposal attachment

Contents

Summary

We have proposed a modest capital program to maintain our reliability performance and meet specific regulatory obligations. Expenditure will be targeted at complying with performance targets for individual (11kV) feeders and improving individual customer performance.

The purpose of this document is to provide an overview of our proposed capex to meet our reliability performance targets with financial numbers expressed in 2013/14 dollar terms (unless stated otherwise). In total, we propose capex of $28.3 million (including overheads of $8.8 million) over the 2014-19 period. The program is to address performance issues with individual feeder and individual customer performance.

The proposed capex is significantly lower than the previous period where we incurred $62.6 million of specific reliability investments, which was largely a result of new and increasingly stringent licence conditions.

This revised submission is largely unchanged from our original proposal. Our reliability performance forecasts assume no substantial change to operating practices or investment triggers for both augmentation and replacement from our original proposal:

- Our proposed program is directed at maintenance of our current reliability performance at existing levels, including compliance with the performance targets in our licence conditions. The key components where we expect to have expenditure are to meet the requirements of the NSW Reliability and Performance Licence Conditions, and to maintain reliability performance at the feeder segment level to ensure we address persistent poor performance for individual customers[1].
- Zero capex for average performance standards – In the last period we incurred expenditure to meet new and increasingly stringent security and reliability targets. Our average performance targets under the licence conditions have not been altered over the 2014-19 period. Based on our reliability performance forecast, we do not expect to require further capex specifically to address average reliability performance.
- Ausgrid forecasts a requirement for capital expenditure for reliability remediation of $19.5 million ($2013-14 real excluding overheads of $8.8 m), but with an offset of $6.6m to account for the proportion that would be expected to be funded by marginal STPIS revenue. As a result the amount to be included in the standard control capital expenditure items for revenue modelling is reduced to $12.6 million after the STPIS offset and overheads are excluded.

[1] Our 2008 proposal included a "black spot" program targeted at maintaining reliability for customers supplied from the worst performing parts of the network. Although this program was not supported by the AER, Ausgrid implemented a modest program to address the worst performing areas of the network. The proposed program for 2014-19 will be improved and better targeted.

Introduction

We have obligations to manage the frequency and duration of interruptions to our customers. Reliability can be seen as the end product of our network design, asset management process, and operating environment.

The purpose of this document is to provide a high level overview of our proposed investments to address reliability performance issues on our network.

The reliability plan is prepared to ensure we maintain reliability performance at all levels of our network and that we meet our NSW reliability and performance licence conditions for the 2014-19 period. The reliability performance forecast on which the plan is based takes into account the reliability impact of our proposed augmentation and replacement programs.

Our plan has linkages with our proposal for the Service Target Performance Incentive Scheme (STPIS). The model we have used to forecast reliability performance has also been used to inform our understanding of the potential STPIS returns associated with implementation of the reliability plan.

Ausgrid has accepted the AER's proposed methodology of trend line analysis for the calculation of Ausgrid's reliability targets, on the basis of simplicity and transparency.

We have used the AER's methodology to perform an updated trend line analysis using updated data including the actual 2013/14 network performance to develop updated reliability targets for the 2014/15-2018/19 period.

What is reliability?

Reliability is a measure of the availability of supply from our network. In urban areas, supply is typically available for 99.98% of the time. For this reason, distribution reliability is expressed in terms of the duration and frequency of sustained outages rather than through measures of the availability of supply.

The reliability measures generally used are:

- The average duration (SAIDI) and average frequency (SAIFI) of interruptions experienced by a customer in a year.[2] Often this measure is expressed for different segments of the network, such as CBD, urban and rural lines. This reflects the difference performance measures which can be achieved for each segment.

Several studies have been taken to measure the value a customer places on customer reliability. The value of interruption varies widely between different sectors of the community and with the interruption duration and time. Studies have found that customers in CBD areas typically experience the greatest economic loss from an electricity interruption, with residential customers experiencing the lowest loss. For this reason, regulatory incentives generally value reliability at a higher level for CBD customers.

What causes interruptions?

Interruptions of supply can occur for a variety of reasons including:

- Directions by government and emergency services to interrupt supply, generally in the case of emergencies such as bushfires.
- Shortfalls in generation or instability in the grid.

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[2] Standard reliability measures (SAIDI & SAIFI) used in Australia exclude interruptions of less than 1 minute duration. In other countries the duration of excluded events may be as long as 5 minutes. Such thresholds provided sufficient time for the automatic restoration of supply, following an outage. When these measures were developed, interruptions of this duration caused minimal disruptions. With the increased reliance on electronic equipment, momentary interruptions can be more disruptive and new measures (MAIFI) are being introduced to capture how often momentary interruptions occur.

- Equipment failures within the transmission system.
- Equipment failures within the distribution system.
- Failure of customer equipment, particularly when this may cause outages within the shared network.

Ausgrid only has direct influence over outages within the distribution system[3]. Distribution system outage may occur:

- When part of the network is taken out of service for maintenance, or to allow construction work (planned interruptions); or
- As a result of the failure of an asset (unplanned interruptions)

Our network is designed with degrees of redundancy (backup) to enable supply to be maintained when some equipment is out of service. The level of redundancy provided by the system varies with the magnitude and criticality of the load, and the repair times of the infrastructure.

For example, the subtransmission network has a level of redundancy based on the criticality of an outage. As most of Ausgrid's subtransmission network supplies significant demand (and customers) it is generally designed with sufficient redundancy to ensure that outages resulting from failures of the subtransmission system are rare. In contrast, a failure on the distribution network will affect less load and fewer customers, and therefore we do not invest as heavily in redundancy of the system.

There are a number of inter-related factors that influence reliability performance. This makes forecasting a complex business, as it can be difficult to determine the weight and correlations between factors. On the next pages we identify key factors influencing reliability, which is then depicted in Figure 1 on page 7.

Failures

Failures are typically caused by underlying issues with the condition of an asset or the operating environment. Causes include:

- Environmental factors such as lightning, extreme events such as storms, bushfires and floods, and vegetation and fauna coming into contact with conductors.
- Degradation of asset caused by age, over-use, or poor maintenance practice, or due to a failure in technical design.
- Damage resulting from vehicles colliding with poles or overhead conductors.
- Damage to underground infrastructure arising from excavations.
- Loading an asset beyond its safe rating.

Reliability will decline if these factors become prominent over time. For example if asset condition declines, maintenance deteriorates, or the number of storm events increase over time.

The inherent design of assets on the network may also influence the likelihood of failures.

For example, underground assets generally have higher reliability than overhead assets as they are not as exposed to storms or lightning activity. It should be noted however that underground assets have longer repair times and can be more prone to failure after sustained wet weather.

Security of supply

A failure of an asset does not necessary result in a customer outage.

In many parts of the network, we have redundancy (back-up) which provides an alternative means of supply if an asset fails. This means that we can either:

[3] The methodology for calculating our reliability recognises that many causes of interruptions are outside the control of Ausgrid and excludes them from our reliability measures.

- Provide full or partial supply, or
- Limit the interruption time to customers.

Redundancy also enables parts of the network to be taken out of service to enable maintenance or to safely connect new construction without the need to interrupt supply to all connected customers.

Generally the level of redundancy increases with the criticality and the magnitude of the load. Thus the network supplying the Sydney CBD has a higher level of redundancy than urban networks.

Subtransmission assets which supply large amounts of load have increased redundancy compared with assets which supply relatively small magnitudes (<10MVA) of demand.

The medium and low voltage network (11kV and 400V) is not designed with the same level of redundancy as the subtransmission network. However, the urban network is still designed in a way that enables switching of the network to minimise the duration of most outages experienced by the customer.

Whilst LV failures generally result in outages, only small amounts of customers are affected and the characteristics of the network generally allow supply to be restored within a few hours.

Underlying reliability performance usually improves if higher levels of supply security are provided.

Network Segmentation

For a given network design, the failure rate of a network component such as a feeder will increase with the feeder length and the number of connected components.

On radial distribution networks, which rely on manual restoration of supply, the level of segmentation of a network (the amount of a network affected by a fault) has an important impact on reliability.

For instance, if a distribution feeder is divided into two segments (with equal lengths and customer numbers), the expected number of failures will be unchanged, but the number of customers impacted by each failure will decrease, resulting in a marked improvement in reliability.

For a given load/customer density it is generally expected that as the rating/utilisation of a distribution feeder increases, the length and numbers of customers connected to each feeder will also increase and the reliability would decrease. Hence reliability will decline as we extend and add new customers to existing segments of the network, without building additional pathways.

One main strategy to improve reliability is to increase the segmentation of the network. This can be done by either providing more feeders or through installing automatic switches along a feeder (eg: reclosers) which reduce the number of customer impacted by a failure.

It should be noted that segmentation is less critical on closed ring networks, (such as subtransmission networks) as single outages do not generally result in customer interruptions.

Response times

Response times only impact SAIDI, which measures the duration of total interruptions experienced by a customer in a year. Response times are governed by:

- Technology on the network which helps to detect and restore supply quicker than manual intervention.
- The network characteristics. For instance, a fault in a remote or difficult access area will take longer to respond to than a fault in an urban area. Similarly, an underground cable fault will generally take much longer to repair than an OH system failure. The long repair times for cables will generally require some level of redundancy to keep outage times within acceptable durations.
- Resourcing and operational setup of organisation. (The more staff available to restore supply the lower the duration of interruption.)

Outage durations will increase if there is large dependence on manual technologies, or the type of outage is more complex to detect and repair. Reliability may also decline if there are less resources available to respond to incidents.

What contributes to interruptions occurring on our network?

Failures on the 11kV network are the most significant contributor to reliability performance, accounting for 67 per cent of SAIDI in the 2012-13 financial year. In contrast, our subtransmission network accounts for 11 per cent and our low voltage network accounts for 22 per cent.

Our historical experience is consistent with the design of our network in terms of redundancy and customer segments.

- We design our subtransmission network with a high degree of security. The network generally provides at least some level of alternative supply if a critical element fails, which minimises customer impacts. This underscores the critical role of the subtransmission network where an outage is likely to impact a large number of customers. Historically, a significant amount of the reliability impact of the subtransmission outages has arisen when a system element fails and another component is already out of service (for example, for maintenance, repair or new construction).

- Our urban 11kV network also has a degree of redundancy, which generally provides for supply to be restored via local switching if an element fails. Whilst we do not always provide for redundancy on the 11kV network in non-urban areas, Ausgrid's network has some residual redundancy based on existing high voltage interconnections. When an 11kV interruption occurs a far greater number of customers are impacted than would occur as a result of a defect in a low voltage section of the network.

- The relatively low impact on reliability of the LV system is reflective of the high level of segmentation. The close proximity of distribution substations in urban areas provides a level of inherent redundancy through manual interconnection of the LV network.

When do we invest?

In NSW, the Government imposes licence conditions that require a DNSP to provide a minimum level of reliability to its customers. Schedule 2 and 3 of our Reliability and Performance licence conditions relate to reliability performance targets:

- Schedule 2 provides limits for average performance of feeders in the CBD, urban, short rural and long rural areas. The limits relate to duration (SAIDI) and frequency (SAIFI) in a year.

- Schedule 3 provides thresholds for investigating and managing individual 11kV feeder performance in respect of duration and frequency of outages. These thresholds are targeted at providing minimum standards for customers supplied from Ausgrid's worst performing feeders.

Our licence conditions effectively set a minimum level of performance which we must achieve. We invest in reliability projects to improve average performance where forecast performance does not meet our compliance targets within the required confidence interval (which makes allowance for the natural variability of reliability outcomes)l. When making this assessment we take into account how other programs of work including augmentation and replacement will impact reliability performance.

Investigation to address individual feeder performance occurs reactively once feeders exceed the threshold of performance. In many cases performance outside the thresholds may be due to one off events which do not require further action or can be addressed through operational measures. Capex investment is only implemented if it is confirmed that prudent remedial actions are required. Similar careful assessment is made of groups of customers in feeder segments to determine whether remedial action is warranted under the licence conditions.

Ausgrid also invests when appropriate in several areas that are not covered by the Licence Conditions and in response to incentive programs such as

- Wide Area Outages – reactively improve systemic issues that have resulted in high impact outage events

- STPIS - proactively in reliability projects that are expected to provide a substantially positive STPIS return.

1. Outcomes last period

Our customers experienced a significant improvement in reliability in the 2009-14 period. We augmented the distribution network to meet new design standards, and invested in specific reliability programs to achieve new performance targets.

The purpose of this section is to identify reliability performance improvements we delivered to our customers in the 2009-14 period. We look at how our specific reliability investments complemented changes to our design standards on the distribution network.

1.1 Overall performance

After a generation of under-investment in the 1990s and 2000s, we started to experience a decline in reliability performance in the early 2000s. This was a result of increased utilisation of assets and increase in the age of assets on our network.

In response to concerns about the reliability and security of the network, the NSW Government introduced new licence conditions in 2005, which were later revised in 2007. The new licence conditions included:

- Reliability input criteria – We were required to ensure that the design of the network was appropriate to avoid reliability incidents. The licence conditions set limits on the allowable utilisation of feeders and substations. They also required a minimum level of security on the network, with enhanced redundancy of the subtransmission and critical CBD area.
- Reliability output criteria – We were required to meet average reliability performance targets and individual feeder targets that became steadily more stringent from 2005/06 to 2010/11.

Our 2009-14 regulatory proposal included a substantial program of works aimed at achieving compliance with the licence conditions. The overall impact of the 2009-14 program has seen a significant improvement in reliability.

On average, an Ausgrid customer experienced almost 20 minutes less interruption time in FY2012, compared to FY2005. The frequency of interruptions has also trended down over this time.

Our investment program means that we are on track to meet the average reliability performance requirements of our licence conditions. We have also managed our individual feeder performance in accordance with our licence conditions. This is discussed in section 1.2 and 1.3 below.

We also invested in a small individual customer program with a total expenditure of $1.2 million (nominal) in the 2009-14 period. This program was directed at ensuring that customers who experience the most interruptions did not experience a further decline in performance.

In overall terms, Ausgrid anticipates a total reliability program expenditure of $62.6million in the 2009-14 period, compared with the regulatory allowance of $71.4million.

1.2 Compliance with average performance (Schedule 2)

Ausgrid's goal was to comply with the reliability standards specified in our licence conditions. As these standards are mandatory, and annual performance historically fluctuates, Ausgrid targeted performance levels which provided a 95 per cent probability of compliance in each of the 4 targets in any year for urban and short rural feeder categories.

The CBD feeder category is subject to a high degree of annual variation in performance due the occurrence of high impact low probability events. The underlying reliability performance for the CBD category is well within the standards in the DRP Schedule 2. The standards would only be exceeded due to the occurrence of one or more high impact low probability events. Due to the unpredictability of these events, Ausgrid mitigates the risk associated with these events reactively. Ausgrid's CBD management targets have been selected to be equal to the corresponding DRP Schedule 2 standard.

The Long Rural feeder category contains a small number of feeders (4). It is therefore not appropriate to determine management targets on the basis of probabilistic statistical analysis. The Long Rural management targets have been selected to be equal to the corresponding standards in the DRP Schedule 2. This target is managed by monitoring the individual performances of each Long Rural feeder every quarter and initiating an investigation whenever an individual feeder performance exceeds the DRP Schedule 2 standard on a 12 month rolling basis. Improvement projects are initiated on a reactive basis where justified and economically prudent.

As can be seen in Figure 2, our historical reliability performance fluctuates from year to year. The non-compliance of urban SAIDI in 2010/11 partly as a result of a 7-day record heat wave in February 2011 is an example of such a random non-compliance.

However there has been an underlying systematic improvement in reliability and we achieved compliance with the reliability performance targets by 2014.

A significant contributor to improved reliability was augmentation works (particularly of the 11kV network) to meet the then security standards (design standards) under our licence conditions.

Replacement programs during the period were primarily targeted at the subtransmission network. Whilst these reduced the risk of major, excluded outages the inherent redundancy of the subtransmission network meant that the impact of the subtransmission asset replacements on the reliability performance was not expected to be material. At a distribution level, the replacement program was insufficient to arrest the ageing of many components of the system.

As our analysis in 2008 indicated that the forecast capital program would not provide the level of improvement necessary to meet Ausgrid's compliance targets we also invested in a moderate program of reliability specific works aimed at improving SAIDI and SAIFI for the segments of the network which were at risk of non-compliance.

Impact of augmentation programs

The key contributor to improved reliability was augmentation works on the 11kV network. As noted in Section 1, faults on the 11kV network contribute almost 70 per cent of SAIDI and SAIFI.

Under DR&P licence conditions we were required to meet new security standards, including ensuring that assets were not overloaded and that supply should be restored within 4 hours of the failure of an urban distribution feeder. Compliance with this criterion required the installation of additional 11kV feeders which increased the segmentation of the 11kV network with resultant improvements in reliability.

Our augmentation works on other elements of the network had a less significant impact on reliability outcomes.

- Subtransmission network – We ensured that the utilisation of assets was managed and provided increased redundancy in the CBD. The major reliability impact of the CBD program is to further reduce the probability of low probability, high impact events. Such events are extremely disruptive to the community and the economy.

- Low voltage network – The main impacts of managing distribution substation utilisation is to minimise overloads, and in particular manage the risk of catastrophic failure resulting from significant overloading.

Impact of replacement program

Our replacement program was primarily targeted at managing the risk that would have occurred from rapidly deteriorating subtransmission assets. Overall the impact of the replacement program is believed to have been neutral because:

- Our replacement was directed at critical subtransmission assets. By targeting assets that are nearing the end of their service life but before they were expected to have functional failure, we reduced the likelihood of potential large scale outages. In addition, subtransmission incidents are usually only a small contributor to reliability performance due to the high degree of redundancy of the system. Because of this inherent redundancy equipment failures generally only result in outages during circumstances which are not considered by normal planning criteria. Such events include faults in 11kV switchboards and concurrent outages of two or more critical components. Due to the high impact and long restoration times, these events can have a significant impact on the community. We made allowances in our reliability forecast for configuration changes associated with the replacement program that could impact reliability (the improved reliability of 132kV zone substations that replace 33kV zone substations).

- Our replacement of assets on the distribution network was not sufficient to arrest the ageing of many of our assets, and therefore may have potentially contributed to deteriorating reliability. Ageing of assets is seen somewhat as a surrogate for asset condition. Any such deterioration in reliability outcomes has been more than offset by the investment in distribution assets to improve supply security over the period.

Impact of reliability compliance investments

Another important contributor to improving average feeder performance was Ausgrid's program to address individual feeder performance (Schedule 3 of the licence conditions.) Whilst this program is targeted at a relatively small number of the worst performing feeders, the reliability benefits of this program also contribute to maintaining Schedule 2 Reliability Standards compliance.

In recognition that the other programs would not be sufficient to achieve the new performance targets, we proposed a $30 million (nominal) program to bridge the gap between our forecast reliability and our internal compliance targets. This proposed expenditure included:

- A program aimed at increasing the segmentation of the network and reducing restoration times by the targeted installation of reclosers and switches.

- Long Rural program – incorporating the installation of a new 27km distribution feeder into the Laguna area to create 2 Short Rural feeders by splitting our worst performing Long Rural feeder, the Paxton 48039 feeder.

Our expected spend on this program is forecast as $11.0 million (nominal), which is in $19 million (nominal) less than our 2008 proposal. The spend is less than proposed for two reasons:

- The proposed new distribution feeder in the Long Rural program was not proceeded with because of a significant improvement in the performance of the Paxton feeder following asset management works funded under opex and other capex programs.

- Many of the new reclosers and switches were installed under the Schedule 3 program rather than the Schedule 2 activities.

1.3 Compliance with individual feeder reliability (Schedule 3)

The Schedule 3 Individual Feeder Standards are intended to limit the extent of interruptions of the worst performing parts of the network. The Licence Conditions require a routine quarterly investigation of any feeder which exceeds the Schedule 3 Individual Feeder Standards and actioning as appropriate.

As the average performance criteria (Schedule 2) present an average outcome of all feeders in a category, work to manage individual feeder performance may be necessary even though the average feeder performance is compliant with the targets.

Estimates of the likely capital expenditure needed for the 2010-14 period were based on the known historical feeder reliability and on a limited set of reliability works, including reducing outages in areas of high environmental vulnerability by replacing bare high voltage conductors with covered conductors, and providing increased segmentation through the installation of reclosers and sectionalisers. Our 2008 forecast expected that to maintain individual feeder compliance, remedial action would be required on 107 feeders over the 2010-14 period with the number of feeders requiring action declining over the period from 30 in FY10 to 15 in FY14[4]. The overall program cost was estimated to be $34 million (nominal).

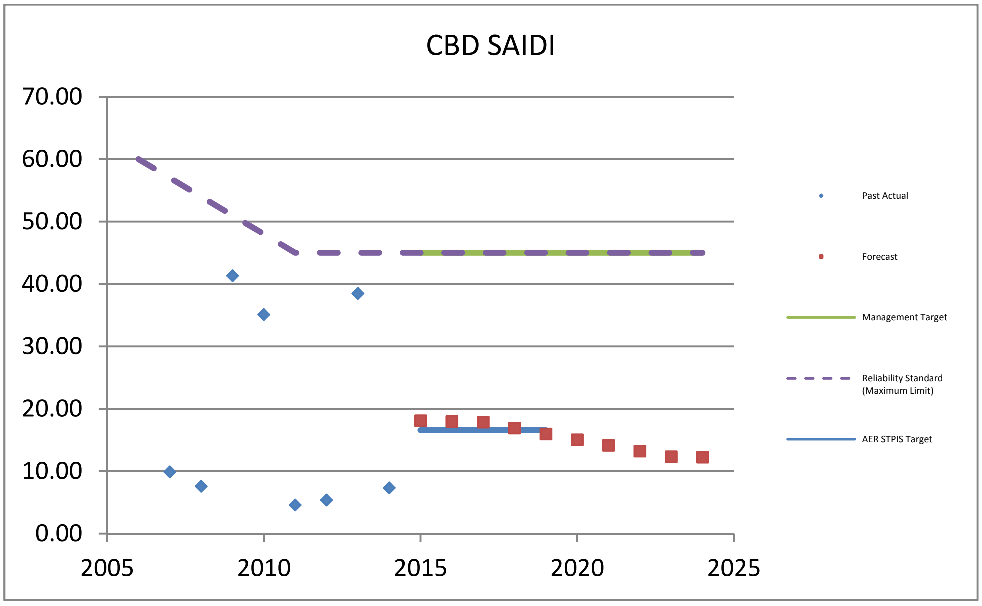
[4] Reliability Investment plan Proposed Expenditure 2010-14. Pp12

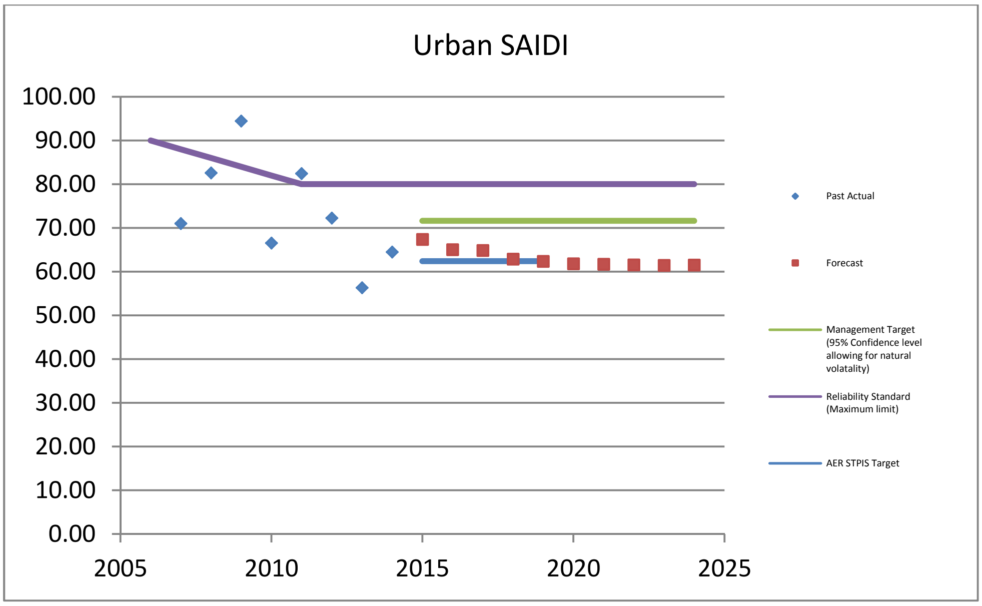
Whilst Ausgrid has largely met its compliance obligations for this program [5] the forecast actual expenditure on this program is $43.7 million (nominal) for the 2009-14 period. Going forward we have increased data on which to base our analysis for 2014-19[6] which will provide more accurate forecasts.

1.4 Analysis of performance in 2009-14

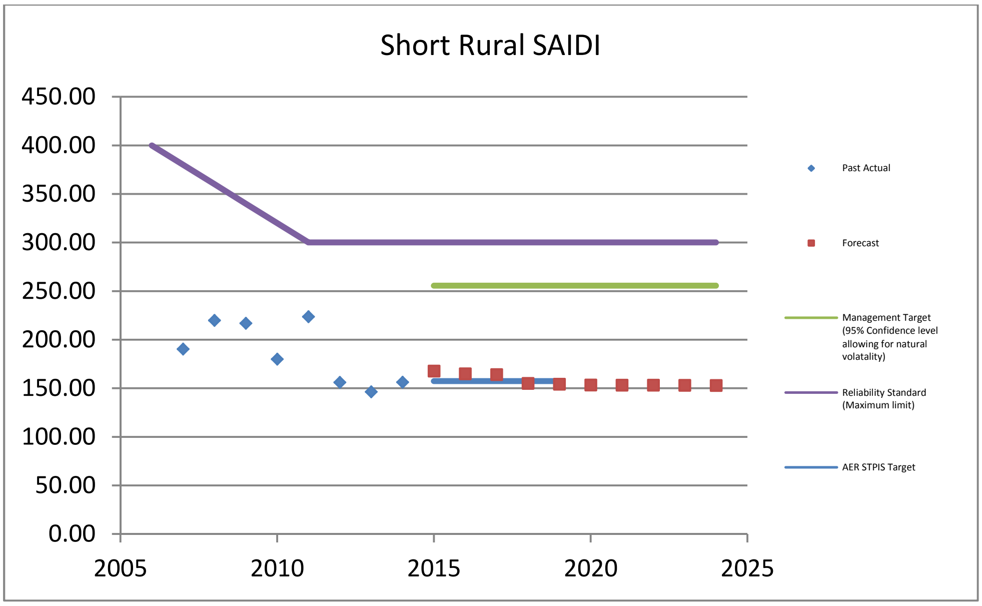
Figure 2 and 3 below show our performance on SAIDI and SAIFI over the 2009-14 period.

Figure 2: Average duration of outage per customer by segment type





[5] with the non-compliances being limited to one Operational action in 2009/10, and one Capital action in 2011/12.
[6] Refer "Indiv Fdr works Prog forecast 2014-29.xlsx"


Short Rural SAIDI
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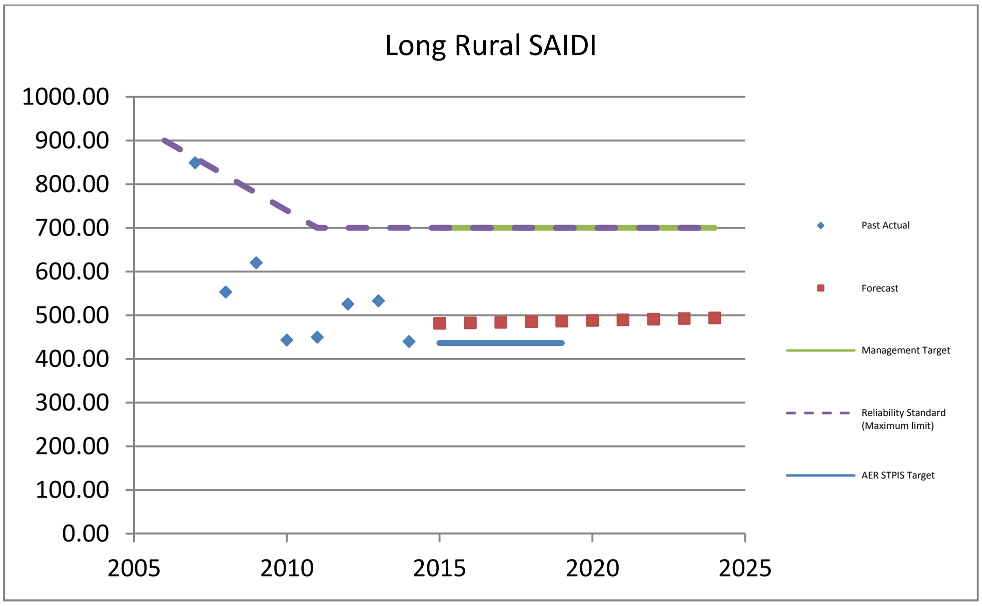
Past Actual
Forecast
Management Target (95% Confidence level allowing for natural volatality)
Reliability Standard (Maximum limit)
AER STPIS Target


Long Rural SAIDI
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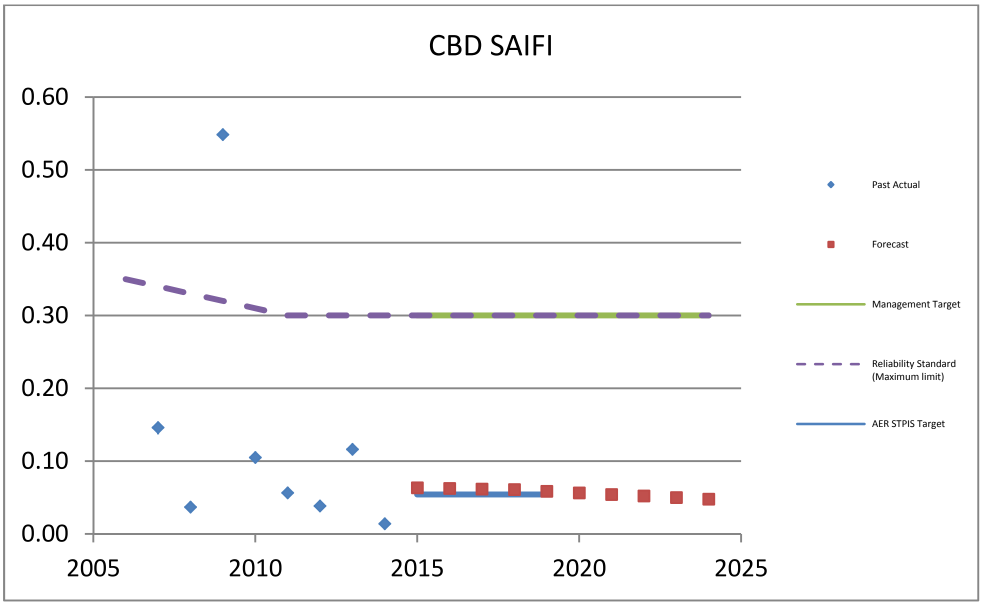
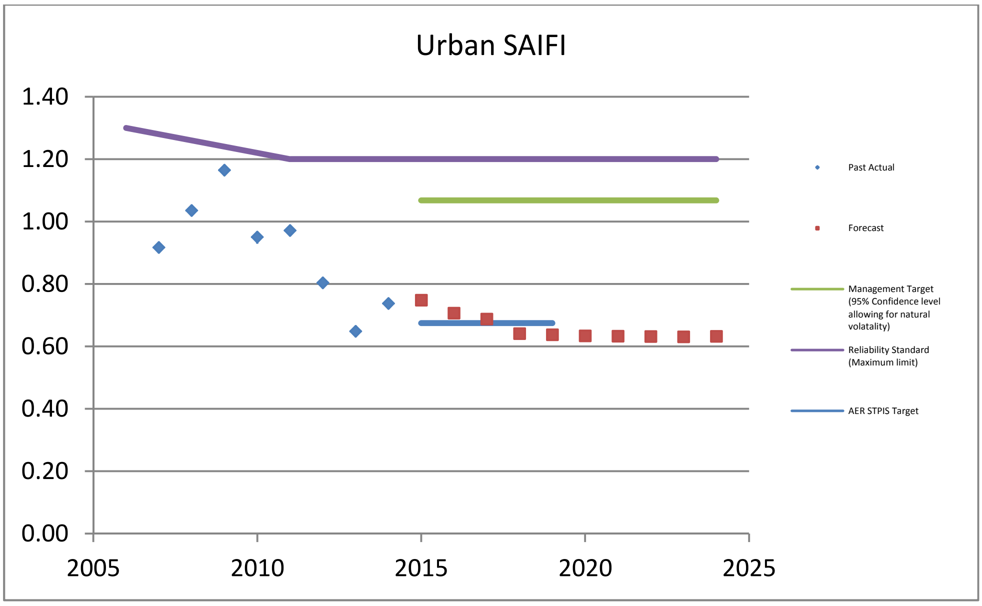
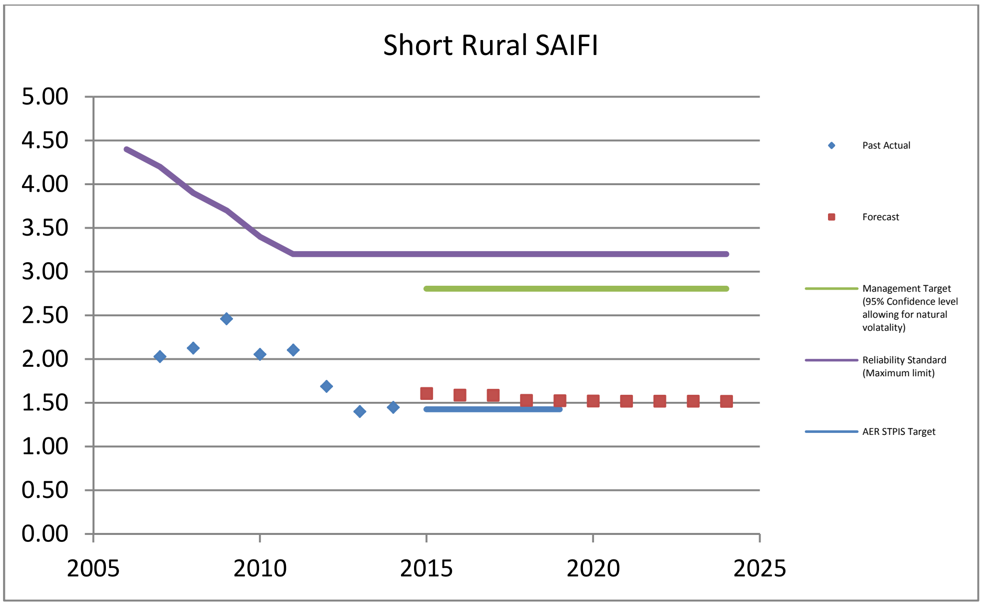
2025
Past Actual
Forecast
Management Target
Reliability Standard (Maximum limit)
AER STPIS Target

Figure 3: Average frequency of outages per customer by segment type






Short Rural SAIFI
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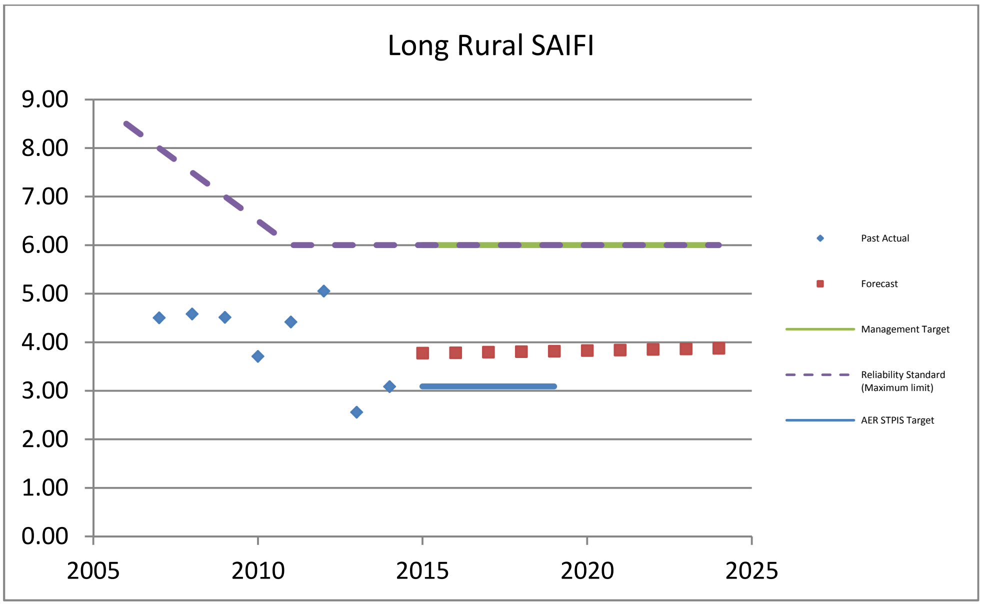
Forecast
Management Target (95% Confidence level allowing for natural volatality)
Reliability Standard (Maximum limit)
AER STPIS Target


Long Rural SAIFI
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5.00
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2025
Past Actual
Forecast
Management Target
Reliability Standard (Maximum limit)
AER STPIS Target

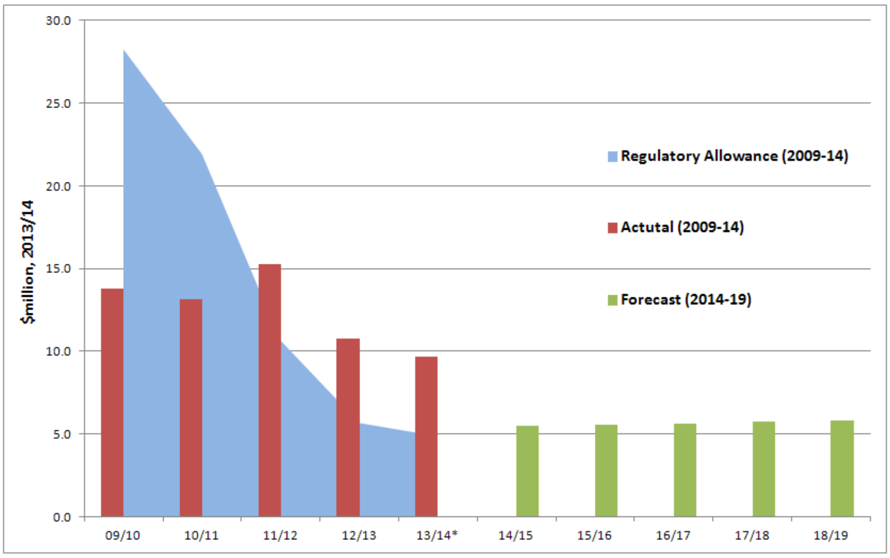
2. Reliability Strategy

Our strategy for the 2014-19 period is to maintain reliability performance and comply with regulatory requirements at minimum cost. Any decision to invest under the STPIS will carefully consider whether our customers truly value the improvement.

The purpose of this section is to identify the key circumstances driving Ausgrid's reliability compliance capex in the 2014-19 period.

At a high level, it can be seen that the proposed reliability capex is significantly lower than actual expenditure in the 2009-14 regulatory. In total, our proposed capex will be 55 per cent lower than forecast actual expenditure in the previous period (by $34.3 million).

Figure 2: Actual and forecast reliability capital expenditure (2009–14 and 2014–19)



The investment will be principally directed at meeting our compliance obligations under Schedule 3. We have no reliability specific investments to meeting average performance targets as our reliability forecast shows that our ongoing investments in replacement and capacity programs will be sufficient to maintain satisfactory reliability performance under our compliance obligations.

In the sections below we show that the focus of our reliability strategy and the drivers of expenditure including:

- Maintain compliance with our licence conditions at minimum cost – Our program only focus on performance targets in our compliance obligations. We have proposed a very modest funded capex for maintaining performance for our worst affected customers and none for programs which mitigate wide scale outages. This is part of our broader strategy to minimise price impacts for our customers.

- Respond to STPIS incentives only if our customers benefit - Our strategy will be to respond to the incentives if we consider there is a significant positive commercial value under the scheme (ie certainty in delivering the required benefit realisation), and if the investment is likely to be valued by our customers.

- Long term strategic considerations - As a prudent asset manager, we also consider strategic developments that impact reliability performance in the long term. For example, we are currently undertaking work to examine the impact of climate change on reliability performance. We also explore technological opportunities and innovations that can achieve reliability outcomes cost effectively.

2.1 Maintain acceptable reliability at minimum cost

Ausgrid's reliability plan is designed to ensure that we maintain reliability performance at all levels of the network and maintain compliance with our licence condition obligations. Ausgrid proposes capex to address the feeders not meeting Schedule 3, including addressing poor performing feeder segments.

- Feeder Segments (Groups of Individual Customers) – This element responds to the legitimate concern that individual customers (or small groups of customers in a location) may experience significantly worse reliability than average or individual feeder statistics indicate. This is particularly an issue where feeders are highly segmented and one segment may experience much worse reliability than the feeder as a whole. Without consideration at the more granular level, persistent poor performance may go unaddressed. Ausgrid manages this category in a similar way to the individual feeder performance – with regular identification of poor performing feeder segments investigated (including consultation with customers about their reliability and needs) to identify where investment is warranted.

- Wide Area Outages (WAO) – Wide Area Outages are high impact events that affect large numbers of customers over a large geographic area as a result of a single event. They have the potential for severe effects, both direct and consequential. An example of a WAO is the interruption to Canterbury Subtransmission Substation that caused the closure of the Sydney M5 tunnel and disruption of the railway system during the afternoon peak hours. Analysis of the causes of recent poor WAO performance shows that although operational improvements and mitigation actions were developed and implemented to address the root causes of the outages, no specific reliability investments were justified. It may be necessary to invest to manage new WAO risks that are identified during the next period, however no allowance has been made in our regulatory submission as none are currently identified for investigation or action.

2.2 Respond to STPIS incentives where valued by customers

STPIS investments are optional and will be made where the expected benefit from a reliable and persistent improvement in category performance exceeds the whole-of-life cost, and they are consistent with Ausgrid policy. In particular, Ausgrid does not intend to invest unless it is confident that benefits will be realised and our customers will value the improvement.

The STPIS is a new scheme and we have little experience with it. Our initial investigations have not identified any projects where returns could be secured sufficiently reliably to be certain that they would exceed costs. Because the scheme is incentive based, STPIS investments are not included in the regulatory building blocks that underpin the determination.

On this basis, we have not planned for any expenditure in this area. This position will be reviewed once the targets have been determined by the AER and the impacts of the new incentive mechanisms are clear.

2.3 Long term sustainability

As a prudent DNSP, Ausgrid monitors developments that impact long term reliability outcomes. These include issues such as the long term health outlook of assets, the impact of climate change, and new technologies. Each of these are discussed below.

Asset condition

Short term decisions to reduce capex may not result in immediate negative impacts to reliability. However, in the long term these decisions may result in a significant and escalating deterioration in reliability.

For example at the time of replacing 132kV gas cables (908 and 909 feeders) we had experienced six failures over a period of 4 years, with repairs taking 2-4 months to carry out. Such poor availability meant that the retention of these assets in service presented a significant risk to the security of the system.

Ausgrid's replacement program has considered these long term issues and developed a sustainable program that does not jeopardise long term performance.

Monitoring the impact of climate change

We are currently researching the impacts of other factors (including new technology and weather changes) that can impact reliability performance.

Research into the effects of external influences (eg effects of variable weather conditions, long term climatic changes, or corrosive and pollution or salt-laden environments) may inform future network and asset design development to be more resilient to these effects.

Research into new technologies

Ausgrid is an industry leader in adopting innovative cost effective new technologies and practices to improve reliability outcomes, and lower the cost to serve in the long run. Technologies include:

- Remote control and automation – these technologies help us to detect faults on the network, enabling us to isolate the fault such that less customers are affected, and limit the duration of an outage.
- Sectionalisation devices: these provide the ability to isolate a fault so that it affects less customers

3. Forecast method and outcomes

We have relied on high level analysis to identify investment to maintain compliance with Schedule 2 and 3 of our licence conditions. Based on our models we forecast capex of $28.3 million for our individual feeder compliance, and no capex to meet our average feeder category reliability targets.

The purpose of this section is to provide an overview of the process used to derive our 'reliability specific' capex for the 2014-19 period.

3.1 Forecast Methodology

We have used a modelling process, rather than a bottom up assessment to identify needs and costs. Bottom up planning can only be undertaken closer to the date of expenditure as much of the reliability program is reactive and therefore relies on up to the minute information about the location of poorly performing individual sections of the network.

The Reliability Investment Plan includes any additional capex specifically required to meet reliability performance standards in the NSW Reliability and Performance Licence Conditons. These relate to average and individual reliability performance of 11kV feeders and feeder segments.

A modelling approach has been used to determine expenditure requirements. This includes forecasting future average reliability performance of each feeder category with allowance for planned capex in the 2014-2019 period. Reliability improvement project requirement are identified to address any forecast gap between the reliability forecasts and the standards. Ausgrid also forecasts requirements for reactive reliability improvement projects at the individual feeder and feeder segment level based on historical performance. Investment requirements are then developed based on average historical reliability project costs.

Forecast methodology

The forecast 2014-19 period reliability capex requirements model is simply based on an assumed number of projects based on the past 5 year average historical number of feeders exceeding the Schedule 3 Individual Feeder Standards, the 5 year average historical number of projects that ensue from those feeder investigations, and the 5 year average historical reliability capex expenditure for these types of projects.

The forecast 2014-19 reliability impact is likewise based on the 5 year average historical CMI saved per project and is collated into the Schedule 2 Reliability Standards analysis sheets.

Impact of Other programs

Other programs would only impact on this works program if the augmentation or replacement works under the other plan fixed a poorly performing feeder. Our forecasts for the individual feeder program are based on historical performance and the numbers of projects previously undertaken. Historically works under this program were only initiated where issues would not be addressed by other programs. As the basis for our individual feeder forecasts already excludes the impacts of other programs, the forecasts should likewise be restricted to works which are not addressed by other capacity or replacement programs.

3.2 Capital program proposed

We have proposed a program of $28.3 million as seen in the Table below.

Table 1: Forecast expenditure for the 2014–19 regulatory period ($ '000, 2013/14)

	2014/15	2015/16	2016/17	2017/18	2018/19	Total
TOTAL Reliability Program	**5,520**	**5,586**	**5,659**	**5,745**	**5,831**	**28,341**
Individual Feeder	4,516	4,571	4,629	4,698	4,768	**23,182**
Individual Feeder Segment	795	804	814	826	838	**4,077**
Support Costs						
Switching and control	40	40	41	42	44	**207**
GIS data capture	169	171	174	178	182	**874**

Individual feeder compliance program (Schedule 3)

The trigger for investing to meet our Schedule 2 licence conditions is when:

- We identify that a feeder exceeds the thresholds in the Schedule 3 licence compliance obligations; and
- Investigation of the feeder indicates that the feeder will continue to exceed the threshold into the future, unless remediation action is taken.

While our regular BAU processes are capable of identifying need for individual feeders, it is difficult to forecast individual feeders for an upcoming regulatory control period. Individual feeder performance can vary significantly from year to year and is impacted by a range of factors which cannot be forecast in advance. For example the connection of new customers to a feeder or feeder augmentation may result in the feeder category changing with consequential alteration of performance targets.

For this reason we have used a model to estimate the volume and costs of works for the 2014-19 period. The model is based on expenditure in the previous period.

For each feeder category, we used 5 years of historical data of the number of feeders that we investigated as a result of exceeding thresholds, and those that were found to have required remediation. We then calculated the average cost of these projects and multiplied this by the volume of works.

Based on our modelling, we forecast that we will need to remediate 56 feeders at a total cost of $23.2 million.

Individual customers (feeder segments) program (Schedule 3)

Investment will be initiated where Ausgrid assesses that groups of customers supplied by a common high voltage feeder segment are consistently experiencing poor reliability associated with outages occurring on their feeder segment when compared to other distribution feeder segments in the same feeder category, and a cost effective solution is viable.

The investment threshold is when:

- We identify that a feeder section has a poor reliability performance over at least 3 or more 12 month rolling periods (worse than 95% of other distribution feeder sections in the same feeder category); and

- Investigation of the feeder section indicates that the feeder section will continue to exceed the threshold into the future, unless remediation action is taken, and no action is already planned under another program; and

- The cost of improvement is considered technically and economically feasible and justified.

It is difficult to forecast individual feeder sections for an upcoming regulatory control period. Individual feeder section performance can vary significantly from year to year and is impacted by a range of factors which cannot be forecast in advance.

For this reason we have used a model to estimate the volume and costs of works for the 2014-19 period. The model is based on works and expenditure in the previous period on individual feeders.

Analysis of annual reliability outcomes for two successive quarters ending in September and December 2013 shows approximately 60 feeder sections per year meet the criteria for investigation, with approximately two thirds of these sections already having an improvement plan in place from other programs. Based on the proportion of whole feeders meriting investment, we have forecast six feeder section projects will be justified each year under this program. We used 5 years of historical data of the number of feeders that we investigated as a result of exceeding thresholds, and those that were found to have required remediation. We then calculated the average cost of these projects at $127,000 (in December 2012 constant dollar) and multiplied this by the volume of works.

Based on our modelling, we forecast that we will need to remediate 30 feeder sections at a total cost of $4.1 million over the 2014-2019 period to address small groups of customers in a location who are experiencing significantly worse reliability than individual feeder statistics indicate. Feeder section performance can particularly be an issue where feeders are highly segmented by automatic protection devices (such as pole mounted reclosers) and one segment may experience much worse reliability than the feeder as a whole. By its nature, despite its importance to the individual customers affected, this program is not expected to have any material impact on Ausgrid's performance in meeting its reliability licence compliance obligations which relate only to feeder category and individual (whole) feeder performance.

STPIS benefits from reliability investments

It is recognised that there will be a performance improvement from reliability investments that will result in a STPIS benefit, and hence there is a need to avoid double dipping on the funding of the reliability investment program.

Feeder reliability performance is assessed each quarter on a rolling 12 month average. Where a feeder is shown to exceed licence condition thresholds, it is investigated and modelled for augmentation. During project development, the current performance is modelled against the proposed project performance improvement. The overall performance gain over a five year period will be less than the one off initial annual performance indication and consequent STPIS benefit. A feeder's reliability performance varies stochastically from year to year. Analysis of feeder performance over an extended period shows typical STPIS benefit realisation is 72% of the one off gain modelled on the expected maximum reliability improvement.

STPIS benefits from reliability Investments

$'000	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Reliability expenditure	$2,053	$4,450	$4,473	$4,278	$4,261	**$19,516**
STPIS offset	-$2	-$578	-$1,038	-$2,193	-$2,755	**-$6,565**
Net capital expenditure	**$2,051**	**$3,872**	**$3,435**	**$2,086**	**$1,507**	**$12,951**

The requirement for capital expenditure for reliability remediation of $28.3 million ($19.5million, $2013-14 real excluding overheads) is required for the 2015-19 regulatory period, but with an offset of $6.6m to account for the proportion that would be expected to be funded by marginal STPIS revenue. As a result the amount to be included in the standard control capital expenditure items for revenue modelling has been reduced by the long term STPIS offset.

Average reliability standards (Schedule 2)

Investment is initiated where we forecast that we will not achieve our Schedule 2 licence conditions with an adequate confidence level for each of the 8 targets.

For the 2014-19 proposal, we have used a modelling approach (Ausgrid's Reliability Forecasting System) to assess whether a trigger will occur for SAIDI or SAIFI in a feeder category. This involved a 2 step process where we estimated the 'starting point' which is the average reliability of the past five years, and estimated the ongoing impact for each subsequent year.

In developing our model, we comprehensively identified key factors that may deteriorate or improve reliability from current performance. The following factors were considered:

- Change in failure rates, and therefore expected failures of equipment – When assets fail, it may cause outages to customers, particularly in cases where there is limited redundancy (back up of supply) in the network. Ausgrid aims through its replacement investment plan for the next period to maintain reliability levels by preventing increases in failure rates. We aim to replace assets just prior to the increase in failure rates that occurs close to the end of asset life (the "bathtub curve"). Our model has therefore included a zero impact from the replacement and maintenance programs except for the upgrade of zone substations from 33/11kV to 66/11kV or 132/11kV which typically has a slight reliability improvement.
- Improvements in security of supply – We expect to achieve the step change in security required by our licence conditions, and are therefore in a 'steady state' of security. This step change in security has greatly assisted in delivering compliance with our reliability condition obligations, particularly by providing improved redundancy in the distribution network. Whilst the design standards (supply security requirements) have now been removed from the ministerial licence conditions, there is no material reliability decline from the changes in ministerial licence conditions.
- Change in segmentation and the impact of increased infrastructure to meet new customer growth – Our modelling has sought to understand how extension of the network to accommodate new customers will impact reliability outcomes. However we have also modelled the countervailing impact of increased segmentation as a result of new feeders. Overall we expect that there will be a slight reduction in the average network segment size over the next period which will result in a slight improvement in reliability for all feeder categories except Long Rural which sees a slight deterioration.
- Changes in technology and practices – Our proposed program of works does not include any change to our existing designs and technologies. We have however modelled the positive impact to reliability from a greater proportion of underground assets.

Further description of our Reliability Forecasting System (RFS) methodology can be found in RFS Methodology Report (Document ID68195).

The RFS found that Ausgrid's previous and current investments would be sufficient to maintain compliance with Schedule 2 of DRP licence conditions, and that no further reliability compliance investment was required.

Related Documents

ID68195 – Feeder Category Reliability Forecast Methodology

ID33258 – Feeder Category Reliability Forecast System

ID24884 – Proposed application of STPIS for the 2014-19 regulatory control period

AER November 2014 Draft Determination