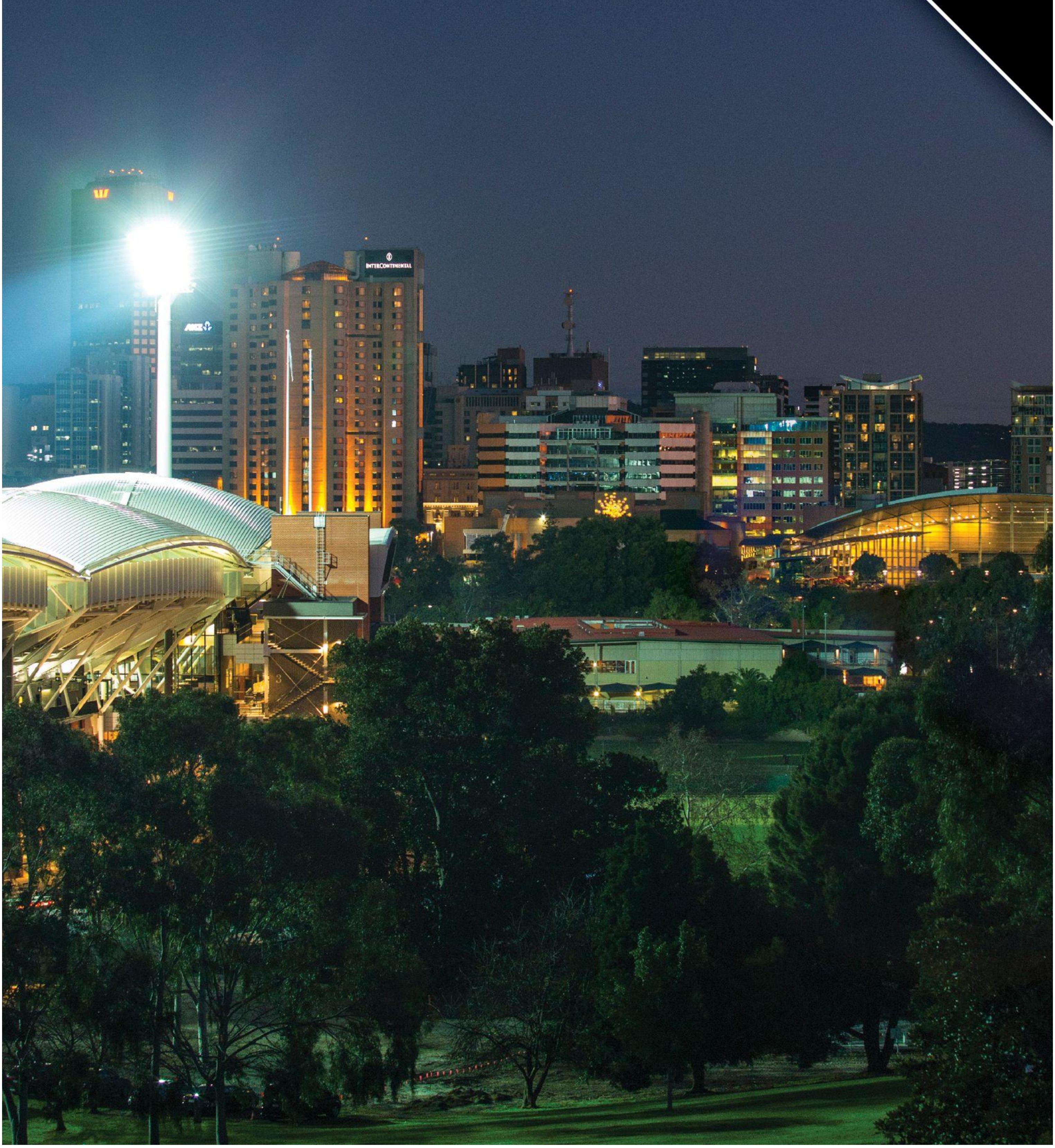
Attachment 21.24

SA Power Networks:
Asset Management Plan 3.4.01
Metering 2014 to 2025

August 2014

SA Power Networks



ASSET MANAGEMENT PLAN 3.4.01 METERING

2014 TO 2025

Published: Aug 2014

SA Power Networks
www.sapowernetworks.com.au

OWNERSHIP OF STANDARD

Procedure 916 Annex B
Issue 2/13

OWNERSHIP OF STANDARD

Name of Standard / Manual: ***AMP 3.4.01 - Metering***

Standard/Manual Owner - Title: ***Manager Network Asset Management***
Name: ***S Wachtel***

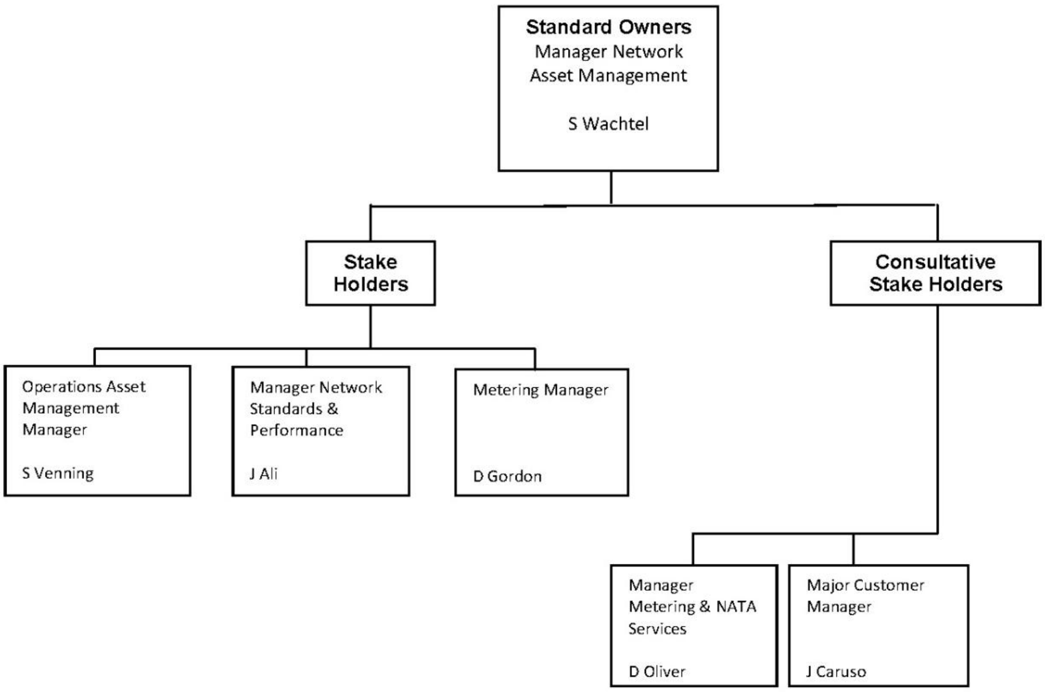
Standard Last Reviewed: June 2014

Standard Last Issued: xxxx 2014

Review Period: 5 years

Next Review Due: xxxx 2019 *(ie. When the next review process is due to commence)*

STANDARD/MANUAL OWNERSHIP STRUCTURE



OTHER RELATED MANUALS

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COMMENTS

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(Asset Management Plan 3.4.01 - Metering)

DOCUMENT REVISION

Date	Version	Explanation
May 2009	0.1	Original AMP
June 2014	0.2	Updated AMP

Contents

1. EXECUTIVE SUMMARY

SA Power Networks comprises of 1,115,200 meters supplying 820,400 customers. The main cost driver for the Meter AMP is compliance to regulated inspections. As meters are a revenue based asset, accuracy requirements are closely scrutinised by the retailer, customer and SA Power Networks.

1.1 Metering equipment

The Network population consists of the following types of assets:

Type	Sub part	Situation	Regulation Sub-class
Direct connected (or whole current)		Low amps- mainly residential	1
Transformer type has 2 parts	a. Transformer connected meters	High amps - mainly commercial and industrial	2
	b. Metering transformers	High amps - mainly commercial and industrial	3
Other devices	Time switches	Controlling off peak loads	Not regulated
	SWD units	Switching controls remotely across power lines	Not regulated

The first photo is of direct connected meters. From basic single element→single element, import/export meter→electronic→ 2 element (J and M tariff).

The second photo is the transformer type. It has 3 coloured bus bars with voltage and current transformers on each, fuses and a combined meter.

Meter data and size reference (see Appendix 6 for more)

Type	Data measurement	Size
7	No meter	Not specific
6	Basic meter- manually read	<160 MWh (in SA)
5	Interval meter- manually read	< 160 MWh (in SA)
4	Interval meter- remotely read	< 750 MWh
3	Interval meter- remotely read	0.75-100 GWh
2	Interval meter- remotely read	100-1000 GWh
1	Interval meter- remotely read	>1000 GWh

1.2 Expenditure

The business expenditure is primarily driven by the inspection and testing of meters.

The testing finds "failures" which are those meters not within the allowable accuracy limits of the National Electricity Rules - Chapter 7 (see Appendix 6) and AS1284 Electricity Metering -part 13 covers In Service Compliance testing (see Appendix 4 for examples). Failures are dealt with by

- any individual meters that fails is rectified immediately (this is unplanned expenditure), in addition to which
- if enough meters in a series statistically fail, then the whole series is replaced (this is planned expenditure).

The management strategy found to be most reasonable (prudent and efficient) is

- replacement for the smaller direct connected meters and
- repair for the larger transformer based meters is considered as an option.

The overview of the tasks and subsequent expenditure is as follows (see diagrams below)

- Capex is about 2.5 times the average Opex cash flow.
- While the opex tasks are dominated by direct connected meters, the cash flow of transformer based equipment is half the total due to their specialised test requirements.
- The capex cash flow is dominated by direct connected meters as most transformer based equipment is robust and is repaired rather than replaced if there is a problem.
- From the Cash flow tables, it can be seen that the planned work dominates the Capex as it is required replacements of failed series of meters.

TASKS

[redacted]

1.3 Trends/changes since last AMP

[redacted]

2. INTRODUCTION

The distribution network that delivers electricity to homes and businesses throughout South Australia is owned and operated by SA Power Networks. Electrical energy is supplied to more than 820,400 customers via revenue quality metering equipment maintained in compliance with National and State regulations.

SA Power Networks is responsible for approximately 1,115,200 meters installed in the distribution network and also has responsibility for reading meters in South Australia on behalf of electricity retailers who subsequently bill customers for the quantity of power consumed.

National and State regulatory authorities require details of SA Power Networks metering management in compliance with:

- National Electricity Rules (NER), Chapter 7
- National Electricity Market Metrology Procedure
- Accreditation by the Australian Energy Market Operator (AEMO) for the role of Metering Provider
- Electricity Metering Code (Administered by the Essential Services Commission of South Australia)

SA Power Networks is registered as a Metering Provider (MP-B) in the National Electricity Market and is accredited for metering service provision in several metering installation categories listed in Appendix 1.

Techniques for metering maintenance management, that are implemented in compliance with appropriate regulations, generally comprise different procedures for inspection and testing of the various metering equipment types.

3. ASSET TYPES & DESCRIPTION

The Metering Asset Management Plan incorporates various metering equipment and associated systems installed in the SA Power Networks distribution network.

The two major forms are the '**direct connected'** and the '**transformer connected**' meters.

3.1 An explantion

In order to measure power (and sum it to get the energy flow), the instrument needs to measure both the voltage and the current.

When voltages and currents are reatively low, it makes sense to run wires directly through the instrument, hence 'direct connected' or 'whole current'.

If the currents are relatively large, the wires become thick and expensive, and the control panel may be a bit remote. Also, the connections on an instrument won't handle very high currents. Such high currents can also be quite dangerous because fault currents could cause arc flash injuries. So, a current transformer (CT) is installed on the high current line (typically a toroid or a square donut shape and the high current simply passes through, forming a one-turn primary). The secondary current is much less, often 5 Amps at full scale (which may be 100A on the main conductor)

The same thing is true of voltages, where a 240V may have no problem with clearances, a 1kV wire would cause headaches-thick insulation and danger. To solve this problem a voltage transformer (VT) can be used to step down the voltage to be compatible to the meter instrumentation.

These items are classed as 'instrument transformers'. The operating principle is generally the same as any other transformer, but they are optimized for the intended application. When inspecting and testing, there is a lot more work required than the direct connected meters.

3.2 Maintenance requirements

Within separate sub classes, are diverse maintenance requirements for meter asset management.

Sub class 1 **– Direct connected meters**.

- Maintenance compliant with National Electricity Rules
- Meter sample testing in accordance with AS/NZS 1284.13: Electricity Metering – In-service compliance testing

Transformer based measurement has 2 components, the meter and the transformers. Each of these have different inspection and testing requirements

Sub class 2 – Transformer conn`ected meters.

- Meters individually inspected and tested
- Inspection conducted at periods required by National Electricity Rules with exception of type 3 meters
- Testing of meters conducted at periods required by National Electricity Rules

Sub class 3 – Metering Transformers.

- Metering transformers individually inspected and tested
- HV transformers at wholesaler and boundary sites maintained in compliance with national Electricity Rules
- Inspection conducted at periods required by National Electricity Rules with exception of type 3 meters
- Testing of transformers by an alternative procedure

Meter operating mechanism

Meter	Operation
Direct connected meters	Electro-mechanical and electronic meters
Transformer connected meters	Electro-mechanical and electronic meters
Metering transformers –	Low voltage (Current transformers) High voltage (Current and voltage transformers)
Time switches	Mechanical and electronic time switches
Sequential Wave Distortion systems	Transmitters, subcams and receivers

Metering communication equipment and associated facilities:

Metering Equipment	Approximate Quantity
Direct connected meters	1,106,500
Transformer connected meters	8,700
Metering transformers for LV (low voltage) and HV (high voltage) LV transformers (with CT devices) HV transformers (both CT and VT)	 5,700 3,000
Time-switches	Exact numbers unknown as they are not a regulated meter, and many have been replaced during solar upgrades
SWD receivers	7,000
SWD transmitters	7

Table 1: Metering Equipment in SA Power Networks

3.3 Meters

The approximate quantities of revenue meters in the network corresponding to periods of installation are indicated in the following graph:

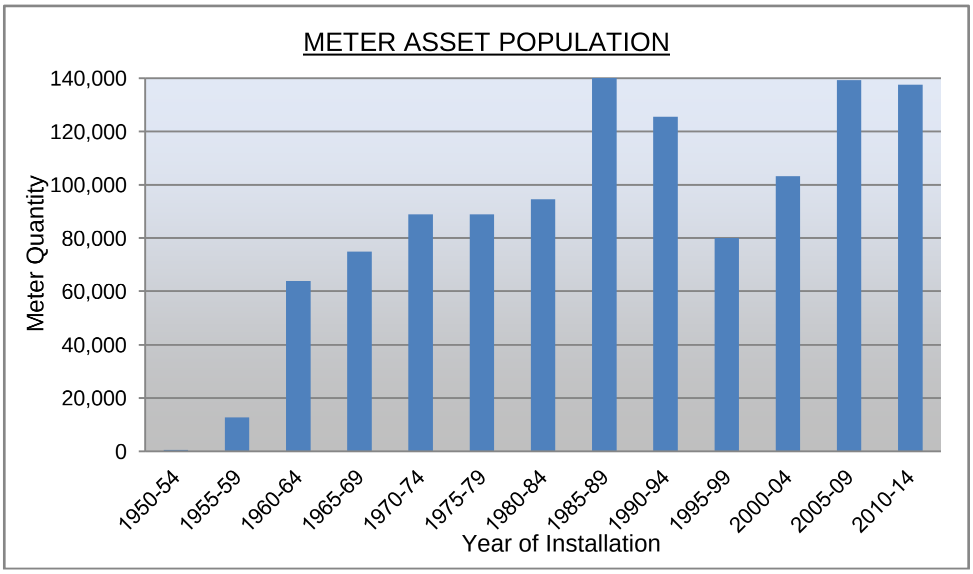


Figure 1: Meter Population by Year of Installation (see also Appendix 2 & 3)

3.3.1 Controlled Load Metering (off peak)

SA Power Networks provides controlled load (off-peak/ J-tariff) metering arrangements for selected customer appliances including storage water heaters, storage floor heating, heat banks and spa pool heating.

Operating costs for these appliances can be significantly reduced due to the lower tariffs applied by electricity retailers for controlled power supplied during off-peak periods.

Electricity supply is switched to control the availability of power during off-peak periods via one of the following items of metering equipment:

- Mechanical or electronic time switches
- Two element, electronic meters with programmable internal switching (combination meters)
- Sequential Wave Distortion (SWD) devices which have the capability of modifying switching arrangements from a central and remote location

3.3.2 Combination meters

These are electronic devices that incorporate two independent measuring elements (for main and off-peak power) with integrated components for programmable time-switching. Selection of combination meters for controlled load installations offers distinct cost benefits since the unit price has reduced to an amount less than the total cost of two single phase meters and a time-switch.

Combination meters are therefore installed preferentially for new installations because they are more compact and reduce the cost of off-peak metering. When a component of an existing installation (comprising main meter, off-peak meter or time-switch) requires repair or removal, a single combination meter is a cost effective asset replacement.

3.3.3 Electronic Meters

Installation of the first electronic meters and interval (load profile) meters commenced in1998 and progressively replaced the range of induction meters purchased for installation in the distribution network.

Since 2006, all new meters purchased and installed by SA Power Networks have been electronic devices with functionality to suit various applications.

Meters at existing two phase installations are replaced with three phase electronic meters which comprise three independent measuring elements so that metering accuracy of each phase is not affected by the number, sequence or load of phase connections.

Electronic meters provide greater versatility compared with induction metering devices and introduce opportunities for a range of beneficial applications including:

- Compact meters requiring less space on meter boards
- Reduced electricity theft as the meter is more tamper resistant
- Improved meter functionality including load profiling
- Multi-rate tariffs for customer cost savings
- Provision for communication facilities and remote interrogation
- Integrated time clocks and circuit switching relays
- Meter reading and auto time synchronising via electronic hand held units

3.3.4 Import / Export Metering (solar or wind energy output)

Customers with embedded electricity generation equipment such as solar (photo voltaic) panels may generate in excess of residential/ business requirements and have the capability of exporting surplus electrical energy to the distribution network.

Electronic meters with functionality for measuring import and export electricity (values displayed on separate registers), are provided at these supply points concurrent with installation of the electricity generation equipment.

The South Australian Government requirements for import/ export metering are provided in a document entitled 'Feed-In Mechanism for Residential Small-Scale Solar Photovoltaic Installations'.

In compliance with the document, meters installed by SA Power Networks for three phase supply applications register the export energy (ie export to the grid) as a net recording of all three phases and is therefore a measure of electricity generated by the solar system that is surplus to customer requirements.

3.3.5 'Smart ready' Meters

'Smart ready' meters are electronic meters that are designed to be upgradable with the addition of an optional telecommunications module to enable a range of 'smart meter' functions. In their manually-read configuration these meters cost only a little more than basic electronic accumulation meters, but provide the additional capability to record peak demand as well as energy consumed, which is required to support new cost-reflective network tariffs.

If the optional telecommunications module is installed, a range of additional functions can be enabled, including:

- Remote power quality monitoring
- Dynamic load control
- Sudden disconnects/ service restoration alerts
- Remote disconnect/ reconnect
- Remote ping

- Remote reading

A 'smart ready' meter will be the preferred meter for all new and replacement installations from July 2015. This is required to enable tariff reform, and also aligns with policy goals to facilitate a transition to the more capable metering required to support new demand-side services at the least possible cost to the community. Customers clearly support a transition to smarter metering, and continuing to install non-upgradable meters would be imprudent and ultimately result in stranded assets and higher cost to the community.

3.4 Metering using Transformers

Low voltage metering transformers installed in the SA Power Networks distribution network may be supplied/ connected/ commissioned by one or more of several contributors including SA Power Networks, switchboard manufacturers and customer electrical service providers.

High voltage metering transformers installed in the distribution network are supplied by SA Power Networks and may be connected/ commissioned by one or more of several contributors including SA Power Networks and customer electrical service providers.

3.5 Time Switches

Time switches are not a regulated item, but are an advantage to the network distributor and the customer. The costs of these can be found in unplanned maintenance (due to being unregulated).

Power interruptions and poor time keeping of mechanical time-switch clocks can cause the power supply for customer appliances to drift outside the intended control period (eg off-peak power supplied to water heaters).

Drift of time-switches does not generally have an adverse effect on the distribution system as it tends to disburse the impact of start-up loads, however an uncontrolled increase of power demand during peak periods can have an adverse effect if the maximum demand causes over-load conditions in sections of the network.

The introduction of electronic time-switch devices has improved the control period switching performance due to superior time keeping accuracy of electronic clocks and more reliable electronic switching components.

Combination meters can be considered time-switch devices. These have been described in the previous section.

3.6 SWD Systems

During the1980s SA Power Networks developed an alternative method for control of off-peak domestic water heating using a power line communication system with low frequency signal known as Sequential Wave Distortion (SWD). The system provides one-way communication between the distribution utility and the customer to perform remote on/ off switching of customer appliances in a manner that can be adjusted to suit off-peak management of network load.

The SWD system essentially comprises a transmitter with transmitter controller located in a SA Power Networks substation. The transmitter injects a control signal, via coupling transformer, along the distribution power line to a SWD receiver at the customer residence. Off-peak power supply (eg for water heating) is switched by the receiver in response to programmed signals from the transmitter controller which SA Power Networks can control remotely by landline telephone for modification of the switching program.

Eight of the SA Power Networks substations in the Adelaide metropolitan area have SWD systems installed providing off-peak load control totalling approximately 70 MW.

Functional operation of the SWD system has considerable benefit to SA Power Networks as it provides a facility for distribution network management to reduce significant off-peak customer load, especially when sections of the network are exposed to high demand for electricity supply.

4. DETAILS - Current Condition and Specific Work Plans

There are a number of sub-classes based on different inspection and testing procedures

Those covered by the National Metering Rules are:

- Sub class 1:Direct connected meters
- Sub class 2:Transformer connected meters
- Sub class 3:Metering transformers

Additional sub-classes are:

- Time-switches
- SWD system

4.1 Sub Class 1 – Direct Connected meters

4.1.1 Asset Condition

The primary focus is on performance within acceptable accuracy tolerances. See Appendix 6

Meter testing to date has identified that deteriorating performance accuracy is limited to isolated meter groups rather than indicating failure trends of age related or family related meters. These groups when found are replaced. This is the largest cost component.

4.1.2 Known Asset Problems

4.1.2.1 Rationalisation of Meter Types

An examination of meters in the distribution network indicates that the total single phase meter group comprises more than 70 different meter types and 60% of these types comprise quantities less than 1000 meters.

Many of these came from regional authorities in country areas obtaining meters suitable to their needs of the time, but not compatible to the overall network. Also many have insufficient details and are considered unclassified.

While these meters are still operationally suitable and have acceptable accuracy performance, the excessive amount of testing required for such a variety of small meter groups is not an effective use of maintenance resources. The choices are:

- Testing –uneconomic
- No testing, no replacement- economic but not fully compliant
- Replacement without testing- this is the current approach adopted -to remain compliant.

Removal of unclassified meters and small meter groups are considered during planning of capital projects.

4.1.2.2 4 Dial Meters

4 dial meters are the "old" style 4 disc meters (technically induction dc meters), normally remaining in residential properties for measurement of the J Tariff. As they fail they are replaced with more modern meters.

4.1.2.3 Electronic Meters

There is a group of early model electronic meters, type YS1826, which are showing evidence of early failure. Their life is around 10 years instead of the expected over 15 years. There are approx 15,000 of these to be replaced in the next 5 years.

4.1.2.4 [redacted]

[redacted]

[redacted]

4.1.3 Strategy

SA Power Networks maintenance strategies for metering equipment are structured in consideration of National Electricity Rules, state regulatory codes, manufacturer's recommendations and experience. See Appendix 4 for inspection and testing details. The smaller meters are replaced rather than repaired as a result of:

- inspections when damage found
- testing – accuracy failures can lead to batch replacement
- faults reported from customers, retailer, meter readers or field personnel
- meter family failures
  - small lot groups
  - early model electronic meters

4.1.4 New Meters

A representative sample of any new pattern or type of meter is tested prior to installation and in accordance to the above standard.

4.1.5 Meter Replacement

SA Power Networks commits resources for annual meter replacement programs which may include groups of meters that are:

- identified as having unacceptable accuracy errors, see Appendix 5 for 2013 results.
- are not suitable for continuing service requirements
- are considered too small for cost effective meter sample testing

4.1.6 Small Family Replacement

Families of meter types and classes for meter sample testing that comprise quantities less than 150 units, are managed in a cost effective manner by scheduling for 'replacement without testing'. The meter groups included each year are selected according to assessment of priority for each meter group condition.

4.1.7 Large Family Replacement

Generally, families that have unacceptable accuracy error are included in the replacement program in the year following the meter sample testing period. However, some large families of direct connected meters may not be able to have the work completed in the following year due to resource availability constraints. In this event SA Power Networks will notify and discuss arrangements for a rectification plan that is acceptable to AEMO.

4.1.8 Operating & Capital Plan - Tasks

Table 2: Direct Connected Meter Equipment (includes the low volume time switches)

Tasks	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Cost
Capex-Planned Meter replacemt	[redacted]												
Non compliant accuracy –single phase													
Non compliant accuracy –2 phase													
Non compliant accuracy –3 phase													
4 dial meters													
Defective electronic meters i-Single phase													
ii-Three phase													
Meter system replment-Holdfast shores i-Single phase													
ii-Multi phase													
iii-Communication													
Capex Unplanned Meter replacement													
Planned Opex													
Meter sample testing													
Unplanned Opex													

NOTES:
1. All figures in units
2. In 2013 unit costs: values to right side of table

4.1.9 Risk

Following the Regulations and Standards, and using the above replacement strategy, it is expected that the ‘failure’ to meter the power correctly will be small.

4.2 Sub Class 2 – Transformer connected meters

4.2.1 Asset Condition

The transformer connected meter population is maintained by SA Power Networks with a primary focus on performance accuracy of individual meters being a dominant priority.

4.2.2 Known Asset Problems

Since metal cased meters are in the final stages of being removed, there are no other major issues in this group

4.2.3 Strategy

To follow regulated Inspection and testing requirements

All transformer connected meters in the SA Power Networks distribution network are individually inspected and tested in accordance with documented metering work procedures. See Appendix 4 for details.

When testing identifies meters that do not comply with class accuracy requirements of the National Electricity Rules, Chapter 7, the individual faulty units are replaced immediately with appropriate new meters.

4.2.4 Operating & Capital Plan - Tasks

Table 3: Transformer Connected Meter Equipment

Tasks	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Cost ea
Capex Type 6CT Meter replacement -With type 5CT	[redacted]												
-With type 5CT meter and comms													
Meter installation/ replacement													
Commn modem replacement													
Planned Opex Type 1-6 CT													
Meter Maint. and investigate													
Interval and comms													

NOTES:

All figures in units, in 2013 unit costs, amount to right of table

4.2.5 Risk

Based on the SA Power Networks standard criteria, the residual risk of implementing this strategy is considered to be low.

4.3 Sub Class 3 – Metering Transformers

4.3.1 Asset Condition

Operational experience with metering transformers installed in the SA Power Networks distribution network indicates that the assets perform satisfactorily in service for long periods of time.

Maintenance history provides evidence that metering transformers rarely require replacement due to failure.

4.3.2 Known Asset Problems

Electrical flashover within high voltage metering cubicles has occurred on several occasions during recent years causing unexpected interruption of supply to major customers and incurring expensive replacement of equipment damaged by high energy discharge.

The incidence of surface tracking across cast resin casings of voltage transformers has been identified as the condition that initiates high voltage electrical flashover between transformer terminals.
Modification of the voltage transformers installed in metering cubicles has been initiated to improve the electrical insulation between transformer terminals.

Electrical flashover has not been experienced with any of the modified high voltage metering cubicles.

4.3.3 Strategy

The strategy is by inspection and testing to find the condition of the transformers and adjust or repair as required. See Appendix 4 for details

4.3.4 Operating & Capital Plan – Tasks

Table 4: Metering Transformer Equipment

Tasks	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Capex	[redacted]											
HV Tfer cubicle												
Planned Opex												
Type 1-6												
HV T/F Cub'l Maint.												

NOTES:
All figures in units
In 2013 unit costs: Planned Opex/unit = $638.4 Types 1-6, $4006.0 HV TF,
Capex/unit = $19,199.3

4.3.5 Risk

Based on the SA Power Networks standard criteria, the residual risk of implementing this strategy is considered to be low.

4.4 Sub Class 4 – Time-switches

4.4.1 Asset Condition

Time-switch assets installed in the SA Power Networks network perform satisfactorily in service for switching required by applications such as controlled load supplies for electric water heating and two rate tariffs for weekend pumping.

4.4.2 Known Asset Problems

Power interruptions and poor time keeping of time-switches clocks can cause the supply of power to drift outside the intended control period (switched off-peak supplies for electric water heating systems).

Drift of time-switches does not generally have an adverse effect on the distribution network as it tends to disperse the impact of start-up loads, however concentration of power demand during peak periods can have an adverse effect if the maximum demand causes over-load conditions in sections of the network.

4.4.3 Strategy

Regular inspection of time-switches installed with metering equipment is undertaken by meter reading personnel during recording of consumption data.

Details of damage, broken seals, tampering and incorrect time-switch settings are reported which generates notifications for rectification by field maintenance staff.

Investigation of time-switch faults is also performed in response to customer requests which most often arise in relation to water heating problems.

The maintenance strategy for time-switches comprises of:

- When sent to check a meter, then repair of defects as detected, otherwise 'operate to failure'.
- When a single meter fails, the meter replacement is with a combination 2 element meter comprising a main meter, controlled load meter and time-switch.
- If a series of time switches need replacement, only the time switches are replaced to minimise business costs (not the other load meters)

4.4.4 Operating & Capital Plan - Tasks

The Time switch tasks and costs are included in with Direct Connect meters for Opex, and the unplanned for Capex

4.4.5 Risk

Based on the SA Power Networks standard criteria, the residual risk of implementing this strategy is considered to be low.

4.5 Sub Class 5 – SWD System

4.5.1 Asset Condition

SWD system assets installed in the SA Power Networks distribution network are generally operating satisfactorily for switching of controlled load supplies such as electricity for water heating.

The system has the capability of remotely adjusting the period of load control for individual customer receivers or selected groups of receivers with the potential benefit of reducing demand on sections of the network during periods of excessive demand.

4.5.2 Known Asset Problem

SWD system equipment is starting to exhibit failures. There are no direct replacements available.

Relocation of feeder routes due to network expansion in some areas has severed SWD communication between substation and customer receivers which has effectively stranded those SWD assets.

4.5.3 Strategy

Regular inspection of SWD receivers installed with metering equipment is undertaken by meter reading personnel during attendance for recording of consumption data.

Details of damage, broken seals and tampering are reported which generates notifications for rectification by field maintenance staff.

Investigation of SWD receiver faults is also performed in response to customer requests which most often arise in relation to water heating problems.

Generally, the maintenance strategy for SWD receivers comprises replacement with new units as there are no spares available.

The Metering replacement involves the main meter, controlled load meter and defective SWD receiver being replaced with a two element electronic meter whenever practical.

4.5.4 Operating & Capital Plan - Tasks

Table 5: SWD Equipment

Tasks	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Planned Opex Transmitter and subcam	--	7	7	7	7	7	7	7	7	7	7	7
Unplanned Opex Defect maint	--	60	58	56	54	52	50	48	46	44	42	40

NOTES:

All figures in units

In 2013 unit costs: Planned Opex/unit = $837.1, Unplanned Opex/unit = $338.8

4.5.5 Risk

Based on the SA Power Networks standard criteria, the residual risk of implementing this strategy is considered to be low.

5. RISK

5.1 Residual Risk

The testing and inspection methods for large populations and large meters proposed in this plan will result in having meters within the required accuracy (and meet the regulations). The replacement method of small lots in direct connected meters is considered a reasonable approach (prudent and efficient) to meet business needs (avoid costly inspections) and maintain compliance.

Hence the residual risk to the organisation is considered appropriate.

6. SUMMARY

6.1 Capital

Table 6: Capex Summary

($,000s)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Capex Planned **Direct connected** Meter replacemt	[redacted]											
Non compliant accuracy single phase	[redacted]											
Non compliant accuracy 2 phase	[redacted]											
Non compliant accuracy 3 phase	[redacted]											
4 dial meters	[redacted]											
Defective electronic meters i-Single phase	[redacted]											
ii-Three phase	[redacted]											
Meter system replment-Holdfast shores i-Single phase	[redacted]											
ii-Multi phase	[redacted]											
iii-Communication	[redacted]											
Transformer connected Type 6CT Meter replacement -With type 5CT meter	[redacted]											
With type 5CT meter and comms	[redacted]											
meter installation/replacement	[redacted]											
Commn modem replacement	[redacted]											
Metering Transformers HV Transformer cubicle	[redacted]											
Capex Unplanned Meter repalcements	[redacted]											
TOTAL	[redacted]											

6.2 Planned Opex

Operating expenditure is associated with condition monitoring of the assets and is shown in table.

Table 7: Planned Opex Summary

$,000s	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Meter sampling	[redacted]											
Type 1-6 CT	[redacted]											
Maint & advice	[redacted]											
Interval & comms	[redacted]											
Type 1-6 TF	[redacted]											
HV TF cubcl	[redacted]											
SWD units	[redacted]											
Total	[redacted]											

6.3 Unplanned Operating Expenditure

Unplanned capital expenditure is associated with refurbishment and replacement of the assets as shown in Table.

Table 8: Unplanned Opex Summary

($000s)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Direct connected	[redacted]											
SWD units	[redacted]											
Total	[redacted]											

7. SOURCES OF INFORMATION

Table of information sources used in this report

Description	Source Location	Document Sections
Discussion	NM and Corporate Services	All
Tariff and metering business case DRAFT 0.79a	Supplied by:Smart Meter Manager	All- Requirements for smart-readymeters

8. APPENDICES

8.1 Appendix 1: Accredited Metering Service Provider

SA Power Networks is registered with the Australian Energy Market Operator (AEMO) as a Metering Provider (MP-B) in the National Electricity Market and is accredited to 'Provide, Install and Maintain' metering installations in the following equipment categories:

Category	Competency
1C	Class 0.2 CTs
1V	Class 0.2 VTs
1M	Class 0.2 Wh meters and class 0.5 varh meters
1A	Class 0.2 CTs, VTs, Wh meters; class 0.5 varh meters; the total installation to 0.5%
2C	Class 0.5 CTs
2V	Class 0.5 VTs
2M	Class 0.5 Wh meters and class 1.0 varh meters
2A	Class 0.5 CTs, VTs, Wh meters; class 1.0 varh meters; the total installation to 1.0%
3M	Class 1.0 Wh meters and class 2.0 varh meters
3A	Class 0.5 CTs, VTs; class 1.0 Wh meters; class 2.0 varh meters; the total installation to 1.5%
4M	Class 1.0 Wh meters and class 1.5 Wh meters
L	Communication links
5	Type 5 interval meters
6	Type 6 basic meters

SA Power Networks provides metering services for installations within the South Australian electricity distribution network at customer supply points categorised as:

- First tier – type 2, 3, 4, 5 and 6 installations
- Second tier – type 1, 2, 3, 4 and 5 installations.

Meter provision services are not undertaken by SA PowerNetworks in locations outside of the region of South Australia in which the Distribution Licence applies.

8.2 Appendix 2: Population Types and Percentages

8.2.1 Meter Types

The existing population of meter assets installed in the SA Power Networks distribution network is tabulated in groups of specific meter types with respective SA Power Networks supply item prefix as follows:

Description of Meter Type in SA Power Networks Population	Supply Item Group Prefix	Meter %
1 phase, 2 wire, direct connected, kWh meter	YA	81.6
1 phase, 3 wire, direct connected, kWh meter	YB	0.6
2 phase, 3 wire, direct connected, kWh meter	YC	1.8
1 phase, 2 wire, 240 volt, commercial grade, transformer connected, kWh meter	YD	<0.1
3 phase, 3 wire, direct connected, kWh meter	YJ	0.1
3 phase, 3 wire, 415 volt, commercial grade, transformer connected, kWh meter	YK	<0.1
3 phase, 3 wire, 110 volt, precision grade, transformer connected, kWh meter	YN	<0.1
3 phase, 4 wire, direct connected, kWh meter	YS	15.4
3 phase, 4 wire, 415 volt, commercial grade, transformer connected, kWh meter	YT	0.4
3 phase, 4 wire, 415 volt, precision grade, transformer connected, kWh meter	YU	0.4
3 phase, 4 wire, 110 volt, precision grade, transformer connected, kWh meter	YW	<0.1

Table 9: Meter Types in SA Power Network Population

8.2.2 Meter Population Distribution

Revenue metering in the distribution network is installed to suit applications for customers that may be segmented by consumption or location, as displayed with approximate proportions in the following table:

Customer Segments	***Proportion***
Tranche (Group)	
Tranche 1 [> 40 GWh pa.]	0.01%
Tranche 2 [4 GWh pa. to 40 GWh pa.]	0.02%
Tranche 3 [750 MWh pa. to 4 GWh pa.]	0.09%
Tranche 4 [160 MWh pa. to 750 MWh pa]	0.29%
Tranche 5 [< 160 MWh pa.]	99.59%
Adelaide Central Business District	0.5%
Metropolitan	59.5%
Rural	38%
Remote	2%

Table 10: Customer Segmentation of Meter Applications

8.3 Appendix 3: Meter Population Numbers

Stock Item	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	Stock Item	Meter Type
	1 phase, 2 wire, 240 volt, direct connected, kilowatt hour meter														
YA1000				1	0	2	4	3,518	43	33	11	7	**3,619**	YA1000	Refurbished meters to 'J'
YA1151				1									**1**	YA1151	Siemens Schuckert W3
YA1152				1	1	1	2						**5**	YA1152	Siemens Schuckert W9
YA1224	745	4,006	2,215	3,753	4,740	6,399	3,989	6,383	73	184	105	64	**32,656**	YA1224	EMMCO BAZ
YA1241	4	3	1	1	0	1	1	0	0	5	0	0	**16**	YA1241	Landis & Gyr CB
YA1242	2	1	13	1	2	4	0	2	0	3	0	4	**32**	YA1242	Landis & Gyr CE
YA1243	4	2	4	38	44	1	8	1	1	4	0	0	**107**	YA1243	Landis & Gyr CF
YA1244		3		4							1		**8**	YA1244	Landis & Gyr FG
YA1246	19	33	16	26	16	0	0	0	0	2	0	0	**112**	YA1246	Landis & Gyr CH1
YA1252				8			1				1		**10**	YA1252	Siemens Schuckert W9
YA1262	42	86	938	1,339	1,086	1,894	772	343	26	55	31	21	**6,633**	YA1262	Sangamo HMT
YA1264					2		1						**3**	YA1264	Warburton Franki WF3
YA1292			3	1		3				1			**8**	YA1292	Chamberlain & Hookam K
YA1324	814	749	533	590	2,231	2,600	1,179	533	24	51	53	20	**9,377**	YA1324	EMMCO BAZ & SD
YA1341		1											**1**	YA1341	Landis & Gyr DB80
YA1344					1		1						**2**	YA1344	Landis & Gyr FG1
YA1351				2		1							**3**	YA1351	Siemens Schuckert D12
YA1352	2	1		2									**5**	YA1352	Siemens Schuckert W9
YA1363	581	524	147	286	403	43	48	41	3	6	2	2	**2,086**	YA1363	Warburton Franki WF2
YA1411		9		1									**10**	YA1411	Aron EI
YA1423							1					1	**2**	YA1423	EMMCO AZ
YA1424	158	3,665	1,141	4,801	2,077	2,612	6,316	2,620	81	144	94	50	**23,759**	YA1424	EMMCO BAZ
YA1443		5	1	0	8	2	2	1	0	0	1	0	**20**	YA1443	Landis & Gyr CF6
YA1446	6	345	43	91	57	49	75	33	1	9	4	0	**713**	YA1446	Landis & Gyr CH1
YA1454	338	149	7	28	81	103	113	56	1	7	2	2	**887**	YA1454	Siemens Schuckert W204
YA1462	13	47	1,629	2,035	108	4,573	995	543	23	50	27	16	**10,059**	YA1462	Sangamo HMT
YA1492			1	0	3	1	0	0	0	1	0	0	**6**	YA1492	Chamberlain & Hookam K
														YA1544	Landis & Gyr FG1
YA1554	1	1,324	83	174	137	195	212	102	4	17	4	2	**2,255**	YA1554	Siemens Schuckert W205
YA1623			7						1	1			**9**	YA1623	EMMCO AZ
YA1624	4,060	20,464	18,473	3,349	4,274	4,853	5,442	4,283	2,406	1,222	220	92	**69,138**	YA1624	EMMCO BAZ 1964(29000)
YA1625	76	7,076	36,126	56,138	12,534	7,082	8,529	8,688	6,575	6,604	392	233	**150,053**	YA1625	Email M1 1964(26000)
YA1627							3		3	4		1	**11**	YA1627	Email M3
YA1643				1									**1**	YA1643	Landis & Gyr CF6 - 'J' tariff
YA1644	1	3	4	2					1				**11**	YA1644	Landis & Gyr FG1
YA1647										3	1		**4**	YA1647	Landis & Gyr CL27
YA1652	3			2			1						**6**	YA1652	Siemens Schuckert W9 - 'J' tariff
YA1663	3,285	13,648	1,219	1,848	2,033	2,341	2,182	2,032	436	271	66	38	**29,399**	YA1663	Warburton Franki WF2
YA1664		278	1,038	136	101	186	283	575	176	54	4	6	**2,837**	YA1664	Warburton Franki WF3 1965(2000)
YA1694										2		1	**3**	YA1694	Iskra T22F & T25F series
YA1815										1			**1**	YA1815	
YA1825	5	90	26	51	27	18,188	25,665	1,962	1,633	1,668	538	59	**49,912**	YA1825	Email M1 - Flat rate
YA1826		2	1	0	1	0	33	3	8	149	43	9	**249**	YA1826	Email M1S - 'Plug-in'
YA1827	608	993	153	215	158	143	19,148	19,205	13,403	22,775	7,574	132	**84,507**	YA1827	Email M3 - Flat rate
YA1828					2	0	4,067	5,396	2,032	217	29	56	**11,799**	YA1828	Email M3S -' Plug-in'
YA1841	29	32	6	16	9	10	3,240	13,885	702	2,103	1,576	305	**21,913**	YA1841	Landis & Gyr CM170xf3
YA1842							985	4,389	77	895	1,390	440	**8,176**	YA1842	Landis & Gyr CM170xf3 - 'Plug-in'
YA1849	25	24	2	20	14	15,048	973	721	667	621	183	28	**18,326**	YA1849	Landis & Gyr CL170xf3
YA1865						44	3	3				1	**51**	YA1865	Ganz GEY
YA1870											27,556	1,507	**29,063**	YA1870	Actaris ACE1000 SMB Type 282
YA1871											2,931	67,556	**70,487**	YA1871	Actaris/ Itron ACE2000 SMB Type 292
YA1872												46,327	**46,327**	YA1872	Itron ACE2000 SMB Type 292, Imp/Exp
YA1893	11	4	4	16	14,338	510	691	680	616	240	20	13	**17,143**	YA1893	GE 1-70-S 1974(24000)
YA1894										1			**1**	YA1894	Iskra T22F & T25F series
YA1895		2	2	3	8	784	18,051	8,349	1,574	546	91	44	**29,454**	YA1895	Iskra E62E1 1976(58000)
YA1897						39	23	11	4	11			**88**	YA1897	Iskra E79E2
YA1925									1	1	2	1	**5**	YA1925	Email M1
YA2241		2	1						1				**4**	YA2241	Landis & Gyr CBD, DBD, CBOD
														YA2344	Landis & Gyr CG1D
YA2444		1	1			1							**3**	YA2444	Landis & Gyr CG1D, CG1OD
YA2446		19	17	15	10	29	28	3	7	8	1		**137**	YA2446	Landis & Gyr CH1D
YA2452			2	1	0	0	0	1	1	0	0	0	**5**	YA2452	Siemens Schuckert ZW12
YA2453		5	1	1					2				**9**	YA2453	Siemens Schuckert ZW13
YA2624		4	1	3	5	7	4	4		2			**30**	YA2624	EMMCO BAZ 2R
YA2625				28	46	21	21	12	8	9	2		**147**	YA2625	Email M1
YA2647			58	59	28	56	34	33	7	14	3	1	**293**	YA2647	Landis & Gyr CL27D (1968)
YA2825						6	26	1	9	15			**57**	YA2825	Email M1
YA2827		2		10	3	9	213	284	569	286	18	4	**1,398**	YA2827	Email M3R
YA2841							17	81	6	34	17	5	**160**	YA2841	Landis & Gyr CLxf3170
YA2849						22		2	3			1	**28**	YA2849	Landis & Gyr CL170xdf3
YA4925	2	4	10	12	4	8	11	12	5,738	4,348	341	719	**11,209**	YA4925	Email M1 & A11P
YA4926	98	287	285	297	223	245	255	290	205	15,709	2,185	1,094	**21,173**	YA4926	Email A11L
YA4927										150	9	16	**175**	YA4927	Email A11L
YA4928										1	35,629	74,916	**110,546**	YA4928	Ampy Email EM1210, 2 element
YA4929											41	7	**48**	YA4929	Ampy Email EM1210, 2 element
YA4930											26	1,765	**1,791**	YA4930	Ampy EM1210, 2 element - 'Plug-in'
YA4938												3	**3**	YA4938	
YA4971	3	8	9	22	11	15	24	5,686	11,680	995	127	53	**18,633**	YA4971	Nilsen EMS2100, EMS2600, 2 element
YA4972			2	0	1	0	0	1,890	1,350	201	33	8	**3,485**	YA4972	Nilsen EMS2100 - 'Plug-in'
YA4973	3	5	11	13	17	16	27	21	25	1,685	114	22	**1,959**	YA4973	Nilsen EMS26FRC, 2 element
YA6801												3,430	**3,430**	YA6801	Landis & Gyr E350 U1200, AMI
YA6828												122	**122**	YA6828	Landis & Gyr EM1210, 2 element, LP
Sub-total	**10,938**	**53,906**	**64,234**	**75,442**	**44,844**	**68,147**	**103,699**	**92,678**	**50,206**	**61,418**	**81,498**	**199,204**	**906,214**	Sub-total	

Metal cased meters

Stock Item	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	Stock Item	Meter Type
YB5223			2							1			3	YB5223	
YB5267		32	2	0	0	0	0	1	0	9	0	0	44	YB5267	
YB5268		38	26	6	3	7	3	6	4	52	1	0	146	YB5268	
YB5271		8	102	0	0	0	0	0	0	1	0	0	111	YB5271	
YB5272				5									5	YB5272	
YB5275				7									7	YB5275	
YB5276		6	15	1		1	1	3		4	1		32	YB5276	
YB5277			8	1	0	0	0	0	0	0	0	1	10	YB5277	
YB5279				35									35	YB5279	
YB5280		24							1	1			26	YB5280	
YB5290		177	1	2	5	2	1	0	0	3	4	1	196	YB5290	
YB5291		6											6	YB5291	
YB5341				143	71	2	3	2	2	3	0	2	228	YB5341	
YB5343				76	0	2	4	3	0	2	0	1	88	YB5343	
YB5421		23											23	YB5421	
YB5422								152	0	5	0	2	159	YB5422	
YB5433						16	0	1	0	2	2	0	21	YB5433	
YB5540			93	0	1	1	0	0	1	0	0	0	96	YB5540	
YB5600			180	0	1	1	0	0	0	0	3	0	185	YB5600	
YB5602							36	0	0	3	2	1	42	YB5602	
YB5603							42		1				43	YB5603	
YB5633							48	0	1	1	2	1	53	YB5633	
YB5640							47	2	0	7	0	1	57	YB5640	
YB5641							123	2	1	8	13	1	148	YB5641	
YB5642							222	4	3	18	8	2	257	YB5642	
YB5652							505	8	7	17	24	2	563	YB5652	
YB5655							5						5	YB5655	
YB5661							12						12	YB5661	
YB5670							33	3	1	2	0	2	41	YB5670	
YB5671							25	0	1	1	6	0	33	YB5671	
YB5680							96	1	1	2	1	0	101	YB5680	
YB5690							402	0	4	6	2	1	415	YB5690	
YB5700		2	13									1	16	YB5700	
Sub-total		316	442	276	81	32	1,608	188	28	148	69	19	3,207	Sub-total	

Stock Item	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	Stock Item	Meter Type
YC1223	5	6	2		1				1			1	16	YC1223	Email AZ, PAZ
YC1311	2	3	8							1			14	YC1311	Aron E2
YC1312		33	7	14	16	3			1	1			75	YC1312	Aron G23
YC1323				1									1	YC1323	EMMCO PAZ2
YC1324	22	645	306	563	2,723	3,054	1,454	912	158	187	54	32	10,110	YC1324	EMMCO SD
YC1344	1	4	1		1								7	YC1344	Landis & Gyr HGI
YC1354				1					1				2	YC1354	Siemens Schuckert D23 ML
YC1424	1	15	21	3	14	20	14	12			1		101	YC1424	EMMCO SD
YC1442														YC1442	Landis & Gyr E , M
YC1455		13	10	3	6	1	2	2	1				38	YC1455	Siemens Schuckert D314
YC1524	2	5		1	3	1		1					13	YC1524	EMMCO SD
YC1612		6							1				7	YC1612	Aron G
YC1624						1		10	6				17	YC1624	EMMCO SD
YC1625		1	0	2	2	13	18	400	799	177	11	10	1,433	YC1625	EMMCO SD-M
YC1648		3	1	12	6	1,723	1,638	933	267	152	36	13	4,784	YC1648	Landis & Gyr HL262xf6 1980
YC1925								6	11		1		18	YC1925	EMMCO SD-M SDMPE
YC1948						6	6	12	8		1		33	YC1948	Landis & Gyr HL240xf6
YC2324	1	8	12	16	10	15	3	5	3	6			79	YC2324	EMMCO SD
YC2424			1	7					1	1			10	YC2424	EMMCO SD
YC2425				1		1	1	1					4	YC2425	EMMCO SD-M
YC2443		2	2	3						1			8	YC2443	Landis & Gyr DF3D
YC2455			29	6	6	9	2	3	1	2	1		59	YC2455	Siemens Schuckert ZD314
YC2625				31	36	15	13	33	91	14	2	1	236	YC2625	EMMCO SD-M, SDMR
YC2647					18	3	2	2	6	1		1	33	YC2647	Landis & Gyr VL5.5AD
YC2648				2		25	43	59	12	29	3		173	YC2648	Landis & Gyr HL262xdf6
YC2925									9	2			11	YC2925	EMMCO SD-M SDMPE
YC2948						2	6	3	7	1		1	20	YC2948	Landis & Gyr FL, HL, ML
Sub-total	34	744	400	666	2,842	4,892	3,202	2,394	1,384	575	110	59	17,302	Sub-total	

Metal cased meters (legend: green shading)

June 2013

Stock Item	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	Stock Item	Meter Type
YD1524				1									1	YD1524	EMMCO SD
YD1824								1					1	YD1824	EMMCO BAZ & SD
YD1864						1	2						3	YD1864	Warburton Franki WF3
YD2825											1		1	YD2825	
YD2841								1					1	YD2841	Landis & Gyr B , M
YD2846						1		1					2	YD2846	Landis & Gyr CH1D
Sub-total				1	0	2	2	3	0	0	1	0	9	Sub-total	

Summator, MD duplicating register and recorder

Stock Item	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	Stock Item	Meter Type
YE3044										1			1	YE3044	Landis & Gyr FEE & EKM series
YE7025								1					1	YE7025	Email-Westinghouse WR32 mag. tape
Sub-total								1	0	1	0	0	2	Sub-total	

Stock Item	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	Stock Item	Meter Type
YJ1136	1												**1**	YJ1136	Ferranti FLY
YJ1323	1												**1**	YJ1323	EMMCO AZ, PAZ
														YJ1336	Ferranti FLY
YJ1344	11	29	5	55	2	1	3	1	0	6	0	0	**113**	YJ1344	Landis & Gyr FG1
YJ2132	1			1									**2**	YJ2132	Ferranti FCTYD3
														YJ2151	Siemens Schuckert ZD7
YJ2244		1								1			**2**	YJ2244	Landis & Gyr FG1D
														YJ2253	Siemens Schuckert ZD15
YJ2344		1	1			1							**3**	YJ2344	Landis & Gyr FG1D
YJ2352	2		2										**4**	YJ2352	Siemens Schuckert ZD13
YJ2543		2	4				1	1		2			**10**	YJ2543	Landis & Gyr FF3D
YJ2544	1		1					1					**3**	YJ2544	Landis & Gyr FG1D
YJ2652							1			1			**2**	YJ2652	Siemens Schuckert ZD13
YJ2654		2					1			1			**4**	YJ2654	Siemens Schuckert ZD23B
														YJ2844	Landis & Gyr FG1D
Sub-total	**17**	**35**	**13**	**56**	**2**	**2**	**6**	**3**	**0**	**11**	**0**	**0**	**145**	Sub-total	

Metal cased meters

3 phase, 3 wire, 415 volt, commmercial grade, transformer connected, kilowatt hour meter

														YK2544	Landis & Gyr FG1D
YK2551							**1**			**3**			**4**	YK2551	Siemens Schuckert ZD17A

3 phase, 3 wire, 415 volt, precision grade, transformer connected, kilowatt hour meter

YL2552			**1**										**1**	YL2552	Siemens Schuckert ZD17P3
			1										**1**	Sub-total June 2013	

3 phase, 3 wire, 110 volt, precision grade, transformer connected, kilowatt hour meter

YN2552							1	1					**2**	YN2552	
YN6125										2	10	4	**16**	YN6125	Siemens Schuckert ZD17P3
YN6126											4	17	**21**	YN6126	Email-Westinghouse SDMPE
YN6187												2	**2**	YN6187	
YN6525									7	3	38	39	**87**	YN6525	Email-Westinghouse SDMPE
YN6526											31	41	**72**	YN6526	
YN6528											2	3	**5**	YN6528	
YN6548									2				**2**	YN6548	Landis & Gyr ZFA110m413er14
YN6586											2	2	**4**	YN6586	EDMI Mk.6
YN6587												5	**5**	YN6587	

Stock Item	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	Stock Item	Meter Type
														YS1244	Landis & Gyr MG1
YS1312		1											1	YS1312	Aron G
YS1324	58	12	3	2	32	36	13	2	7	5	2	2	174	YS1324	EMMCO SD
														YS1337	Ferranti FM
YS1351	4	2				1				1			8	YS1351	Siemens Schuckert D12
YS1412	3	66	10	30	24	9	5	5	4	7			163	YS1412	Aron G34
YS1424	138	164	44	127	175	733	965	973	118	159	25	4	3,625	YS1424	Email SD 1967
YS1444								1					1	YS1444	Landis & Gyr MG1
YS1445								5	1				6	YS1445	Landis & Gyr MG21
														YS1447	Landis & Gyr ML3FS
YS1524	7	10	20	13	23	23	26	13	2	6	3		146	YS1524	Email SD
YS1615								1		1			2	YS1615	
YS1624	1	3	62	19	30	125	158	121	125	71	12	3	730	YS1624	Email SD
YS1625		3	9	516	155	171	253	4,323	9,509	4,756	169	32	19,896	YS1625	Email SD-M
YS1644			1	2							2	1	6	YS1644	Landis & Gyr MG1
YS1647				29	871	217	149	139	142	63	4	3	1,617	YS1647	Landis & Gyr YL5 1965
YS1648		2	1	32	7	3,707	5,635	4,189	1,371	657	95	38	15,734	YS1648	Landis & Gyr ML262xf6 1980
YS1651	2	1	5	3	1								12	YS1651	Siemens Schuckert D12
														YS1653	Siemens Schuckert D16
YS1655	1	153	322	142	343	169	318	145	32	34	4	5	1,668	YS1655	Siemens Schuckert D306
YS1694			1	2	139	651	183	214	106	91	4		1,391	YS1694	Iskra T22F & T25F1 1976
														YS1695	Iskra E62E2
YS1815											1		1	YS1815	
YS1824		9	32	22	23	41	149	207	69	50	6	2	610	YS1824	EMMCO SD 1967(150)
YS1825			1	2					5	34	3		45	YS1825	EMMCO SD-M SDMPE
YS1826	359	324	123	166	186	176	209	160	103	16,237	13,535	1,644	33,222	YS1826	Ampy 5192B Reporter
YS1828									1	1			2	YS1828	Ampy 5192B Reporter
YS1840											19,434	15,684	35,118	YS1840	Ampy Email EM3030
YS1847		3		35	65	20	25	16	26	20	1	1	212	YS1847	Landis & Gyr YL5
YS1894										11			11	YS1894	Iskra
YS1925			1	2	32	12	11	225	1,191	683	99	15	2,271	YS1925	EMMCO SD-M
YS1944			1	1	4								6	YS1944	Landis & Gyr MG1
YS1947		1	1	11	38	23	16	11	20	7		1	129	YS1947	Landis & Gyr YL5 &YL11
YS1948				19	1	360	671	476	332	83	9	3	1,954	YS1948	Landis & Gyr ML240xf6
YS1953				1	1								2	YS1953	Siemens Schuckert D16
YS1955		2	1	7	1					1		1	13	YS1955	Siemens Schuckert DA304
YS2244	1	3	5	2	1	1				1			14	YS2244	Landis & Gyr MG1D
YS2324								1					1	YS2324	EMMCO SD
YS2351	3		6	3									12	YS2351	Siemens Schuckert ZD12
YS2354	4	2	5	2	1				1	2			17	YS2354	Siemens Schuckert ZD22B
YS2424	2	13	14	12	9	15	3	1	3	7	2	1	82	YS2424	EMMCO SD
YS2444						1							1	YS2444	Landis & Gyr GI Series
YS2445	3	2	1	9	5	2	2			2			26	YS2445	Landis & Gyr MG21D
YS2454	1	12	3	12	3		1	3	3	1			39	YS2454	Siemens Schuckert ZD22G
YS2524		2	1	3	4	6	3			1			20	YS2524	EMMCO SD
YS2544	2	2	2	3	2			1	1	1			14	YS2544	Landis & Gyr MG1D
YS2554		1	1	1	1		1						5	YS2554	Siemens Schuckert ZD22L
YS2624		1	50	28	52	57	70	70	51	41	3	5	428	YS2624	Email SD
YS2625		1	5	49	139	118	189	343	1,874	307	28	25	3,078	YS2625	Email SD-MR
YS2644		2	1	3	2			1		2			11	YS2644	Landis & Gyr MG1D
YS2647				2	43	14	12	18	17	11		1	118	YS2647	Landis & Gyr YL5D 1966
YS2648		6	5	8	3	430	482	835	256	527	27	14	2,593	YS2648	Landis & Gyr ML262xdf6
YS2651	1		1	1									3	YS2651	Siemens Schuckert ZD12
YS2653			1	2									3	YS2653	Siemens Schuckert Z16
YS2655		20	52	25	42	191	251	143	50	93	9	2	878	YS2655	Siemens Schuckert ZD306
YS2694		1		1	31	11	25	28	22	18	2	1	140	YS2694	Iskra T22FD 1976
YS2824		1	8	3	9	5	7	5	10	9		3	60	YS2824	EMMCO SD
YS2826	2	8	26	27	33	48	50	48	58	2,055	2,073	108	4,536	YS2826	Ampy 5192F Reporter
YS2840											1,291	6,326	7,617	YS2840	Ampy Email EM3130
YS2844		1	4		3	1		1	2	3			15	YS2844	Landis & Gyr MG1D
YS2847			5	12	27	8	9	8	7	7			83	YS2847	Landis & Gyr ML12D, YL5D
YS2850												85	85	YS2850	Landis & Gyr EM5100
YS2855			3	3	3	1		1	2			1	14	YS2855	Siemens Schuckert ZDA304, 7CA3842
YS2925		1	9	1	8	20	6	175	894	125	27	4	1,270	YS2925	EMMCO SD-M
YS2947				5	10	14	5	6	6	2		1	49	YS2947	Landis & Gyr YL5D
YS2948		1	1	3	0	130	166	252	178	275	7	2	1,015	YS2948	Landis & Gyr ML240xdf6
YS2953			2	1			1		2	1			7	YS2953	Siemens Schuckert ZD16
YS2955		3	6	8	5	1	1	4		1			29	YS2955	Siemens Schuckert ZDA304
YS3354				3									3	YS3354	Siemens Schuckert D22ML
YS4826										37	26	17	80	YS4826	Email Q4
YS4827										107	2,974	13,483	16,564	YS4827	Ampy EM3332, I/E
YS4830												20,235	20,235	YS4830	Landis & Gyr EM5131, I/E
YS6801												1,444	1,444	YS6801	Landis & Gyr E350 U3300, AMI
YS6830												294	294	YS6830	Landis & Gyr EM5131, I/E, LP
Sub-total	**592**	**839**	**855**	**1,415**	**2,587**	**7,548**	**10,070**	**13,170**	**16,601**	**26,614**	**39,877**	**59,491**	**179,659**	Sub-total	

Metal cased meters

Stock Item	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	Stock Item	Meter Type
YT1511					1	3							**4**	YT1511	Aron EIT34DD
YT1524		5	17	28	32	28	21	8	2	8	4		**153**	YT1524	EMMCO SD
														YT1525	Email SD-M SDMPE
YT1547				1		2	1	3		1			**8**	YT1547	Landis & Gyr ML2F3
YT1555				1				1					**2**	YT1555	Siemens Schuckert D306
YT1824				1	10	26	47	10	16	12	3	1	**126**	YT1824	EMMCO SD
YT1825				1	12	3	9	13	2	11	20	1	**72**	YT1825	EMMCO SD-M
YT1848				2	3	60	158	116	26	74	60	4	**503**	YT1848	Landis & Gyr ML240xdf6
YT1896						4	1			1	2		**8**	YT1896	Iskra T3CT1
YT2511			2										**2**	YT2511	Aron EIT34DD
														YT2525	Email SD-M SDMPE
YT2544		3	7	6	6	3	0	0	1	2	0	0	**28**	YT2544	Landis & Gyr MG1D
YT2555			1	7	9	5	3	2		2	1		**30**	YT2555	Siemens Schuckert ZD304, ZD306
YT2825				3	19	10	7	105	301	221	163	9	**838**	YT2825	EMMCO SD-M & SDMR
YT2848				3	2	38	62	77	131	270	113	9	**705**	YT2848	Landis & Gyr ML240xdf6
														YT2858	
Sub-total		**8**	**27**	**53**	**94**	**182**	**309**	**335**	**479**	**602**	**366**	**24**	**2,479**	Sub-total	

Metal cased meters

3 phase, 4 wire, 415 volt, precision grade, transformer connected, kilowatt hour meter

Stock Item	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	Stock Item	Meter Type
YU1553				2						1			**3**	YU1553	Siemens Schuckert D16P5
YU2543				1									**1**	YU2543	Landis & Gyr MF32D
YU2547									1				**1**	YU2547	Landis & Gyr ML20xd
														YU2548	Landis & Gyr FL246xdf6
YU2553			5	3	2	1	2	3	2	8			**26**	YU2553	Siemens Schuckert ZD16P4, ZD16P5
YU6525									91	80	231	214	**616**	YU6525	Email SDMPE, A1, Q3
YU6526										27	60	342	**429**	YU6526	Email Q4
YU6527											564	1,787	**2,351**	YU6527	Ampy Email EM3352
YU6528											20	512	**532**	YU6528	Landis & Gyr EM5315, I/E (PV program)
YU6529												1,971	**1,971**	YU6529	Landis & Gyr EM5315 (Std. program)
														YU6543	Landis & Gyr MF32HR6
														YU6547	Landis & Gyr ML246xhr3f6
YU6548										4	1		**5**	YU6548	Landis & Gyr ZMA110M402er14
YU6549										8	7	1	**16**	YU6549	Landis & Gyr ZMB410CTaeCSr14ar14a
YU6586										5	11	18	**34**	YU6586	EDMI Mark 6
YU9547								2	2				**4**	YU9547	Landis & Gyr ML20HT
Sub-total			**5**	**6**	**2**	**1**	**2**	**5**	**96**	**133**	**894**	**4,845**	**5,989**	Sub-total	

3 phase, 4 wire, 110 volt, precision grade, transformer connected, kilowatt hour meter

Stock Item	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	Stock Item	Meter Type
YW6126										1	9	18	**28**	YW6126	Email Q4
YW6526										1			**1**	YW6526	Email Q4
YW6528												5	**5**	YW6528	
Sub-total										**2**	**9**	**23**	**34**	Sub-total	

	<1960	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Total Quantity	
Totals	**11,581**	**55,848**	**65,977**	**77,915**	**50,452**	**80,806**	**118,900**	**108,778**	**68,803**	**89,512**	**122,911**	**263,778**	**1,115,261**	Totals
Progressive Meter Totals	**11,581**	**67,429**	**133,406**	**211,321**	**261,773**	**342,579**	**461,479**	**570,257**	**639,060**	**728,572**	**851,483**	**1,115,261**		

8.4 Appendix 4: Inspection and Testing of direct connected meters

8.4.1 Preventative Maintenance - Inspection & Testing

Inspection and testing of metering installations is required to be carried out in accordance with tables documented in National Electricity Rules, schedule 7.3 or an alternative testing practice approved by AEMO.

The proposed asset management strategy for inspection and testing of SA Power Networks metering installations is summarised in the following table:

Metering Equipment	Management Strategy	Resource
	Meters Direct Connected	
Inspection	All individually inspected at least once per year.	SA Power Networks / AMRS
Test	Meter sample testing in accordance with AS/NZS 1284.13	SA Power Networks
	Meters Transformer Connected	
Inspection	All individually inspected once per year.	SA Power Networks
Test	Meter sample testing in accordance with AS/NZS 1284.13	SA Power Networks
	Current Transformers Low Voltage	
Inspection	All individually inspected once per year.	SA Power Networks
Test	Sample testing for type 4, type 5 and type 6 in accordance with 'Alternative Testing Minimum Requirements' for LV CT metering installations. Type 1, type 2 and type 3 tested individually at periods in accordance with NER.	SA Power Networks
	Current Transformers High Voltage	SA Power Networks
Inspection	All individually inspected once per year.	
Test	All tested individually at periods in accordance with NER.	SA Power Networks
	Voltage Transformers	
Inspection	All individually inspected once per year.	SA Power Networks
Test	All tested individually at periods in accordance with NER.	SA Power Networks

8.4.2 App Testing of Direct Connected Meters

8.4.2.1 Testing Method

To facilitate management of revenue meter assets, the meters are divided into classes identified by the *SA Power Network Stock Item Number* and the *Period of Installation*.

Sample quantities of meters are determined in accordance with the sampling criteria for 'testing by variables' and then appropriate lists of meters for testing are identified by a process of random selection.

Where test results reveal an average accuracy error greater than +/- 1.5%, the individual meter is replaced immediately by the testing officer as a corrective maintenance action.

Following completion of testing for each meter sample, the accuracy performance is examined for conformance with normal distribution by statistical analysis of the recorded test results.

If normality of test results for any meter class is not confirmed then the 'testing by attributes' technique is adopted. Sample quantities comprising additional meters are required to be tested in accordance with the sampling criteria for 'testing by attributes' and then appropriate lists of meters for testing are identified by a process of random selection.

8.4.2.2 Statistical Analysis of Results

Standard AS/NZS 1284.13 provides a process for statistical analysis of test results to identified meter classes that require replacement before the error exceeds an acceptable tolerance of +/- 2% induction +/- 1.5% static.

Analysis of test data for 'testing by variables' commences with the calculation of sample mean (x) and standard deviation (s) followed by selection of values for load factors (KL and KF) and error limits (L and U) for each sample.

Inequality calculations of sample values are compared with upper and lower errors for chosen criteria to determine acceptability of the sample test results and consequent pass or failure of the meter class.

8.4.2.3 Second Sample Testing

In the event that tests of the first meter sample do not pass the analysis process, a second sample may be tested, consistent with the same sampling plan, to confirm that the sample selection is representative of the meter class. Meters of the first sample are excluded from the meter class prior to selection of the second sample to ensure that previously sampled meters are not retested.

If the analysis of first meter tests fails for a large quantity of meters in a five year installation period, the class may be divided into smaller classes according to separate years of installation and then the second testing performed with appropriate random samples selected from each smaller class. This process identifies specific years of manufacture for which the performance of a meter type is not acceptable and consequently avoids unnecessary replacement of meter classes that are operating satisfactorily.

If the second sample of meter tests fails analysis, all the meters in the class are included in the meter replacement program during the subsequent year. If the meter test analysis is acceptable, the class is scheduled for sample testing again within the appropriate compliance testing period.

8.4.2.4 Meter Load Point Accuracy

The average accuracy error value may indicate an optimistic state of actual meter errors at the designated load points because of the averaging effect of the error formula. For this reason, it is also prudent to consider the errors at individual load points as well as the average error.

Therefore if the average error of the meter class is acceptable, then individual load point errors should be examined to ensure that the majority of errors are within the prescribed standard limits of +/- 2.0%.

If more than 25% of individual load point errors are not within this tolerance, then all meters in the class are deemed to have unacceptable accuracy and are included in the meter replacement program during the subsequent year.

8.4.3 Inspection and Testing of Transformer Connected Meters

8.4.3.1 Inspection of Tranformer Connected Meters

The period for inspection of type 3 (>10 GWh and 2-10 GWh) metering installation equipment by SA Power Networks represents a departure from specific National Electricity Rules compliance.

Scheduling of all type 3 transformer connected meter inspections at 5 year intervals to coincide with meter testing activities, improves management effectiveness and maintains consistency, especially for customer sites with fluctuating annual consumption.

Metering Installation	Maintenance Type	Cycle Period
Type 1	Routine inspection	2.5 years
Type 2	Routine inspection	12 months
		(2.5 yrs. if check meter installed)
Type 3 (>10, 2-10, <2 GWh)	Routine inspection	When meter tested
Type 4, 5, 6	Routine inspection	When meter tested

Table 11: Transformer connected meters inspection cycles

Regular inspection of manually read transformer connected metering installations is undertaken by meter reading personnel.

Details of damaged meters, broken seals and tampering are reported for investigation or repair by field maintenance staff.

In addition to scheduled preventative maintenance, inspection and accuracy testing of transformer connected meters is performed by Services or Field Services personnel in response to customer requests and enquiries regarding high bills.

8.4.3.2 Testing of Tranformer Connected Meters

Testing periods for transformer connected meters are presented in the following table:

Metering Installation	Maintenance Type	Cycle Period
CT connected meters - Electronic	Routine test	5 years
CT connected meters - Induction		
Type 1, 2	Routine test	2.5 years
Type 3, 4, 5, 6	Routine test	5 years

Table 12: Transformer connected meters testing cycles

As for inspections, testing is done individually, in accordance with documented metering work procedures and in addition to scheduled preventative maintenance, in response to customer requests and enquiries regarding high bills.

8.4.4 Inspection and Testing of Metering Transformers

8.4.4.1 Inspection of metering Transformers

The period for inspection of type 3 (>10 GWh and 2-10 GWh) metering installation equipment by SA Power Networks represents a departure from specific National Electricity Rules compliance.

Scheduling of all type 3 metering transformer inspections at 5 year intervals to coincide with meter testing activities, improves management effectiveness and maintains consistency, especially for customer sites with fluctuating annual consumption.

Concurrent transformer inspection and meter testing for type 3 metering at 5 year intervals is also appropriate for planning in conjunction with transformer testing periods of 10 years.

Metering Installation	Maintenance Type	Cycle Period
Type 1	Routine inspection	2.5 years
Type 2	Routine inspection	12 months
		(2.5 yrs. if check meter installed)
Type 3 (> 10, 2-10, <2 GWh)	Routine inspection	When meter tested
Type 4, 5, 6	Routine inspection	When meter tested

Table 13 CT & VT inspection cycles

In addition to scheduled preventative maintenance, inspection and accuracy testing of metering transformers is performed by Services personnel in response to customer requests and enquiries regarding high bills.

8.4.5 Testing of Metering Transformers

8.4.5.1 Low Voltage Metering Transformers

The method of testing low voltage metering transformers by SA Power Networks represents a departure from specific National Electricity Rules compliance.

Procedures for primary/ secondary ratio verification and burden determination of low voltage metering transformers are conducted during meter test and inspection activities to provide an indication of potential equipment faults.

In consideration of the difficulties encountered to arrange interruption of customer supply for the purpose of testing metering transformers by the direct injection method, an alternative testing technique via secondary injection has been adopted.

Low voltage metering transformer tests are performed using Red Phase 590G secondary injection testing equipment which provides acceptable test accuracy to reliably identify defective transformers.

Transformer testing by secondary injection significantly reduces the period required for customer power outage compared with that for conducting primary injection tests.

Low voltage metering transformer testing is scheduled to be concurrent with transformer connected meter testing and inspection of the installation equipment whenever possible.

SA Power Networks is increasing the quantity of metering transformers tested per year in an endeavour to achieve testing at intervals prescribed in the National Electricity Rules, Chapter 7.

8.4.5.2 High Voltage Metering Transformers

High voltage metering transformers located at wholesale and boundary installations are tested by the direct primary injection method in compliance with the National Electricity Rules, Chapter 7.

The method of testing high voltage metering transformers, other than those at wholesale and boundary installations represents a departure from specific National Electricity Rules compliance.

The process for testing the high voltage is performed in the same manner and with the same customer considerations as low voltage.

8.5 Appendix 5: Meter Sampling Testing -2013

RECORD of METER SAMPLE TESTING 2013

Rev.: November '13

Ref.	Date Completed	Test Batch		Test Technician	Test Sample Size	Tests Completed	Meters Fail Accuracy Field Test	Comments
		Stock Item	Install'n Period					
13-01	6-Mar-13	**YA1324**	1950-59	W.Bonney DG	35	41	1	Sample **passed** analysis. Fail error: +1.54 Batch ave. acc. error mean +0.774%
13-02	15-Oct-13	**YA1324**	1960-64	W.Bonney DG	35	40	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.493%
13-03	24-Jul-13	**YA1454**	1950-59	W.Bonney DG	15	25	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.546%
13-04	25-Oct-13	**YA1554**	1960-64	A.Clark J.Vass DG	35	41	3	Sample **failed** analysis. Fail error: -1.54, +1.50, +2.21 Batch ave. acc. error mean 0.607%
13-05	21-Jun-13	**YA1624**	1950-59	G.Gill DG	75	78	10	Sample **failed** analysis. Fail error: -6.38, -3.01, -1.94, +2.11, +2.15, +2.22, +2.22, +2.27, +2.95, +3.02 Batch ave. acc. error mean 0.378%
13-06	30-Jul-13	**YA1624**	1960-64	W.Bonney J.Vass DG	100	106	1	Sample **passed** analysis. Fail error: +1.56 Batch ave. acc. error mean 0.052%
13-07	27-Aug-13	**YA1624**	1995-99	A.Clark DG	50	54	1	Sample **passed** analysis. Fail error: -2.64 Batch ave. acc. error mean 0.113%
13-08	9-Aug-13	**YA1625**	1960-64	J.Vass DG	75	80	3	Sample **passed** analysis. Fail error: +1.60, +2.06, +2.11 Batch ave. acc. error mean 0.254%
13-09	26-Jun-13	**YA1663**	1950-59	G.Gill DG	50	79	3	Sample **failed** analysis. Fail error: -2.11, +8.96, +24.45 Batch ave. acc. error mean -0.225%
13-10	7-Aug-13	**YA1663**	1960-64	G.Gill DG	100	104	5	Sample **passed** analysis. Fail error: +1.86, +2.01, +2.44, +12.44, +153.68 Batch ave. acc. error mean 0.363%
13-11	8-Oct-13	**YA1663**	1995-99	W.Bonney DG	25	30	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.690%
13-12	18-Oct-13	**YA1664**	1995-99	W.Bonney DG	15	20	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.136%
13-13	27-Aug-13	**YA1825**	1995-99	S.Lengyel DG	50	55	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.026%
13-14	24-Jul-13	**YA1827**	1950-59	W.Bonney DG	35	48	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.038%
13-15	14-Oct-13	**YA1827**	1960-64	A.Clark DG	35	40	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.224%
13-16	13-Sep-13	**YA1828**	1995-99	A.Clark DG	50	55	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.141%
13-17	25-Sep-13	**YA1841**	1995-99	A.Clark DG	35	42	2	Sample **failed** analysis. Fail error: +10.66, +17.10 Batch ave. acc. error mean 0.288%
13-18	12-Sep-13	**YA1849**	1995-99	S.Lengyel DG	35	40	1	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.287%
13-19	6-Sep-13	**YA1893**	1995-99	A.Clark DG	35	40	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.260%
13-20	5-Sep-13	**YA1895**	1995-99	S.Lengyel DG	50	55	4	Sample **passed** analysis. Fail error: -12.71, -2.21, -1.98, -1.85 Batch ave. acc. error mean -0.157%
13-21	31-Oct-13	**YA2827**	1995-99	W.Bonney DG	35	40	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.036%
13-22	19-Sep-13	**YA4926**	1960-64	J.Vass DG	20	20	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.044% / 0.108%
13-23	26-Sep-13	**YA4926**	1995-99	J.Vass DG	20	25	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.030% / 0.042%

13-24	1-Jul-13	**YA4971**	1995-99	G.Gill DG	100	109	20	Sample **passed** analysis. Fail error: -3.46, -1.95, -1.80, -1.23, -1.22, -1.16, -1.14, -1.14, -1.10, -1.04, -1.01, -1.01, +1.11, +1.16, +1.18, +1.18, +1.39, +1.43, +1.56, +1.57 Batch ave. acc. error mean -0.168% / 0.052%
13-25	29-Oct-13	**YA4972**	1995-99	A.Clark J.Vass DG	50	55	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.014% / 0.047%
13-26	1-Feb-13	**YS1424**	1990-94	W.Bonney DG	35	40	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.061%
13-27	31-Jul-13	**YS1625**	1990-94	W.Bonney DG	75	80	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.109%
13-28	14-Mar-13	**YS1625**	1995-99	W.Bonney DG	100	105	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.029%
13-29	7-May-13	**YS1648**	1990-94	W.Bonney DG	75	80	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.010%
13-30	22-Aug-13	**YS1655**	1960-64	W.Bonney DG	15	20	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.526%
13-31	18-May-13	**YS1655**	1990-94	D.Nicholson DG	10	15	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.033%
13-32	12-Apr-13	**YS1694**	1990-94	W.Bonney G.Gill DG	15	20	1	Sample **failed** analysis. Fail error: +11.74 Batch ave. acc. error mean 0.515%
13-33	25-Mar-13	**YS1824**	1990-94	W.Bonney DG	15	20	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.092%
13-34	11-Aug-13	**YS1826**	1950-59	W.Bonney DG	20	25	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.137%
13-35	9-Aug-13	**YS1826**	1960-64	W.Bonney DG	20	25	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.110%
13-36	19-Mar-13	**YS1826**	1990-94	W.Bonney DG	15	20	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean 0.032%
13-37	3-May-13	**YS1925**	1990-94	W.Bonney DG	15	20	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.186%
13-38	31-May-13	**YS1948**	1990-94	W.Bonney DG	25	30	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.062%
13-39	17-May-13	**YS2625**	1990-94	W.Bonney DG	20	25	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.562%
13-40	8-Apr-13	**YS2648**	1990-94	W.Bonney DG	35	40	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.107%
13-41	29-Jul-13	**YS2655**	1990-94	W.Bonney DG	15	20	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.286%
13-42	24-May-13	**YS2925**	1990-94	W.Bonney DG	15	20	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.252%
13-43	22-May-13	**YS2948**	1990-94	W.Bonney DG	15	20	0	Sample **passed** analysis. Fail error: none Batch ave. acc. error mean -0.067%
				Total:	1,695	1,947	55	

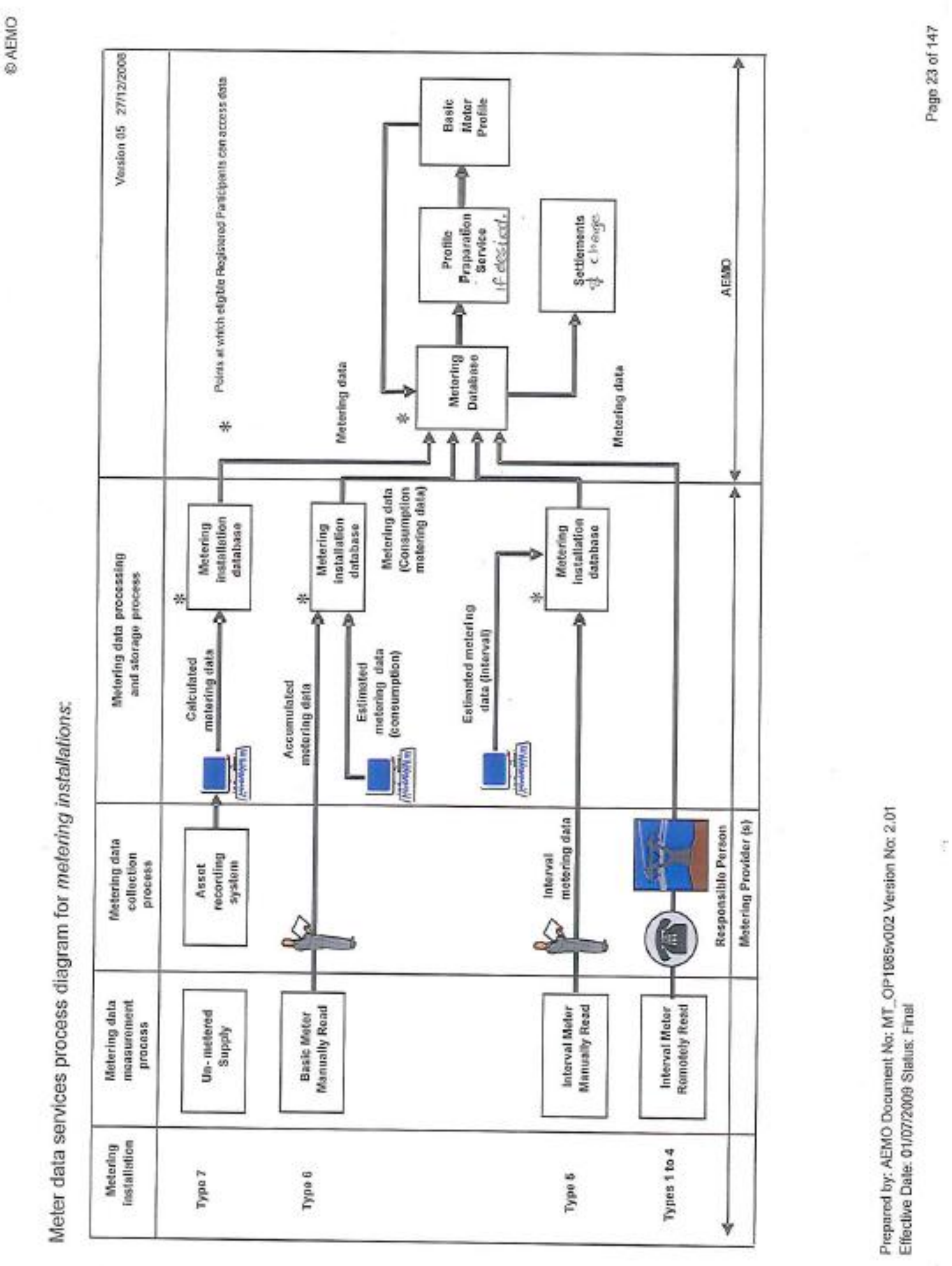
Note:

- If a meter test reveals an error greater than
  +/- 1.5% for induction meters or
  +/- 1.0% for electronic meters
  then the individual meter is repaced immediately by the testing officer.

- When a meter batch does not pass analysis of the first sample test results, a second sample selected at random from other meters in the batch may be tested for accuracy and the results analysed in accordance with AS/NZS 1284.13: In-service compliance testing.

- Average accuracy error mean of all meter sample tests in batches that passed accuracy criteria is -0.011%.

8.6 Appendix 6: Meter data services, capacity and accuracy requirement



S7.2.3 Accuracy requirements for metering installations

Table S7.2.3.1 Overall Accuracy Requirements of Metering Installation Components

Type	Volume limit per annum per connection point	Maximum allowable overall error (±%) at full load (Item 7)		Minimum acceptable class or standard of components	Metering installation clock error (seconds) in reference to EST
		active	reactive		
1	greater than 1000GWh	0.5	1.0	0.2CT/VT/*meter* Wh 0.5 *meter* varh	±5
2	100 to 1000GWh	1.0	2.0	0.5CT/VT/*meter* Wh 1.0 *meter* varh	±7
3	0.75 to less than 100 GWh	1.5	3.0	0.5CT/VT 1.0 *meter* Wh 2.0 *meter* varh (Item 1)	±10
4	less than 750 MWh (Item 2)	1.5	n/a	Either 0.5 CT and 1.0 *meter* Wh; or whole current general purpose *meter* Wh: • meets requirements of clause 7.3.1(a)(10); and	±20 (Item 2a)

Type	Volume limit per annum per connection point	Maximum allowable overall error (±%) at full load (Item 7) active	reactive	Minimum acceptable class or standard of components	Metering installation clock error (seconds) in reference to EST
				• meets the requirements of clause 7.11.1(b). (Item 1)	
5	less than x MWh (Item 3)	1.5 (Item 3b)	n/a	Either 0.5 CT and 1.0 *meter* Wh; or whole current connected general purpose *meter* Wh: • meets requirements of clause 7.3.1(a)(11); and • meets the requirements of clause 7.11.1(d). (Item 1)	±20 (Item 3a)
6	less than y MWh (Item 4)	2.0 (Item 4b)	n/a	CT or whole current general purpose *meter* Wh recording *accumulated energy data* only. Processes used to convert the *accumulated metering data* into *trading interval metering data* and *estimated metering data* where necessary are included in the *metrology procedure*. (Item 1)	(Item 4a)
7	volume limit not specified (Item 5)	(Item 6)	n/a	No *meter*. The *metering data* is *calculated metering data* determined in accordance with the *metrology procedure*	n/a

8.7 Appendix 7: Definitions

Term	Definition
SWD	Sequential Wave Distortion Systems Have the capability of modifying switching arrangements from a central or a remote location.
NECF	National Energy Customer Framework.