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Metering Asset Management Plan

2020-2025
Regulatory Proposal
January 2019





ASSET MANAGEMENT PLAN 3.4.01

METERING

2018 - 2025

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Ownership of Standard

OWNERSHIP OF STANDARD

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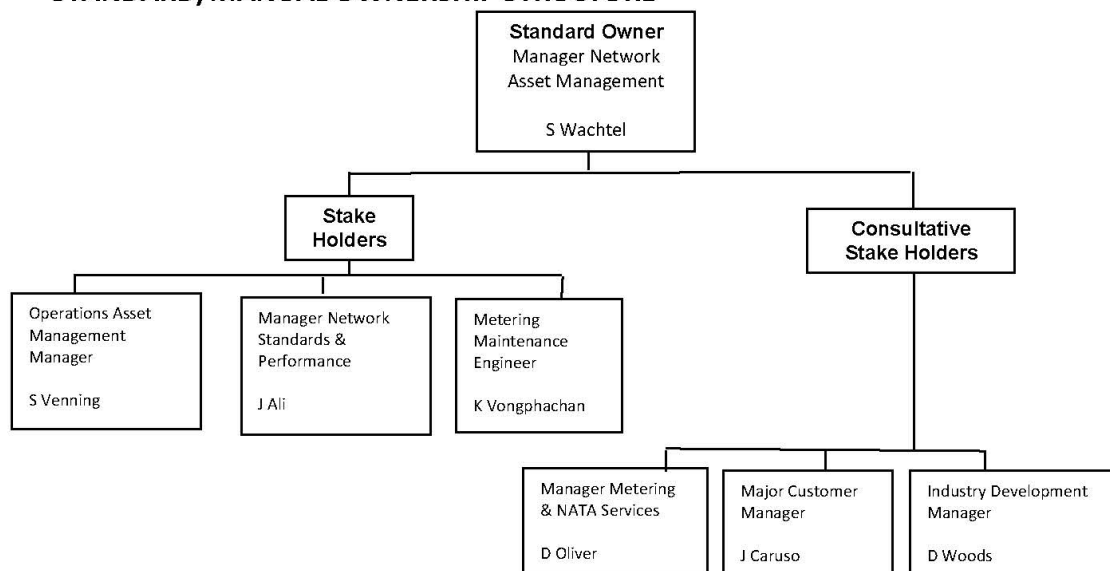
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STANDARD/MANUAL OWNERSHIP STRUCTURE



OTHER RELATED MANUALS

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COMMENTS

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Document Version

Date	Version	Explanation
May 2009	0.1	Original AMP
2 October 2014	0.2	Updated AMP
27 October 2014	1.0	Final
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Executive Summary

This document will specify the strategy and methodologies used by SA Power Networks to manage the metering assets, for which it is the Metering Coordinator, in compliance with applicable Rules and Regulations. It will also provide detail on the availability and management of the resources and test capability required to perform the work that has been set out.

As the Local Network Service Provider (LNSP) under the National Electricity Rules (NER), SA Power Networks is responsible for maintaining approximately 800,000 metering installations. The majority of that population are type 5 and 6 metering installations.

The Manager Network Standards and Performance is the Metering Coordinator under the NER and thus holds overall accountability for the provision, installation and maintenance of metering installations as well as the collection, processing and delivery of metering data. Under delegation from the Manager Network Standards and Performance, the Operational Asset Management Group maintain the Metering Asset Management Plan and are responsible for the asset management strategies and activities.

SA Power Networks engages the services of an AEMO accredited metering provider (MP-B) that have the capability to perform the maintenance activities required on the metering assets.

The metering installations covered by this Metering Asset Management Plan include the following assets:

- Direct Connected and Transformer Connected Meters
- Low Voltage Current Transformers

For each of the assets above, detail is provided on the process of testing and the management strategy. The management strategy used is either time based (as per NER Schedule 7.6) or statistics based (as per AS1284.13).

Following introduction of Power of Choice on 1 December 2017, failed meters will be issued to Retailers for replacement with an appropriate meter, as per the National Electricity Rules.

1. Definitions

AEMO	Australian Energy Market Operator
ESCoSA	Essential Services Commission of South Australia
FRMP	Financially Responsible Market Participant
LNSP	Local Network Service Provider, has the meaning given to that term in the National Electricity Rules
MC	Metering Coordinator
MP	Metering Provider
NECF	National Energy Customer Framework
NER	National Electricity Rules
RP	Responsible Person, has the meaning given to that term in the National Electricity Rules
SWD	Sequential Waveform Distortion. An alternative method for control of off-peak domestic water heating using a power line communication system with low frequency
Varh	VAR-hour
Wh	Watt-hour

2. Introduction

This Metering Asset Management Plan specifies the strategies and methodologies used by SA Power Networks to manage the metering assets for which it is the Metering Coordinator and ensure it meets all regulatory requirements and business obligations.

Under the National Electricity Rules, the Metering Coordinator (MC) holds accountability for the provision, installation and maintenance of metering installations as well as the collection, processing and delivery of metering data. SA Power Networks is the Local Network Service Provider (LNSP) for South Australia and hence the initial Metering Coordinator for type 5 and 6 metering installations until a new Metering Coordinator is appointed by the FRMP in accordance with the NER.

This Metering Asset Management Plan will encompass the following assets:

- Direct Connected Meters
- Transformer Connected Meters
- Current Transformers (Low Voltage)

3. Summary of Installation History

SA Power Networks is responsible for approximately 990,000 meters, installed at approximately 800,000 installations within the distribution network. The population of meters are split into approximately 215 stock numbers, each of which represent a different make/model of meter or a different program within a model of meter.

3.1 Direct Connected Meters

SA Power Networks commenced installing electronic meters in 1998. Since this time, electronic meters have progressively been installed to replace induction meters. From 2006, all new meters purchased and installed by SA Power Networks have been electronic devices.

SA Power Networks has Network Tariffs to provide customers with off peak controlled load. The off peak controlled load is controlled by either a time switch or sequential waveform distortion (SWD). The separation of rates and energy usage is achieved by using two meters or using a combination meter.

3.2 Transformer Connected Meters

Of the approximately 215 meter stock codes, 10 are for transformer connected meters.

In recent years the installation of Type 6 transformer connected meters has ceased. All new or altered Type 6 CT installations have Type 5 meters installed.

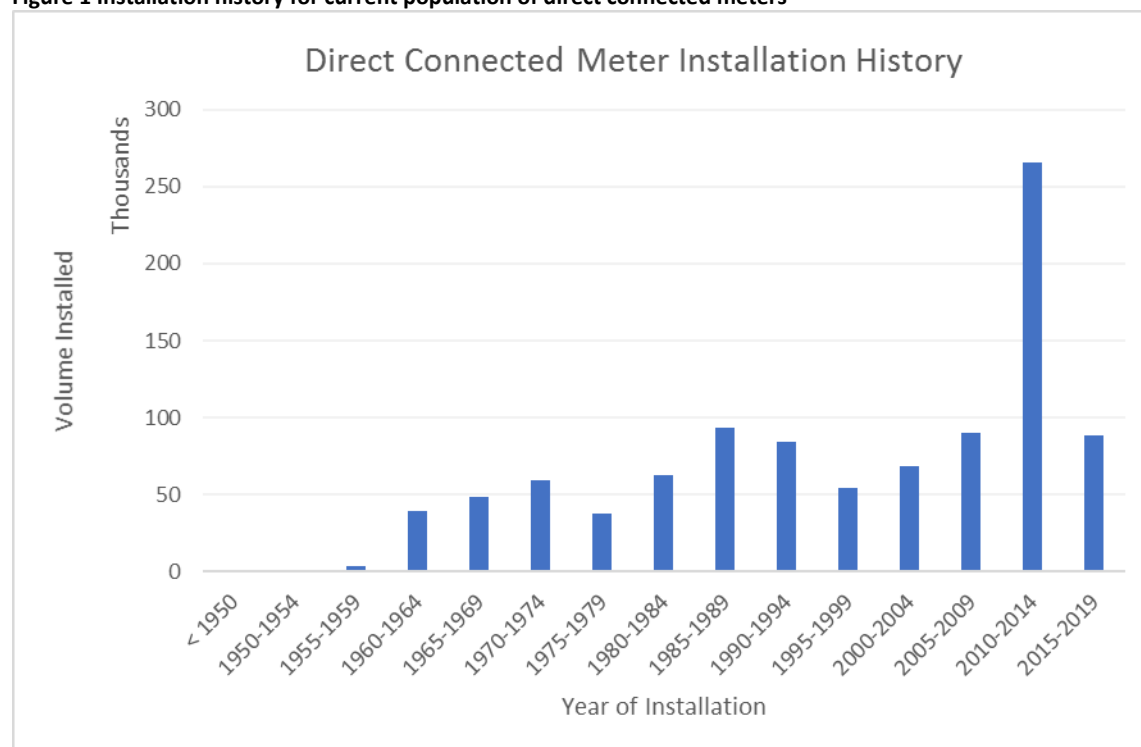
3.3 Instrument Transformers

Low voltage current transformers are grouped into families as per the AEMO Guideline 'Alternative Testing Minimum Requirements'. A summary of the population is included within Table 1.

Table 1 – Overall equipment quantities as at 25 May 2018

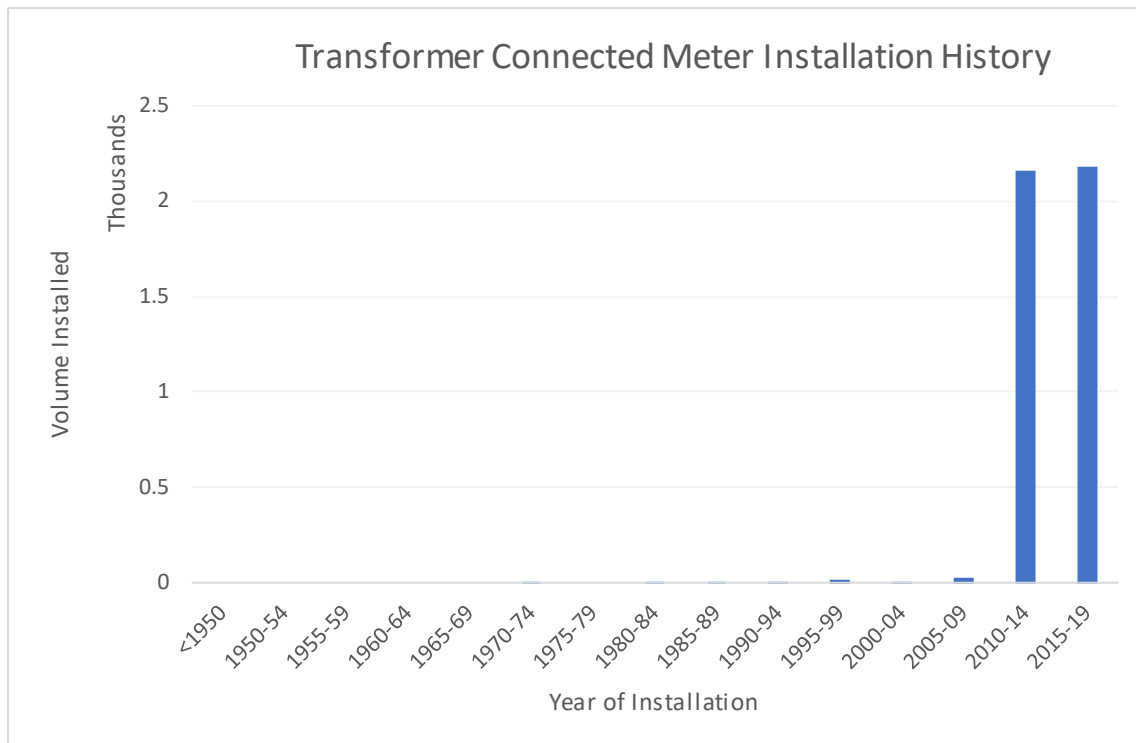
Metering Equipment	Approximate Quantity
Direct Connected Meters	994,434
Transformer Connected Meters	4,398
LV Current Transformers	13,194

Figure 1 Installation history for current population of direct connected meters



The large spike in meter installations during the 2010-2014 period was driven predominantly by customer-initiated meter changes to accommodate solar panels. The Distributor feed-in tariff used staged cut-off dates of 30 Sep 2011 for Class 1 (44c/kWh) and 30 September 2013 for Class 2 (16c/kWh). The advent of the cut off dates resulted in increased adoption of solar panels (and the required meter changes) in an effort to qualify for the Class 1 and 2 feed in tariffs before they cease.

Figure 2 Installation history for current population of transformer connected meters



The populations for transformer connected meters are predominantly installed in recent years because the maintenance and testing strategy, prior to commencement of Power of Choice, for these meter types are to replace the meter on site and take the meter back for workshop testing. This is due to these meters being majority used for commercial customers where site access is difficult and the incremental cost to replace rather than test on site is small.

Table 2 Direct Connected Meter Families and Current Volumes as at 25 May 2018

Direct Connected Meter Families	
YA – Single Phase	811,057
YB – Old Council (i.e., Other Providers)	796
YC – Two Phase	11,630
YS – Three Phase	170,951
Total	994,434

Table 3 Transformer Connected Meter Families and Current Volumes as at 25 May 2018

Transformer Connected Meter Families	
<u>Low Voltage</u>	
YT – 3 Phase, 4 Wire, 415V, Commercial	40
YU – 3 Phase, 4 Wire, 415V, Precision	4,358
Total	4,398

Table 4 Low Voltage Current Transformer Families and Current Volumes as at 3 May 2018

LV CT Families	
A – 150/300/600: 5A	2,037
B – 400/800/1200: 5A	360
C – 1000/2000/3000: 5A	90
S – 200: 5A	9,594
T – 800: 5A	1,086
W – 1500: 5A	6
Other	21
Total	13194

4. Summary of Resources

The responsibility for managing metering assets is spread across multiple groups within SA Power Networks.

The Manager Network Standards and Performance is the initial Metering Coordinator (as defined in the National Electricity Rules) and thus holds ultimate accountability for ensuring compliance with the rules. These responsibilities are delegated, as appropriate, to other groups within the business suited to manage that responsibility. The Network Standards and Performance group is also responsible for ensuring that the business interpretation of the Rules and Regulations remain current and valid.

In the context of Asset Management, the primary roles and groups within the business are outlined below.

The Operational Asset Management group manages the asset management strategies and activities for meters. These responsibilities include:

- Development and review of the Meter Asset Management Plan
- Developing and review of the Sample Testing Plan
- Analysis of test results to determine action required
- Controlling and monitoring the budgets allocated to meter asset management work

The Standards Equipment group is responsible for the meter equipment. These responsibilities include:

- Test equipment
 - Review suitability of test equipment and methods
 - Risk Assessment
- Management of metering components for existing meters and test equipment for use on the SAPN network

The Field Services Electrical Services group provides resources to undertake the customer/retailer related maintenance work required. The work that Field Services Electrical Services provide includes:

- Meter testing
- Meter investigation
- Meter maintenance and repairs

An AEMO accredited metering provider (MP-B) is engaged to provide the resources to undertake the asset management related maintenance work required. This work includes:

- The maintenance of Type 1-6 metering
- In service meter testing
- Compliance testing
- In service instrument transformer testing of low voltage current transformers
- Meter installation investigations
- Meter installation maintenance

5. Summary of Test Capability

The AEMO accredited metering provider (MP-B) engaged by SA Power Networks is qualified to 'Provide, Install and Maintain' the following metering installations and 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 1.5 Wh 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

For high volume low voltage field testing, the following test sets are generally used:

- MTE PTS 2.1 Single Phase Test Set
- MTE PTS 2.3C Three Phase Test Set
- Red Phase 461 Single Phase Test Set
- Red Phase 471 Single Phase Test Set
- Red Phase 590G Secondary Injection Test Set
- Single phase and three phase laboratory meter test benches

Databases are used to manage the test equipment details and calibration records. For traceability, each individual meter test results sheet also contains details of the test unit used. Calibration of test units is performed by a NATA accredited laboratory with results stored in the Metcal database.

The NATA accredited laboratory perform the primary injection field testing and has a large variety of field and laboratory test equipment, that is suitable for field testing of instrument transformers.

Testing work is generally conducted by the following resources:

- Metering services provider (Generally use 13 staff qualified to test metering equipment)
- Calibration Laboratory (Generally use 3 staff qualified to test metering equipment)
- Electrical Services (Generally use 30 staff qualified to test metering equipment)

SA Power Networks may contract testing work to other appropriately certified organisations.

6. MAMP Review Period

The Meter Asset Management Plan will be reviewed annually in October each year. This will allow strategies and plans for the following year to be revised and finalised prior to commencement.

7. Asset Types

The asset types that a metering installation may include are:

- Direct Connected and Transformer Connected Meters
- Low Voltage Current Transformers

SA Power Networks will coordinate and perform the required maintenance activities on all components at metering installations for which it is the Metering Coordinator.

Replacement activities will be issued to the nominated Retailer for replacement in accordance with the NER.

If SA Power Networks role as the initial Metering Coordinator concludes and it has not been appointed as the ongoing Metering Coordinator or Metering Provider, SA Power Networks responsibility for that metering installation (including any current transformers and voltage transformers) ceases. As per the NER, responsibility will be transferred to the customer and FRMP or FRMP appointed Metering Coordinator.

7.1 Low Voltage Current Transformers

7.1.1 Type of Test

Low voltage current transformers are tested using the secondary injection method.

7.1.2 Period Between Tests and Test Volumes Per Year

If the low voltage current transformer is individually tested, the period between tests is as below:

Table 5 Low Voltage Current Transformer Test and Inspection Cycle

Metering Installation	Testing Cycle	Inspection Cycle
Type 5-6	10 years	5 years (to coincide with meter testing)

If the low voltage current transformer is sample tested, the period between tests is as per 'Alternative Testing Minimum Requirements: Low Voltage Current Transformer Metering Installations' section 3.7:

- Initial period for new low voltage current transformers is 10 years (from last test date)
- Ongoing period is 5 years provided that the low voltage current transformer family passes the tests

Table 6 Low Voltage Current Transformer Testing Volumes

	2018	2019	2020	2021	2022	2023	2024	2025
LV CT Testing	21	280	201	0	0	21	280	201

7.1.3 Compliance Process and Applicable Standards

Low voltage current transformers are sample tested in accordance with the AEMO 'Alternate Testing Minimum Requirements: Low Voltage Current Transformer Metering Installations'.

The period for inspection of low voltage current transformers by SA Power Networks is in accordance with Schedule 7.6.1 of the NER.

7.1.4 Test Equipment and Traceability of Test Equipment

Each test set has a 'Test Set Number' used to identify the test set. The results form for each completed test results contains the test set number. Further details on the test set are within the calibration database and traceability schedule.

7.1.5 Expected Maximum Uncertainty of Test Results

Table 7 Expected Maximum Uncertainty of Low Voltage Transformer Test Results

Description	Uncertainty
CT Ratio 2.5/5 to 20,000/5	0.02%
CT Ratio 20,000/5 to 75,000/5	0.05%
Phase 5 to 120% Primary I	1 min = 0.029 CRad

7.1.6 Test Resources

SA Power Networks engages a metering services provider to perform the test and inspection of low voltage current transformers.

7.1.7 Management of Low Voltage Current Transformer Compliance Failures

When an individual Type 1-4 low voltage current transformer installation is found noncompliant, the low voltage current transformer is arranged to be replaced as soon as possible. When an individual Type 5-6 low voltage current transformer installation is found noncompliant, the financially responsible Market Participant (FRMP) is notified.

When a low voltage current transformer family failure is identified, SA Power Networks will notify the FRMP.

7.2 Metering (Transformer and Whole Current Connected)

Table 8 Meter Compliance Process

Type	Test and Inspection Strategy	Resource
Transformer Connected		
Type 5-6	Large populations sample tested in accordance with AS1284.13:2002 Small populations individual tested and inspected in accordance with NER Schedule 7.6	SA Power Networks
Direct Connected		
Type 5-6	Sample testing in accordance with AS1284.13:2002	SA Power Networks

7.2.1 Process of Testing and Inspection

Where possible, compliance testing is performed while the meter is in service using one of the following test sets:

- MTE PTS 2.1 Single Phase Test Set
- MTE PTS 2.3C Three Phase Test Set
- Red Phase 461 Single Phase Test Set
- Red Phase 471 Single Phase Test Set

Plug-in type meters cannot be tested in service. When a plug-in meter is encountered, the meter is carefully removed and tested using a specialised portable testing station. The meter is carefully put back into service if the accuracy is within allowable tolerance (as defined by the NER).

Each test set has a 'Test Set Number' used to identify the test set. The results form for each completed test results contains the test set number. Further details on the test set are within the calibration database and traceability schedule.

Maximum uncertainty given below:

Table 9 Expected Maximum Uncertainty of Meter Test Results

Description	Uncertainty
Watt Hour (Wh)	0.2 %
VAR Hour (Varh)	0.4%

Compliance meter testing is performed by a metering services provider.

Inspection of remotely read meters is performed by a metering services provider and inspection of manually read meters is performed by meter readers.

7.2.2 Sample Testing of Meters

Direct connected and CT Meter sample testing is performed in accordance with AS1284.13:2002.

All meter families that are suitable for sample testing use Sample Testing by Variables in the first instance. Prior to analysis, the sample results are assessed for normality using the D'Agostino-Pearson omnibus test implemented in an Excel spreadsheet. If normality is not indicated, Sample Testing by Attributes is instead adopted and additional tests are conducted to meet the Sample Testing by Attributes sample size. In certain circumstances, subdivision of the batch to attempt to confirm normality of each subdivision may be undertaken instead. Each subdivision is its own batch.

Consistent with AS1284.13, the meter families are split into batches separated by meter stock number (which is generally indicative of different manufacturers and/or patterns) and year of installation (grouped into 5 year bands). This information is currently stored and kept up to date in the SA Power Networks CIS O/V database and can be extracted as needed.

The sample size is determined from the population of each batch and in accordance with AS1284.13. The sample test numbers are made up entirely of in-service field tested meters.

A representative sample of any new pattern or new type of meter were workshop tested prior to installation on the network. After a number of years in service, the

first batch of each new meter (or new meter pattern) installed in the network is sample tested as per AS1284.13. The results of the initial sample tests will provide an initial compliance period that is then applied to all installations of that meter type/pattern.

7.2.3 Failures

In the event that tests of the first meter sample of a large batch 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 batch.

If the second sample fails the test analysis or SA Power Networks does not elect to perform a second sample test, the FRMP is notified of the need to replace all the meters in the failed batches.

Assessment of the results are conducted by the Operational Asset Management group and distributed to stakeholders in a summary record.

7.2.4 Notifying FRMP

When a meter batch fails the sample testing analysis, the FRMP is notified of the batch failure and the need for replacement. The FRMP will also be notified of meters from previous replacement plans that have not been removed.

7.2.5 Notifying FRMP Without Testing

SA Power Networks have historically replaced certain meters for reasons other than the result of sample testing. These meters are scheduled for 'replacement without testing' for various reasons that may include:

- Identified safety issues;
- The meter family exhibiting premature failures or unexpected issues
- The meters inadequately capturing large usage (4 dials)
- The meter batch is unviable to sample test
- The meter batch size is uneconomic to individually test

This management strategy will continue via 'notifying the FRMP without testing'.

7.2.6 Holdfast Shore Apartments

At Holdfast Bay, there are three blocks of 47, 75 and 100 apartments in each. The meters are 20 years old. There are separate meters for power and lighting for each apartment and for their roof mounted air conditioning equipment. The meters are all centrally located at the lower floor in each block.

The meters are no longer available (supplier out of business). When the meter/s fails and repair is not possible without significantly altering the meter or metering installation, the FRMP will be notified of all affected meters.

7.2.7 Testing Plan

Table 10 Meter Testing Volumes

	2018	2019	2020	2021	2022	2023	2024	2025
Direct Connected Meters	2030	2062	2040	2655	2135	2116	2083	2835
Transformer Connected Meters	242	0	1	0	1	0	0	242

8. Management of Test Equipment

Test equipment is calibrated at 12 month intervals by a NATA accredited laboratory. A calibration label is affixed to each piece of test equipment and a spreadsheet is maintained that contains equipment details and calibration dates.

Equipment audits are conducted annually both internally and by external auditors during the QMS surveillance process.

For traceability, each test sheet records the name of the technician performing the test and the test set used.

Appendix A – Summary of Meter Strategy

Metering Installation	Section Number	Proposed Strategy	Detail	Resource
LV CT Test	7.3	Sample	Alternative Testing Minimum Requirements: Low Voltage Current Transformer Metering Installations 'variables'	Metering Provider
LV CT Inspection	7.3	Accordance with NER*	Accordance to Schedule 7.6.1*	Metering Provider
Direct Connected Meter Test	7.4	Sample	AS1284.13 'variables'	Metering Provider
Direct Connected Meter Inspection	7.4	Accordance with NER*	Accordance with Schedule 7.6.1	Contractors/Metering Provider
Transformer Connected Meter Test	7.4	Sample/ Accordance with NER	AS1284.13 'variables' Accordance with Schedule 7.6.1	Metering Provider
Transformer Connected Meter Inspection	7.4	Accordance with NER*	Accordance with Schedule 7.6.1*	Metering Provider

* Type 3 (>10 GWh and 2-10 GWh) departs from Schedule 7.3.3. All type 3 metering installations will be inspected at 5 year intervals when the meter is tested

Appendix B – Meter Population Details

Table 11

Description of Meter Type in SA Power Networks Population	Supply Item Group Prefix	Meter %
1 phase, 2 wire, direct connected, kWh meter	YA	81.20
3 phase, 4 wire, direct connected, kWh meter	YS	17.11
2 phase, 3 wire, direct connected, kWh meter	YC	1.16
3 phase, 4 wire, 415 volt, precision grade, transformer connected, kWh meter	YU	0.44
1 phase, 3 wire, direct connected, kWh meter	YB	0.08
3 phase, 4 wire, 415 volt, commercial grade, transformer connected, kWh meter	YT	0.01

Table 12

<i>Customer Segments</i>	<i>Proportion</i>
Type (Group)	
Type 1 [> 40 GWh pa.]	0%
Type 2 [4 GWh pa. to 40 GWh pa.]	0%
Type 3 [750 MWh pa. to 4 GWh pa.]	0%
Type 4 [160 MWh pa. to 750 MWh pa]	0%
Type 5 & 6 [< 160 MWh pa.]	100%
Adelaide Central Business District	0.5%
Metropolitan	59.5%
Rural	38%
Remote	2%

SA POWER NETWORKS METER POPULATION																	
Sorted by Stock Item																	
Rev.: Jun 2018																	
Stock	< 1950	1950-1954	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014	2015-2019	Total	Stock
Item																Quantity	Item
Meter Type																	
3 phase, 4 wire, 415 volt, commercial grade, transformer connected, kilowatt hour meter																	
YT1524						1										2	YT1524
YT1824								2	1							3	YT1824
YT1848										2	2	1	2			7	YT1848
YT2825										4	10	3	4			21	YT2825
YT2848						1		1		1	1	1	2			7	YT2848
Sub-total	0	0	0	0	0	2	0	3	1	7	13	5	9	0	0	40	Sub-total
3 phase, 4 wire, 415 volt, precision grade, transformer connected, kilowatt hour meter																	
YU6526															1	1	YU6526
YU6527													18	397	628	1,043	YU6527
YU6528													4	218	459	681	YU6528
YU6529													1,542	1,090		2,632	YU6529
YU6547										1						1	YU6547
Sub-total	0	0	0	0	0	0	0	0	0	1	0	0	22	2,157	2,178	4,358	