

Electricity Distribution Metering Asset Management Strategy (EDM AMS) 2018 - 2025

Part 1 Electricity Meters & Metering Equipment

PUBLIC

ISSUE/AMENDMENT STATUS

Issue	Date	Description	Author
1.0	30/04/2015	Issue 1	Brendan Buckland
2.0	30/06/2018	Updated data and tables – forecast period extends to 2025	Brendan Buckland Srikanth Sridhar
2.1	27/11/2018	Updated Sections 3,4 &6	Brendan Buckland Srikanth Sridhar

Disclaimer

This document belongs to AusNet Services and may or may not contain all available information on the subject matter this document purports to address.

The information contained in this document is subject to review and AusNet Services may amend this document at any time. Amendments will be indicated in the Amendment Table, but AusNet Services does not undertake to keep this document up to date.

To the maximum extent permitted by law, AusNet Services makes no representation or warranty (express or implied) as to the accuracy, reliability, or completeness of the information contained in this document, or its suitability for any intended purpose. AusNet Services (which, for the purposes of this disclaimer, includes all of its related bodies corporate, its officers, employees, contractors, agents and consultants, and those of its related bodies corporate) shall have no liability for any loss or damage (be it direct or indirect, including liability by reason of negligence or negligent misstatement) for any statements, opinions, information or matter (expressed or implied) arising out of, contained in, or derived from, or for any omissions from, the information in this document.

Contact

This document is the responsibility of the Asset Management division of AusNet Services.
Please contact the owner of the document with any inquiries:

Adrian Hill
Head of Metering Business
Asset Management
AusNet Services
Level 31, 2 Southbank Boulevard
Melbourne Victoria 3006
Ph: (03) 9695 6000

Supporting Documentation

The following document suite comprises the AusNet Services Asset management strategy for managing and maintaining equipment assets for advanced metering technologies. These documents shall be annually updated with reviewer feedback incorporated and support the respective FMECA management recommendation approaches.

Document	Ver.	Review Dates	Owner(s)	Approver	Reviewer
Part 0 - AMI Asset Management Strategy Overview	0.1	30 th June '18	Brendan Buckland	Andrew Kennan	Srikanth Sridhar Alan Crockett
Part 1 - Electricity Meters & Metering Equipment	2.0	30 th June '18	Brendan Buckland	Andrew Kennan	Srikanth Sridhar
Part 2 – WiMax Asset Management Strategy	2.0	30 th June '18	Brendan Buckland	Andrew Kennan Craig Tooley	Alan Crockett Libby Leonard Ben Cole
Part 3 - Mesh Asset Management Strategy	1.0	30 th June '18	Brendan Buckland	Andrew Kennan Craig Tooley	Alan Crockett Libby Leonard Ben Cole
Failure Mode, Effects & Criticality Analysis	1.0	30 th June '18	Brendan Buckland	Andrew Kennan Craig Tooley	Srikanth Sridhar Alan Crockett Libby Leonard Ben Cole
Metering Business Risk & Issue Management	1.0	Monthly	Brendan Buckland	Andrew Kennan	Srikanth Sridhar Alan Crockett

Acknowledgments

1. Recommendation's from this strategy will be summarised and managed through the AMI Asset Management Strategy Overview.
2. Figures, volumes and costings referenced within this document are subject to change. Where a statistic is required the document owner should be contacted for latest information.

Table of Contents

1	Executive Summary	7
2	Overview	9
2.1	Purpose.....	9
2.2	Scope.....	9
2.3	Structure.....	10
2.4	References.....	10
3	Asset Description.....	11
3.1	The Meter Asset.....	11
3.1.1	AMI Meters.....	12
3.1.2	Non-AMI Meters.....	14
3.1.3	Low Voltage Current Transformers (LV CT).....	15
3.1.4	Support & Test Equipment.....	15
3.2	Current Meter Population & Profile	15
3.2.1	Meters Installed by Division	16
3.2.2	Meters Installed by Site Configuration	17
3.2.3	Meter Types	18
3.2.4	Meter Programs	19
3.2.5	Meter Firmware Versions.....	19
4	Low Voltage Current Transformer (LV CT) Fleet	20
4.1	Age Profile	20
4.1.1	AMI Meter Age Profile	21
4.1.2	LV CT Age Profile	22
5	New Meter Connections & Replacements	23
5.1	New Meter Connections	23
5.2	Meter Replacements.....	23
5.3	New Meter Connections & Replacement Forecasts	25

EDM AMS – Part 1 Electricity Meters & Metering Equipment

6	Meter Maintenance	26
6.1	Meter Accuracy and Assurance Testing.....	26
6.1.1	Family Testing of AMI Meter Families.....	26
6.1.2	Family Testing of Non-AMI Meter Families.....	27
6.1.3	Scheduled Meter Inspections.....	28
6.1.4	Meter Data Verification Sample Testing	28
6.2	Meter Assurance Investigations.....	29
6.2.1	Customer Initiated Accuracy and Assurance Tests.....	30
6.3	Low Voltage Metering Current Transformer (CT) Test & Inspections.....	31
6.4	Meter Asset Management	32
6.4.1	Remote Condition Monitoring of Meters	32
6.4.2	Meter Acceptance test and Release.....	33
6.4.3	Meter Procurement	33
6.4.4	Meter Stores and Logistics.....	34
6.4.5	Warranty.....	35
7	Risks & Dependencies.....	37
7.1	Five Minute market data settlement.....	37
7.2	Metering Contestability	38
7.3	Single Meter Manufacturer	38
7.4	Single Comms Module Manufacturer	39
7.4	Bulk meter family failure.....	39
7.5	Single Supplier for CTs.....	40
7.6	Increased failure of Load Control Devices.....	40
7.7	Relationship with third party vendors.....	41
7.8	Meter Procurement & Inventory Management	42
7.9	Local Meter Reading.....	42
7.10	Impacts on Meter Program Versioning Strategy	43
8	Resources & Service Providers	43

EDM AMS – Part 1 Electricity Meters & Metering Equipment

8.1	Metering Resources.....	43
8.2	Metering Equipment Vendors.....	44
8.3	Meter Testing, Returns and Refurbishment.....	45
8.4	Test Equipment.....	45
Appendix A: References		48

1 Executive Summary

The Electricity Distribution Metering Asset Management Strategy (EDM AMS) provides the framework for AusNet Services' management of its metering assets for the period up to year 2025. Within the context of the current and forecast states of the assets, this EDM AMS identifies the strategies to operate and support a safe, compliant and efficient metering asset.

The EDM AMS consists of a Strategy Overview document (Part 0), together with the following three attachments describing the specific asset states and strategies for each of the major meter asset categories:

- **Part 1** – Electricity Meters and Metering Equipment (this document): the physical meter, meter firmware, meter program, low voltage current transformers, and associated meter test equipment.
- **Part 2** – WiMax Asset Management Strategy: WiMax communication modules and firmware installed in the meters, and the associated antenna.
- **Part 3** – Mesh Asset Management Strategy: Mesh communication modules and firmware installed in the meters, and the associated antenna.

Note: These aforementioned documents override any previous versions of meter asset management strategy documents.

The AusNet Services Type 5 and Type 6 electricity metering assets are predominantly comprised of Advanced Metering Infrastructure (AMI) specified meters which all are supplied by Landis + Gyr (L+G) Australia. There are approximately 743,000 AMI meters currently installed in AusNet's Network Distribution area, consisting of multiple meter variants of single and multi-phase types which have been installed from 2009.

With the AMI mandated rollout effectively complete, there are approximately 11,000 non-AMI meter types remaining installed (as of October 2018). These are predominantly sites where AusNet has been advised of a customer refusal or access issues preventing conversion to an AMI meter. Specific management strategies have been devised to manage this small fleet of non-AMI meters.

Meter Asset Management, for the context of this document, includes, capital expenditure projects such as new electricity meter connections and meter replacements and operational meter maintenance activities including in-service meter testing, meter inspections, meter asset procurement and logistics, forecasting and planning.

Currently, AusNet Services install annually approximately 20,000 meters to support both new connection and meter replacement obligations. A comprehensive in service assurance testing regime is also implemented annually.

EDM AMS – Part 1 Electricity Meters & Metering Equipment

The EDM Asset Strategy, for the majority is delivered and managed by the AusNet Services, Metering Business. Key deliverables and responsibilities of the team ensure the following

- Continued improvement in the delivery of safe, compliant and efficient metering and metering activities through:
 - Enhancement of the remote condition monitoring of meters and the distribution network;
 - Conducting compliance testing and inspections of meters and LV CTs, and verification of meter data;
 - Formal, rigorous acceptance testing of new meter types and meter programs prior to deployment; and
 - Ongoing training, competency assessments and formal job authorisations.
- In service compliance testing as per AS 1284.13 for the Type 5 and 6 meter fleet.
- Undertake initial acceptance and functional testing of new meter variants, firmware and software releases as required.
- Management and oversight of the meter data verification obligation for AMI meters in accordance with AS 1199 in line with Chapter 7 clause S7.4.3 (e) of the National Electricity rules.
- Implementation of the AEMO approved alternate testing practice for low voltage current transformers (LV CTs), requiring sample testing of CT families every ten years and the remaining LV CTs in each LV CT family to be visually inspected every five years.
- In consultation with AEMO, to develop a managed approach for the remaining non-AMI meters, including the proposed installation of an AMI meter when scheduled testing of the non-AMI meter falls due.
- Development of improved meter fault analysis methods to minimise unscheduled maintenance and customer initiated tests, utilising remote meter and event data and related network information.
- Investigation and development of new meter programs to support:
 - The “smart network of the future” initiatives for safer, more efficient recording and analysis of the distribution network, and
 - Creation of enhanced metering programs to suit new tariffs for the delivery of emerging new customer services and Distributed Energy Resource initiatives.

2 Overview

2.1 Purpose

The purpose of this document is to define the asset management strategy for the AusNet Services Type 5 and Type 6 electricity metering fleet, in setting the direction and work program to support the regulatory obligations in the provision of metering services for the period to 2025. The asset management strategy aims to:

1. Ensure the continued safe operation of the meter asset;
2. Enhance the capability of the AusNet Services meter fleet to be compliant with this metering regulatory obligations as listed at Appendix A;
3. Maintain and test the meter asset so that it continues to meet regulatory compliance and business needs in the most efficient manner possible (for optimal total life cycle cost);
4. Enhance and apply the meter capabilities to better manage the AusNet Services' electricity distribution network and position AusNet Services for the future operating and regulatory environment, in alignment with the AusNet Services business plan.
5. Include the planning, forecasting, procurement and logistics operations associated with ensuring adequate supply of metering equipment is available to meet our regulatory obligations.

2.2 Scope

The Electricity Meter and Metering Equipment scope applies to:

- All Type 5 and Type 6 AMI and non-AMI electricity metering installations for which AusNet Services is the Responsible Person (RP) / Metering Coordinator (MC).
- Includes all direct connect (whole current) and Metering current transformer (CT) operated meter types, their associated meter program version creation and control and related meter firmware release and testing.
- All associated metering installation equipment, including the low voltage metering current transformers (LV CTs) and Network supplied external load control devices.;
- All associated field and laboratory support equipment for the meters, including meter and CT test equipment, meter vendor proprietary software and hardware required to develop meter program changes and to locally interrogate AMI meters in the field, and proprietary backend systems to load locally read interval data for comparison with remotely read to undertake meter inspections programs; and
- Relevant meter procurement, operating, maintenance, support, replacement and disposal activities associated with the above equipment, including testing and remote monitoring.

EDM AMS – Part 1 Electricity Meters & Metering Equipment

This Meter Asset Management Strategy excludes activities applicable to:

- The meter communications modules and module firmware applicable to the AMI meters (subject of Part 2 & Part 3 of the EDM AMS);

2.3 Structure

This document is structured as follows:

- **Asset Description:** This section provides a summary of the meter asset, the key features and functionality, the current volumes, age profile and status by component/type and the current operating state.
- **Strategic Plans:** This section presents the strategies and volume forecasts for the various activities applied to the management of the meter asset, grouped as follows:
 - **New Connections & Replacements** – meter installations and exchanges due to new connections, meter abolishment, meter addition/alterations and meter faults.
 - **Meter Maintenance** – comprised of scheduled and unscheduled tests, inspections and investigations, and the associated meter asset management functions.
- **Resources & Service Providers:** This section identifies the resources and delivery partners used by AusNet Services in support of installing and maintaining the metering asset.

2.4 References

The key regulatory requirements governing the management of the metering assets and supporting systems are identified in the EDM AMS Strategy Overview (Part 0).

Refer to Appendix A for the full list of governing regulations, standards and other references specific to meters.

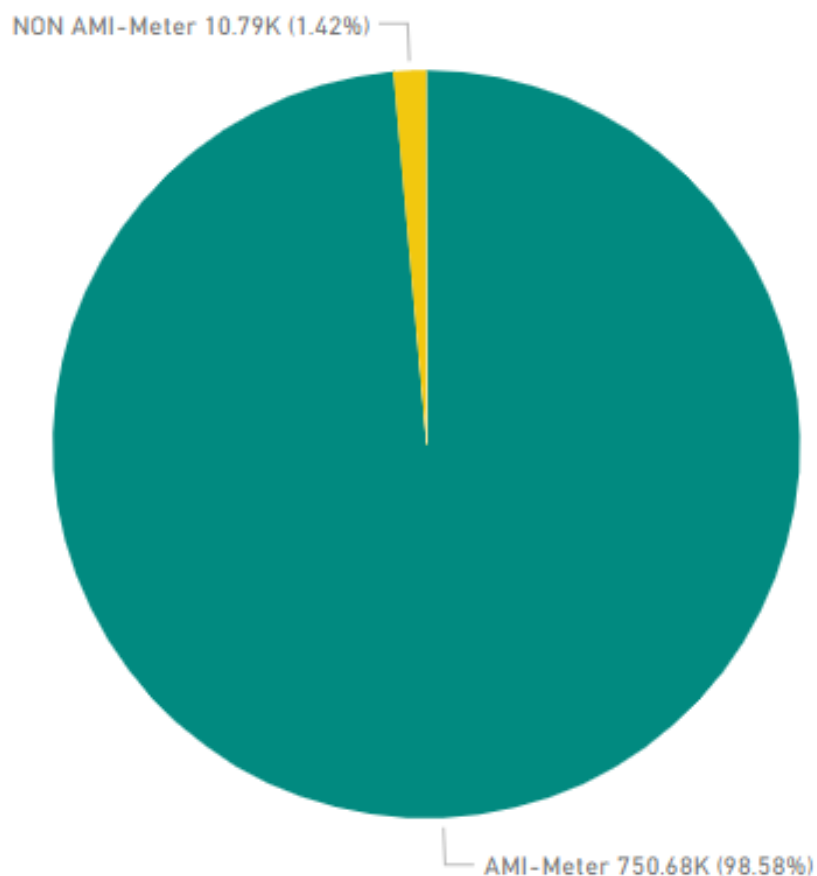
3 Asset Description

3.1 The Meter Asset

The Installed AusNet Services meter fleet is comprised of ³

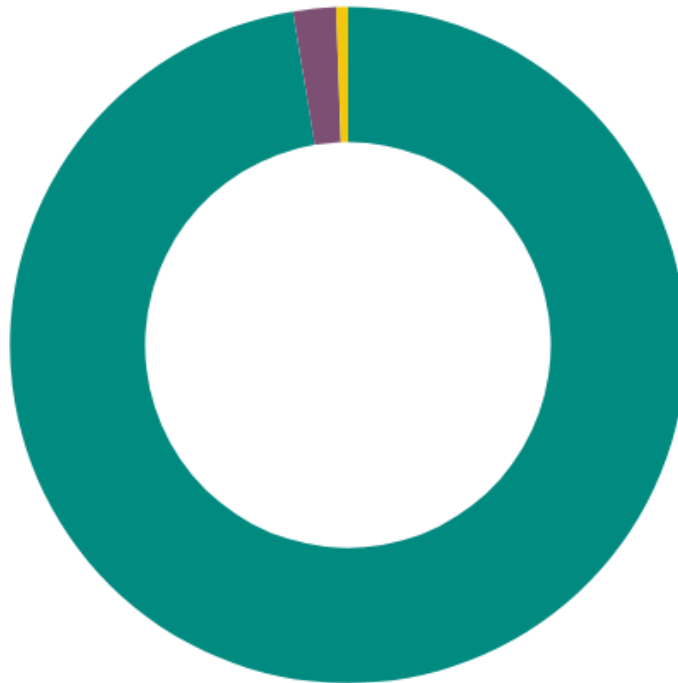
- 734,783 customer connection points (NMI) in total, of which 726,459 have AMI NMIs installed;
- 761,462 installed Type 5 and Type 6 electricity meters, of which 750,676 are AMI meters;
- 12,739 installed LV CTs; and

AMI Vs Non AMI Meter Count



INSTALLATION TYPE

● RRIM ● BASIC ● MRIM



The metering solution used at a given customer site is determined by a number of factors, including the:

- the assigned Network Tariff;
- the physical connection characteristics (e.g. phasing, direct or CT connected);
- Whether load switching is required (e.g. hot water, slab heating, climate saver). If a customer requires bi-directional metering (e.g. has a customer installed a co-generation (solar) load; and
- Any network management requirements and considerations such as Supply Capacity control (e.g. peak load diversification, or Demand Energy Resource (DER) initiatives.

3.1.1 AMI Meters

The AMI meter is a “smart”, electronic meter that, when installed with a wireless communications module¹, supports the minimum functional specifications required by the Victorian Government (Appendix A).

¹ Management of the communications module asset is described in Part 2 of the EDM AMS.

³ Numbers as of June 2018

EDM AMS – Part 1 Electricity Meters & Metering Equipment

AusNet Services currently operates a fleet of Landis+Gyr (L+G) U-series E350 meters of various phase and connection types which comply with the requirements of the governing regulations identified in Appendix A.

The key components of the AMI meter are:

- the metering hardware, consisting of Liquid Crystal Display and including 100 amp rated main supply contactor for all types, and a 40 amp rated load control contactor for some variants.;
- The meter firmware, which provides the logic for controlling and unlocking the meter functions and interfaces to the communications module; and
- The meter program, which provides the specific settings for the functions for each meter to be enabled.

Figure 1 below shows these logical components of the AMI meter and communications module ("communications card").

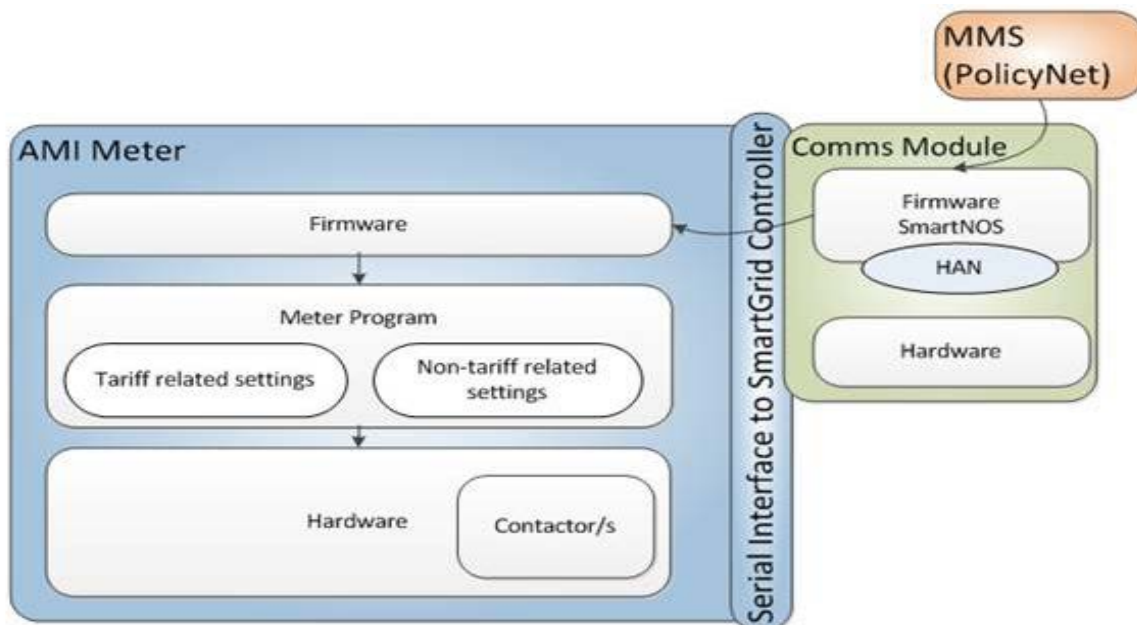


Figure 1: Block Diagram of AMI Meter & Communications Module

Key functionality of the AMI meter includes:

- Meters are rated to a maximum of 100A per phase. For CT meters, the load per phase is current transformed to 5A.
- All meters are four quadrant types allowing for import and export kWh and kVarh units to be recorded and profiled.
- Options to record 5², 10, 15, 30 and 60 minute interval metering data on single or multiple channels, depending on the meter type, memory selection type and program.

² 5, 10 and 15-minute interval data are subject to end to end verification and testing

EDM AMS – Part 1 Electricity Meters & Metering Equipment

- Capable of storing in excess of 1,100 days of single channel interval data, exceeding the 200 day minimum storage for interval meters required by Metrology Procedure Part A.
- The meter's LCD display is programmed to show the physical meter registers and total accumulated energy registers. Records meter events, including voltage/current breaches, memory failures, suspect import energy detections, etc.
- All meters have been programmed to record specific alarms and events, including:
 - meter internal temperature rises above the normal operating temperature for safety reasons;
 - possible tampering as indicated by reverse energy due to line/load connections being transposed; and
 - power down and power up events that assist in power loss and restoration management.

These events and alarms are used to validate the correct operation and acknowledgment of remote instructions to the meter. They are key tools in assisting in detecting meter failures and managing meter performance.

- Capable of remote re-energisation and de-energisation through the internal 100A rated load supply contactor.
- Some meter variants also include an internal 40A rated load control contactor programmed to switch specific customer hot water, heating or other loads according to network tariff or load control requirements. Customers are able to apply additional heating through the manual "boost" (via the "boost" button located on the main meter face).

Note: This load control contactor assists in the management of network peak loads and supply quality through randomised "switch on" times, and by applying different switching periods for customer groups

The core functionality of the AMI meter is defined by the AMI Minimum Functional Specification, v1.1.

3.1.2 Non-AMI Meters

The residual non-AMI meter fleet consists of various electro-mechanical meter variants, manufacturers and age, predominantly operating as Type 6 meters. The list of installed non-AMI meters is maintained in AusNet Services SAP management systems.

All non-AMI metered sites requiring a meter change are to be installed with AMI metering solutions.

3.1.3 Low Voltage Current Transformers (LV CT)

The Landis+Gyr Direct Connect meter variants are rated to 100 A per phase. Accuracy and performance cannot be guaranteed if the customer's load exceeds that approved rating. Low voltage current transformers (LV CTs) are used to step down the supply current by a defined ratio to enable metering of consumers drawing loads greater than 100A. The majority of these are three phase customers, requiring a CT meter and three LV CTs, (one CT per phase).

As per Clause Victorian Service & Installation Rules (VSIR) – Amendment 1 – April 2017 8-17

8.8 Metering Equipment - Limits of Operation

8.8.1 Direct Connected Meter - Limits of Current Carrying Capacity - The maximum current rating of direct connected meters is 100 amps which must not be exceeded. The maximum demand, as determined under the Wiring Rules, of any electrical installations must be limited by a main switch(es) circuit breaker/s to ensure the current rating of direct connected meters is not exceeded. Where the maximum demand of electrical installations cannot be limited accordingly, CT metering shall be required.

Note: For information related to circuit breakers refer to clause 6.7.1.2 (Electrical Installations subject to a specific electricity distribution connection agreement, contract or a deemed electricity distribution contract).

Hence as a rule, new or existing sites designed with a determined maximum demand approaching 90A per phase or more, should strongly consider installation of LV CT Metering from the outset, to avoid rework due to load growth.

The installed LV CT fleet for sites consuming less than 160MWh per year are listed at section 4, and maintained in AusNet Services SAP management systems.

LV CT metered sites consuming more than 160 MWh are subject to the metering contestability framework and processes and do not form part of this strategy document.

All LV CTs are supplied and provided for by AusNet Services regardless of whether the site consumes less than 160MWh. The terms and conditions within the AusNet Services connection agreements allow for the CTs to be connected to all CT operated connection points within the AusNet distribution patch. This process is administered by the Customer Services/New Connections team within AusNet Services and delivered under agreement with Select Solutions.

3.1.4 Support & Test Equipment

Support and test equipment, including software, used by AusNet Services for the management of the metering asset is detailed in section 8.4.

3.2 Current Meter Population & Profile

The following sections present the AusNet Services meter population as at October 2018, categorised in various ways. The various categorisations are useful in the management of the fleet and forecasting of activity volumes.

3.2.1 Meters Installed by Division

The AusNet Services' electricity distribution area is allocated into nine geographical divisions. These divisions act as the main local area offices and depots for meter storage, logistics and returns.

Requests for new installations or maintenance services, specific to the towns and communities within those divisions, are routed and managed at this divisional level.

Refer to Figure 2 below.

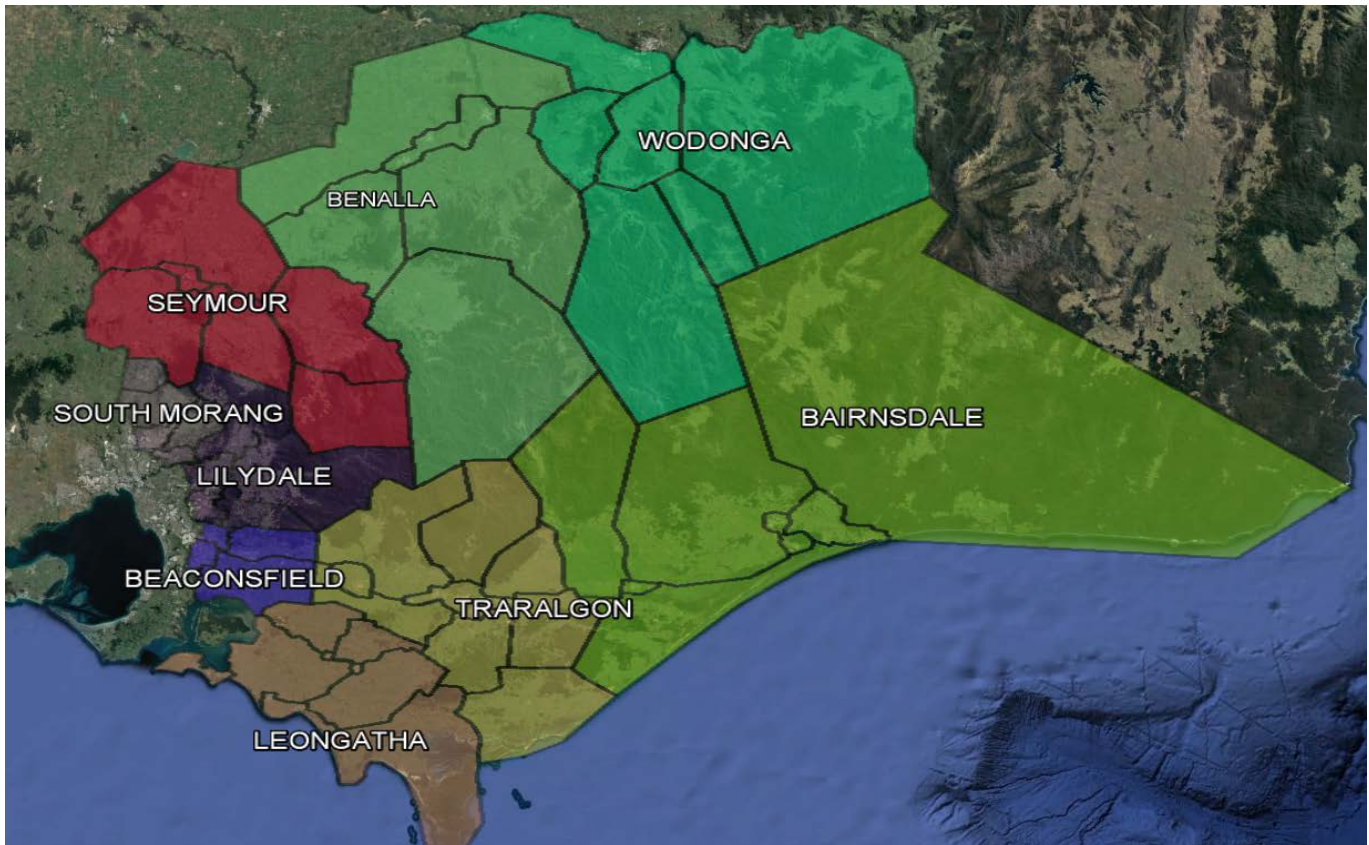


Figure 2: AusNet Services' Geographical Divisions

EDM AMS – Part 1 Electricity Meters & Metering Equipment

Table 1 below is a summary table, by geographical areas (divisions), of the number of customer connection points (NMI) with the corresponding numbers of AMI and non-AMI meters installed at those NMIs, as at 1st October 2018.

Division	NMIs (AMI)	Meters (AMI)	NMI (Non AMI)	Meters (Non AMI)	Total NMI	Total Meters
BAIRNSDALE	49705	52783	699	919	50404	53702
BEACONSFIELD	136198	138429	900	1137	137098	139566
BENALLA	35580	37037	417	487	35997	37524
LEONGATHA	49036	51944	667	887	49703	52831
LILYDALE	186774	191610	2470	3330	189244	194940
SEYMOUR	20858	21603	353	424	21211	22027
SOUTH MORANG	136281	137868	1141	1384	137422	139252
TRARALGON	69222	74611	1293	1702	70515	76313
WODONGA	42800	44798	388	523	43188	45321
TOTAL	726454	750683	8328	10793	734782	761476

Table 1: Meter Location by Division (as at Oct' 2018)

Note: Throughout this document, “AMI meters” or “AMI NMIs” are where an AMI-capable meter has been installed, irrespective of whether that AMI meter is communicating and/or has been Logically Converted to operate as remotely-read AMI Type 5 meter. Logical Conversion (LC) is the process of converting an AMI-capable meter from a manually read interval or basic meter to a remotely read interval meter compliant with the AMI Minimum Service Level Specification. Key pre-requisites to the LC process are an AMI-capable meter, functional meter firmware, functional / compliant meter communications module, and reliable operation of the AMI communication network and systems.

3.2.2 Meters Installed by Site Configuration

Table 2 below indicates the number of single metered sites versus sites with two or more meters installed. The recently completed AMI rollout has reduced the number of sites requiring multiple meters, due largely to the single phase two element AMI meter with the integrated load control contactor (refer section 3.2.3). For example, approximately 148,000 single phase non-AMI meters in two meter installations were replaced with 74,000 single phase two element AMI meters, with the integrated load control contactor of the AMI meter switching the electric hot water systems.

Description	NMIs	Meters
Single Meter Site	708228	708228
Multi-Meter Site	26643	53331
Total	734871	761559

Table 2: Meter Volume by Site Configuration (as of Oct' 2018)

The remaining multi-metered sites are generally customers on older sunsetted dedicated circuit tariffs which are no longer available to new entrants.

3.2.3 Meter Types

The mandated AusNet Services AMI rollout between 2009 and 2014 has resulted in the replacement of approximately 150 non-AMI meter types with five AMI meter types. These AMI meter types, and the installed volumes of each type as at 1st Oct 2018, are presented in **Table 3** below.

Meter Type Code	Description	Installed Volumes
400	Single phase, one element meter, 100A rated (no load control contactor)	106,629
410	Single phase, one element meter, 100A rated with 40A load control contactor	347,930
420	Single phase, two element meter, 100A rated with 40A load control contactor	122,171
430	Three phase, whole current, 100A rated direct connect meter with 40A load control contactor	131,365
450	Multi-phase CT connect meter, current transformer (CT) meter with load control contactor	4,241
500	Single phase, single element meter, 100A rated (no load control contactor)	28,086
510	Single phase, single element meter with 1 integrated 31.5 amp rated load control contactor, 230V AC	9980
520	Single phase, two element meter with 1 integrated 31.5 amp rated load control contactors, 230V AC, class 1 $I_{max} = 100A$, $I_b = 10A$	46
530	Three phase, whole current, 100A rated direct connect meter with 40A load control contactor	20
550	Multi-phase CT connect meter, current transformer (CT) meter with load control contactor	0
Total Installed AMI Meters		750,468
Non-AMI	Various electronic, electro-mechanical single phase, multi-phase and CT meters	10,786
Total Installed Meters		761,254

Table 3: Volume by Meter Type (as at Oct 2018)

Before new meter variants are released into the production environment, all new meter types are assessed for compliance, tested and evaluated to ensure compliance with the AMI Minimum Functional Specification and acceptable for use within the AusNet Services network.

The use of single phase two element meter types may only be limited to meter replacements where existing “like for like” replacements or use of that meter type is required. These are generally limited to those customers where recording of hot water and floor heat load separately to the main light and power load, is required.

As per section 3.1.2, all non-AMI metered sites requiring a meter change should be installed with an AMI compliant meter, (subject to customer not refusing the request).

3.2.4 Meter Programs

The AMI meter program provides the specific settings for the functions for each meter, including compatibility for network tariff assignments, supply/load control operation and customer information (meter physical register LCD display). As a general rule, four default meter programs per meter type are available to cater for the following network configurations:

- standard network configurations;
- solar configurations;
- electric hot water enabled configurations; and
- electric floor/storage heat enabled load control configurations.

There are variations to these standard programs due to some customer specific application e.g. different switching periods for hot water systems and services.

The meter programs are core to the correct operation of the meter and implementation of network billing, and as such, the configurations of these programs are managed as part of the meter asset management strategy.

New meter programs may be developed and released to facilitate new settings required for the smart networks management, or any new tariff offerings, particularly where load limiting or load control changes are implemented. Meter program changes are tested and accepted prior to deployment, ensuring all process and system interfaces in the creation and deployment of a meter program are controlled.

Table A in the Appendix lists the meter programs deployed as at 1st Oct 2018. As highlighted, some meter programs have been superseded (“sunsetting”). Installed meters with sunsetted meter programs will be remotely or locally re-programmed to the latest approved version prior to logical conversion of the meter. (Note: The sunsetted programs deployed in installed meters do not affect the tariff or switch settings of the meter.)

3.2.5 Meter Firmware Versions

Meter firmware is an essential component for enabling remote communication to an AMI meter, enable additional meter functionalities and to potentially remediate problematic or defective metering installations without the need to replace the meter.

Comprehensive validation and test execution processes are undertaken before any meter firmware updates are released or base lined and made available for deployment.

AMI meters with firmware versions of R3.1 or higher have been approved and base lined as capable of being logically converted and remote services enabled.

Ausnet Services strategy for accepting new firmware releases from the meter vendor is to review the firmware release notes and to verify any impacts to our existing meter operations.

That firmware which would directly impact the performance or accuracy of the metering fleet will be subjected to functionality test and release. It is not AusNet’s Strategy to automatically baseline all of the deployed meters to the most current released firmware version if there is no operational or customer benefit to do so.

Table B in the appendix lists the meter firmware versions against the deployed meter volumes. As highlighted, there are 67,354 AMI meters installed with firmware versions not suitable for use in meters for remote services. The updated meter firmware will be deployed remotely or locally to these meters prior to logical conversion.

4 Low Voltage Current Transformer (LV CT) Fleet

Low voltage current transformers (LV CTs) and the associated CT meters, are installed at customers' sites expected to exceed 100A current drawn on any one phase.

Table 4 below summarises the installed volumes of LV CTs for the Type 5 / Type 6 customers consuming less than 160MWh per year. Note that most three phase CT metering installations require three individual LV CTs.

Installed Low Voltage Metering Current Transformers			
CT Type	CT Ratio	CT Meter count	LV CT count
Unallocated	100/5	1	3
C	1000/5	15	45
B	1200/5	7	21
A	150/5	102	307
W	1500/5	5	15
S*	200/5	3578	10735
C	2000/5	1	3
A	300/5	61	183
B	400/5	224	672
A	600/5	14	41
C	3000/5	1	3
T	800/5 Extended Range	237	711
Total		4246	12739

Table 4: Installed LV CT Population (as at Oct 2018)

4.1 Age Profile

The age profile of the meter and LV CT fleet is characterised by year the meter was installed, determining the scheduled testing profile.

The expected life-of-type of the AMI meters is 15 years.

The age profile of remaining non-AMI meters is not presented given that these will be replaced by AMI meters at the earliest opportunity. As outlined in section 6.1.2, the scheduled testing plan for non-AMI meters is to be determined for AEMO approval.

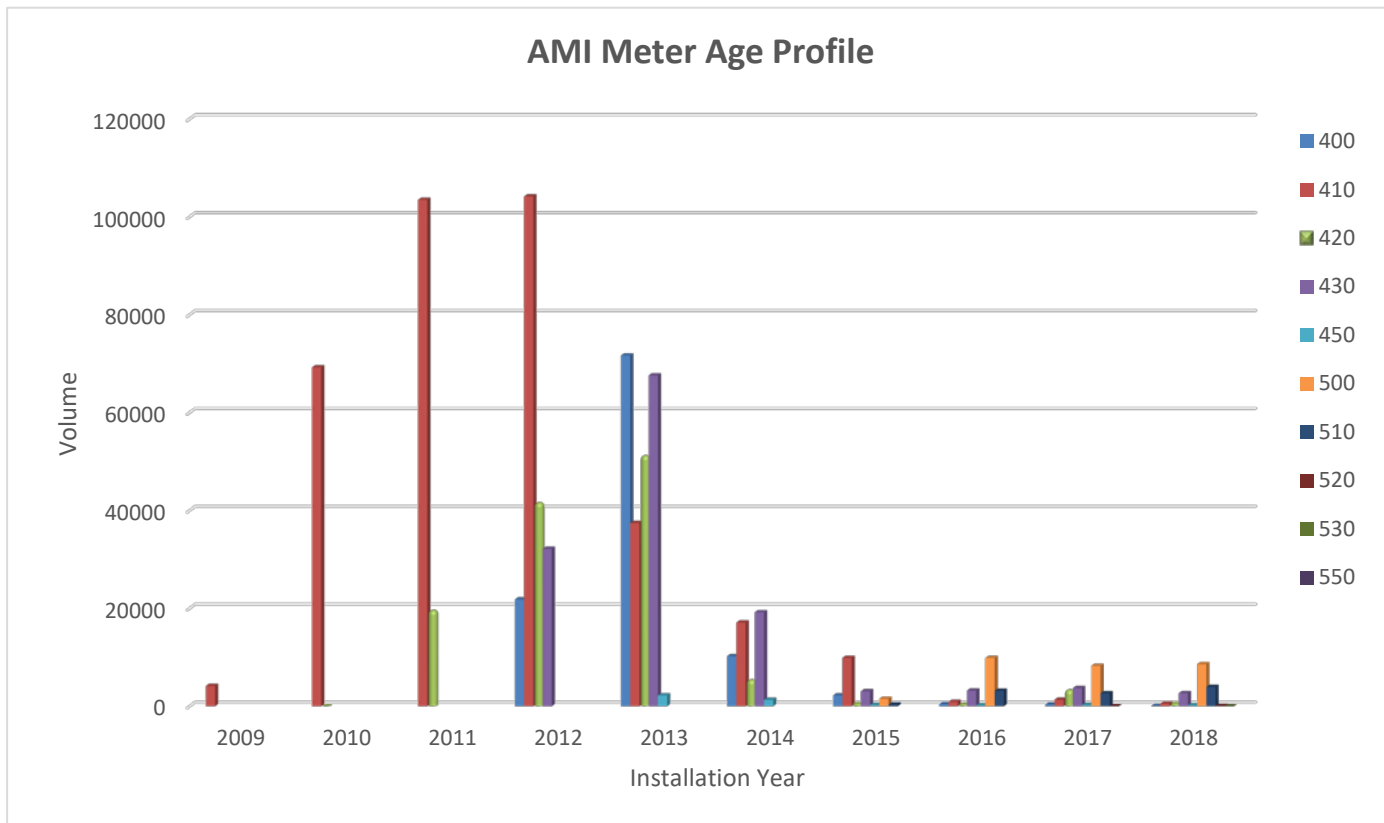
EDM AMS – Part 1 Electricity Meters & Metering Equipment

4.1.1 AMI Meter Age Profile

The forecasted profile of AMI meter installations by year up until the end of CY2025 is shown in **Table 5**. The forecast of meter installations, derived from the projections of new connections, replacements and abolishment, is presented in section 1.1.

Meter Type	400	410	420	430	450	500	510	520	530	550
CY 2009		4120								
CY 2010		69195	4							
CY 2011		103447	19491							
CY 2012	21804	104144	41488	32139						
CY 2013	71641	37409	51109	67563	2185					
CY 2014	10201	17072	5305	19164	1282					
CY 2015	2187	9847	544	3025	239	1485	317			
CY 2016	402	880	398	3162	149	9826	3129			
CY 2017	336	1302	3255	3683	234	8215	2626	2		
CY 2018	58	514	577	2629	152	8560	3908	44	20	
Total	106629	347930	122171	131365	4241	28086	9980	46	20	0

Table 5: Actual AMI Meter Volumes by Year of Installation (as at Oct 2018)



EDM AMS – Part 1 Electricity Meters & Metering Equipment

4.1.2 LV CT Age Profile

The profile of LV CTs by year of installation, up until the end of CY2018, is shown in **Table 6**.

CT Ratio	CT Type	Inst. Pre 2002	Inst. 2003	Inst. 2004	Inst. 2005	Inst. 2006	Inst. 2007	Inst. 2008	Inst. 2009	Inst. 2010	Inst. 2011	Inst. 2012	Inst. 2013	Inst. 2014	Inst. 2015	Inst. 2016	Inst. 2017	Inst. 2018~
CT 1000/5	C	42		3									3					
CT 1200/5	B	27																
CT 150/5	A	315					3	3				3		15	3		3	
CT 1500/5	W	3	3	6	3		6	6	3	3	3	3						
CT 200/5*	S	4127	393	459	480	501	513	562	603	642	516	461	319	377	431	411	605	153
CT 300/5	A	219	9										6	6			3	
CT 3000/5	C	6																
CT 400/5	B	822	9	9	3	3		6			69	3	9	12				
CT 2000/5	C	15																
CT 600/5	A	53															3	
CT 800/5	B	336	48	36														
CT 800/5*	T				27	36	54	39	98	67	6	36	50	22	21	3	42	3
Yearly Total		5965	462	513	513	540	576	616	704	712	594	506	387	432	455	414	656	156
Total CTs		5965	6427	6940	7453	7993	8569	9185	9889	10601	11195	11701	12088	12520	12975	13389	14045	14201

* -
Includes
Extended
Range CTS

Table 6: LV CT Population by Year of Installation (as at Oct 2018)

5 New Meter Connections & Replacements

This section provides the meter forecast based on volumes associated with providing new connection, abolishment, meter additions/alteration and fault services throughout the strategy period.

5.1 New Meter Connections

All new meter connections up to 2025 will require AMI compliant meters to be installed. Given the current and expected network tariffs, this will assume that all new requests for new metering connections will be exclusively resulting in single meter sites. (i.e. one NMI = 1 Meter)

New Connections volumes are driven by population and housing growth rates forecast in each of AusNet Services' specific geographic areas. The New Connection figures provided in this document are a gross forecast and are not net of site or meter abolishment.

As of 1st Dec 2018, new regulatory changes mandate that meters should be capable of recording trading intervals across 5 minutes. Current rules support recording of 30-minute trading intervals. Currently, AusNet Services is validating new firmware to ensure all new meters installed post 1st Dec 2018 are capable of recording 5 minute interval data.

The forecast New Connection volumes for each year through to CY2025 are presented in **Table 7** in section 5.3 below.

External load control contactors are only provided by AusNet under “like for like” exchanges to existing customers where that service was provided by the network previously and replacement devices installed under the mandate of the AMI deployment. All new customers requiring a new meter installation are to provide their own load control devices to either switch multiple loads, or a single load greater than 30 amps.

All wiring diagrams to support current wiring and metering arrangements, are updated on the Victorian Service & Installation Rules website as well as the AusNet Services web site for consumer benefit. The forecast number of LV CTs required per year is approximately three times the number of CT meters to be installed for new connections (approximately 200 LV CTs per year). CTs are supplied and provided for to the customer for all LV CT operated sites in it distribution network.

5.2 Meter Replacements

Meter replacements occur due to two scenarios:

1. customer initiated requests (B2B market transactions for solar or site specific upgrades of supply)
2. metering defects and faults

EDM AMS – Part 1 Electricity Meters & Metering Equipment

The key reasons for meter replacements which are governed by the B2B market rules include:

- Meters removed for site renovation under Additions & Alterations SOs
- Solar requests or other customer initiated changes where the meter needs replacing
- Site changes requiring meter replacement; e.g. conversion from 1 phase to 3 phases, builder's supplies removal, addition of a "switching service".
- Customer increased consumption above 160MWh pa and hence the contestable metering process is implemented.

Meter faults exchanged as a result of operational issues include:

- Equipment failure such as an LCD display failure, electronics failure, contactor fault, metrology test failure; and
- Externally caused failure such as HV Injection, and damaged/vandalised.

Meter Faults are monitored daily via performance reporting which includes among other things non-communicating meters, reverse energy detected flags and various events and warnings which could indicate a potential meter performance issue.

The current fleet of the electronic AMI meters is expected to have a useable life of 10-15 years, based on the meter supplier's information and operational experience to date. Therefore, a significant increase on current failure rates is not expected in the period leading to 2025. AusNet Services will monitor failure rate trends and assess results of the meter testing and inspections described in section 6 to continually re-confirm forecast meter faults.

Customer perceived faults were a significant driver for meter replacements during the AMI rollout between CY2010-2014 with customers questioning the accuracy or its correct operation. However, replacements due to this issue have decreased as customers' understanding and satisfaction with AMI meters improved. It is expected that this trend will continue. Furthermore, meter replacements due to solar requests and other meter configuration changes have also reduced as AusNet Services' capability to deliver remote service (e.g. remote meter reconfiguration services) continues. AusNet Services has reflected these decreasing trends in the forecast meter replacements in Table 7 in section 5.3 below, showing overall reduction in replacements despite an increasing meter population.

All meters removed from site are returned for assessment and refurbishment. Forecast for meter returns are presented at section 6.4.4, Meter Logistics.

EDM AMS – Part 1 Electricity Meters & Metering Equipment

5.3 New Meter Connections & Replacement Forecasts

Asset management plans & resources for New Connections & Replacements are based on forecasts shown in table below (as at June 2018).

	Meter Type	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025
New Connections	400	1,997	80	211	1	84	85	86	87	89	90	91
	410	8,719	78	678	221	82	83	84	85	87	88	89
	420	144	5	2,207	131	5	5	5	5	6	6	6
	430	1,686	1,980	2,164	766	2070	2101	2133	2165	2197	2230	2264
	450	81	71	97	25	74	75	76	78	79	80	81
	500	1,473	10,310	7,545	2,774	10,781	10,943	11,107	11,273	11,443	11,614	11,788
	510	316	3,157	2,208	1,748	3,301	3,351	3,401	3,452	3,504	3,556	3,610
	520	0	0	2	2	0	0	0	0	0	0	0
	530	0	0	0	0	0	0	0	0	0	0	0
	Total	14416	15681	15112	5668	16397	16643	16892	17145	17405	17664	17929
Faults / Replacements	Meter Type	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025
	400	430	390	500	152	499	518	579	694	814	938	1,064
	410	1,348	1,229	1,382	527	1,382	1,434	1,603	1,922	2,255	2,596	2,946
	420	833	855	692	241	691	717	801	961	1,128	1,298	1,473
	430	1,312	1,150	1,092	350	1,114	1,155	1,291	1,549	1,817	2,091	2,373
	450	26	34	28	11	28	29	32	39	46	53	60
	500	2	28	123	148	115	120	134	160	188	216	246
	510	1	9	20	24	20	21	23	28	33	38	43
	520	0	0	0	0	0	0	0	0	0	0	0
	530	0	0	0	0	0	0	0	0	0	0	0
	Total	3952	3695	3837	1453	3849	3994	4463	5353	6281	7230	8205
Abolishments	Meter Type	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025
	400	497	355	261	92	334	327	321	314	308	302	296
	410	1,069	839	700	240	790	774	758	743	728	714	700
	420	429	380	396	143	358	350	343	337	330	323	317
	430	565	523	463	151	492	482	473	463	454	445	436
	450	24	13	10	4	12	12	12	12	11	11	11
	500	0	215	230	62	202	198	194	190	187	183	179
	510	0	47	55	16	44	43	42	42	41	40	39
	520	0	0	0	0	0	0	0	0	0	0	0
	530	0	0	0	0	0	0	0	0	0	0	0
	Total	2584	2372	2115	708	2232	2186	2143	2101	2059	2018	1978
Total Installed in each CY	Meter Type	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025
	400	2,427	470	711	153	583	603	665	781	903	1,028	1,155
	410	10,067	1,307	2,060	748	1,464	1,517	1,687	2,007	2,342	2,684	3,035
	420	977	860	2,899	372	696	722	806	966	1,134	1,304	1,479
	430	565	566	567	568	569	570	571	572	573	574	575
	450	107	105	125	36	102	104	108	117	125	133	141
	500	1,475	10,338	7,668	2,922	10,896	11,063	11,241	11,433	11,631	11,830	12,034
	510	317	3,166	2,228	1,772	3,321	3,372	3,424	3,480	3,537	3,594	3,653
	520	566	567	568	569	570	571	572	573	574	575	576
	530	0	0	0	0	0	0	0	0	0	0	0
	Total	16501	17379	16826	7140	18201	18522	19074	19929	20819	21722	22648
Field Returned Meters	Meter Type	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025
	400	927	745	761	244	833	845	900	1,008	1,122	1,240	1,360
	410	2,417	2,068	2,082	767	2,172	2,208	2,361	2,665	2,983	3,310	3,646
	420	1,262	1,235	1,088	384	1,049	1,067	1,144	1,298	1,458	1,621	1,790
	430	1,877	1,673	1,555	501	1,606	1,637	1,764	2,012	2,271	2,536	2,809
	450	50	47	38	15	40	41	44	51	57	64	71
	500	2	243	353	210	317	318	328	350	375	399	425
	510	1	56	75	40	64	64	65	70	74	78	82
	520	0	0	0	0	0	0	0	0	0	0	0
	530	0	0	0	0	0	0	0	0	0	0	0
	Total	6536	6067	5952	2161	6081	6180	6606	7454	8340	9248	10183
Total Installed	Meter Type	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025
	400	107,831	107,259	107,076	106,860	107,694	108,534	109,380	110,233	111,093	111,960	112,833
	410	351,259	338,335	349,095	348,713	351,433	354,174	356,937	359,721	362,527	365,354	368,204
	420	121,000	115,482	122,378	122,301	123,255	124,216	125,185	126,162	127,146	128,137	129,137
	430	126,086	119,313	128,841	130,457	131,475	132,500	133,534	134,575	135,625	136,683	137,749
	450	3,913	2,043	3,868	4,190	4,223	4,256	4,289	4,322	4,355	4,388	4,421
	500	1,559	11,878	19,957	22,603	22,779	22,957	23,136	23,317	23,498	23,679	23,860
	510	336	3,538	6,158	8,035	8,098	8,161	8,224	8,289	8,353	8,418	8,484
	520	0	0	2	9	9	9	9	9	9	9	10
	530	0	0	0	0	0	0	0	0	0	0	0
	Total	711,984	697,848	737,375	743,168	748,965	754,807	760,694	766,628	772,607	778,634	784,707

Table 7: Forecast New Connections, Replacements & Returns (as at June 2018)

6 Meter Maintenance

Meter maintenance activities are initiated to maintain the safety and compliance of the meter asset post its installation into the field. It provides the forecast plans for both:

- Scheduled and Unscheduled meter investigations which include LV CT and meter tests, (including customer initiated accuracy and assurance testing), meter inspections and investigations (meter event and alarm management), and investigations to support distribution network monitoring quality of supply.
- Ongoing support and management of the meter asset, including monitoring, planning and scheduling of metering activities, the implementation and deployment of new meter programs and firmware releases, the management of meter test equipment, and oversight of the meter stores and logistics function.

6.1 Meter Accuracy and Assurance Testing

Routine scheduled meter tests are conducted to ensure the continued compliance and accuracy of the meters as per Chapter 7 of the National Electricity Rules, and Part A of the Metrology Procedures.

6.1.1 Family Testing of AMI Meter Families

AusNet Services leverages AS 1284.13 – Electricity metering In-service compliance testing as a basis for compliance to its in field meter testing and assurance obligations. The purpose of this standard is to ensure that the “metrological performance of electricity meters” is maintained and allows metering providers to sample test where 100% testing is not viable.

AS 1284.13 can be applied to the following meter categories:

- Direct connected and CT operated meters
- Electronic and induction meter types
- Single phase and polyphase meters

AusNet Services as the accredited Meter Provider for its distribution network applies AS1284.13 Electricity Metering In-Service Compliance testing for all type 6 and manually or remotely read type 5 meters. The stated purpose of this standard is to ensure that the “metrological performance of electricity meters”³ is maintained. The standard allows metering providers to sample test meters of the same type to achieve this purpose. It requires “the population of any new pattern or type (or variant of an existing pattern or type) of meter placed into service must undergo compliance testing within one to three years of being placed into service”⁴. This means that the initial sample testing, the “Initial In-Service Compliance Test”, for new meter types (or “families”) must be conducted before the third year after installation. If this Initial In-Service Compliance Test is successful, then the next sample test required on

³ AS/NZS, *Electricity metering Part 13: In-service compliance testing*, Standards Australia, 2002, p. 4

⁴ *Ibid*

this meter type family (the “Ongoing In-Service Compliance Test”) is due in the next ten years (as indicated in AS1284.13 for class 1 meter).

AusNet Services meter populations installed in 2009 and 2010 has already been subjected to an Initial In-Service Compliance Test in 2012. The meter population installed in 2011 and 2012 was sample tested in 2014, and the family installed in 2013 and 2014 was sample tested in 2016.

Based on the volumes of each AMI meter type installed in each year, the forecast numbers of scheduled meter tests will vary each year and which are identified by random sample generation.

The introduction of new meter variants to replace the U1200 and U3300 series meters, as highlighted in section 3.2.3 above will see further initial compliance testing taking place within this forecast period. Should any of the In-Service Compliance Tests fail; AusNet Services will implement further testing with different sampling test methods, in accordance with AS1284.13. The populations may also be investigated to redefine the meter population sizes and include other considerations such as the installed meter population geographic location (i.e., is there pattern of the “failed” meters being confined to one geographic area), batch/manufacturing characteristics (i.e., have the failed meters been identified as one particular manufacturing batch or manifest), exposure to particular climatic conditions (i.e., are failed meters been exposed to extreme high/low temperature, or exposure to salt/sea air) etc.

Should analysis of further test results determine a population to have ‘failed’, AusNet Services would project manage the exchange of the failed population, and provide appropriate notifications to all customer, regulatory and retailer stakeholders throughout the project. Refer to Section 7.4 Large Population Failure.

6.1.2 Family Testing of Non-AMI Meter Families

AusNet Services had initially planned against conducting any scheduled family testing on non-AMI meters based on the view that as these populations were due for test under AS 1284.13, that a replacement meter program would otherwise be implemented. This approach was approved by the AEMO.

The AMI meter deployment concluded with approximately 14,000 non-AMI meters remaining in service, largely due to customer refusals, no access, and customer site defects. AusNet Services has taken all reasonable endeavours to reduce these instances but the likelihood is that this number will remain for some time.

As of June 2018, the current number of customers with a non AMI compliant meter is 11,060. AusNet Services initiated a revised strategy to ensure that populations of the remaining non AMI meters were proven to meet the overall accuracy requirements of the NER. In 2017/18, AusNet proposed to AEMO to include a random sample testing approach as per AS 1284 part 13, against the remaining non AMI meter populations left in service post AMI deployment. Testing has commenced in accordance to this proposal.

The success of this program of works is dependent on customers providing safe and unhindered access, based on the view that an exchange or upgrade to an AMI compliant meter is not required. That is, the in service testing of the meter is based on the view that sufficient

EDM AMS – Part 1 Electricity Meters & Metering Equipment

population sampling will be obtained should AusNet and the customer agree that exchange to an AMI meter is not mandated and only considered should the customer agree.

Long term de-energised and defective sites are excluded from the final target list.

Below is a breakdown of the total number of non AMI meters based on the number of phases and the number of tests required to deem this population compliant based on variables or attributes.

Meter Type as per number of phases	No. of meters installed in the field	No. of tests required as per AS1284.13 - Variables	No. of tests required as per AS1284.13 - Attributes
1 phase	7687	75	200
2 phase	1485	50	125
3 phase	2293	50	125
Unclassified	1178	35	80
Total	12643⁵	210	530

Table 8: Forecast of Non AMI Meter Testing 2017-18 (as at June 2018)

6.1.3 Scheduled Meter Inspections

As per Chapter 7 of the NER, Type 5 and 6 meters are inspected co-incidentally to when the meter is tested. There is no mandated “separate” or independent inspection schedule or obligation under the Rules for this activity.

Meter inspections of Type 5 and Type 6 meters are required by the NER Schedule S7.3, with a typical inspection including

- checking of meter seals;
- comparison of pulse counts and direct readings of meters;
- verification of meter parameters and physical connections; and
- Comparison of CT ratios.

In addition, for non-remotely read meters, (i.e. meter remaining on a cyclic manual meter reading schedule), meter readers are trained to perform inspections coincident to the manual meter reading cycle. Remotely read AMI meters, which do not have this periodic visit, are inspected coincident with scheduled and unscheduled meter tests, as approved by the AER.

6.1.4 Meter Data Verification Sample Testing

AusNet Services is aware of its obligation under section 3.7 of the Metrology Procedure Part A to ensure that the metering data maintained in the relevant metering data services database (i.e. backend systems) is consistent with metering data collected from Type 5 or 6 metering installations (including constants and multipliers) .That is, that data at the actual meter, is

⁵ Numbers as of Feb 2017 expected to change dynamically as customers move across to AMI meters

consistent to data collected and maintained within the meter data management systems for Retailer/distribution billing purposes.

In accordance with this obligation, AusNet Services must ensure that a sample testing plan is established and maintained on a yearly basis to verify meter installation data.

AusNet Services has an established process and work instruction formulated with reference to Australian Standards AS1199 and AS2490, (refer Appendix A). AusNet Services has adopted the sample testing by “attributes” using Australian Standards AS1199 as its preferred methodology to verify the meter data collected by backend systems is consistent with “raw” data in the meter.

Applying the methodology described by Australian Standards AS 1199 and AS 2490, AusNet Services will verify meter data for:

- Type 5 meters and
- Type 6 meters

for each year between up to CY2025 as per the specification.

6.2 Meter Assurance Investigations

Meter assurance investigations occur as a result of several factors including, customer/Retailer requests, Energy and Water Ombudsman enquiries and complaint resolutions, as well as inspections and investigations of potential meter faults.

There is an upward trend in the number of meter investigations due to a variety of reasons including, for example customers installing solar systems onto the network which are yet to be approved or authorised by the company, the nature of electronic meters and the variety of information which can be collected and analysed which may require further investigation such as reverse energy detection, tamper events, high/low volts) etc.

The upward trend of meter assurance investigations does not equate to an equal number of damaged or defective meter installations requiring a meter replacement. By far, the majority of investigations are for as yet, non-approved SOLAR or generation systems being connected into the network resulting in reverse energy detected events being collected by the meter. Processes have been developed which include both desktop and field based analysis to ensure the correct operation of the metering equipment.

AusNet Services proactively monitors the condition of the meter asset using the remotely collected data, meter events and alarms captured in the Meter Management System (MMS). Meters requiring further investigation are identified and on-site meter tests or inspections conducted. This process is able to identify possible safety issues and metrology anomalies, and supports AusNet Services in assuring the safety and compliance of its meter fleet.

Refer to the snapshot below of the daily reporting from SAP to indicate the list of meter events alerts captured from meters. This list will be monitored in the system continuously and reporting notifications which requires user intervention to raise service orders for on-site meter investigations.

EDM AMS – Part 1 Electricity Meters & Metering Equipment

Display Measurement Documents: Measurement Document Selection

On-site meter investigations are also required to support the distribution network monitoring function, which has, and continues to provide numerous benefits for customers and the market. The on-site meter investigations are a key element in the provision of these benefits.

The volume of meter investigations and tests initiated by AusNet Services is planned to be minimal, approximately 100-200 per year.

	CY '16	CY '17	CY '18	CY '19	CY '20	CY '21	CY '22	CY '23	CY '24	CY '25
Meter Investigations	1036	2891	3687	3716	3745	3774	3803	3833	3863	3893

Table 9: Forecast of Meter Investigation Service Orders (as at June 2018)

6.2.1 Customer Initiated Accuracy and Assurance Tests

The large scale rollout of AMI meters, and associated introduction of interval metering, saw a significant increase in the number of customer queries and complaints. Many of these complaints were specific to the rollout program, regarding mandatory exchanges, cost and perceived health issues. The numbers of these specific issues have now reduced in volume. However, the increase in the number of customer queries regarding metering accuracy and data, generally as a result of high bill or Retailer advice issues, is trending higher.

The introduction of interval metering, the visibility of detailed consumption data, and access to additional services has enabled the customer to be more informed and more proactive in the management of their consumption. As a result, the number of customer initiated requests for

EDM AMS – Part 1 Electricity Meters & Metering Equipment

metering investigations and tests is expected to remain high. The forecast volumes are presented in the table below.

	CY16	CY2017	CY2018	CY2019	CY2020	CY2021	CY2022	CY2023	CY2024	CY2025
Customer Initiated Tests	357	338	369	372	374	377	380	383	386	389

Table 10: Forecast of Customer Initiated Meter Investigation / Tests (as at June 2018)

6.3 Low Voltage Metering Current Transformer (CT) Test & Inspections

AusNet Services is responsible for testing and inspections of low voltage current transformers (LV CTs) connected to customers consuming less than 160MWh per year.

Metering transformers are subject to an in-service testing and enhanced inspection regime monitored and overseen by AEMO, in order to:

- Provide additional data regarding LV CT parameters, and
- Ensure the accuracy and assurance of the infield populations of CTs.

Details of the testing and inspection plan are updated annually in the AusNet Services Meter Asset Test Plan, which is submitted to AEMO for approval.

AusNet Services has adopted an alternative sample testing practice approved by AEMO with a subsequent enhanced inspection regime, one of the options presented by the AER in its December 2011 Compliance Bulletin. Under this approach, each LV CT type (or “family”) is sample tested⁶ in the tenth year after installation, and 100% of the LV CTs in the family inspected every five years.

For information purposes, all LV CTs installed in or prior to 2002 have been sample tested in 2012. LV CT families installed in each year post 2002 have continued to be tested to the prescribed sample size in the tenth year after installation.

As customers with LV CTs are typically large consumers, testing will use an in-service method to avoid an extended power outage. The in-service method is a secondary injection method⁷ to generate burden measurements, ratio checks, and admittance readings to comply with AS.60044 standards; this secondary test philosophy has been accepted by AEMO. All LV CTs on a customer site are tested at the same time regardless of whether all are part of the random sample or not.

AusNet Services uses different types of proprietary test equipment to test its current transformers. These test sets provide the required measurements, checks and readings to confirm the accuracy of the CTs. The characteristics of these test systems are outlined in section 8.4.

⁶ Sample size prescribed by AEMO in the Current Transformer Testing Working Group reference tables

⁷ AEMO has approved Select Solutions to use the secondary injection method as its method to generate burden measurements in its 2007 Meter Asset Management Plan.

EDM AMS – Part 1 Electricity Meters & Metering Equipment

In addition to the sample testing, 100% of LV CTs are inspected every five years to the CT families sample tested, (that is, whilst CTs are subject to random testing, the full population is subject to an onsite inspection process. This approach is supported within the AEMO approved Alternative Test Approach – Variables Testing to the actual and forecast LV CT installations.

These inspections represent an important aspect of the alternative testing regime agreed with AEMO.

Individual LV CTs that fail the testing and inspection program will be replaced. Where the testing and inspection program is presenting possible problems with an LV CT family, further analysis and testing will be conducted, and the appropriate replacement action taken.

6.4 Meter Asset Management

The Meter Asset Management team is responsible for ensuring AusNet Services remains compliant to the MPB regulatory obligations. In addition, it is responsible for all:

- monitoring and scheduling of meter maintenance activities;
- monitoring and analysis of meter performance and compliance;
- development, testing, acceptance and deployment of new meter programs and firmware;
- management of meter test equipment;
- management of the meter, meter program and meter firmware configuration for remote service capability.
- Oversight and forecasting of meter logistics, including warranty, refurbishments, disposals and procurement.

The regulatory and asset management demands on this team are expected to increase through to 2025 given the impact of regulatory changes and the drive to deliver additional AMI benefits. These include testing new and existing meters for 5 minute capability to deliver 5 minute settlement data, load control and Supply Capacity Control initiatives, delivering 3G to 4G enhancements (due to the Telstra decommissioning of the 3G network as well as overseeing the WiMax obsolescence strategy. Some of the specific businesses as usual functions are detailed in the sections below.

6.4.1 Remote Condition Monitoring of Meters

Proactive, routine monitoring of the performance and condition of the meters is a key element to AusNet Services' ability to continue to assure the safety and compliance of its meter fleet. With the introduction of the AMI meters, and the integration of these with the smart networks technologies and processes, AusNet Services is able to remotely monitor the condition of individual meters through the collection and analysis of data, meter events and alarms. This in turn enables AusNet Services to more efficiently provide the safety and compliance assurance required.

EDM AMS – Part 1 Electricity Meters & Metering Equipment

Much of the collection and analysis of data for the condition monitoring function is automated for greater efficiency. Where potential anomalies are identified, further analysis is conducted by trained, experience staff, and initiating on-site meter investigations where required.

This remote condition monitoring is extended to also provide data and information for the management of AusNet Services' distribution network.

6.4.2 Meter Acceptance test and Release

The meter asset management team develops and administers the AusNet Services' meter procurement strategy, ensuring the provision of compliant, functional, reliable meters supporting AusNet Services' network tariff policies and customer connection requirements. AusNet Services currently sources meters from Landis + Gyr Australia. There are eight approved AMI meter types currently in use with AusNet Services. New meter types will need to be procured and tested in the years to 2025 as Landis + Gyr ceases production of current AMI meter types, and are replaced with updated meters with enhanced functionality. The current production life of AMI meters is forecast to be 3-4 years before new or upgraded variants are released. Based on that forecast, AusNet expects at least 5 -10 new variants on meters to be released over the forthcoming strategy period

All meters are type tested to comply with the current National Measurements Institute (NMI) Pattern Approval and relevant Australian Standards, and each variant is provided with an individual initial verification report on release from Landis + Gyr. AusNet Services tests all new meter types for acceptance for use on the AusNet Services network, and to confirm compliance with specification and contractual requirements. This acceptance testing occurs on production meters at Landis + Gyr's testing facilities.

AusNet Services' Quality Assurance processes assists in identifying and mitigating the potential for large meter population faults and failures. This is a potential exposure due to the large volumes of each AMI meter type population currently being deployed. It is recognised that due to such large volumes of new cutting age technology being deployed, there is a higher than normal risk of potential meter failures or recalls being experienced.

New or modified meter programs and firmware also undergo testing and formal acceptance prior to deployment, verifying that the new programs and firmware will continue to comply with safety and regulatory obligations, and support AusNet Services' tariff and connection policies.

6.4.3 Meter Procurement

Currently, the meter procurement function is overseen by the Metering Business. The procurement function, in the context of this document, is the process for ensuring there is adequate supply of suitable metering equipment to be made available to the AusNet Central logistics service provider, (CEVA), for their distribution to regional area depots.

At the completion of the AMI remediation program, the function of ordering meters has reverted to the AusNet Metering business. The Meter Asset Management team now oversees the forecasting and ordering of meters with the meter supplier. This also includes the creation of relevant purchase requisitions and purchase orders based on specific meter requirements.

All contracts and contract negotiations, including terms and conditions for the supply of metering equipment, are conducted via the AusNet Procurement team. The Metering Business

contributes to this process in establishing the specification and scope of services required to be delivered under the contract.

The Metering Business currently oversees the contract for the supply of AMI complaint meters, metering current transformers and load control devices.

The Metering Business is also indirectly involved in the contract for the supply of AMI communication equipment in respect that that contract to which these devices are supplied, forms only a subset of the overall contract for the mesh operating system with Itron (formally SiverSprings Networks). This contract is managed by the AusNet ICT team.

The Metering Business is currently ordering Mesh communication cards and pole top access points under the agreement so as to ensure there is adequate supply of communications equipment is available for new connection and fault remediation.

Forecast requirements for ordering, meter distribution and meter returns are determined from the New Connection and Replacement forecasts presented in section 5.3 (Table 7). All meters removed from site are returned for assessment and refurbishment and replaced under warranty where applicable. Meters are refurbished wherever cost effective. All refurbished meters will be inspected, re-calibrated and issued with a calibration test certificate in accordance with the NER Chapter 7 prior to be returned to stock for re-use as a meter.

6.4.4 Meter Stores and Logistics

The physical inventory management and warehouse distribution of the meters is managed by the AusNet Services logistics team, with the overarching contract management function associated with CEVA being the responsibility of the Planning, Performance and Operations area.

The Planning, Performance and Operations team is also responsible for inventory stock counts and reconciliations.

In addition to new inventory management and distribution, all returned from service meters are transported back to the central CEVA warehouse from regional depots. A process is then conducted to sort and manage the returned inventory into respective categories ahead of determining if these meters need to be returned for refurbishment, or to be scrapped (destroyed). The Returned Meter Advice (RMA) process involves acknowledging of the meter types and volumes that will be returned to the meter refurbishment provider so transparent information is available in respect of identifying which assets have been returned from service, and the location as to where that asset may reside currently.

In respect of managing inventory of communication cards (NICs) these are supplied directly to the CEVA warehouse from the overseas manufacturer. CEVA conducts for AusNet, a service to install (preload) all of the newly received electricity meters with a mesh NIC card before despatching the meter to the regional depots.

This has two benefits:

- a) The pre loading of the mesh NIC (communications card) ensures that when the meter is installed, it will attempt to automatically connect and activate as a remote operating meter. This ensures a more efficient and effective use of labour as opposed to deploying meters

EDM AMS – Part 1 Electricity Meters & Metering Equipment

without NIC cards and is a cheaper option than having the meter supplier (Landis & Gyr) conduct the similar operation. (CEVA currently provides this service at half the cost compared to Landis & Gyr).

- b) Avoids second visits or follow up visits post installation of the meter in respect of following up to install a communications card. It also assists with inventory management in avoiding deploying NICs as a separate and individual inventory item as opposed to the meter which ensures less risk with lost or unaccounted for stock.

6.4.5 Warranty

The warranty period for the L+G AMI meters is five years for meters delivered between CY2009-2012, and ten years for meters delivered from CY2013 onwards. The forecast of returned meters is presented in Table below.

Meters are disposed where it is deemed the repair is uneconomical, or beyond repair (e.g. HV injection type, vandalism etc.)

Depending on future business requirements and functionality enhancements that may be required due to Regulatory or business drivers, it can be expected that a number of meters are expected to be disposed off in the CY2016-2025 period.

EDM AMS – Part 1 Electricity Meters & Metering Equipment

Total Installed in each CY	Meter Type	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025
	400	2,427	470	711	153	583	603	665	781	903	1,028	1,155
	410	10,067	1,307	2,060	748	1,464	1,517	1,687	2,007	2,342	2,684	3,035
	420	977	860	2,899	372	696	722	806	966	1,134	1,304	1,479
	430	565	566	567	568	569	570	571	572	573	574	575
	450	107	105	125	36	102	104	108	117	125	133	141
	500	1,475	10,338	7,668	2,922	10,896	11,063	11,241	11,433	11,631	11,830	12,034
	510	317	3,166	2,228	1,772	3,321	3,372	3,424	3,480	3,537	3,594	3,653
	520	566	567	568	569	570	571	572	573	574	575	576
	530	0	0	0	0	0	0	0	0	0	0	0
	Total	16501	17379	16826	7140	18201	18522	19074	19929	20819	21722	22648
Field Returned Meters	Meter Type	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025
	400	927	745	761	244	833	845	900	1,008	1,122	1,240	1,360
	410	2,417	2,068	2,082	767	2,172	2,208	2,361	2,665	2,983	3,310	3,646
	420	1,262	1,235	1,088	384	1,049	1,067	1,144	1,298	1,458	1,621	1,790
	430	1,877	1,673	1,555	501	1,606	1,637	1,764	2,012	2,271	2,536	2,809
	450	50	47	38	15	40	41	44	51	57	64	71
	500	2	243	353	210	317	318	328	350	375	399	425
	510	1	56	75	40	64	64	65	70	74	78	82
	520	0	0	0	0	0	0	0	0	0	0	0
	530	0	0	0	0	0	0	0	0	0	0	0
	Total	6536	6067	5952	2161	6081	6180	6606	7454	8340	9248	10183
Total Installed	Meter Type	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025
	400	107,831	107,259	107,076	106,860	107,694	108,534	109,380	110,233	111,093	111,960	112,833
	410	351,259	338,335	349,095	348,713	351,433	354,174	356,937	359,721	362,527	365,354	368,204
	420	121,000	115,482	122,378	122,301	123,255	124,216	125,185	126,162	127,146	128,137	129,137
	430	126,086	119,313	128,841	130,457	131,475	132,500	133,534	134,575	135,625	136,683	137,749
	450	3,913	2,043	3,868	4,190	4,223	4,256	4,289	4,322	4,356	4,390	4,424
	500	1,559	11,878	19,957	22,603	22,779	22,957	23,136	23,317	23,498	23,682	23,866
	510	336	3,538	6,158	8,035	8,098	8,161	8,224	8,289	8,353	8,418	8,484
	520	0	0	2	9	9	9	9	9	9	9	10
	530	0	0	0	0	0	0	0	0	0	0	0
	Total	711,984	697,848	737,375	743,168	748,965	754,807	760,694	766,628	772,607	778,634	784,707

Table 11: Forecast Meter Returns

7 Risks & Dependencies

EDM Asset Management Strategy is developed to satisfy AusNet's current regulatory requirements and is current as of this date. However, the strategy is subject to change due to future changes in the NEM rules. Some of the risks associated with the foreseeable changes are captured in this section.

7.1 Five Minute market data settlement

The Australian Energy Market Commission (AEMC) has implemented a final determination on a rule change to reduce the trading interval recorded in electricity meters from the current thirty minutes to five minutes. This change will align the dispatch and financial settlement of electricity in the National Electricity Market (NEM). The impact to the existing meters is predominately based around the capability and memory of the meter to record, store and forward 200 days' worth of 5-minute data, and the relevant processing capacity of meter management and data management systems to support its introduction.

Five-minute settlement will be implemented over a 4-year period, commencing 1st December 2018 until 1st December 2022. AusNet Services has commenced a review of the rule change impacts on current and future services including view on continuation of metering competition in Victoria.

Landis & Gyr (L+G) have recently released enhanced firmware to support the change of interval data from 30 minutes to 5 minutes. Initial release of firmware by the meter vendor supports all meter types that are presently manufactured as new and considered the current release. Versions. A subsequent release of firmware to support all existing and previously released variants will determine if older meter variants can support 5-minute recording, and also importantly, the data storage requirement associated with Type 5 metrology rules acceptance.

There is a risk that all older AMI meter variants will not support the data storage capacity stipulated by the business rule which suggest that the meters should as a minimum 200 days of 4 channels, 5-minute interval data. There is a major dependency on L+G delivering a meter with upgraded firmware in time before 1st December 2018.

A major risk to compliance to this obligation is the reliance of Landis & Gyr to provide working and production ready firmware to support 5 min data by the 1st December 2018. A decision on the merits to discontinue a meter refurbishment program also will be determined as an outcome as to whether firmware to support older U1200 series meters is available.

L&G have indicated that the new firmware for 5 min data will be available to test in Q3 2018 for new and existing meter variants. However, the risk could be that the release of firmware is delayed or if significant defects have been identified as an outcome of testing program.

7.2 Metering Contestability

The derogation to extend the obligation for the Local Network Service Providers to be responsible for the supply, installation and maintenance of electricity metering services to each of their respective Distribution areas, was extended in 2017 to a proposed new date of 1st December 2021. This would therefore mean that the provision of new metering, new connections, meter fault and replacement services, would fall under the National regulatory environment, and be subject to competition, and metering services provided for via the respective Energy Retailers.

There is an obvious risk therefore of AusNet having stranded assets and not enabling and leveraging off the existing AMI infrastructure and the value adds the infrastructure is providing. Better outage management, fault detection, power quality monitoring, loss of neutral analytics is just some of the value adds being experienced by the network which leverage the AMI infrastructure.

There is a risk that these benefits may be lost, and all of the services experienced by customers currently may no longer be available to all Network customers should contestable metering be introduced at the expense of the existing AMI functionality their associated services and service levels.

7.3 Single Meter Manufacturer

Landis& Gyr (L+G) is AusNet's sole meter vendor and will continue to be its meter supplier for the foreseeable future. L & G have indicated that there is a need for a firmware upgrades to support the change of interval data from 30 minutes to 5 minutes to their existing suite of U1200, U1300 and U3300 meters. There is a major dependency of L+G delivering a meter with upgraded firmware in time before 1st December 2018. Failure to provide a working firmware to support 5 min data may expose AusNet Services to a major noncompliance in not being compliant to the current 5 Minute Settlement rules.

AusNet Services are exploring other possible meter supply and manufacturer options as a contingency measure. This will include investigations of other meter manufacturers and seeking technical information about alternative meter ability to support the following criteria:

STAGE 1	(a) Assessment of meter for AMI minimal functional compliance (b) Assessment of meter against AusNet's business requirements (predict temperature meter events, Load Control settings, meter programs & tariffs) (c) Assessment for 5 Minute data capability	12 – 14 weeks
STAGE 2	(a) Assessment of meter integration capability into MDMS and other downstream systems (b) Compatibility with UIQ /SIQ	Estimated 14-30 weeks depending on level of integration enhancement required.

L+G's acquisition of Acumen Metering business, the smart metering arm of Origin Energy may impact L+G's priority and supply of smart meters to AusNet Services. At this stage, the risk is considered minor since there is a longstanding agreement with L+G for provision of meters with a roadmap for regular supply forecast.

7.4 Single Comms Module Manufacturer

Silver Spring Networks is the manufacturer of communications module that AusNet uses on its meters. Similar to the risks associated with a single meter vendor, there are risks with having a single communications module vendor with stock availability and manufacturing delays. It becomes a highly critical risk influencing the strategy given that we need to maintain at least a minimum of 3 months' worth stock to carry on our normal BAU and comms remediation projects. This is explored in detail in the accompanying Mesh Communications Strategy document.

7.4 Bulk meter family failure

AusNet Services use a seven-point program as a framework to assist in meeting the requirements of its in-service compliance testing. The program applies to all meter types. The meter type and its population size determine the timeline of the compliance testing regime. Should preliminary results of random sample testing determine a meter population to have failed assurance; a review of the sample size of meter population will proceed. Testing is initially conducted by "variables" with the option of reverting to "attributes".

A greater degree of certainty in field test results will be obtained by increasing the volume of test results obtained prior to deeming that population as a "pass" or "fail" as defined in AS1284 part 13 item 8.7.

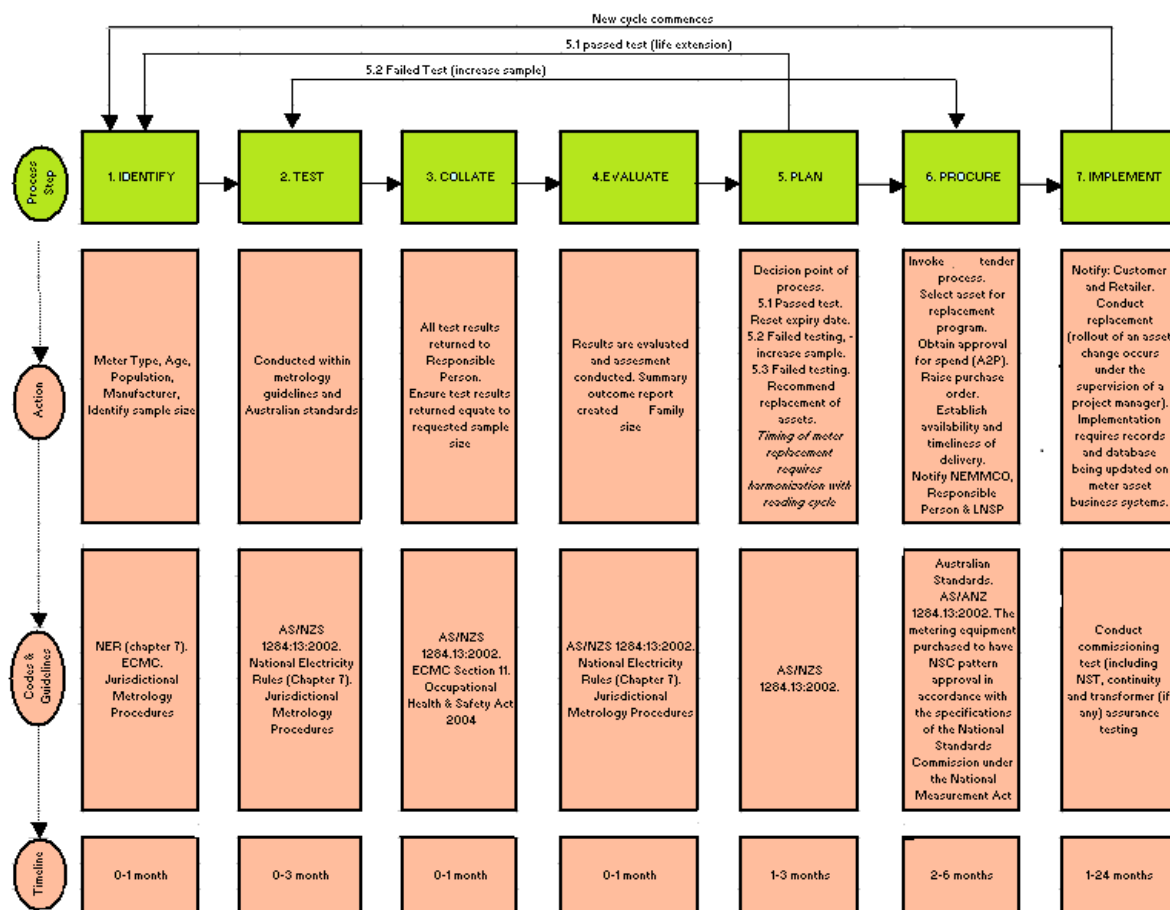
Some of the key reasons as for meter population failure includes but not limited to:

- a) Meter accuracy testing
- b) Degradation of battery life
- c) Faulty contactors or optical couplers
- d) Susceptible to potential HV injection failures.

AusNet Services may redefine the population as required. Should a large sub-population fail testing, AusNet adopts the seven-point program that defines the meter replacement timeline and its duration. Analysis of test results, in particular those obtained from failed meter populations, will be reviewed with intent to determine if sub population can be identified in respect of minimising large population fails. That is, consideration as to geographic locations, load characteristics, usage patterns, consumption histories etc. will be used to assist in determining any sub population characteristics in mitigating against unnecessary meter exchanges.

A plan detailing procurement, resource, approval, financial and regulatory processes will be collated, in accordance to the seven-point strategy detailed below.

EDM AMS – Part 1 Electricity Meters & Metering Equipment



7.5 Single Supplier for CTs

AusNet sources its current transformers (CTs) from WF Energy Controls. The procurement process involves raising a purchase order to Landis & Gyr who then engages WF Energy Controls for the supply of the CTs. AusNet would be exposed to a considerable risk if WF Energy Controls cease manufacturing or unable to supply for any reason given they are the sole supplier. This is considered a minor risk for AusNet given that WF Energy Controls is the major manufacturer of CTs for majority of the Victorian Electricity Distribution Network.

The risk can be partially mitigated by AusNet exploring alternative options for CT manufacturers. This can also be considerably reduced by AusNet's accurate forecast of the CTs needed based on historical statistics and placing order in advance and maintaining buffer stock levels to avoid any major disruption of supply.

7.6 Increased failure of Load Control Devices

The earliest fleet of L+G meters were first deployed by AusNet in 2009 during the roll out of AMI program. Given the ideal lifespan of a meter is 10 years as indicated by the manufacturer, AusNet has a considerable number of meters which would be potentially end of life during the next EDPR forecast period (to 2025). Given these meters are out of their warranty period; these installed meter fleet are susceptible to increased failure rate due to increased risk of hardware failure. Continued monitoring and reporting of removed from service meter

conditions will likely identify trends that could be associated with potential increases in meters reporting mechanical hardware failures and potential population meter issues.

The meter fleet is subject to annual asset testing program and any meter population identified as failed during the testing program will be replaced as per AusNet's Seven Point maintenance program framework. Alternatively, any meters failing within the warranty period will be replaced under L+G's RMA policy.

7.7 Relationship with third party vendors

AusNet maintains relationships with multiple suppliers and service providers that include direct and 3rd party vendors with regards to procurement of meters & metering equipment and testing arrangements.

For a more efficient management of responsibility in addition to the delivery of Metering Services, there should be a review conducted on the contract management and service level management function associated with vendors engaged in the delivery of metering and metering services.

As an example, the provision of field metering services is shared across at least four separate operating arrangements, being Downer, Select Solutions and the respective internal Field Services teams in North and East regions of AusNet's distribution network. To add complexity, each are also engaging in third party service provider arrangements for the provision of metering services to remote or rural areas or for specific metering services, such as meter testing.

All teams providing direct and indirect metering functions for the Metering Business are responsible for the services provided which are usually guided by the contract terms and the agreed SLA. Given some of the service providers sit outside of the Metering business, maintaining the relationship between these teams can be complex in nature.

For example, The MPB team within the Metering Business is responsible for the procurement and provision of meter and metering equipment. The MDP team within the metering business team is responsible for meter data management and market data delivery. The Metering Business unit is ultimately responsible for responding to audit and regulatory obligations pertaining to Meter Provision and Meter Data Services. In addition to these teams, the New Connections team within the Customer Operations Team is responsible for the commissioning of new meter installations and updating MSATS with meter standing data updates. This team sits outside of the metering business and are responsible for ensuring new meter connection on time and all relevant NMI Standing Data and other connection point details are maintained and updated in MSATS as per the market SLA.

As per the clause 4.3, of MP Service Level Procedures for MSATS updates and notifications following Metering Installation Commissioning, the MP must:

(a) ensure that all relevant NMI Standing Data for the connection point is updated within **5 business** days from the day that the MP is appointed as the MP for a market load in MSATS, including:

- (i) entry and update of relevant NMI Standing Data information into the MP's systems and databases; and
- (ii) Provision of meter change installation notice to the respective MC and MDP(s) for the connection point; and

(b) provide a notice of completed metering installation work to the LNSP within **2 business days** of completion of the installation.

However, the Metering Business is ultimately responsible for (in responding to audit and regulatory obligations pertaining to Meter Provision and Meter Data Services), however there is no direct association or management between some teams providing these services and the various business units (New Connection/Customer Services, Metering Business, Network Intelligence and automation).

In addition, there is an element of risk and complexity in not having direct (or separate) supply agreements with meter vendors. As an example, procurement of metering transformers is currently directed through the meter supplier as opposed to separate arrangement directly through to the transformer manufacturer. Direct engagement of vendors providing metering equipment and services should be considered. These risks have been identified by the business and recorded in the Metering Business Risk Register.

7.8 Meter Procurement & Inventory Management

All metering inventory for AusNet is managed by AusNet's Logistics and Procurement team. The implementation of SAP ERP has somewhat complicated the stock ordering process and ensuring that autonomous, consistent and regular delivery of meter stock is problematic. Ordering of some items is additionally complicated by hardware and software components across differing business units being unable to be created on one purchase order, as well as the complexities in US dollar conversions.

AusNet's Metering Business group's knowledge around using the procurement system for stock ordering and handling is minimal and heavily reliant on certain individuals outside the metering group. There is a high risk should AusNet lose the key resources in the procurement and purchasing area. Delays to procuring stock are evident under the current processes and exposure to non-compliance in being unable to rectify faults and defects due to lack of inventory are evident.

A current review of inventory management and procurement is currently underway. This includes ensuring owners and responsible parties for procurement and management of inventory are clearly defined.

In addition, a third party service provider to AusNet being CEVA operates a metering inventory and distribution service on behalf of AusNet. This contract is managed and monitored currently by the Logistics and procurement team within AusNet Services. The Metering Business has no direct relationship with the services or operations of the CEVA warehouse, however is reliant on the services provided to ensure adequate reporting and advice pertaining to stock and inventory holdings is maintained accordingly.

7.9 Local Meter Reading

The Metering Business, via its internally resourced Field Service Team, conducts all local scheduled meter reading services and some meter maintenance activities as part of its MD-P obligations.

EDM AMS – Part 1 Electricity Meters & Metering Equipment

The Multi-Vendor Reading System (MVRS) provided by Itron is used for obtaining and managing scheduled quarterly and monthly cyclic meter reading. For meter investigation activity, EMPwin+, a proprietary software application provided by Landis & Gyr is the software package used for locally retrieving the meter reads and investigating and locally programming meters. An accompanying optical probe is also required for this purpose.

EMPwin+ is generally upgraded as and when new meters are released, when new firmware is enhanced, or when new meter functionality is enabled.

During the forecast period, at least 4 new or upgraded versions of proprietary software is expected to be released, with testing, evaluation and release, managed and conducted by the Meter Asset Management Team. Each test and release takes between 3 to 6 months to test and release into production.

7.10 Impacts on Meter Program Versioning Strategy

The Meter Asset Management Team has created a meter program versioning strategy document which is used to describe the method when creating new. The Program Strategy applies the logic of grouping meter functionalities including remote capabilities, Load Control functionalities, groups etc.

With the introduction of five-minute data capability, there will be new meter programs created to support this functionality for the impacted meter variants. It would be opportune to review the Program Strategy to investigate if a more effective and efficient meter programming format could be utilised. This could lead to changing the strategy for meter programs as we try and consolidate meter programs across our fleet to suit various tariffs and customer usages.

8 Resources & Service Providers

8.1 Metering Resources

AusNet Services uses a combination of internal resources and third-party service providers to deliver the forecasted metering programs described within this asset management strategy. All personnel are approved trained and certified as competent to safely perform the assigned activities to the required regulations and standards. AusNet Services oversees the performance and quality of these internal and external resources to ensure compliance but should be further reviewed so business owners can be clearly defined.

Minimum skills and requirements for resources performing metering work identified in this asset management strategy are listed below:

- Certificate III in Electro-technology or equivalent
- Standard AMI Electrical Meter installation course conducted by certified training bodies;
- First Aid, CPR
- Training in the following:

EDM AMS – Part 1 Electricity Meters & Metering Equipment

- Asbestos awareness;
- VESI Environmental framework;
- VESI framework
- ESI safety rules;
- Testing of connections
- Manual handling;
- Safe approach distances

More advanced training and skills are required for some of the specialist metering activities, such as installation, testing and inspection of CT meters and LV CTs.

In addition to the above, all installers are issued with an Australian Electricity Supply Industry Skills Passport which will reflect both the AMI meter course and additional courses which are regularly audited.

Before being permitted to work alone on any installation, each installer undertakes a period of approximately two weeks in a mentoring program as a part of their induction covering each of the tariff types and the associated metering configurations. Thereafter, internal auditors undertake a “Check of Understanding” to ensure the installer is capable of performing the required work.

AusNet Services uses the VESI Skills and Training Matrix as a guideline to assess and monitor the performance of the field resources employed.

AusNet Services has a number of delivery partners to supplement the internal metering workforce and field service teams. Contract arrangements with these delivery partners are performance based with benchmarking of costs and standards to ensure quality and value is maintained.

This mixture of internal field teams and a range of external providers provide AusNet Services the flexibility for maintaining meter installations in accordance with this strategy and the relevant regulatory obligations.

8.2 Metering Equipment Vendors

AusNet Services manages the processes of ongoing purchase, ordering, receipting, storing and distributing the required volumes of new meters and metering equipment. Based on forecast requirements for new connections, replacement and test activities, monthly delivery schedules are co-ordinated with the respective suppliers.

The vendors used to supply AusNet Services with the required meters and associated metering hardware are listed in the below table.

Vendor	Item Supplied
Landis + Gyr Australia	<ul style="list-style-type: none">▪ AMI Electricity meters▪ Load control contactors▪ Meter Refurbishment and recalibration services

EDM AMS – Part 1 Electricity Meters & Metering Equipment

WF Energy Controls	<ul style="list-style-type: none">▪ Low Voltage Metering Current Transformers
Eugaquip	<ul style="list-style-type: none">▪ CT Meter test blocks
AusNet Services Logistics & Procurement	<ul style="list-style-type: none">▪ Source cable loom for CT metering,▪ Meter panel cable from Olex Cables,▪ Service fuses and fuse holders,▪ Meter panel screws and fasteners from Fuji Fasteners

Table 4: Meter Equipment Vendors

8.3 Meter Testing, Returns and Refurbishment

When metering equipment is removed and refurbished, the metering equipment is laboratory tested by NATA accredited service providers (subject to age and type). AusNet Services uses the resources listed below to provide the required specialist refurbishment and recalibration services for meters and LV CTs, in accordance with the relevant Australian Standards.

In-field test equipment is calibrated annually by Select Technical Solutions.

Vendor	Service
Landis + Gyr	<ul style="list-style-type: none">▪ Meter returns claimed under warranty▪ Defective metering investigations▪ Re-verification of metering▪ Meter refurbishment & meter repair services
Select Technical Solutions	<ul style="list-style-type: none">▪ Specialist quality assurance testing▪ Batch sample testing of new meter deliveries▪ In service high voltage metering transformer testing
WF Energy Controls	<ul style="list-style-type: none">▪ Re verification of low voltage current transformers.
Formway Metering Services	<ul style="list-style-type: none">▪ Supplementary meter refurbishment & meter repair services.

8.4 Test Equipment

AusNet Services use and maintain a variety of meter test instruments and software to support the activities identified in the asset management strategy. The table below lists the current test equipment.

Equipment Type	Model Number	Sl. No.	Manufacturer
Meter Test Set	465B & 462E Phantom load	3754, 3759	Red Phase Instruments
Meter Test Set	689 Test set and Phantom load	7192	Red Phase Instruments
Meter Test Set	689 Test set and Phantom load	7193	Red Phase Instruments
Meter Test Set	689 Test set and Phantom load	7298	Red Phase Instruments
Meter Test Set	689 Test set and Phantom load	7299	Red Phase Instruments

EDM AMS – Part 1 Electricity Meters & Metering Equipment

Meter Test Set	689 Test set and Phantom load	7288	Red Phase Instruments
Meter Test Set	PTS2.3	26742	MTE
Meter Test Set	PTS2.3	26743	MTE
Meter Test Set	PTS2.3	26747	MTE
CT Test Set	590GV2	6595	Red Phase Instruments
CT Test Set	590GV2	6596	Red Phase Instruments
CT Test Set	590GV2	6597	Red Phase Instruments
CT Test Set	590GV2	6755	Red Phase Instruments
CT Test Set	590GV2	6756	Red Phase Instruments
CT Test Set	590GV2	7021	Red Phase Instruments
CT Test Set	590GV2	7061	Red Phase Instruments
CT Test Set	590GV2	7062	Red Phase Instruments
CT Test Set	590GV2	7063	Red Phase Instruments

In addition, AusNet Services use the EMPwin+ proprietary software provided by the meter supplier, Landis + Gyr, for local meter re-programming, meter investigations and meter data verification. EMPwin+ can only be accessed by authorised users and installed on appropriate IT laptop, desktop or tablet hardware. A corresponding IEC-type optical probe is required to enable local connectivity to the AMI meters to enable access to the administrative functions delivered by EMPwin+. The meter reading software MV90 and the Multi-Vendor Reading System (MVRS) are also used in meter investigations and inspections.

AusNet Services ensures its testing and reference standard instruments are calibrated and maintained on an annual basis. AusNet Services use appropriate NATA accredited testing laboratories to carry out calibration checks and tests. A test report for each item of equipment is maintained for reference. Currently, AusNet Services utilise the services of Select Solutions Technical Services Group (Accreditation #754) for calibration services for all electricity meter testing equipment.

The LV CT test equipment, listed in the table above, is described below:

Red Phase Instruments – 590G-V2 CT Error Tester

The 590G-V2 has a pre-recorded Standard verification for IEEE C57.13-1993 and IEC 60044 Instrument Transformers. The 590G-V2 has the following test capabilities:

- CT ratio and phase error measurements
- CT 1.6kHz Admittance test
- CT excitation curve and knee point test
- Burden test
- CT winding resistance measurements
- CT polarity measurements

OMNICON

The OMNICON has the following test capabilities:

EDM AMS – Part 1 Electricity Meters & Metering Equipment

- CT-ratio and phase-angle accuracy with consideration of nominal and operational burden for various currents
- CT winding resistance
- CT excitation / saturation (unsaturated and saturated)
- ALF and FS (direct and indirect)
- Burden impedance
- CT residual magnetism

Appendix A: References

References applicable to the management of the meter asset include:

#	Reference	Organisation
A	Metering Asset Management Plan (MAMP) – Information Paper, Version 005	AEMO
B	Metrology Procedure: Part A National Electricity market, version 3.0	AEMO
C	Metrology Procedure: Part B National Electricity market, version 5.0	AEMO
D	Victorian Advanced Metering Infrastructure Review 2012–15 budget and charges applications PUBLIC VERSION, October 2011	AER
E	AS 1243 – 1982 Voltage transformers for measurement and protection	Australian Standard
F	AS/NZS 1294.13:2002 Electricity metering – Part 13: In-service compliance testing	Australian Standard
G	AS 1675 – 1986 Current Transformers – Current transformers (IEC 60044-1:1996, MOD)	Australian Standard
H	AS 60044.2-2003 Instrument Transformers – Part 2: Single-phase inductive voltage transformers (IEC 60044-2:1997, MOD)	Australian Standard
I	AS 2490-1997 Sampling Procedures and Charts for Inspection by Variables for Per cent Non-conforming	Australian Standard
J	AS 1199.0 Sampling Procedures for Inspection by Attributes	Australian Standard
K	AS 1284.13:2002 Electricity Metering – Part 13: In-service compliance testing	Australian Standard
L	AS 1284.10.2-2006 Electricity Metering - Data exchange for meter reading, tariff and load control - Direct local data exchange via hand held unit (HHU) - ANSI Standard Interface	Australian Standard
M	AS 62052.11 Electricity metering equipment (AC) - General requirements, tests and test conditions - Metering equipment (IEC 62052-11, Ed.1.0 (2003) MOD)	Australian Standard
N	AS 62052.21. Electricity metering equipment (ac) - General requirements, tests and test conditions - Tariff and load control equipment (IEC 62052-21, Ed. 1.0 (2004) MOD)	Australian Standard
O	AS 62053.21. Electricity metering equipment (AC) - Particular requirements - Static meters for active energy (classes 1 and 2) (IEC 62053-21 Ed.1.0 (2003) MOD)	Australian Standard
P	AS Australian Standard 62053.22. Electricity metering equipment (AC) - Particular requirements - Static meters for active energy (classes 0.2 S and 0.5 S)	Australian Standard
Q	Alternative Testing Minimum Requirements: Low Voltage Current Transformer Metering Installations Version 1.1	
R	Department of Primary Industries (now DEDJTR) – Victoria, Advanced Metering Infrastructure Minimum Functionality Specification version 1.1	Victorian Government
S	Electricity Customer Metering Code, Essential Services Commission Victoria, Issue No 7	

EDM AMS – Part 1 Electricity Meters & Metering Equipment

#	Reference	Organisation
T	National Electricity Rules, Version 46, Chapter 7, available online at http://www.aemc.gov.au/	AEMC
U	NMI M6 Electricity Meters Pattern Approval Requirements (in accordance with the National Measurement Act)	

Note: All standards are available from Standards Australia website.

Table A: Meter Volume and Program Matrix

Meter Type Code	Meter Program	No. of Installed Meters	Meter Program
400	4105	93,954	Standard 1Ph1e Light and Power (LP)
	4215	12,661	1Ph 1E LP with Solar
410	1106*	76	Non-standard 1Ph1E
	1216*	0	Non-standard Solar 1Ph1E
	4106	193,288	Standard 1Ph1E LP
	4107	96,364	Standard 1Ph1E with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	4108	969	Standard 1Ph1E with load contactor afternoon boost (on at 1pm, off at 5pm, on at 11pm, and off at 7am)
	4109	2,554	Standard 1Ph1E with load contactor switching (on at 9pm, off at 12pm, on at 3am, and off at 8am) with 60 minutes random turn on delay
	4216	54,681	Solar 1Ph1E with load contactor switching (on at 11pm, and off at 7am) with 60 minutes random turn on delay
420	4102	92,844	Standard 1Ph 2E with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	4103	6,127	Standard 1Ph 2E with load contactor switching for afternoon boost (on at 1pm, off at 5pm, on at 11pm, and off at 7am) with 60 minutes random turn on delay
	4104	3,632	Standard 1Ph2E with load contactor switching (on at 9pm, off at 12 midnight, on at 3am, and off at 8am) with 60 minutes random turn on delay
	4212*	5	Non-standard 1Ph2E with 11pm load contactor switching and 30 minutes random turn on and turn off delay
	4222	19,331	Standard 1Ph 2E with 11pm load contactor switching and 120 minutes random turn on delay
	4232	237	Standard 1Ph 2E with 11pm load contactor switching and 120 minutes random turn on delay
430	4306	103,037	Standard 3Ph Direct Connect with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay

EDM AMS – Part 1 Electricity Meters & Metering Equipment

	4307	6,106	Standard 3Ph Direct Connect with load contactor switching for afternoon boost (on at 1pm, off at 5pm, on at 11pm , and off at 7am) with 60 minutes random turn on delay
	4308	18	Standard 3Ph Direct Connect with load contactor switching (on at 9pm, off at 12pm, on at 3am, and off at 8am) with 60 minutes random turn on delay
	4932	22,237	Solar 3Ph Direct Connect meter with load contactor switching (on at 11pm, and off at 7am) with 60 minutes random turn on delay
450	4950	3,641	Standard 3Ph CT meter with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay with 60 minutes random turn on delay
	4951	8	Standard 3Ph CT meter with load contactor switching for afternoon boost (on at 1pm, off at 5pm, on at 11pm , and off at 7am) with 60 minutes random turn on delay
	4952	592	Solar 3Ph CT meter with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
500	9105	26,593	Production Version for Standard Default 1P 1E w/o LC ; Program created as per U1300 meter type
	9215	1,622	Production Version for Standard Solar 1P 1E w/o LC ; Program created as per U1300 meters
510	9107	9,388	Standard 1Ph1E with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	9108	2	Standard 1Ph1E with load contactor afternoon boost (on at 1pm, off at 5pm, on at 11pm , and off at 7am)
	9109	10	Standard 1Ph1E with load contactor switching (on at 9pm, off at 12pm, on at 3am, and off at 8am) with 60 minutes random turn on delay
	9216	638	Solar 1Ph1E with load contactor switching (on at 11pm, and off at 7am) with 60 minutes random turn on delay
520	9102	40	Standard 1Ph 2E with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	9103	1	Standard 1Ph 2E with load contactor switching for afternoon boost (on at 1pm, off at 5pm, on at 11pm , and off at 7am) with 60 minutes random turn on delay
	9222	4	Standard 1Ph 2E with 11pm load contactor switching and 120 minutes random turn on delay
	9232	1	Standard 1Ph 2E with 11pm load contactor switching and 120 minutes random turn on delay
Total Meters		750,684	

*** Program has been “sunsetting”, or superseded, and is no longer approved for deployment**

Meter Program Volumes (as at Oct’ 2018)

Table B – Meter Firmware Version Matrix & Volume

Meter Firmware Versions & Deployed Volumes (as at June 2018)

Meter Type Code	Meter Count	Meter Firmware	Baseline for Logical Conversion
400	53446	S00237-05.05.R26	YES
	185	S00237-05.05.R31	YES
	52968	S00237-05.05.R43	YES
410	0	125.27	NO
	1	255.255	NO
	5	S00237-05.05.R02	NO
	46	S00237-05.05.R11	NO
	8	S00237-05.05.R21	NO
	39	S00237-05.05.R23	NO
	170	S00237-05.05.R26	YES
	1292	S00237-05.05.R31	YES
	346184	S00237-05.05.R43	YES
420	617		NO
	0	255.255	NO
	3	S00237-05.05.R11	NO
	0	S00237-05.05.R21	NO
	54	S00237-05.05.R23	NO
	132	S00237-05.05.R26	YES
	672	S00237-05.05.R31	YES
	120823	S00237-05.05.R43	YES
430	1163		NO
	0	255.255	NO
	23	S00237-05.05.R23	NO
	180	S00237-05.05.R26	YES
	1101	S00237-05.05.R31	YES
	127990	S00237-05.05.R43	YES
450	52		NO
	0	255.255	NO
	0	S00237-05.05.R26	YES
	8	S00237-05.05.R27	YES
	61	S00237-05.05.R31	YES
	4069	S00237-05.05.R43	YES
500	357		357
	22246	5.5.R43	22246
	6710	5.5.R43	6710
	1236	5.5.R44	1236
520	46	5.5.R43	YES
530	23	5.5.R43	YES
Non AMI	11060	NA	NO
Total Meters	754228		