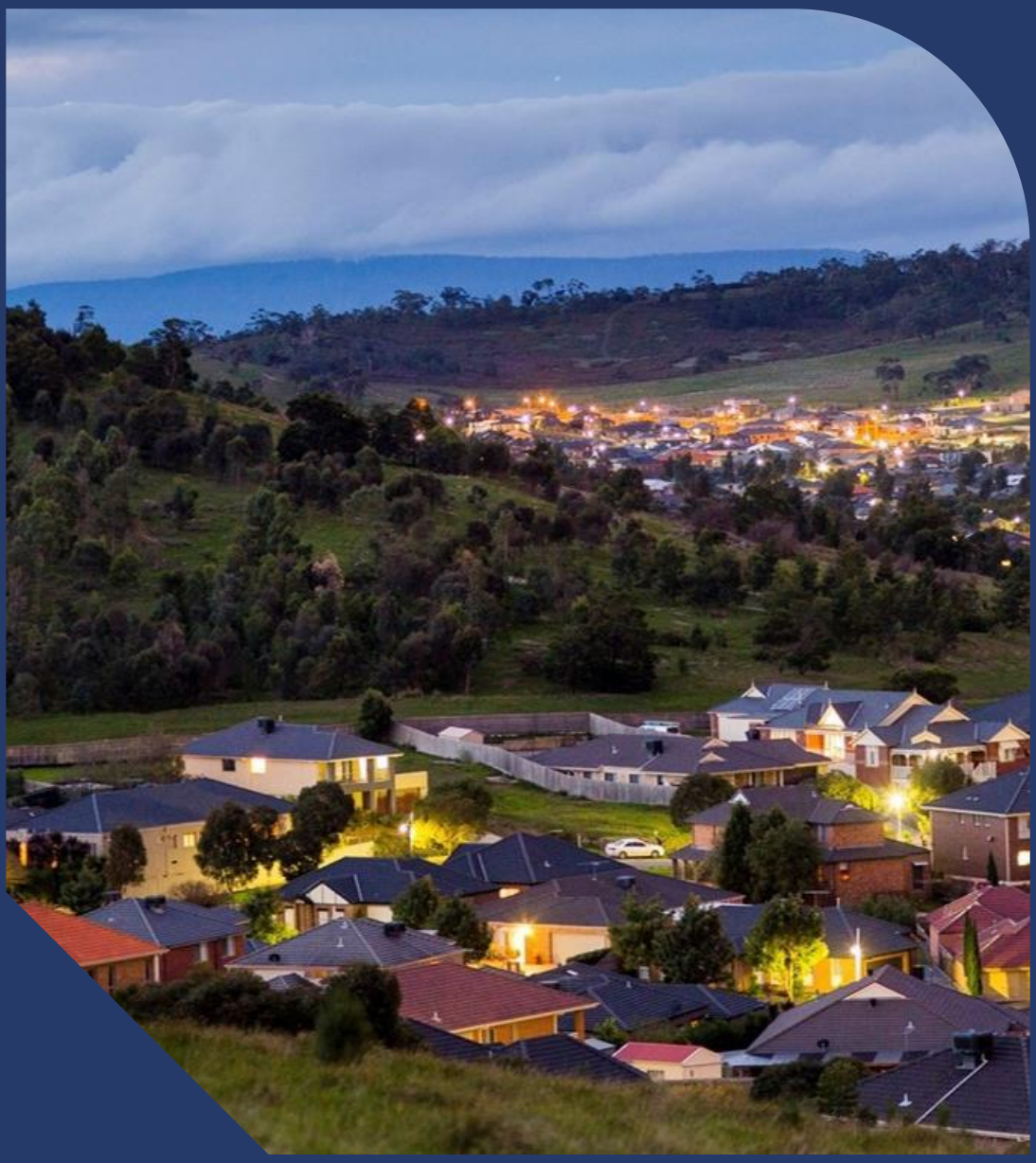
AusNet

Meter Asset Management - Distribution

AMS Distribution Metering Strategy (2024-31)

Electricity Meters & Metering Equipment - Part 1



ISSUE/AMENDMENT DRAFTING 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 extend to 2025	Brendan Buckland Srikanth Sridhar
2.1	27/11/2018	Updated Sections 3,4 &6	Brendan Buckland Srikanth Sridhar
2.2	12/04/2022	Updated Sections 4,6 and 7	Brendan Buckland Srikanth Sridhar
2.3	18/07/2022	Updated Section 5	Brendan Buckland Srikanth Sridhar
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2.5	22/10/2022	Amended feedback from J.Betlehem	Brendan Buckland Srikanth Sridhar
2.6	8/01/2024	Review in line with revised forecast 5.3 and 7.6 and added updates to scheduled meter replacement initiative	Brendan Buckland Srikanth Sridhar
3.0	31/01/2025	Changes made following EDPR review	Justin Betlehem

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Supporting Documentation

The following document suite comprises the AusNet 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	Owner(s)	Approver	Reviewer
Part 0 - AMI Asset Management Strategy Overview	1.0	Brendan Buckland	Fran Duiker	Justin Betlehem
Part 1 - Electricity Meters & Metering Equipment	3.0	Brendan Buckland Srikanth Sridhar	Fran Duiker	Justin Betlehem
Part 2 - Mesh Asset Management Strategy	1.0	Brendan Buckland Alan Crockett	Fran Duiker	Justin Betlehem

Acknowledgments

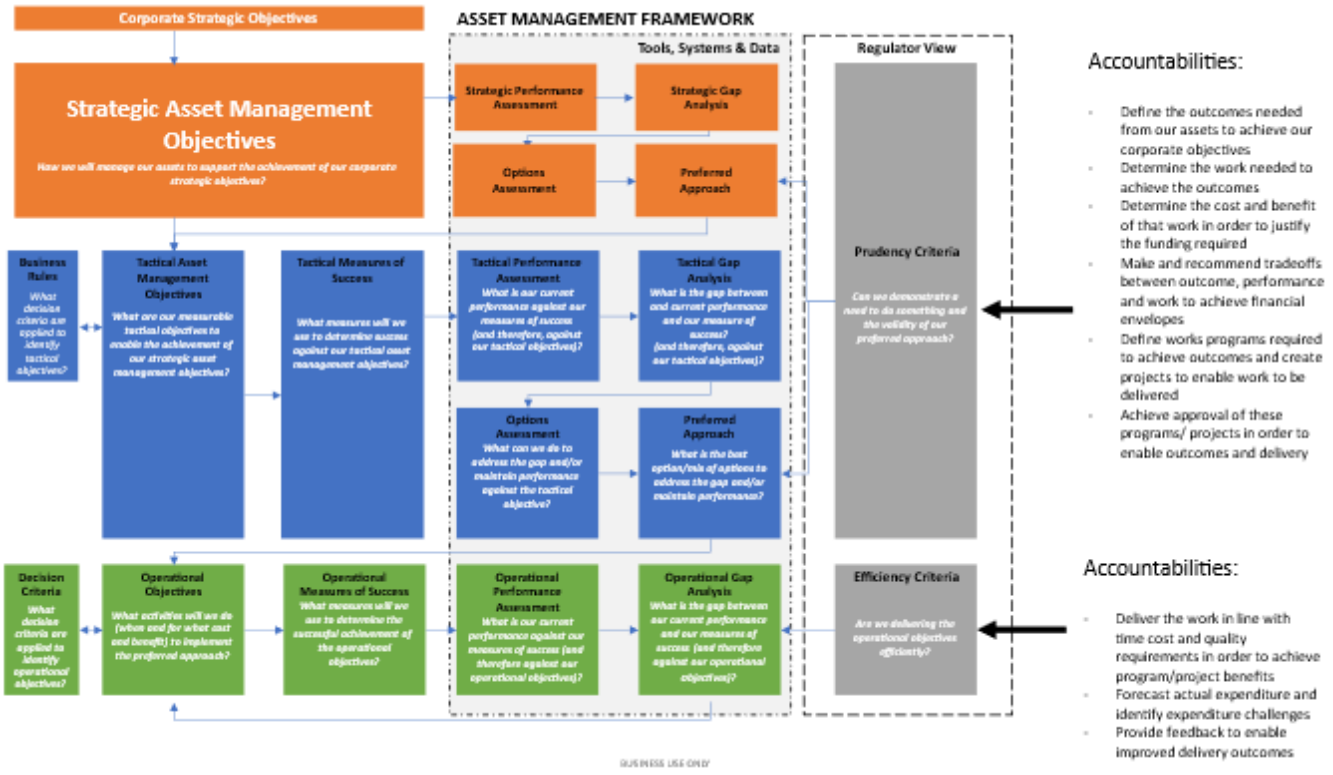
1. Recommendations from this strategy will be summarised and managed through the AMI Asset Management Strategy Overview.
2. This document forms a part of the overall AusNet Asset Management Framework.
3. Figures, volumes and costings referenced within this document are subject to change. Where a statistic is required the document owner should be contacted for latest information.

Table of contents

1. Executive Summary

The Electricity Distribution Metering Asset Management Strategy (**EDM AMS**) provides the framework for AusNet' management of its metering assets for the period up to year 2026 and beyond. Within the context of the current and forecast states of the assets, this EDM AMS identifies the strategies to support our Metering Business mission in "Shaping the Best Metering Solutions and Services for our Communities". The EDM contributes to the overarching Asset Management framework by detailing the metering strategic and operational objectives which contributes to our Corporate Strategic objectives, shown in Figure 1 below.

Figure 1: Asset Management Framework overview



The EDM AMS consists of a Strategy Overview document (Part 0), together with the following two parts 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** – Mesh Asset Management Strategy: Mesh communication modules and hardware, firmware used in the communications solution, and the associated digital metering applications and support.

Note: These aforementioned documents override any previous versions forming the Metering Asset strategy.

More than 820k Type 5/6 meters are currently installed in the AusNet's Electricity Distribution area, with over 90% of these remotely read capable, Advanced Metering Infrastructure (**AMI**) smart meters. In addition, we install approximately 20,000 new meters to meet greenfield new connection and meter replacement obligations annually.

Following our completing our AMI mandated rollout in 2014 and the subsequent AMI remediation project completed by 2018, we have more than 99% of AMI capable meters connected in our Distribution Network. The other non-AMO meters are located at sites where we were advised of a customer refusal to have a smart meter installed, or where customer side defects exist (such as access issues) which prevent conversion to an AMI meter. Specific management strategies have been devised to manage and maintain the remaining fleet of non-AMI meters and are included within this strategy document.

Meter Asset Management, for the context of this document, includes the oversight of capital expenditure projects such as new electricity meter connections and meter replacements as well as operational metering activities (e.g., field maintenance works programs, in-service meter and LV CT testing, meter inspections, "local" meter reading and meter services). In addition, activities such as meter asset procurement and logistics, forecasting and planning, remote metering digital system configuration and performance monitoring are included into Meter Asset Management functions.

The EDM Asset Strategy, is delivered by Metering Asset Management team to support our strategic objectives:

1. To position AusNet as a leader in the Energy Transition
2. To transform our customer experience.
3. Create and develop industry leading Employee value proposition.
4. Accelerate new business value.

The Metering business, in support of these strategic objectives ensures the delivery of safe, compliant and efficient metering and metering activities through:

- Enhanced condition monitoring of meters and the distribution network.
- Conducting compliance testing and inspections of meters and Low Voltage (**LV**) Current Transformers (**CTs**), and verification of meter data as per Chapter 7 of the NER.
- Formal, rigorous acceptance testing of new meter types and meter programs prior to approval to deploy.
- Ongoing training, competency assessments and formal job authorisations.
- Optimising the functionality of the AMI metering platform to extract the best customer outcomes.
- Manage the compliance obligations associated with being an accredited Meter Provider (**MPB**) and registered Meter Coordinator (**MC**).

2. Overview

2.1 Purpose of Document

The purpose of this document is to define the Asset Management strategy for our 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 2031 and beyond. The Asset Management strategy aims to:

1. Support the continued safe operation of the meter asset to provide the best customer experience.
2. Enhance the capability of the our 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. Provide strategies to implement the meter capabilities to better manage the AusNet' electricity distribution network and position AusNet for the future operating and regulatory environment, in alignment with our 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.

Part 1 of this strategy will describe strategies and plans to meet our metering compliance obligations in respect of acting as Meter Provider and Meter Coordinator. In particular, this document will detail how AusNet complies with obligations detailed within Chapter 7 of the NER and Part A of the AEMO Metrology Procedure and Service Level Agreements around the provision of metering services.

These obligations include but are not limited to:

6. In service compliance testing as per AS 1284.13 for the Type 5/6-meter fleet.
7. In service metering inspection strategy and implementation.
8. Initial acceptance and functional testing of new meter variants, firmware and software releases as required.
9. Management and oversight of the meter data verification obligation for AMI meters in accordance with AS 1199.1-2003 in line with Chapter 7 clause S7.4.3 (e) of the National Electricity rules.
10. Implementation of the AEMO approved alternate testing practice for 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.
11. Devising approaches for management of the remaining non-AMI meter fleet, including the proposed co-incident replacement of non-AMI meters when scheduled testing of the non-AMI meter is due and abolishment's of long term de-energised metering structures.
12. 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.
13. Investigation and development of new meter configurations and settings to support:
    a. The "smart network of the future" initiatives for safer, more efficient recording and analysis of the distribution network power quality.

b. Creation of enhanced metering programs to facilitate new tariffs for the delivery of emerging new customer services and Distributed Energy Resource initiatives.

c. Meter settings to support dynamic load control and bulk storage device switching to align to low network demand periods.

d. Network device configurations to support pole top battery connections and Solar backstop initiatives among other things

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 is the MC.
- Direct connect (whole current) and CT operated meter types, their associated meter program version creation and control and related meter firmware release and testing.
- Associated metering installation hardware, including the LV CTs and Network supplied external load control devices.
- Associated field and laboratory test, commissioning and support tools and processes, 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.
- Relevant meter procurement, operating, maintenance, support, replacement, and disposal activities associated with the metering hardware.

This Part 1 of the Meter Asset Management Strategy excludes activities applicable to:

- The meter communications solution and application including mesh communication modules and supporting pole top infrastructure. Module firmware applicable to the AMI communications solution is also excluded and is incorporated into Part 2 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 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).

2.5 Meter Asset Management Oversight

The Metering Group team role with AusNet is to ensure we remains compliant to the MC and Meter Provider obligations in line with Sec 8a. of Metrology Procedure Part A. In addition, it is responsible for all:

- Meter Strategy, test plans, and other compliance reporting, forecasting and response associated with AMI metering.
- New product acceptance, evaluation and test.
- Accountable for metering compliance obligations relating to AusNet's Registrations as MC and Accreditation as Meter Provider.
- acceptance and release of new meter variants, meter programs and supporting firmware versions, including optimising AMI functionality, development and testing.
- Configuration Management of the meter and communication hardware including meter program design, test and release and firmware configuration for remote service capability.
- Oversight and forecasting of meter logistics, including warranty, refurbishments, disposals, and procurement.
- Meter Projects – WiMAX decommissioning, 3G decommissioning and 4G implementation.
- 5 minute data and Global Settlement works program.
- Oversight of meter maintenance activities.
- Monitoring and analysis of meter performance and compliance.
- Management of meter test equipment, calibration and accuracy.

3. Asset Description

3.1 The meter asset

The Installed AusNet meter fleet as of Oct 2023 comprised of

- 806,562 NMIs which consist of 828,363 Type 5 and Type 6 meters installed.

  (Meter equipment complies to clause s 7.4.3.1 – Overall Accuracy requirements for metering installations – Chapter 7 of National Electricity Rules v185).
- 815,122 meters are AMI remote capable meters.
- 7,596 are non-AMI meters (installed to 5,872 NMI connection points).
  - 4,101 are energised NMIs and
  - 1,771 are de-energised NMIs.
- 15,534 LV CT

Of the 820,771 AMI capable meters installed, the following table indicates their read status in the Market.

Meter Install Type	Total
BASIC	3,170
MRIM	2,480
RRIM	815,121

Of the 793,503 installed Remotely Read AMI meters, Mesh represents 98% of Meter Comms Types and MicroAP representing the remain 2%.

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

- the assigned Network Tariff.
- the physical connection characteristics (e.g., phasing, direct or CT connected).
- Whether load switching is required (e.g., bulk storage 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 future network management 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", solid state, electronic meter that, when installed with a wireless communications module, supports the minimum functional specifications required by the Victorian Government.[1]

AusNet 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 NMI M6 Electricity Meters Pattern Approval Requirements (in accordance with the National Measurement Act).

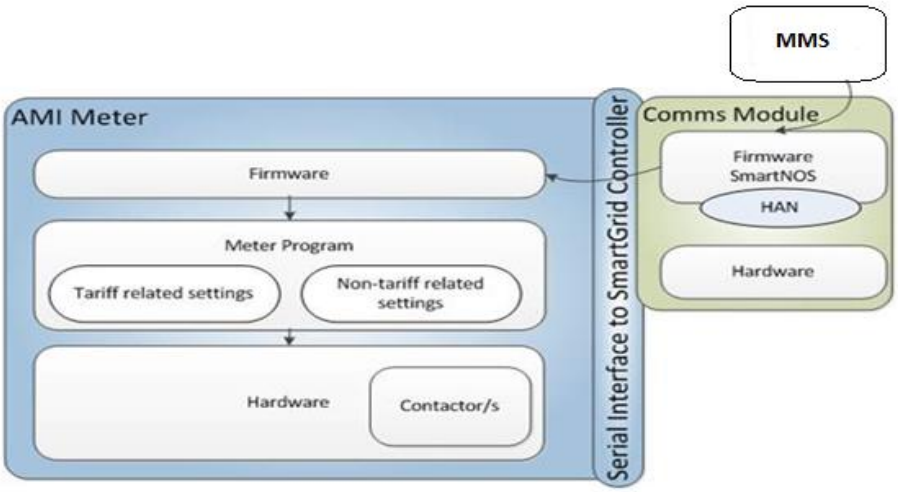
The key components of the AMI meter are:

- 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 solution used for remote interface; and
- The meter program (configuration file), which provides the specific settings for the functions for each meter to be enabled.

Error! Reference source not found. below shows these logical components of the AMI meter and communications module ("communications card').

1 Metering complies as per Victorian DPI Advanced Metering Infrastructure Minimum AMI Service Levels Specification Release 1.1 dated Sep 2008

Figure 2: Block Diagram of AMI Meter & Communications Module



Key functionality of our AMI meter solution includes as a minimum, compliance to the Victorian Department of Primary Industry, Minimum AMI Functionality Specification – Release 1.2 dated Sep 2013 Clause 3.2 Metrology).

At a high level, the main attributes of the solution include:

- Whole Current (direct connect) meters rated to a maximum of 100A per phase.
- For LV CT meters, the load per phase is current transformed to a rated 5A primary capacity.
- All meter variants are four quadrant types allowing for import and export kWh and kVarh units to be recorded and profiled.
- Options to record 5, 10, 15, 30 and 60 minute interval metering data on single or multiple channels, depending on the meter type, memory selection type and program.
- Capable of storing more than 1,100 days of 30-minute single channel interval data.
- The meter's LCD display can be programmed to display a variety of energy consumptive registers, meter event statuses, communication connectivity health status and total accumulated energy registers.
- Meter event recording including date/timestamp, including voltage/current breaches, memory failures, suspect import energy detections, etc.
- Capable of remote re-energisation and de-energisation through the internal 100A rated load supply contactor.
- 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 (some meter variants). An additional "boost" function is available to allow customers to provide for additional bulk storage heating through the "boost" button located on the main meter face.

* The configurable load control contactor operating time settings assist AusNet in the management of network peak loads and supply quality through the capability implemented via "randomised" switch on times, and by applying different switching periods for specific customer cohorts. The load control can be overridden and re-configured remotely.

All meters have been programmed to record specific performance alarms and events. These events 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. :

- 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.

3.1.2. Non-AMI meters

The residual non-AMI meter fleet consists of various meter types, manufacturers, age and are predominantly operating as Type 6 manually read meters on a quarterly meter reading cycle. The list of installed non-AMI meters is maintained in the SAP-ISU application and are subjected to test and inspection regimes similar to AMI class 1 meters.

All non-AMI metered sites where either a customer requested, or business-initiated meter change is required will be installed with an AMI capable, class 1 grade meter free of charge.

3.1.3. Low Voltage Current Transformers (LV CTs)

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 the approved current rating consistently for an extended period of time. LV CTs are used where customers require a multiphase load exceeding an average 90Amps per phase which exceed the safe operating limits of a directly connected meter . The use of metering transformers to step down the supply current by a defined ratio allows metering of consumers drawing loads greater than 100A. The majority of these are three phase customers, requiring a CT operated meter and three LV CTs, (one CT per phase).

As per Clause 8.8 of the Victorian Service & Installation Rules (VSIR) – Amendment 1 – April 2017

> ***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).*

For new or to be upgraded installations, designed with a calculated maximum demand approaching 90A per phase or more, installation of LV CT Metering is required.

AusNet provides LV CT metering to all new and upgraded supply points in its distribution area that required transformer operated metering. Therefore, irrespective of the provision of contestable metering services to some of these connection points, where the metering may be declared as Type 3 or Type 4, we will supply the LV metering CTs to facilitate the metering connections to these customers. Provisions in Network tariff assignments to these contestable metering installations account for the provision of the metering transformers in these circumstances. Ongoing testing, maintenance and assurance associated to these in service CTs connected to Type 3 and 4 installations is the responsibility of the nominated MC and Meter Provider.

The installed LV CT fleet for Type 5 and 6 Metering Installations consuming less than 160MWh per year to which AusNet is the nominated MC and MP, are listed under section **Error! Reference source not found.**. Associated asset attributes to these sites and standing data such as type, rating, last test date, install date among other aspects are maintained within the SAP-ISU (CIS) management system.

3.1.4. Support & Test Equipment

We use ancillary equipment, including software, for the in service management and maintenance of the metering asset is detailed in section 8.4.

3.2 Meter population & profile

3.2.1 Meters Installed by division

The AusNet' electricity distribution area is allocated into nine geographical divisions, see Figure 3: AusNet's 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,

Figure 3: AusNet's Geographical Divisions

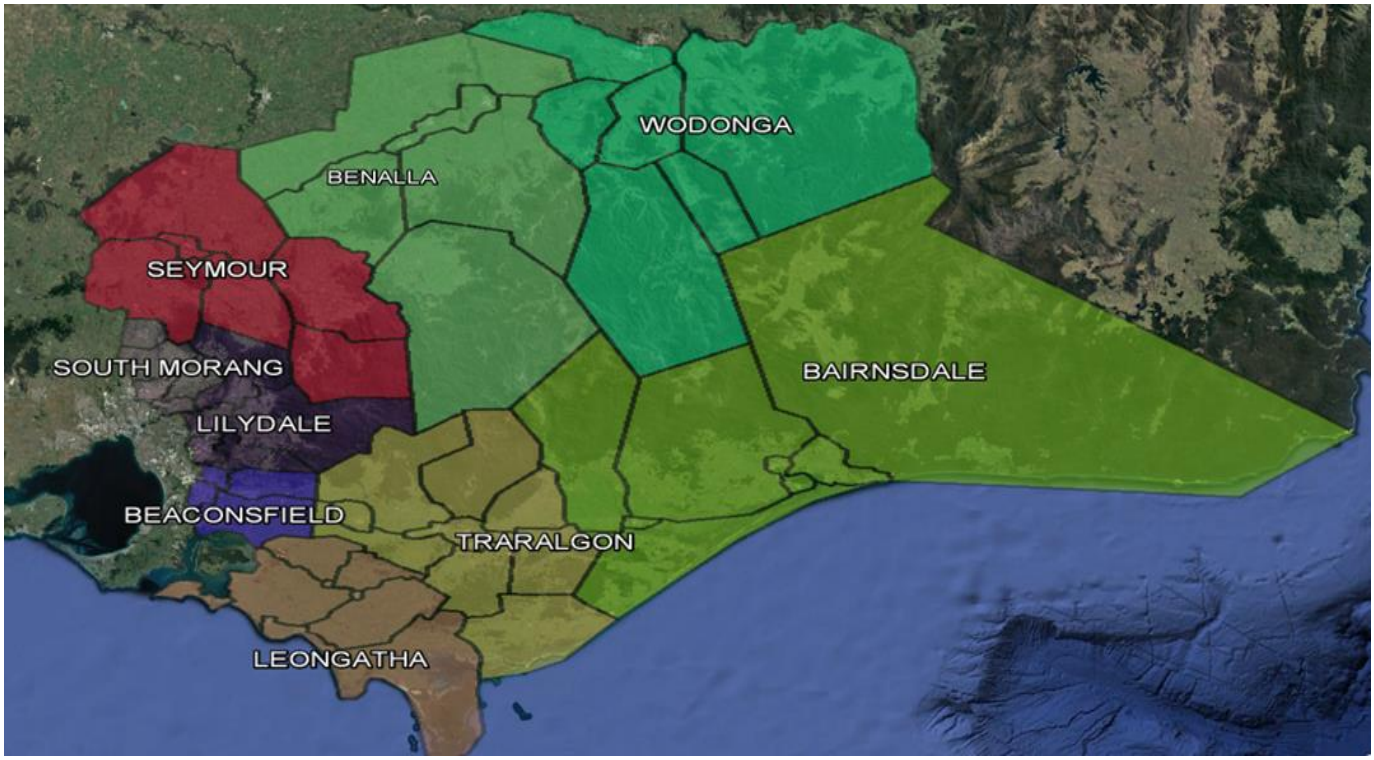


Table 1 below is a summary table, by geographical areas (divisions), of the number of customer connection points (i.e., NMIs) with the corresponding numbers of Type 5/6 AMI and non-AMI meters installed as of 1 January 2024 in the respective regional zones as depicted in Figure 3: AusNet's Geographical Divisions.

Table 1: Meter Location by Division

Division	NMIs (AMI)	Meters (AMI)	NMI (Non-AMI)	Meters (Non-AMI)	Total NMI	Total Meters
BAIRNSDALE	52906	55441	485	639	53390	56080
BEACONSFIELD	165008	166817	575	730	165583	167547
BENALLA	37524	38649	302	349	37826	38998
LEONGATHA	53067	55456	456	605	53523	56061
LILYDALE	193973	198028	1709	2310	195679	200338
SEYMOUR	22691	23305	259	307	22950	23612
SOUTH MORANG	158325	159642	816	1005	159141	160647
TRARALGON	74868	79367	905	1170	75773	80537
WODONGA	45469	47056	273	367	45742	47423
TOTAL	**803831**	**823761**	**5780**	**7482**	**809607**	**831243**

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 read 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 to consistently send Interval consumption data and allow for reliable remote connectivity.

3.1.5. 3.2.2 Meters installed by division

Description	NMIs	Meters
Single Meter Site	749861	749861
Multi-Meter Site	40643	81382
Total		

below indicates the number of single metered sites and ulti metered sites where two or more meters are installed.

Table 2: Meter volume by site configuration

Description	NMIs	Meters
Single Meter Site	749861	749861
Multi-Meter Site	40643	81382
Total		

The mandated AMI meter deployment has reduced the number of multi meters assigned to a NMI, due largely to the single phase two element AMI meter with the integrated load control contactor (refer section 3.2.3). There are 74,000 sites where two single phase non-AMI meters were replaced and consolidated with one single phase two element AMI meters with an

integrated load control contactor. These sites were predominately dedicated circuit type installations where the Network tariff dictates the obligation to measure and record separately the light and power load, as opposed to the load used for bulk storage hot water heating, floor heat and heat bank type systems.

The remaining multi-metered sites are generally customers on older sunset dedicated circuit tariffs which are no longer available to new entrants. The remaining population of multi-meter sites are a combination of single phase and multi-phase where the installation requires the maintenance of two meters for customer and retailer billing obligations. In the future, dedicated circuits and meters for EV chargers at residential premises may increase the number of multi meter sites, depending on future tariff incentives for EV charges.

3.2.3 Meter Types

Our AMI deployment resulted in the replacement of approximately 150 non-AMI meter types with five AMI meter variants. These AMI meter types, and their subsequent equivalent updated releases with the installed volumes, are presented in Table 3 below.

Our default meter configuration is to install all AMI meters with a 40-amp rated load control contactor as part of a standard service offering. This allows for several future proof benefits including the possibility of providing network control to DER sources (solar inverter control and battery storage solutions, EV battery charging control, Electric hot water load control (in recognition of future Gas Distribution limitations and electrification of the network initiatives) as well as other potential load control and supply capacity control options.

Table 3: Our current AMI meter variants (as of May 2024)

SAP-ISU Meter Type Code	L & G Model Number	Model Description	Installed Volumes
400	U1210DNNNSP	Single phase, one element meter, 100A rated (no load control contactor)	102892
410		Single phase, one element meter, 100A rated with 40A load control contactor	336597

	U1211DNNNSP		
420	U1225DNNNSP	Single phase, two element meter, 100A rated with 40A load control contactor	116136
430	U3301DNNNSP	Three phase, whole current, 100A rated direct connect meter with 40A load control contactor	123688
450	U3351NNNNSP	Multi-phase CT connect meter, current transformer (CT) meter with load control contactor	5216
500	U1310DNNVNBN001SP	Single phase, single element meter, 100A rated (no load control contactor)	93787
510	U1315DNNVNBN001SP	Single phase, single element meter with 1 integrated 31.5 amp rated load control contactor, 230V AC	20337
520	U1325DNNVNBN001SP	Single phase, two element meter with 1 integrated 31.5 amp rated load control contactors, 230V AC, class 1 Imax = 100A, Ib = 10A	1966
530	U3401DNNNNBS001SP	Three phase, whole current, 100A rated direct connect meter with 40A load control contactor.	17010
540	U3404DNNNNBS001SP	Three phase, whole current, 100A rated direct connect meter with 40A load control contactor.	6131
		Total Installed AMI Meters	**823760**
Non-AMI		Various electronic, electro-mechanical single phase, multi-phase and CT meters	7480
		Total Installed Meters	**831240**

Prior to any new meter variant being released into the production environment, they are assessed for compliance, tested, and evaluated to ensure they are compatible with the AMI Minimum Functional Specification and acceptable for use within the AusNet network.

The use of single phase two element meter types will 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 meter program within an AMI meter enables 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 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 to facilitate customer specific applications 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 (in accordance with clause 7.9 and schedule 7.6 of the NER).

New meter programs are developed, tested 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. Programs are devised to minimise the need to mitigate the need to exchange meters to facilitate tariff re-assignments or specific configuration setting changes. Updates to existing meter programs are tested and accepted prior to deployment, ensuring all process and system interfaces in the creation and deployment of a meter program are controlled and limit impact to meter data to market operations. Appendix B show a table of our deployed meter programs.

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. As per Clause 3.13 of Vic DPI Minimum AMI functionality Spec. v 1.2, the AMI system shall have the capability to remotely upgrade the firmware in AMI system devices including data concentrators and meters. 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.

Our 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. We do not automatically baseline all the deployed meters to the most current released firmware version if there is no operational or customer benefit to do so.

Appendix C show a table of our deployed meter programs.

4. Low Voltage Current Transformer (LV CTs)

LV CTs and the connected CT compatible meters are installed at a site where load is expected to exceed 90 amps per phase **Error! Reference source not found.**4 below summarises the installed volumes of LV CTs for the Type 5 / Type 6 customers consuming less than 160MWh per year. Note that not all CT metering installations require three individual LV CTs, depending on the Network infrastructure supplying the connection point.

Table 4: Installed LV CT population

	Installed LV CTs		
CT Type	**CT Ratio**	**CT Meter count**	**LV CT count**
C	1000/5	15	45
B	1200/5	5	15
A	150/5	88	264
W	1500/5	6	18
S	200/5	4251	12753
C	2000/5	1	3
A	300/5	52	156
B	400/5	210	630
A	600/5	14	41
C	3000/5	0	0
T	800/5 Extended Range	277	831
Total		**4919**	**14756**

4.1 Age Profile

The age profile of the meter and LV CT fleet is characterised by year the respective equipment was installed, which in turn, determines the scheduled testing profile. This is a more effective and transparent method of determining in service test and inspection regimes as opposed to year of manufacturer and allows for a more regular and static forecast of volumes to be included into annual test and inspection plans.

The expected operational life-of an AMI meter is forecast to be between 15 and 20 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 in

accordance to AS1284 part 13 which dictates a ten year in service test cycle approach for general purpose class metering.

The operational life of a LV metering current transformer is forecast to be in excess of 45 years. Given the robust design and lack of any solid state electronics in their manufacture, and in addition to strict rules around prohibited locations associated with where these devices can be installed (weatherproof enclosures, lockable housing etc, means that these assets rarely fail in service accuracy testing. AusNet uses all extended range CTs which allow for greater tolerance and accuracy in current carrying and measurement capability.

4.1.1 AMI Meter Age Profile

The age profile of our AMI meter population by year of installation until the end of CY2022 is shown in Table 5 and Figure 4. The forecast for meter installations, including projections of new connections, meter replacements (due to faults and upgrades) and abolishment, is presented in section 5.3.

Figure 4: Actual AMI Meter Volumes by year of installation

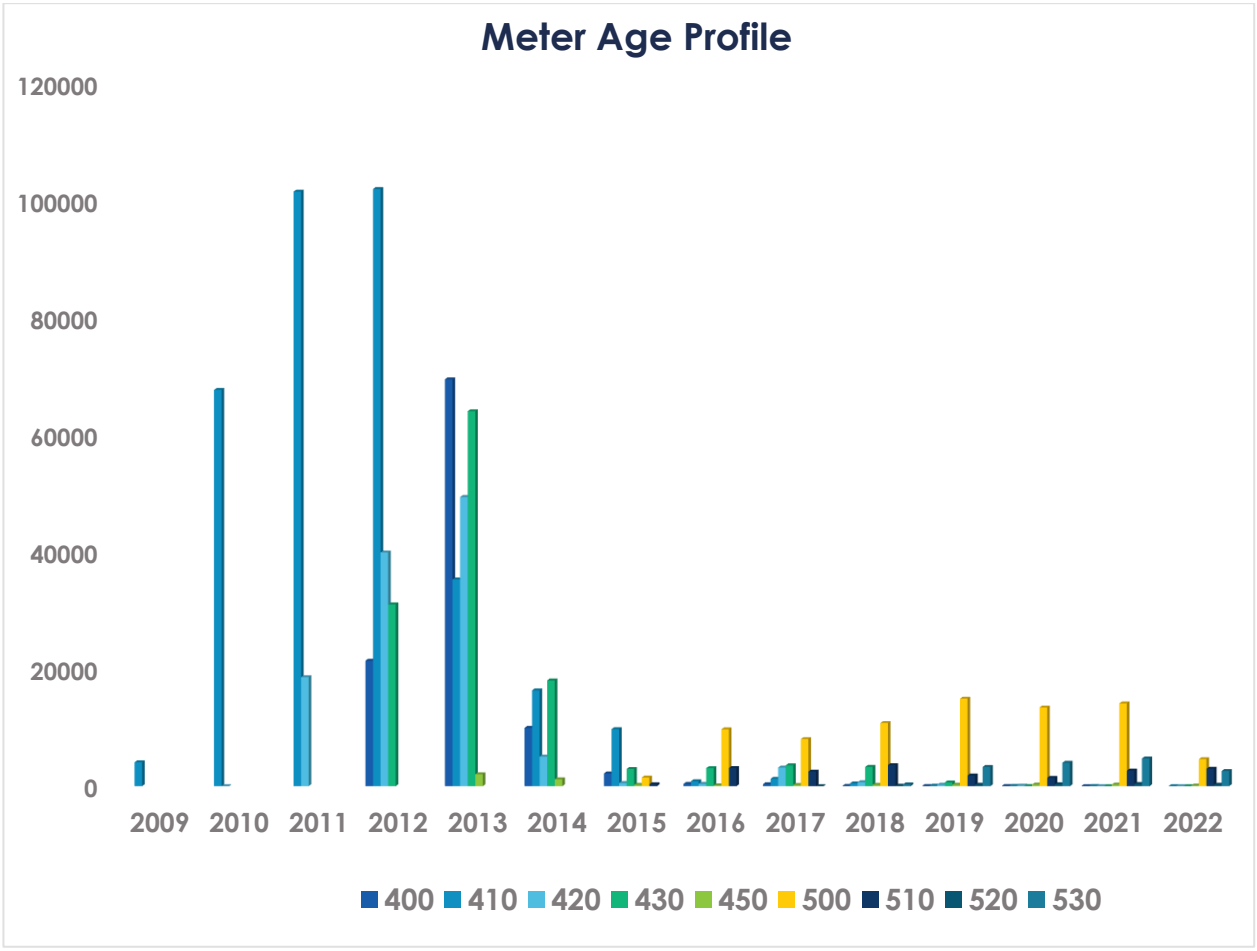


Table 5: Volume of meters installed by meter type

Meter Type	400	410	420	430	450	500	510	520	530
CY 2009		4079							
CY 2010		67764	3						

CY 2011		101611	18642						
CY 2012	21454	102053	39969	31083					
CY 2013	69563	35362	49455	64120	2026				
CY 2014	9965	16370	5049	18070	1175				
CY 2015	2164	9754	530	2937	226	1469	316		
CY 2016	391	842	385	3072	142	9721	3102		
CY 2017	327	1252	3179	3557	211	8047	2484	2	
CY 2018	35	466	671	3292	223	10792	3597	72	313
CY 2019	10	74	242	630	246	14956	1814	251	3285
CY 2020	6	44	83	20	269	13450	1418	317	3999
CY 2021	1	6	5	3	261	14150	2659	372	4732
CY 2022	0	2	1	2	97	4617	2975	249	2583
Total	**103916**	**339679**	**118214**	**126786**	**4876**	**77202**	**18365**	**1263**	**14912**

4.1.2 LV CT Age Profile

The profile of LV CTs by year of installation is shown in Table 6 below.

Table 6: LV CT Population by year of installation

CT Type	A			B			C			S	T	W	Yearly Installed Total
CT Ratio	CT 150/5	CT 300/5	CT 600/5	CT 400/5	CT 800/5	CT 1200/5	CT 1000/5	CT 2000/5	CT 3000/5	CT 200/5	CT 800/5	CT 1500/5	
Inst. Pre 2002	315	219	53	822	336	27	42	15	6	4127		3	**5965**
2003		9		9	48					393		3	**462**
2004				9	36		3			459		6	**513**
2005				3						480	27	3	**513**
2006				3						501	36		**540**
2007	3									513	54	6	**576**
2008	3			6						562	39	6	**616**
2009										603	98	3	**704**
2010										642	67	3	**712**
2011				69						516	6	3	**594**
2012										441	36		**477**
2013	21	156	42	642		21	45		3	312	42		**1284**
2014										369	18		**387**
2015										423	21		**444**
2016										396	3		**399**
2017										570	39		**609**
2018										522	33		**555**
2019										660	54		**714**
2020										732	48		**780**
2021										639	48		**687**

5. New Meter Connections & Replacements

The following meter forecast details activities related to providing "green field" new connection services, abolishment, meter additions/alteration and fault services throughout the strategy period.

5.1 Meter movements

AMI capable meters will be installed for all new electricity meter connections undertaken during this strategy period. We will be responsible for all meter installation and maintenance activities as the accredited Meter Provider and Meter Coordinator in line with the current Victorian Government rules over responsibility for the provision of Type 5/6 Metering Services

The New Meter Connections forecast is driven by population and housing growth rates based on historical volumes in addition to recognising periodical variations in each of AusNet' specific geographic areas due to any growth forecast. The New Meter Connection figures provided in this document are a gross forecast and are not net of site or meter abolishment.

The forecast new connection, abolishment and meter replacement forecast volumes for each year through to CY2031 are presented in Table below 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 our website 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 its distribution network.

5.2 Meter Replacements

Meter replacements generally occur under the following processes:

1. customer initiated requests (B2B market transactions to facilitate bi-directional metering request or customer requested upgrades of supply where a change of metering is required)
2. metering defects and faults.
3. mitigation of escalating meter failures and meter issues from impacting compliance with our obligations.

Some of the scenarios for facilitating meter replacements include:

- Meters removed for site renovation under Additions & Alterations Service Orders.
- Bi-directional metering being required due to installation of generation systems such as solar PV arrays.
- Site changes requiring meter replacement, e.g., Supply upgrade 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.

- Electrification of the grid initiatives that will see gas appliances replaced with electricity operating equivalents and potentially requiring larger capacity meters to be installed for car charging, electric cooking/heating and hot water systems.

Meter faults exchanged due to mechanical, or functionality issues include:

- Equipment failure such as an LCD display failure, electronics failure, contactor fault, caused by HV injection storm related damage; and
- Externally caused failure third party caused damaged and vandalism.
- Meter accuracy failure

Meter performance is monitored daily via meter events and health checks monitoring 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 reliable field life of 15 years based on the meter supplier's technical advice and operational experience to date. Therefore, a significant increase on current failure rates is not expected in the period to 2025 however failure rates are expected to increase in periods post 2025. We actively monitor failure rate trends and assess results of the meter testing and inspections described in section 6 to continually re-confirm forecast meter condition and correct operation. Meter failure data is statistically analysis with Weibull data analytics, see section 7.7.

Meters removed from service are evaluated for potential to be refurbished. Only those metering models/types that are of current production model and can be produced as new from the factory would be suitable for refurbishment. This is due to older meter models not in scope for being 5 minute data recording capable. The forecast for meter returns is presented in section 6.4.4, Meter Stores and Logistics. A similar principle applies to the NIC cards that interface the AMI meter to remote operability. The NIC is an interchangeable device which resides within the AMI meter. Rather than exchange a meter which fails remote communications, the NIC card can be exchanged, thus avoiding the expense to replace an otherwise operational meter and which avoids interrupting supply to facilitate a meter exchange. Part 2 of the EDM asset management strategy describes the communications strategy in depth.

5.3 Global Settlements – Five Minute Meter Deployment

As of 1st Dec 2018, meters installed or replaced within our Distribution Network are required to be 5 minute data recording capable meters (as per National Electricity Amendment 5 MS Rule 2017 No.15). The requirement prevents re-using any re-furbished meter that does not have the adequate memory to store enough meter data compliant with these obligations.

6. Meter Maintenance

Meter maintenance activities are initiated to maintain the safety and compliance of the meter asset post its installation into the field (Refer Sec 7.8.6 Metering Coordinator obligations – NER Ch.7, V185).

It provides for both:

- Scheduled and Unscheduled works which include LV CT testing and meter testing for customer-initiated accuracy and assurance testing), meter inspections and condition monitoring (meter

event and alarm management), and investigations to support distribution network quality of supply monitoring.

- Ongoing support and management of the meter asset, including monitoring, planning and scheduling of metering activities, the implementation and deployment of new meter programs (reconfigurations) and firmware releases, the management of meter test equipment, and oversight of the meter supply chain and product roadmaps.

6.1 Meter accuracy and assurance testing

To ensure compliance and accuracy of the meter fleet, routine annual meter and CT population sample testing is completed to comply to Chapter 7 clause S7.4.3.5 and S7.4.3.6 of the National Electricity Rules (NER), and Part A of the AEMO Metrology Procedures.

6.1.1 Family Testing of AMI Meter Families

We reference AS1284.13 – 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 Type 5 and 6 meter installations:

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

The NER allow metering providers an alternative to sample test meters of the same type. This standard referenced is used to achieve this purpose.

Part of the testing obligation for new meters states, "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". 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 the first meter installation. Our forecast volumes of meter tests per year are shown in Table 7

If this Initial In-Service Compliance Test is successful, then the next sample test required on 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).

Should any of the In-Service Compliance Tests fail, we 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 a 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', we will manage a project to exchange the failed population, and provide appropriate notifications to all customer, regulatory and

retailer stakeholders throughout the project. We would then notify AEMO of any population sample testing results.

Table 7: Forecast volumes of meter tests per year

	Meter Code	400	410	420	430	450	500	510	520	530	
Year											Yearly Total for Testing
2021	Quantity to be tested	0	800	315	0	0	0	0	0	0	1,115
2022	Quantity to be tested	315	500	500	315	0	0	0	0	0	1,630
2023	Quantity to be tested	500	500	500	500	125	0	0	0	0	2,125
2024	Quantity to be tested	200	315	0	315	80	0	0	0	0	910
2025	Quantity to be tested	125	500	80	125	32	125	50	0	0	1,037
2026	Quantity to be tested	50	500	315	125	20	200	125	0	0	1,335
2027	Quantity to be tested	315	500	500	315	32	200	125	2	0	1,989
2028	Quantity to be tested	500	500	500	500	125	315	200	13	50	2,703
2029	Quantity to be tested	200	315	200	315	125	315	125	32	200	1,827
2030	Quantity to be tested	125	200	80	125	50	315	125	50	200	1,270
2031	Quantity to be tested	0	0	0	0	0	0	0	0	0	0

6.1.2 Family Testing of non-AMI meter families

We maintain approximately less than 5,000 energised non-AMI Type 5/6 meters which remain in service post the mandated deployment to transition to AMI. This number exists primarily due to customer refusals which include refusing access to the meter installations and refusing a replacement smart meter. Additionally, site defects such as impeded access and customer side defects which limited AusNet's ability to exchange the meter currently exist. We have taken all reasonable endeavours to reduce these instances and is reviewing customer engagement strategies that may assist in reducing further the numbers of non-AMI meters over the medium term.

In the interim, populations of non-AMI meters will be tested as per AS 1284 Part 13 until such time as the legacy non-AMI meter populations cease to exist. To support the transition to AMI meters, we have adopted a strategy to remove the non-AMI meter when it is due for testing as opposed to completing in field testing of the meter. The success of this program is dependent on customers providing safe and unhindered access and has not refused the installation of an AMI meter. Should the customer refuse the offer of an AMI meter, the existing non-AMI type will be tested.

Any non-AMI meter that fails on site accuracy and assurance testing will be replaced with an AMI capable meter. (As per Order No. S 342 of Victorian Government Gazette in Council for AMI (Obligation to Install Meters) Order Dates 10th Oct 2017 - Clause 6 (1b).

6.1.3 Metering installation Inspection

As per Chapter 7 of the National Electricity Rule, Table S7.6.1.3 and clause 7.9, it is our intent to inspect meters when they are tested in line with the below schedule. As per the testing approach in referencing AS 1284 Part 13 for in service meter testing for Type 5/6 meters, metering installations tested will be co-incidentally inspected at the time of the meter test.

Table S7.6.1.3 Period Between Inspections

Unless the Metering Coordinator has developed an asset management strategy that meets the intent of this Schedule 7.6 and is approved by AEMO, the period between inspections must be in accordance with this Table S7.6.1.3.

Description	Metering Installation Type			
	Type 1	Type 2	Type 3	Type 4, 4A, 5 & 6
Metering installation equipment inspection	2.5 years	12 months (2.5 years if *check metering* installed)	> 10 GWh: 2 years 2≤ GWh ≤ 10: 3 years <2 GWh: when *meter* is tested.	When meter is tested.

Notwithstanding this approach, additionally, AusNet completes co-incidental meter inspections when:

- A meter is installed or exchanged
- A customer paid meter test is conducted
- Meters are "locally" read (scheduled quarterly and monthly cycle days
- In field meter" maintenance activities are completed such as communication fault investigations and replacements, meter investigations, local metering services completed for re-energisations, de-energisations and special reads, and meter re-configurations.

The local inspection schedule is supplemented by remote monitoring daily of the entire AMI meter fleet. This initiative allows for a more detailed and informed view of aspects and events that may potentially impact meter performance or the accuracy of the data collected.

A typical, local meter inspection assessment includes validating the information below compared to information stored within Itron's UtiltilyIQ (**UIQ**) meter management system and the SAP Customer Information System.

- verification of meter details (serial number, meter type, meter program and settings)
- verification of meter parameters and physical connections.
- Comparison of CT ratios.
- Correct application of meter security seals.
- Meter condition (condensation, vandalism, meter integrity, environmental (i.e., exposure to sun, wind, rain, salt)

The below table indicates the forecast for Meter inspections for the next five years. This includes inspections which will be conducted co-incidentally to other maintenance activities occurring.

The forecasted activity coincides with AusNet's strategy to decommission its WiMAX communications network by 2025.

The scope to decommission WiMAX saw all existing WiMAX meter Network Interface cards (NICS) replaced with a mesh operating platform which commenced in 2018.

In addition, site visits to deploy 4G hardware in accordance with Telstra's decision to decommission the 3G operating platform included completion of a coincidental meter inspection to those sites impacted.

Approximately 200,000 site visits will occur over the current forecast period for decommissioning purposes and are included into the forecast.

The Table 8 below identifies the AusNet AMI meters installed by year of installation and the year to which a subsequent site visit is planned to be completed for maintenance purposes. This is where its most likely that a co-incidental meter inspection could occur.

Table 8: Forecast meter inspection numbers

			Forecast inspection numbers				
Year of meter install	Total Completed	Total Remaining	2021	2022	2023	2024	2025
2009	543	3,549	3549				
2010	17,555	50,979	10000	10000	10000	10000	10979
2011	40,253	81,388	1388	20000	20000	20000	20000
2012	93,534	103,562	23562	20000	20000	20000	20000
2013	171,144	53,267	13267	10000	10000	10000	10000
2014	48,029	3,581				3581	
2015	16,960	535					535
2016	17,463	322					322
2017	19,183	34	0	0	0	0	0
2018	19,618	4	0	0	0	0	0
2019	21,792	0	0	0	0	0	0
2020	12,423	0	0	0	0	0	0
Grand Total	478,497	297,221	51766	60000	60000	63581	61836

6.1.4 Condition Monitoring

Meter events and alarms are remotely collected daily via UIQ. Reports of meters identified with potential performance issues are collated and actioned daily across the entire fleet of AMI remote meters. These events include AMI meter time sync errors (meter outside of the time tolerance of +/- 20 seconds), reverse energy detected flags, and predict temp alarms among others (Refer to clause 3.8.3 Events for daily collection – VIC DPI Minimum AMI functionality Specification, v 1.2 dated Sep 2013).

The ability to remotely obtain daily events and status indicators as well as a suite of power quality interval data from all remotely communicating meters, is a useful tool to supplement in service meter inspection programs, which are primarily based in ensuring that a meter has not been tampered or that aspects of standing data are recorded accurately in the Meter Asset Management System.

We collect and action the following events and status which are monitored daily for the approximately 800k installed remotely communicating meters:

1. Auto time synchronisation and reset of meters outside of +/- 20 seconds.
2. Meter program/tariff mismatch identification events.
3. Reverse energy detected events.
4. Terminal cover tamper events.
5. Main meter cover removal events.
6. High and low voltage recording.
7. Predict temperature alarms.
8. Load control contactor "open" and "close" verifications.
9. Main supply contactor operation. (includes "load on meter" alarm when attempting to connect supply where a load is identified to a meter)
10. Remote monitoring to identify consumption to a previously de-energised site.
11. Meter theft using voltage and other PQ data to perform loop analysis on the distribution network circuit.

12. Neutral impedance algorithms to assist in detecting failed or faulty neutral.
13. Low Battery Alarms.
14. Non-Volatile Memory Alarms.
15. Self-Check Error.

In addition, we use a raft of power quality data which monitors and verifies supply quality conditions.

Explore is a software application, developed internally by the AusNet Network Intelligence and Analytics team, which visualises the data sets available from the AMI network. The application allows for the visualisation of voltage, current and interval profiles, as well as meter events at the individual NMI level and at the pole-top substation level. Explore leverages data from many sources such as SNET (the biggest database in AusNet), SAMS (geospatial data), SAP (asset information) and CIS (customer information).

Users can search for a site using any of the below attributes:

- NMI (i.e., 6305000000)
- Meter Number (i.e., 4330011)
- Customer Address (i.e., 123 Fake Street)
- Substation Name (i.e., Bluemist Tarangulla)
- Substation Number (i.e., 2112006900)

For every meter assigned to a NMI, the following information is brought back after a search:

- Model of the meter
- Serial number of the meter
- Meter type
- Program ID (hover over the "I" symbol to get a detailed description of the Program ID)
- Current status of the meter
- Last Network Entry
- Hardware and Software Version numbers
- Communications type
- Communications serial number, hardware and software versions
- Wiring configuration of the meter (single phase, polyphase, three phase)

At a customer (NMI) level, our application, Explore, provides a 'single plane of glass' view of voltage, current, consumption and metering events at a period, examples of this are shown in Figure 5 below. At a network level, we use Explore to actively improving our electricity distribution network management, including voltage management, outage management, planning and connections. Figures 6-9 below show examples of this.

Figure 5: Visualisation of data at a customer (NMI Level)

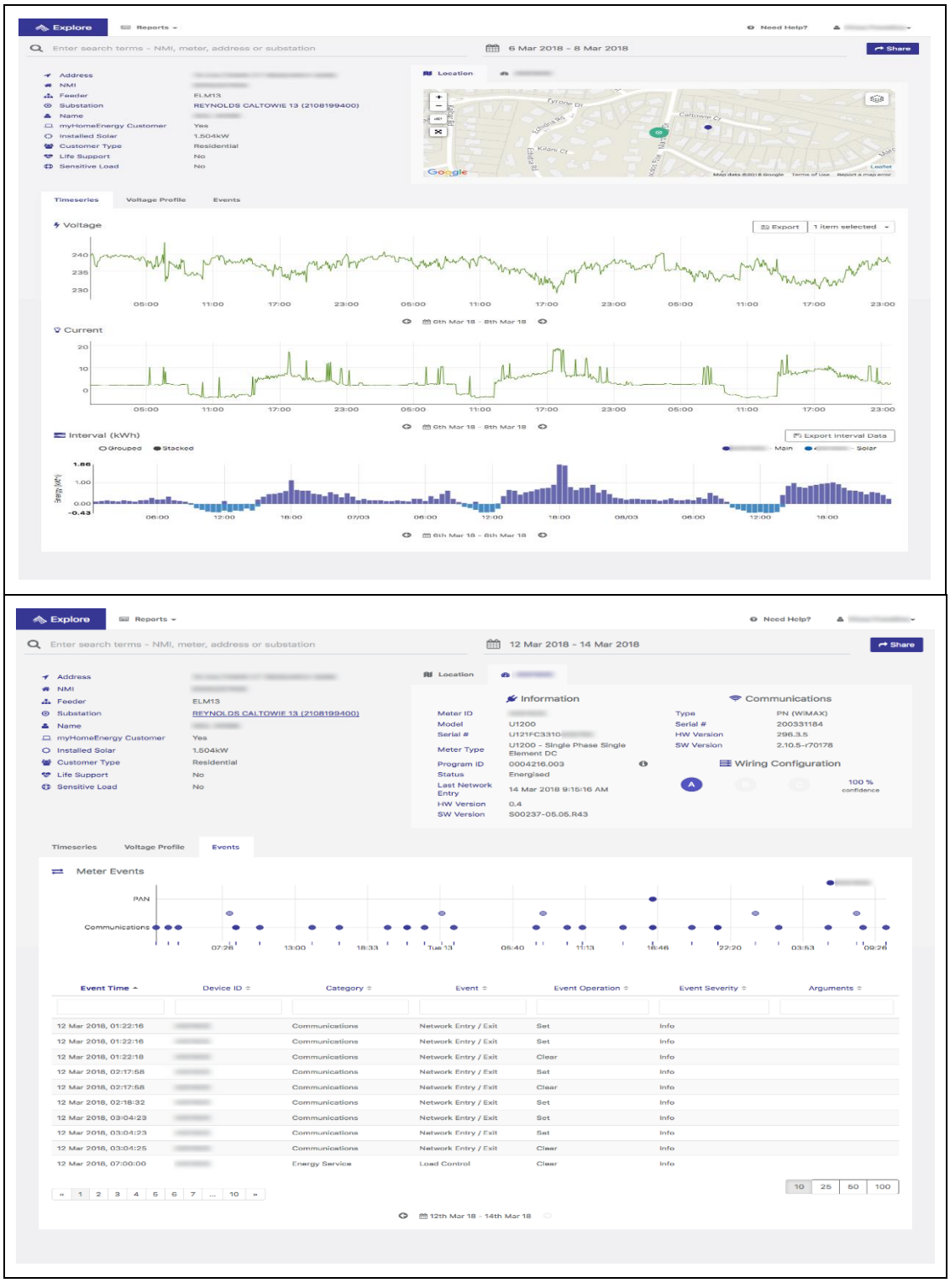


Figure 6: Visualisation of data at a network level

Figure 7: Live customer outages using Last Gasp information from the smart meters

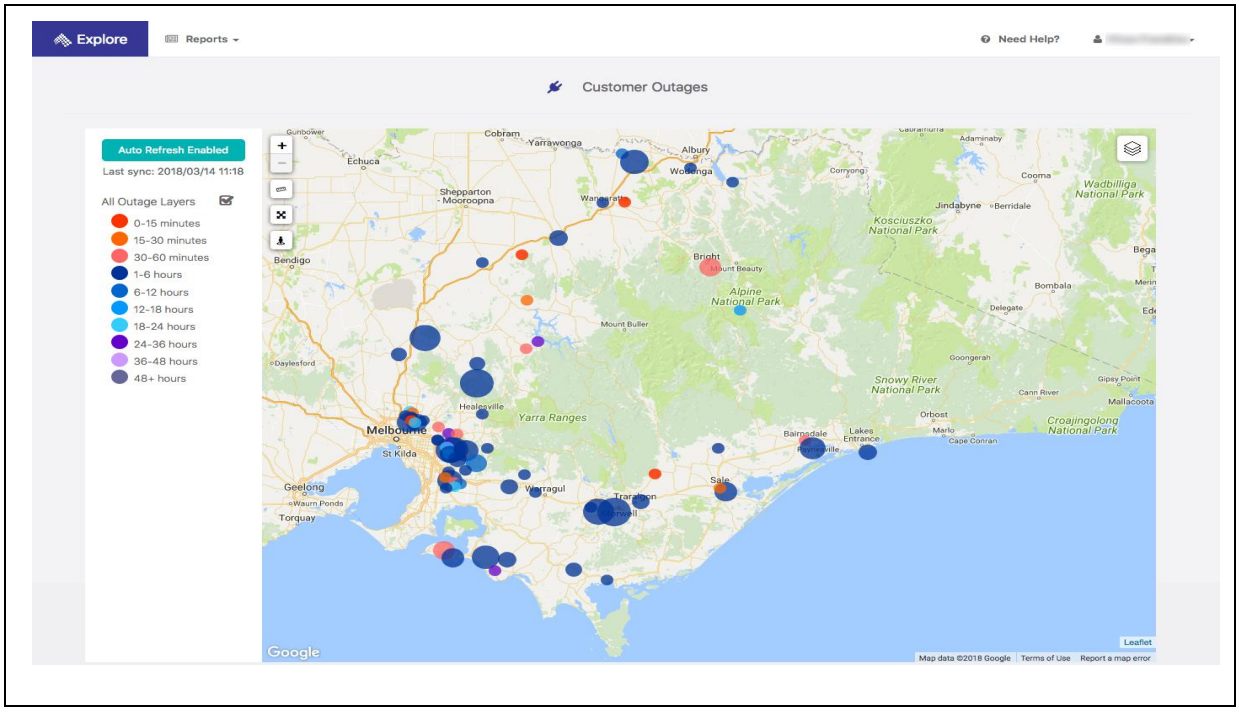


Figure 8: Advanced geospatial capabilities to show customers (their phase allocation), heat maps, Street View, electrical conductors & other distribution network information

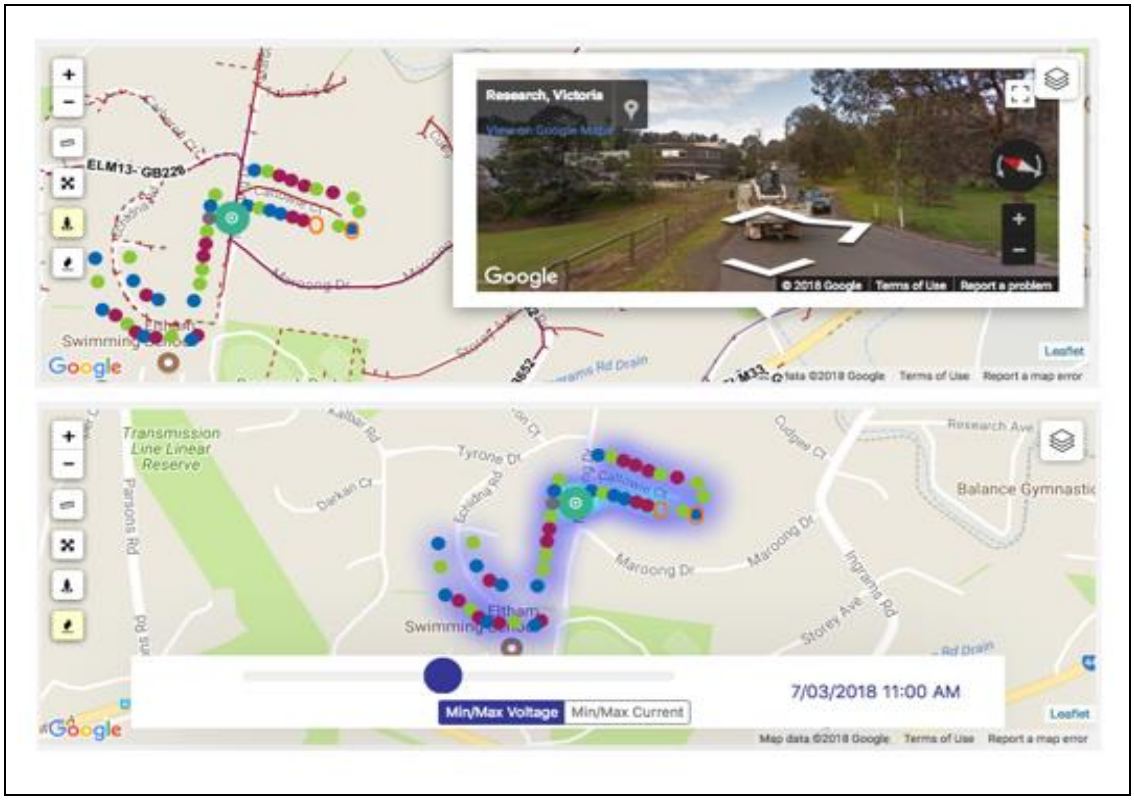
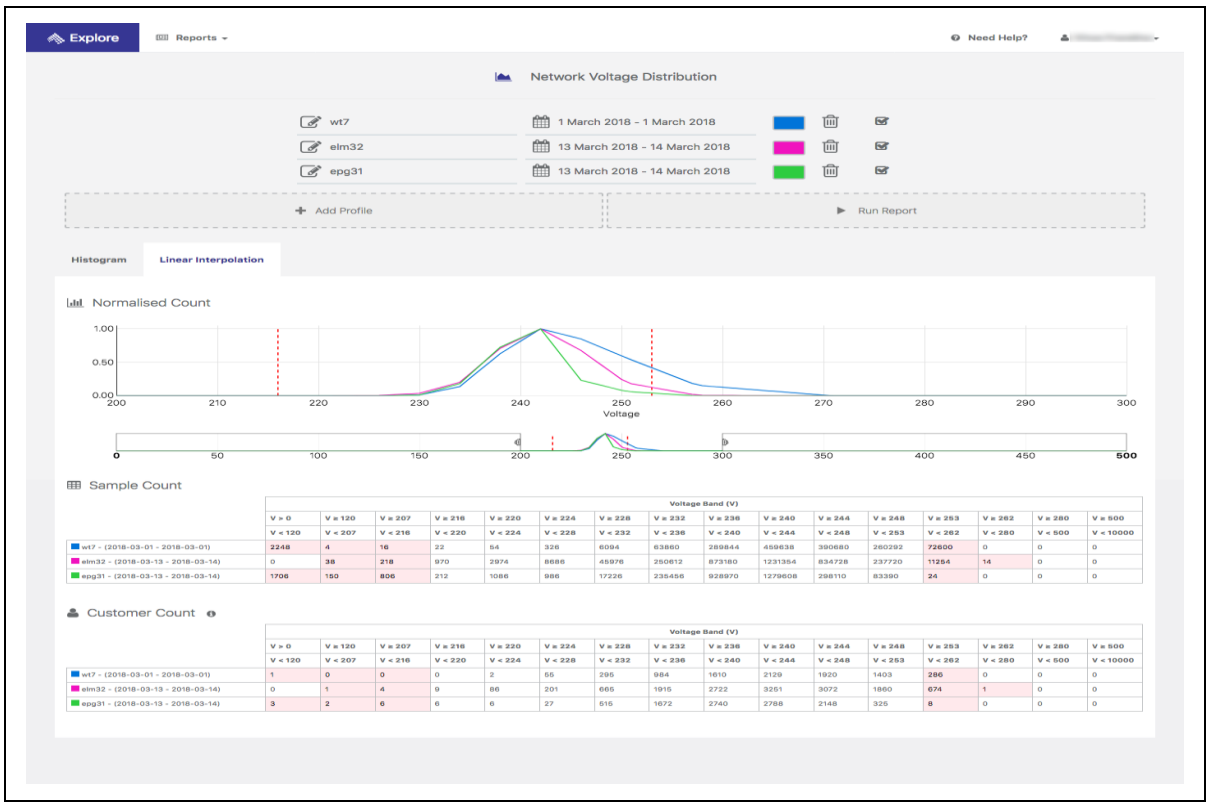


Figure 9: LV voltage profiling for substations, feeders



This information is used to derive conditions around neutral integrity and theft of electricity among other things. It is also used for network planning and solar/battery, DER planning and generation system approval processes.

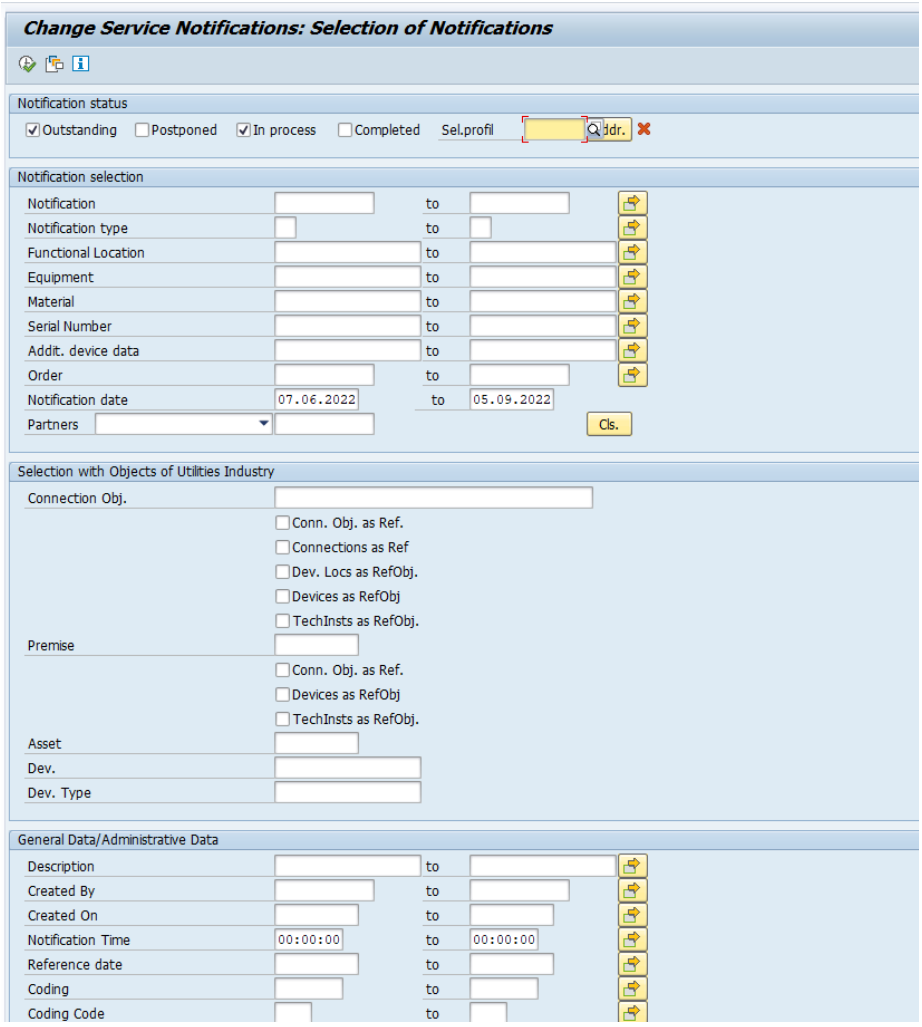
6.1.5 SAP-CIS Event notifications

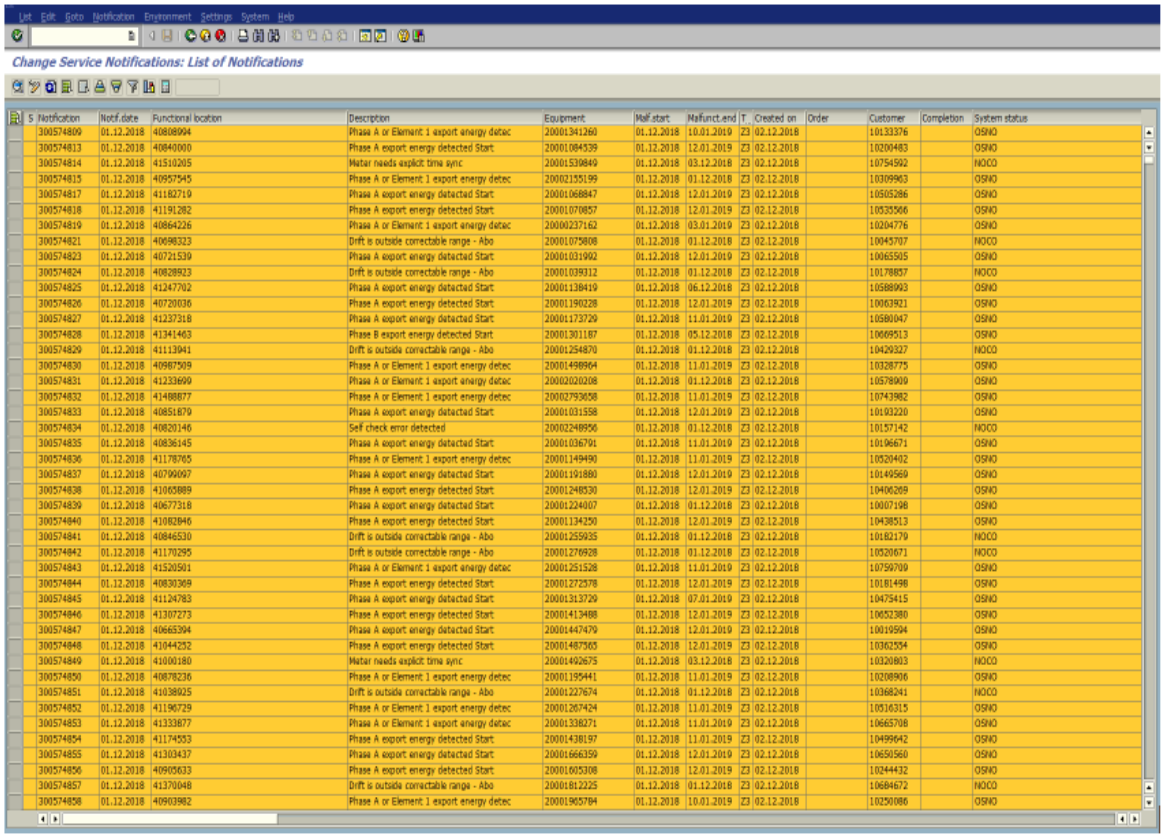
The following are SAP transactions that are used to derive monthly meter events that are captured from meters. Some of these events include but not limited to:

- Low battery detected
- Meter subscription failure
- Predict Temp Events
- Self-Check error
- Time Sync Error
- Phase Export Energy detection

Figure 10 below are extract used as example of the type of information available from SAP-CIS to allow for performance monitoring of the AMI meters.

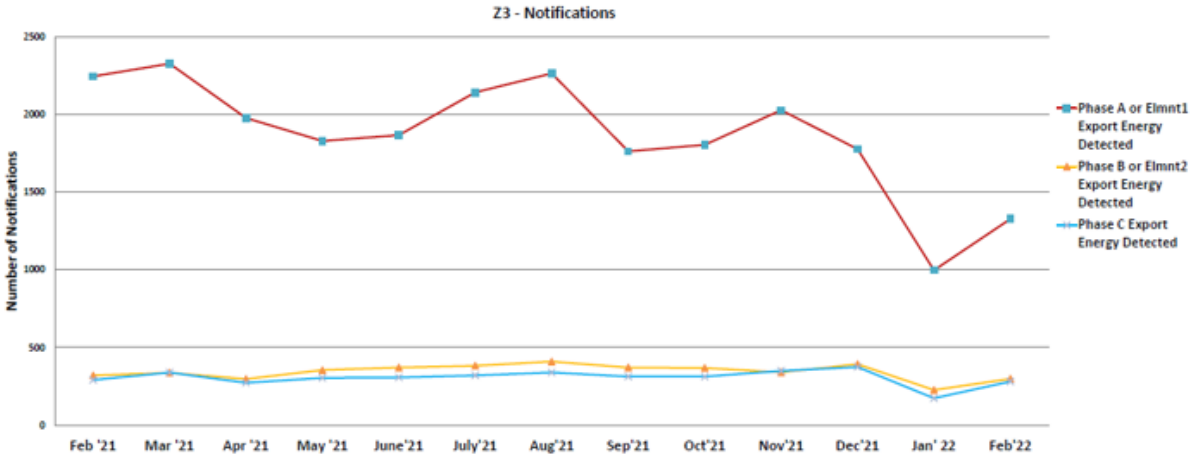
Figure 10: Extracts of our meter performance monitoring data management

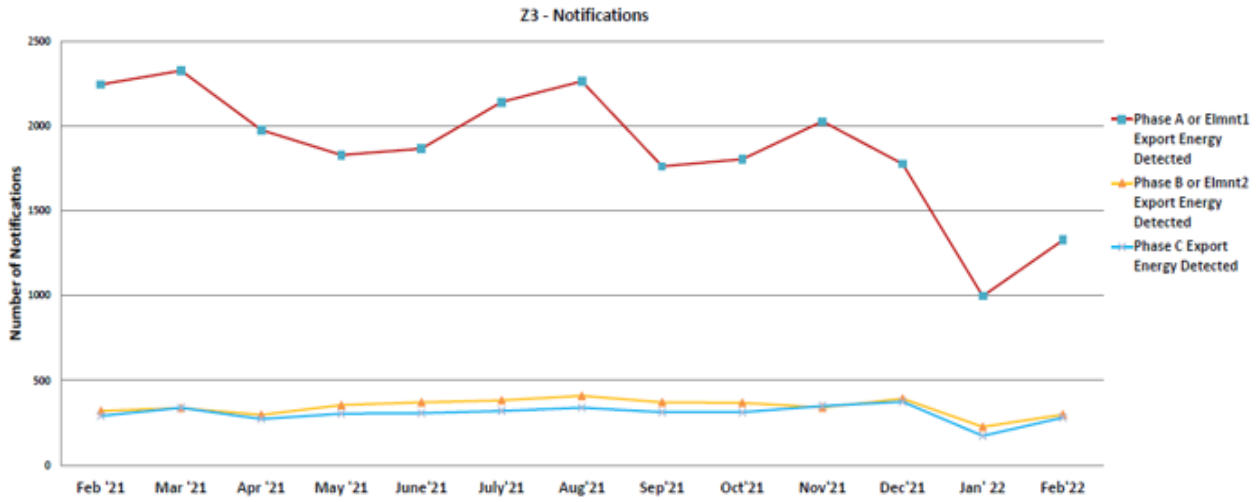




Change Service Notifications: List of Notifications

S	Notification	Notif.date	Functional location	Description	Equipment	Malf.start	Malfunct.end	T	Created on	Order	Customer	Completion	System status
	300574809	01.12.2018	40808994	Phase A or Element 1 export energy detec	20001341260	01.12.2018	10.01.2019	Z3	02.12.2018		10133376		OSNO
	300574813	01.12.2018	40840000	Phase A export energy detected Start	20001084539	01.12.2018	12.01.2019	Z3	02.12.2018		10200483		OSNO
	300574814	01.12.2018	41510205	Meter needs explicit time sync	20001539849	01.12.2018	03.12.2018	Z3	02.12.2018		10754592		NOCO
	300574815	01.12.2018	40957545	Phase A or Element 1 export energy detec	20002155199	01.12.2018	01.12.2018	Z3	02.12.2018		10309963		OSNO
	300574817	01.12.2018	41182719	Phase A export energy datactad Start	20001068847	01.12.2018	12.01.2019	Z3	02.12.2018		10505286		OSNO
	300574818	01.12.2018	41191282	Phase A export energy detected Start	20001070857	01.12.2018	12.01.2019	Z3	02.12.2018		10535566		OSNO
	300574819	01.12.2018	40864226	Phase A or Element 1 export energy detec	20000237162	01.12.2018	03.01.2019	Z3	02.12.2018		10204776		OSNO
	300574821	01.12.2018	40698323	Drift is outside correctable range - Abo	20001075808	01.12.2018	01.12.2018	Z3	02.12.2018		10045707		NOCO
	300574823	01.12.2018	40721539	Phase A export energy datactad Start	20001031902	01.12.2018	12.01.2019	Z3	02.12.2018		10065505		OSNO
	300574824	01.12.2018	40828923	Drift is outside correctable range - Abo	20001039312	01.12.2018	01.12.2018	Z3	02.12.2018		10178857		NOCO
	300574825	01.12.2018	41247702	Phase A export energy datactad Start	20001138419	01.12.2018	06.12.2018	Z3	02.12.2018		10588993		OSNO
	300574826	01.12.2018	40720036	Phase A export energy detected Start	20001190228	01.12.2018	12.01.2019	Z3	02.12.2018		10063921		OSNO
	300574827	01.12.2018	41237318	Phase A export energy datactad Start	20001173729	01.12.2018	11.01.2019	Z3	02.12.2018		10580047		OSNO
	300574828	01.12.2018	41341463	Phase B export energy detected Start	20001301187	01.12.2018	05.12.2018	Z3	02.12.2018		10669513		OSNO
	300574829	01.12.2018	41113941	Drift is outside correctable range - Abo	20001254870	01.12.2018	01.12.2018	Z3	02.12.2018		10429327		NOCO
	300574830	01.12.2018	40987509	Phase A or Element 1 export energy detec	20001498964	01.12.2018	11.01.2019	Z3	02.12.2018		10328775		OSNO
	300574831	01.12.2018	41233699	Phase A or Element 1 export energy detec	20002020208	01.12.2018	01.12.2018	Z3	02.12.2018		10578909		OSNO
	300574832	01.12.2018	41488877	Phase A or Element 1 export energy detec	20002793658	01.12.2018	11.01.2019	Z3	02.12.2018		10743982		OSNO
	300574833	01.12.2018	40851879	Phase A export energy datactad Start	20001031558	01.12.2018	12.01.2019	Z3	02.12.2018		10193220		OSNO
	300574834	01.12.2018	40820146	Self check error detected	20002248956	01.12.2018	01.12.2018	Z3	02.12.2018		10157142		NOCO
	300574835	01.12.2018	40836145	Phase A export energy datactad Start	20001036791	01.12.2018	11.01.2019	Z3	02.12.2018		10196671		OSNO
	300574836	01.12.2018	41178765	Phase A or Element 1 export energy detec	20001149490	01.12.2018	11.01.2019	Z3	02.12.2018		10520402		OSNO
	300574837	01.12.2018	40799097	Phase A export energy datactad Start	20001191880	01.12.2018	12.01.2019	Z3	02.12.2018		10149569		OSNO
	300574838	01.12.2018	41065889	Phase A export energy detected Start	20001248530	01.12.2018	12.01.2019	Z3	02.12.2018		10406269		OSNO
	300574839	01.12.2018	40677318	Phase A export energy datactad Start	20001224007	01.12.2018	01.12.2018	Z3	02.12.2018		10007198		OSNO
	300574840	01.12.2018	41082846	Phase A export energy detected Start	20001134250	01.12.2018	12.01.2019	Z3	02.12.2018		10438513		OSNO
	300574841	01.12.2018	40846530	Drift is outside correctable range - Abo	20001255935	01.12.2018	01.12.2018	Z3	02.12.2018		10182179		NOCO
	300574842	01.12.2018	41170295	Drift is outside correctable range - Abo	20001276928	01.12.2018	01.12.2018	Z3	02.12.2018		10520671		NOCO
	300574843	01.12.2018	41520501	Phase A or Element 1 export energy detec	20001251528	01.12.2018	11.01.2019	Z3	02.12.2018		10759709		OSNO
	300574844	01.12.2018	40830369	Phase A export energy detected Start	20001272578	01.12.2018	12.01.2019	Z3	02.12.2018		10181498		OSNO
	300574845	01.12.2018	41124783	Phase A export energy datactad Start	20001313729	01.12.2018	07.01.2019	Z3	02.12.2018		10475415		OSNO
	300574846	01.12.2018	41307273	Phase A export energy detected Start	20001413488	01.12.2018	12.01.2019	Z3	02.12.2018		10652380		OSNO
	300574847	01.12.2018	40665394	Phase A export energy detected Start	20001447479	01.12.2018	12.01.2019	Z3	02.12.2018		10019594		OSNO
	300574848	01.12.2018	41044252	Phase A export energy detected Start	20001487565	01.12.2018	12.01.2019	Z3	02.12.2018		10362554		OSNO
	300574849	01.12.2018	41000180	Meter needs explicit time sync	20001492675	01.12.2018	03.12.2018	Z3	02.12.2018		10320803		NOCO
	300574850	01.12.2018	40878236	Phase A or Element 1 export energy detec	20001195441	01.12.2018	11.01.2019	Z3	02.12.2018		10208906		OSNO
	300574851	01.12.2018	41038925	Drift is outside correctable range - Abo	20001227674	01.12.2018	01.12.2018	Z3	02.12.2018		10368241		NOCO
	300574852	01.12.2018	41196729	Phase A or Element 1 export energy detec	20001267424	01.12.2018	11.01.2019	Z3	02.12.2018		10516315		OSNO
	300574853	01.12.2018	41333877	Phase A or Element 1 export energy detec	20001338271	01.12.2018	11.01.2019	Z3	02.12.2018		10665708		OSNO
	300574854	01.12.2018	41174553	Phase A export energy detected Start	20001438197	01.12.2018	11.01.2019	Z3	02.12.2018		10499642		OSNO
	300574855	01.12.2018	41303437	Phase A export energy datactad Start	20001666359	01.12.2018	12.01.2019	Z3	02.12.2018		10650560		OSNO
	300574856	01.12.2018	40905633	Phase A export energy detected Start	20001605308	01.12.2018	12.01.2019	Z3	02.12.2018		10244432		OSNO
	300574857	01.12.2018	41370048	Drift is outside correctable range - Abo	20001812225	01.12.2018	01.12.2018	Z3	02.12.2018		10684672		NOCO
	300574858	01.12.2018	40903982	Phase A or Element 1 export energy detec	20001965784	01.12.2018	10.01.2019	Z3	02.12.2018		10250086		OSNO





In utilising data from the remote monitoring of the AMI meters, a combination of which assists in identifying even the most sophisticated forms of meter tampering and energy theft compared to traditional methods of in field observance to local visual inspection of the meter. Algorithms that have been created using the power quality data are integral to assist identifying fraud and theft of energy investigations. In many aspects, this theft could not be determined by a localised field visit to check the condition of the meter. It is this power quality data that is integral for AusNet to manage fraud and theft of energy investigations by comparison of voltage and current data against pattern of supply from neighbouring supply points and local substation information.

Historically, fraud and theft were limited to holes being drilled through meters and wire used to adjust meter registers, or to stop the rotating disc of a mechanical meter. The remote condition monitoring minimizes the need to expose field personnel to aggressive customers and potentially hazardous confrontations, a principle supported by AusNet's occupational health and safety (**OH&S**) policy.

It is important to note that many instances of theft or fraud have not involved removal of the meter seals from AMI type metering. This is particularly relevant where illegal bypass connections have occurred well before the meter terminals. In any case, the methods used by AusNet to remotely monitor AMI metering provide a level of assurance that supports the overall metering inspection strategy and compliance obligations.

6.2 Meter Investigations

Meter investigations can originate from several sources, including:

- Customer/retailer B2B requests to investigate correct operation of the meter.
- Energy and Water Ombudsman enquiries and complaint resolutions,
- Inspections and investigations of potential meter faults emanating from retrieved meter events and remote condition monitoring.

Post initial back-office analysis and investigations being completed, unresolved enquiries will be issued to field resources for further investigation.

Some of the scenarios which may warrant in field investigations include:

- reverse energy detected meter events, which are primarily due to customers installing unapproved small scale PV generation systems onto the network,
- quality of supply investigations triggered by voltage events and analytics collected from the AMI meters. (high/Low voltage complaints)
- to investigate meter tamper events, and:

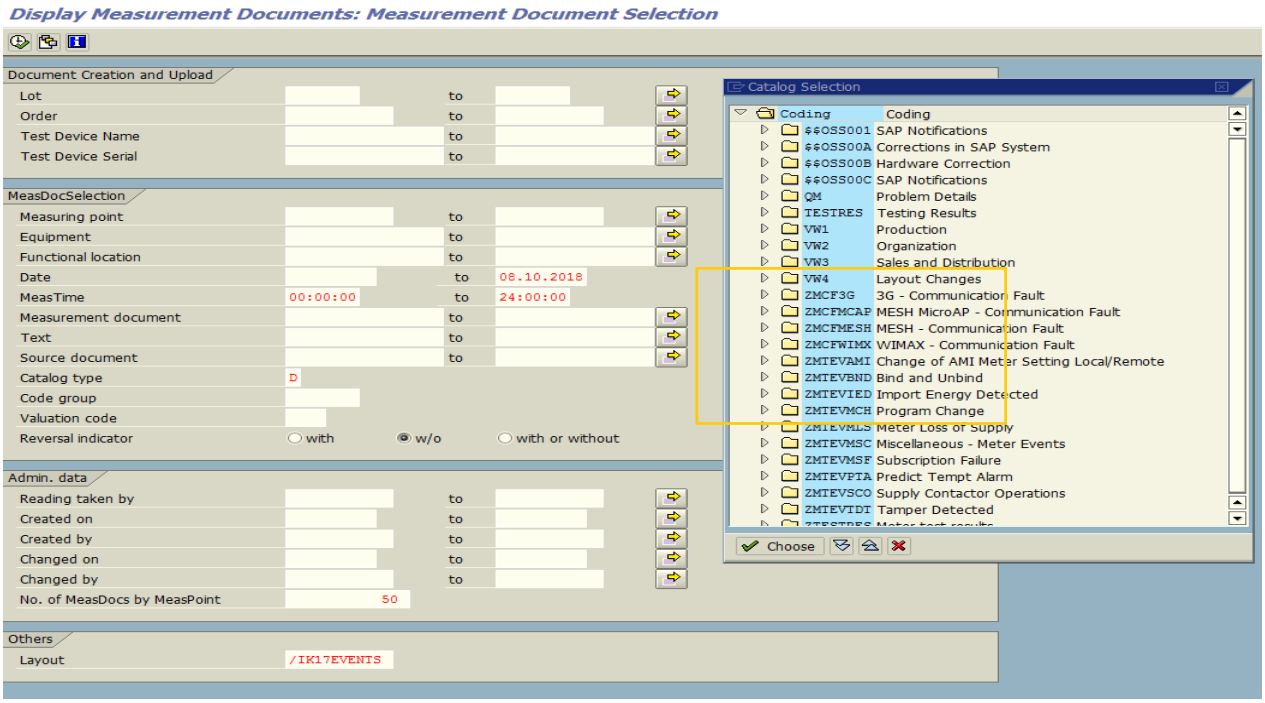
- to validate billing and standing data mismatches and via Energy Retailers who may query correct operation of meters around transposed metering scenarios and energy consumption concerns, including high bill complaints and request for meter accuracy testing.

The current downward trend of meter investigations is forecast to stabilise to 2025 period due to the now embedded nature of the AMI operating meters and includes consideration of customers and energy Retailer's and customer acceptance of the accuracy and performance of the smart meters and their now proven accuracy, assurance and stability.

Our back-office processes were developed to include both desktop and field-based analysis to ensure the correct operation of the metering equipment. AusNet continues to proactively monitor the condition of the AMI meter fleet using and analysing the remotely collected data, meter events and alarms captured by via UIQ. Meters requiring further investigation will be escalated to field technicians. This process l includes identification of safety and hazardous issues and any metrology anomalies.

Figure 11 below obtained from the SAP-ISU system, details how meter events are received and grouped from the meter via UIQ and collated ahead of investigation. This list is monitored and forms the basis of investigating potentially erroneous metering installations.

Figure 11: extract of SAP-ISU showing how meter events are recorded



On-site meter investigations are also issued to support investigations resulting from the distribution network monitoring of remotely collected Power Quality data.

We base our forecasts of the volume of meter investigations and tests on current volumes. The table below shows these forecasts. As a general observation, increase volumes of meter accuracy and assurance investigations generally occur when increase in tariff rates occur.

Table 9: forecast of meter investigations

Actuals	Forecast

	CY '22	CY '23	CY '24	CY '25	CY' 26	CY'27	CY'28	CY'29	CY'30	CY'31
Meter Investigations	**185**	**190**	**195**	**200**	**205**	**210**	**215**	**230**	**250**	**300**

*Higher volume forecast due to meter end of life performance issues

6.2.1 Customer Initiated Accuracy and Assurance Tests

The historically higher volumes experienced in 2017/18 of customer-initiated meter accuracy testing was generally caused by the uncertainty and scepticism around the accuracy of the AMI smart meters post their mandated deployment. Many of these requests were specific to the publicity around AMI capable metering compared to billing and energy consumed from the previously installed electro-mechanical meter type. Other reasons included tariff and load control accuracy and settings, and perceived health issues relating to enabling remote communications capability.

The numbers of these specific issues have reduced in volume from the peak of the AMI meter deployment and remediation activities due mainly to consumers and retailers having more confidence in the accuracy and performance of AMI capable meters. The reduction in estimated accounts which can influence a consumer's decision to request an accuracy test is a contributing factor, and flexible tariff options available for interval capable metered customer allowing the freedom of choice for customers to manage their electricity Retailer and pricing options which has promoted more awareness of cost per kwh consumed.

In addition, we have online energy portal (My Home Energy) which allows customers free on-line access to their interval data (energy consumption) to manage and monitor their energy use.

The forecast for customer-initiated accuracy testing therefore remains stable for the forthcoming period and there is no expected decline in meter performance or accuracy. It is however noteworthy that the oldest fleet of AMI meters in AusNet's fleet will be nearing 20 years of age in 2026. As AMI meters have a forecast asset life of 15 to 20 years, an increase in monitoring AMI meter performance, accuracy and faults will be important to identify potentially end of life cycle component failure. To this extent, AusNet also proposes to implement a scheduled meter replacement program commencing in 2026 based on replacing the oldest AMI meters in its fleet. This aims to reduce the risk and impact to bulk meter failure due to hardware, age and performance degradation. This will commence with replacing the first 40k of deployed AMI meters where the hardware was specific to enabling WiMAX communication to operate as the primary communication medium. Whilst AusNet has enabled the mesh operating platform to be successfully integrated into these meters, there is a risk that overall performance and reliability of these meters may be compromised by operating within the mesh operating platform.

The forecast volumes of customer-initiated tests are presented in the Table 10 below.

Table 10: Forecast of customer-initiated meter tests

	Actuals		**Forecast**							
	CY '22	CY '23	CY '24	CY '25	CY' 26	CY'27	CY'28	CY'29	CY'30	CY'31
Customer Initiated Tests	**505**	**515**	**525**	**540**	**555**	**570**	**585**	**600**	**625**	**650**

6.3 LV CT test & inspections

LV CTs connected to our fleet of Type 5 and 5 Metering Installations are subject to an in-service testing and enhanced inspection regime previously endorsed by AEMO, as per our CTTWG – Alternative Testing & Inspection Guidelines for Metering in the NEM version 2.0 dated March 2020.

We use this AEMO approved alternate testing and enhanced inspection strategy which:

- Provides additional data collation regarding LV CT parameters, and
- Ensures the accuracy and assurance of the infield populations of CTs.

Details of the testing and inspection annual test and inspection volumes are updated annually in our Meter Asset Test Plan, which is submitted to AEMO for their advice each year. Table 11 and Table 12 below show our forecast volume of LV CT testing and inspections.

Our test approach is as stated in the options paper presented by the AER in its December 2011 Compliance Bulletin. Under this approach, each LV CT type (or "family") is sample tested in the tenth year after installation, and 100% of the remaining LV CTs in the family inspected every ten years.

For information purposes, all populations of LV CTs installed in or prior to 2002 have been sample tested in 2012. Subsequent testing of LV CT population occurs based on year of installation which means LVCTs continue to be tested annually based on the prescribed sample size as referenced in the guideline, 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 method to generate burden measurements, ratio checks, and admittance readings to comply with AS.60044 standards. The secondary test philosophy has been accepted by AEMO. All LV CTs on a customer site are tested irrespective of whether all CTs are part of the random sample. A summary of the test equipment used for LVCT testing is outlined in section 8.4.

Table 11: Forecast of LV CT testing

	CT Type											
Year	S Type 200/5	T Type 800/5	W Type 1500/5	B Type 400/5	B Type 1200/5	C Type 1000/5	C Type 2000/5	C Type 3000/5	A Type 150/5	A Type 300/5	A Type 600/5	Yearly Total for Testing
	Quantity to be Tested											
2021	50	9	0	0	0	0	0	0	0	0	0	59
2022	50	13	0	0	0	0	0	0	0	0	0	63
2023	50	13	0	80	13	13	0	3	13	50	13	248
2024	50	13	0	0	0	0	0	0	0	0	0	63
2025	50	13	0	0	0	0	0	0	0	0	0	63
2026	50	3	0	0	0	0	0	0	0	0	0	53
2027	80	13	0	0	0	0	0	0	0	0	0	93
2028	80	13	0	0	0	0	0	0	0	0	0	93
2029	80	13	0	0	0	0	0	0	0	0	0	93
2030	80	13	0	0	0	0	0	0	0	0	0	93
2031	0	0	0	0	0	0	0	0	0	0	0	0

Table 12: Forecast of LV CT inspection

	CT Type											
Year	S Type 200/5	T Type 800/5	W Type 1500/5	B Type 400/5	B Type 1200/5	C Type 1000/5	C Type 2000/5	C Type 3000/5	A Type 150/5	A Type 300/5	A Type 600/5	Yearly Total for Inspection
	CTs to be Inspected											
2021	433	18	0	0	0	0	0	0	0	0	0	451
2022	391	23	0	0	0	0	0	0	0	0	0	414
2023	262	29	0	562	8	32	0	0	8	106	29	1036
2024	319	5	0	0	0	0	0	0	0	0	0	324
2025	373	8	0	0	0	0	0	0	0	0	0	381
2026	346	0	0	0	0	0	0	0	0	0	0	346
2027	490	26	0	0	0	0	0	0	0	0	0	516
2028	442	20	0	0	0	0	0	0	0	0	0	462
2029	580	41	0	0	0	0	0	0	0	0	0	621
2030	652	35	0	0	0	0	0	0	0	0	0	687
2031	0	0	0	0	0	0	0	0	0	0	0	0

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 if required.

6.3.1 Meter Data Verification Sample Testing

We comply with the obligation under section 12.5 (a) of the Metrology Procedure Part A, which is to ensure that the metering data maintained in the relevant metering data services database (i.e., Meter Data Management System) is consistent with metering data collected from Type 5 or 6 metering installations (including constants and multipliers). That is, that energy data recorded at the meter, is consistent and representative of data collected and maintained within the meter data management systems for Retailer/distribution billing purposes.

In accordance with this obligation, we ensure that a sample testing plan is established and implemented on an annual basis to verify meter installation data (In accordance with Metrology Procedure Part A, version 7.1 clause 12.5 (a).

We have implemented a process and work instruction referencing to Australian Standards AS1199 and AS2490, (refer Appendix A). Sample testing by "attributes" using Australian Standards AS1199 as our preferred methodology to ensure that a sample size of installed meters can be validated to ensure energy data collected and stored, is consistent between systems. The process relies on comparing raw energy data stored within UIQ, to compare to validated data sets from the Energy IP market data system.

Type 6 data will be compared from meter reads obtained from the MVRS meter reading platform.

Applying the methodology described by Australian Standards AS 1199 and AS 2490, we verify meter data annually for:

- Type 5 meters Manually Read Interval Meters (MRIM)
- Type 5 meters Remotely Read Interval Meters and
- Type 6 meters

6.3.2 Meter acceptance test and release

The following principles apply to evaluation, testing and acceptance of new metering product suitable for use in the AusNet Distribution network.

1. Compliance – Does the meter meet the relevant Australian Standards and Pattern Approval requirements?
2. AMI functionality – Does the solution meet the minimum AMI meter functionality requirements?
3. Is the equipment compatible with AusNet's meter management systems and architecture?
4. Does the solution meet AusNet's business requirements, (installation, security, safety, and operational objectives?

Prior to any meter being released into a production environment, a three-stage evaluation and approvals process occurs which includes.

- Desktop evaluation (to evaluate compliance to standards, Pattern Approval and compliance
- Functional testing – includes aspects of meter configurations, hardware capability, setting and parameters.
- End to End test – Preproduction environment testing to evaluate remote connectivity and capability to deliver remote services and date delivery

All new variant test scenarios, scripts and results are collated in Quality Centre with test summary reports generated at the conclusion of testing phases. Any defects identified under this process are allocated a severity rating and managed accordingly.

In addition, new or modified meter programs and updated firmware releases to support existing deployed meters also undergo testing and formal acceptance prior to deployment. This is to ensure all changes are compatible with mitigating risk associated with deploying changes to existing meters and to validate that the end-to-end connection, metering services and data to market operations are not compromised.

It is forecasted that new meter variants and types will be released during this forecast period and require testing prior to release. This is because of older installed meter types being made end of life by the current supplier over the forecast period but will still require various upgrades to meet performance and service levels. As the current production life of AMI meters is currently 3-4 years before a new or upgraded variant is released, We expect at least 5 -10 new variants will be released over the forthcoming strategy period with similar volume of meter firmware updates being separately released for existing meter variants.

A broad test and assessment strategy relating to new meter variant testing, evaluation and acceptance is provided Table 13 below.

Table 13: Stages of meter acceptance testing and release

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.

6.4 Meter programs, settings and configuration versioning strategy

We have created a meter program versioning strategy document which is used to describe the method when creating new configuration files for the AMI meters. 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 are new meter programs created to support this functionality for the impacted meter variants. AusNet will be working collaboratively with our digital service providers to review the Meter Program/configuration creation process which will 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.

The program and configuration development are a critical component of ensuring continued accurate data to market operations of the metering solution. The meter configuration file is the link between, the meter, SAP-CIS, network tariff assignment, load control, Energy IP for data and EAI to allow data to market. The meter program also holds credentials associated with load control, register displays, and meter event alarms and notifications.

A master reference document held in SAP as the mother table, provides the master list of all meter configurations files and their link to network tariff assignments. A simplification of the mother table administration will need to be considered due to limitations in the table design.

6.4.1 AMI hardware procurement planning

We currently have a meter supply agreement with Landis + Gyr Australia, who manufacture and supply all our required AMI meter models. The mesh communications hardware is supplied by Itron Australasia. There are nine approved AMI meter variants currently in use, with 5 of these being the current production variants, the other being end-of-life.

Our Mesh meter hardware includes Network Interface Card and Micro AP devices and Access Points. The existing 3G connected Access Points were progressively replaced by 4G capable devices due to the Telstra 3G network being decommissioned in 2024.

To assist in planning for procuring meters and communications equipment, a rolling 12 month forecast of meter requirements is maintained to ensure accurate procurement of meter variants required to meet connection and replacement obligations.

The forecast includes a combination of inputs using the monthly reconciliation of meters installed and replaced as well as using data from meter movement and fault reports. The analysis includes monitoring and tracking meter performance and event information that may lead to meters being reported as replaced as faulty.

Purchase orders for procurement of meter hardware are created to suppliers bi-annually. A delivery schedule is negotiated with the supplier to ensure consistent monthly meter deliveries into the AusNet stores system and to mitigate any impacts to receiving an irregular consignment of meters.

Monitoring physical inventory use against the forecast on a monthly basis allows for variations to stock ordering to be quickly identified and accounted for at the next stock ordering point (that is, prior to the next purchase order request being raised). AusNet operates on holding between 3-6 months of inventory to mitigate risk of manufacturer delays as experienced during the COVID pandemic. The planning and procurement process includes contingency stock planning to mitigate sole supplier risk and to minimise supply chain disruption caused by shipping and manufacturing delays.

All equipment is receipted into the AusNet central warehouse located in Yarraville. In addition, the Metering Business forecasts for the supply of LV CTs, load control devices, and meter security seals. Forecast requirements for ordering, meter distribution and meter returns are presented in section 5.3 (Table 7).

All equipment removed from site are returned for assessment and refurbishment and replaced under warranty where applicable. Meters that meet the age and condition criteria are refurbished wherever cost effective. Only the current specified meter variants that are supported and supplied as new from the manufacturer are in scope for refurbishment.

All refurbished meters will be inspected, re-calibrated and issued with a calibration test certificate in accordance with the NER Chapter 7 prior to being returned to stock and provided a depreciated and asset life as per a new meter.

6.4.2 Meter stores and logistics

The physical inventory management and warehouse distribution of the meters is managed by our logistics team with a central store operating from AusNet's Yarraville depot. Inventory stock counts and reconciliations are completed at a minimum, annually from our stores and logistics team.

Returned from service metering equipment is transported back to Yarraville for reconciliation and disposal (or refurbishment) from the regional depots. A process is 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 (recycled).

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 Yarraville warehouse. Landis & Gyr provide a preloading process prior to meters being delivered to Yarraville depot which avoids in field pairing complications of managing two separate inventory items.

The preloading provides benefits including:

a) Ensures that when the meter is installed, it will attempt to automatically connect and activate as a remote operating meter from time of installation and energisation. Therefore, quicker data to market operations can be achieved.

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.

6.4.3 Warranty

The warranty period for the L+G AMI meters is five years for meters delivered between CY2009-2012, and 10 years for meters delivered from CY2013 onwards.

We monitor removed meter volumes, types and condition reports to identify meters which may be deemed eligible for repair/replacement under the warranty terms and conditions.

7. Risks & dependencies

This 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 at any time due to changes in the NEM rules. Some of the risks associated with the possible changes are captured in this section.

7.1 AMI optimisation program

Currently, AusNet maintains approximately 7,500 non-AMI meters of varying types. Of these approximately one third are installed to long term de-energised NMIs, where the installation has been de-energised more than 5 years.

To ensure optimum performance of the remote metering operating platform, it is AusNet's intention is to replace non-AMI meters to remote capable AMI types wherever possible.

There are several benefits associated with deploying remote read meters in exchange to those non remaining meter types.

These include:

1. More accurate meter reading and less estimated reads
2. Mitigate the risk of field operatives in respect of fatigue and working alone driving vast distances to capture "local" meter readings to meet quarterly meter reading cycles.
3. Identify Power quality and power loss events to include into Distribution System Management initiatives
4. Mitigate risk associated with access to hazardous sites (including aggressive customer and access issues)
5. Allow for remote metering services to be implemented

To facilitate maximising the benefits associated with deploying AMI and enabling two-way communications to metering and unlocking benefits to which remote metering provides to consumers, it is AusNet's intention to:

1. Abolish metering to long term de-energised sites where power supply has not been connected for over 5 years, thus mitigating potential hazardous and unsafe installations from inadvertent reconnection of supply, reduce risk created from storm and natural disaster such

as bushfire, and resolve hazards emanating from vandalism and avoid potentially fraudulent and unsafe connections to supply.,

2. Implementing innovative metering solutions to customers who have previously refused installation of smart meters at their property. This may include installing pole top metering outside of the property boundary. AusNet currently has approximately 1500 installations where customers have refused installation of a smart meter of which at least 50% are fed via overhead services. Installing an AMI meter onto the distribution pole feeding the service is potentially an option.
3. Replacement of all non-AMI meters to any customer requesting an AMI meter at no cost to the customer.
4. Assistance in customer side defect remediation such as provision of advice and technical detail in respect of suitable remediation scope of works limited to meter and mains box wiring.
5. Ensure all smart meters are read as either remotely or manually Type 5 Interval meters (RRIM or MRIM , not as register read BASIC Type 6 meters) thus unlocking interval data benefits such as time of use data billing and tariff options.

There are approximately 1500 NMIs recorded where customers have either previously refused the installation of a smart meter or refused the installation of remote communications cards to allow for remote connectivity of the smart meter. To avoid customer confrontation and as a matter of employee safety, AusNet has a technical design to allow for AMI smart meters to be safely installed to the nearest distribution supply pole to allow connection of the customer service line, to the pole mounted meter. This will allow customers energy data to be remotely collected and forwarded as per current normal meter and B2B services.

This solution avoids on site meter reading visits and avoid local meter reading charges. This proposal also allows for safe and unhindered access to allow for meter maintenance activities to occur. It also allows for the existing meter to be retained by the customer at their discretion for check metering purposes. Work is continuing to review technical and engineering solutions for URD areas where a similar concept is required to service customers in underground reticulated areas.

7.2 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 length recorded in electricity meters from thirty minutes to five minutes. (Refer to National Electricity Amendment 5 MS Rule 2017 No.15.) This change aligns 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, 5-minute data, and the relevant processing capacity of meter management and data management systems to support its introduction and data delivery performance

Landis& Gyr (L+G) provided new firmware to support the change of interval data from 30 minutes to 5 minutes for the currently specified new meter variants.

All new meters procured by AusNet are released and installed with suitable firmware releases and meter configuration to support 5-minute data recording. By default, all new connections and meter replacements completed post 1 Jan 2019 will have 5-minute capability enabled from the date of the meter being installed.

As per AusNet's 5-minute deployment plan, only meters currently operating as part of the mesh communications platform, and of meters manufactured after 1 December 2018 will be of an eligible type to allow for 5-minute recording.

Should the mandate extend to require all customers to have a 5-minute capable meter, a physical meter exchange will be required which will potentially impact over 600K of meters due to solution compatibility issues.

7.3 National Electricity Rule changes to provide metering services in Victoria

The NER changes in Victoria retain the obligation of 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. These requirements will continue until the Victorian government amends these requirements. There is currently no expectation that this will occur in the short term.

7.4 Single meter manufacturer

Landis& Gyr (L+G) is our sole meter vendor and will continue to be its meter supplier for the forecast period. Notwithstanding this, we propose to mitigate the sole supplier risk by evaluating compatibility and capability to a range of alternative meters supplied by alternative meter manufacturers.

Our strategy for supply chain continuity is to maintain on shore at least three to six months of contingency stock. This will assist in mitigating supply chain risk as experienced during the COVID19 pandemic. To avoid further risk, We implemented contingency stock management to ensure sufficient stock is available on shore to meet its connection and maintenance obligations.

New meter supply is supplemented by a meter refurbishment process (subject to meter type, condition and cost effectiveness).

7.5 Single comms module manufacturer

Itron is the manufacturer of communications module hardware that is integrated into the Landis & Gyr metering variants. Itron also supplies the Mesh capable pole top hardware and the Meter Management solution designed to communicate remotely with the metering fleet. 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. All stock is manufactured overseas in the USA.

To avoid risks associated with supply chain management (as experienced during recent years manufacturing and delivery restrictions which resulted in delays of hardware of between 8 to 12 months), we maintain at least a minimum of 3 months' worth of stock to maintain normal business and remediation projects. This is explored in detail in the accompanying AMS Mesh Communications Strategy document (Part 2).

Our strategy for supply chain continuity is to maintain on shore at least three to six months of contingency stock.

To avoid further risk, we proposed to ensure sufficient contingency stock is available on shore to meet its connection and maintenance obligations. Current specified hardware is now Gen 5 which is the latest technology which supports both 5 minute data capability as well as 4G telco technology. The previous Gen 4 technology, on removal, will be recycled and not re -introduced into the network.

7.6 Bulk meter family failure

As the oldest installed AMI meter types exceed 15 years old, a greater risk associated with failure of electronic hardware and support of meter firmware is evident. Additionally, our oldest meter fleet is not currently 5-minute data recording capable. We have approximately 700k of meters manufactured and installed prior to the 2018, 5 minute program obligation, that are not in scope for 5 minute conversions. In addition, these meter models are increasingly difficult to maintain in the field due to firmware and operating platform constraints. That is, ongoing performance issues where upgrades to meter firmware and compatibility issues in UIQ and remote communication technology upgrades to meet meter data to market obligations, is increasingly difficult to facilitate for these older meter variants.

To mitigate impact against large population meter failures, we use a seven-point program as a framework. The program applies to all meter types. The meter type and its population size determine the scope and timeframe to remediate, shown in Figure 12 below.

Should preliminarily results of random sample testing determine a meter population to have failed accuracy, 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 population fail

b) Degradation of battery life

c) Meter flash memory deterioration

d) Faulty contactors (load control and main supply control) and optical couplers

e) Susceptible to potential HV injection failures.

f) LCD display failures

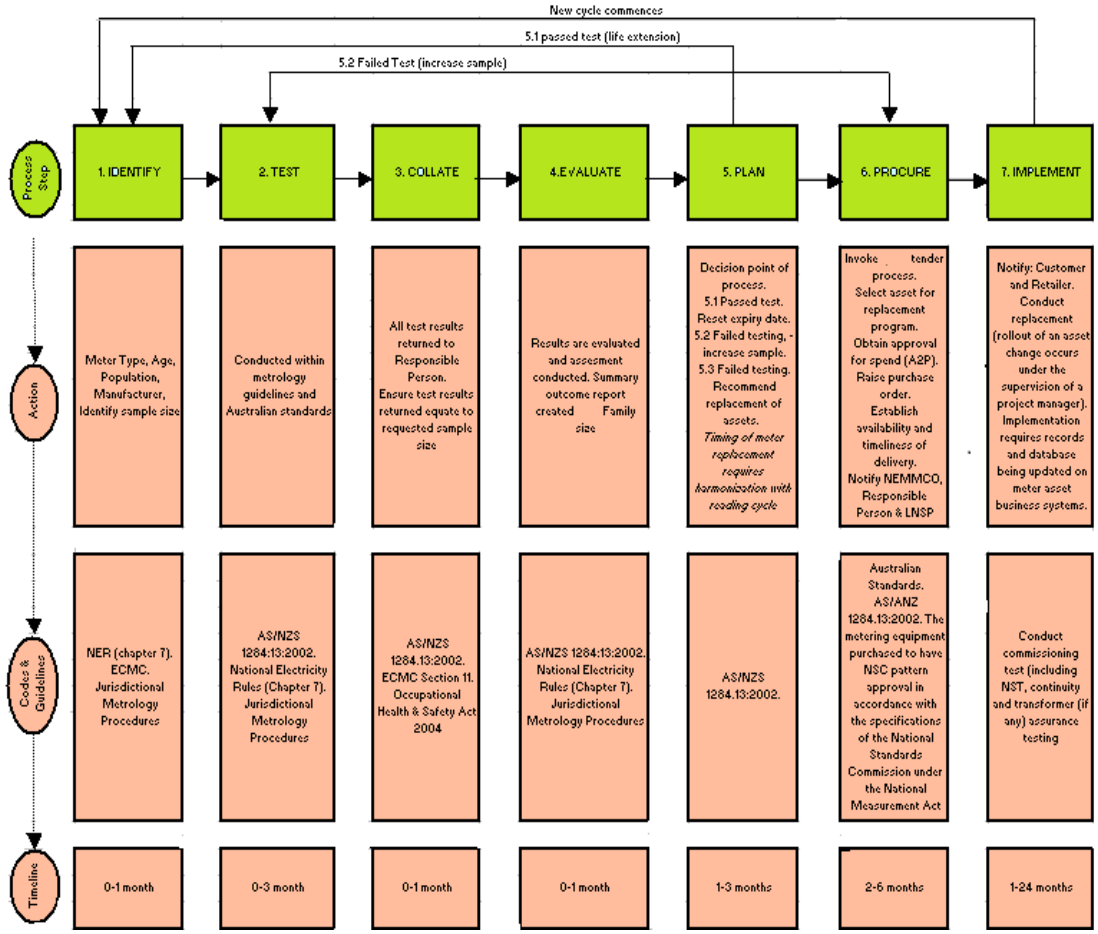
g) Remote communication module faults

h) Large scale and repeated time synchronisation failures

We may redefine the population as required for those meter populations subject to annual in-service test regimes. Should a large sub-population fail testing, we would adopt the steps detailed below that defines the meter replacement timeline.

Analysis of test results, particularly 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.

Figure 12: approach to planning and manage meter family failures



7.7 Mitigation of bulk meter failure

Technical information and advice available from manufacturers of electronic meters indicates that AMI type meters will have an expected operating life of 15 years. We expect higher volumes of meter failure for meters exceeding this expected life. Our first AMI electronic meters were installed in 2009 which will see the oldest meters in the fleet being 15 years old in 2024. There is a risk due to the large volume of meters installed across a five-year period of mandated replacements, that by 2031, over 700,000 meters will be older than 15 years.

Additionally, it should be acknowledged that there are limitations in enhancing old meter variants installed. These limitations can be due to the amount of meter memory, physical hardware, and firmware limitations.

Some meter variants are no longer supported by the meter manufacturers to enable additional functionality due to mechanical hardware constraints. Suppliers are no longer manufacturing these meter variants. They generally recognise the meter operating life cycle of 15 years limits the supportability of older meter variants.

We used the Isograph's Availability Workbench's (**AWB's**) Weibull module to analysis our full population of smart meter for meter models (400, 410, 420, 430, 450), including failure data and specific meters replaced for other reasons such as not meeting 5-minute settlement requirements, see Table 14 **Error! Reference source not found.**below.

Table 14: Weibull analysis summary of older model meters

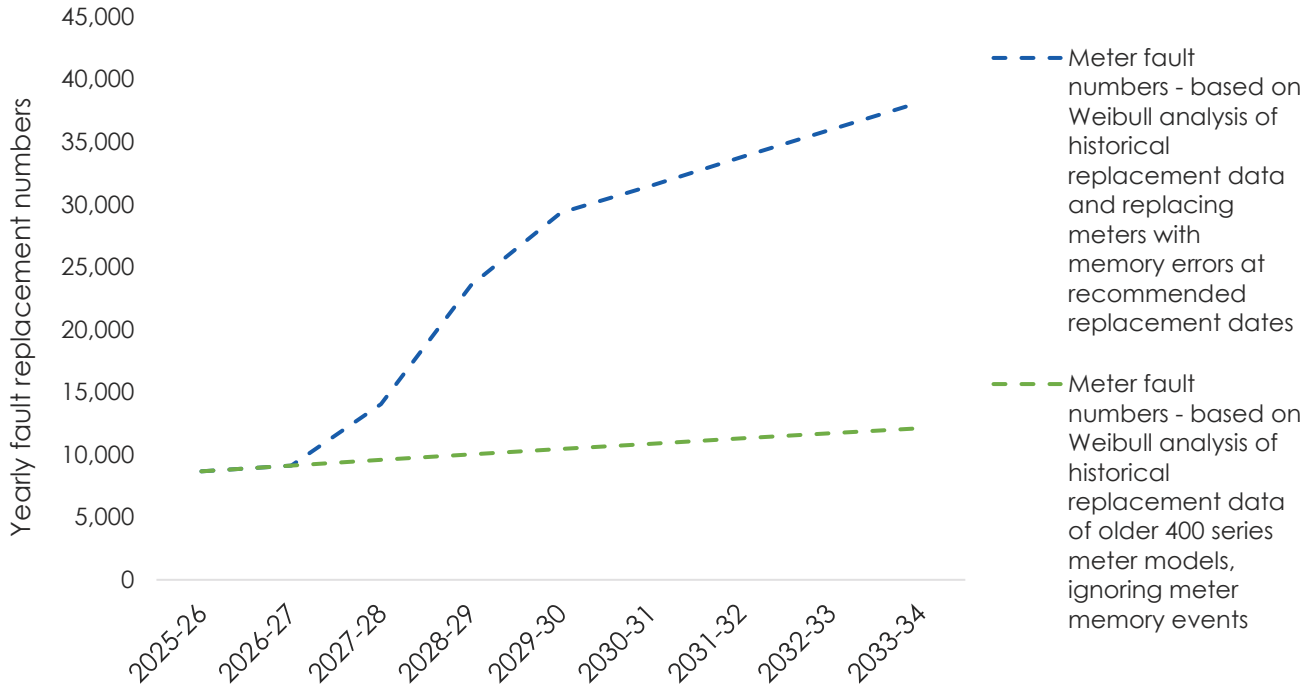
	Weibull Parameters		Expected Failures										
Model	Beta	Eta	Forecast_2025	Forecast_2026	Forecast_2027	Forecast_2028	Forecast_2029	Forecast_2030	Forecast_2031	Forecast_2032	Forecast_2033	Forecast_2034	Forecast_2035
400	1.5	62	1,074	1,117	1,158	1,198	1,237	1,274	1,310	1,346	1,380	1,413	1,446
410	1.9	47	3,473	3,696	3,917	4,136	4,353	4,567	4,780	4,990	5,199	5,407	5,612
420	1.6	47	1,736	1,814	1,890	1,963	2,035	2,104	2,172	2,238	2,303	2,367	2,429
430	1.7	40	2,096	2,213	2,327	2,439	2,547	2,654	2,759	2,861	2,962	3,061	3,158
450	1.2	48	61	62	63	64	65	66	67	68	68	69	70
693,471			**8,440**	**8,903**	**9,356**	**9,801**	**10,237**	**10,666**	**11,088**	**11,503**	**11,913**	**12,317**	**12,715**

Source: AusNet using AWB's Weibull analysis software

Our meters are failing at higher rates and meters are now indicating meter flash memory events are now occurring in 1,500 unique meters per month. Over time within these meters the flash memory will continue to degrade and will likely result in meter failures and data corruption within 3-4 years of the recording the memory event.

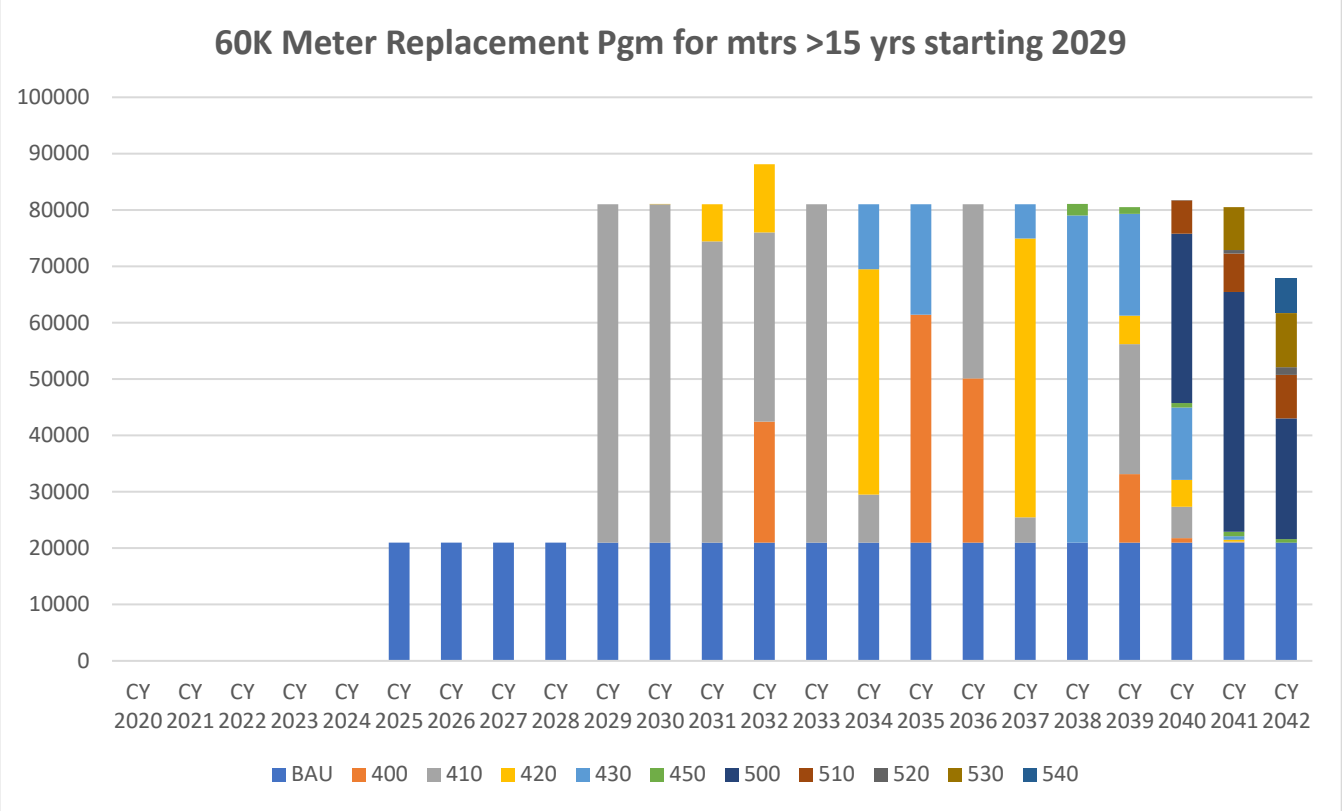
To mitigate the risk of meter memory failures from impacting customers and our regulatory obligations, we propose to replace meters 3 years after a unique memory event is recorded. Figure 13 below shows our forecast of meter failures based on Weibull analysis and our approach to mitigating flash memory degradation.

Figure 13: Our meter failure forecasts based on Weibull probabilistic failure rate analysis and the recommended replacement of meters indicating compromised memory integrity events



We plan to replace our meters over 13 years, as shown in Figure 14 below.

Figure 14: Planned meter replacement strategy



Our strategy of undertaking a targeted meter replacement over a 13-year period aims to:

1. Reduce exposure and impact of meter failure to populations that exceed their 15 year life cycle and starts to fail at higher rates.
2. Smear out the risk of having over 600k of meters which were installed within 5 years of each other. (i.e., shift the age profile of the majority of meters being within 5 years of age of each other to even the average age of the oldest meters to being no more than 20 years old
3. Allow for structured planning and replacement forecast to be considered for future planning to secure hardware and labour resources.
4. Allow for funding for hardware and services.
5. Ensure the metering fleet is updated to support network of the future initiatives.
6. New meters installed will all be 5 minute capable.

The strategy is not designed to replace every meter on its 15-year installed anniversary. Indeed, at the current forecast volumes of meter replacements, we plan to replace meters to best manage our regulatory obligations and avoid unnecessary metering costs for our customers.

7.8 Single supplier for LV CTs

We source 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. This is completed twice yearly based on accurate historical use of LVCT records, as well as referencing to a rolling twelve month forecast of use.

As WF Energy Controls have been supplying LV CT equipment for many years, and are considered a reputable company, and manufacture CTs on shore in Australia, and there are alternative suppliers of similar compatible equipment, the current risk to supply chain is minimal. The risk can be partially mitigated by exploring alternative options for CT manufacturers. The risk is reduced by our robust forecast of the LV CTs needed based on historical statistics and placing order in advance and maintaining buffer stock levels of at least 3 months' worth of use to avoid any major disruption of supply.

7.9 Increased failure of load control devices

The majority of mechanical and solid-state external load control time switches which were historically used for tariff switching (hi/low tariff) and to switch bulk storage hot water and heat systems to non-AMI Type 6 metered sites, have for the majority been removed from service. The AMI meter with its capability to switch loads via an internal contactor rated at 40 Amps, has reduced the cost and maintenance associated with maintaining externally controlled switching devices.

In addition, all new requests for switching services now need to be provided for by the customer either to support switching loads which are exceeding 20 amps, or for multiple control loads.

However, as a result there are several legacy installations whereby switching of load outside of the AMI meter was required, several load contract one and multi pole contactors were installed to customer installations. The maintenance and support of these installations is still the responsibility of the LNSP.

Whilst there is no view that these external contactors are nearing end of life, nor have experienced a higher-than-average proportion of failure, there is still a requirement to ensure adequate availability and installation knowledge is maintained to support complex load control wiring arrangements. This an important aspect to support maintenance of external contactors and complex load control metering arrangements, is to ensure adequate training, advice, technical and operational knowledge is available to disseminate and refer to as training material.

In respect of load control being provided directly via the AMI meter, fault patterns and advice received from meter replacement reports does not indicate a higher-than-average fault rate associated with However given the high volume of AMI meters installed across a condensed number if year, load control contactors are generally assured for 15k operations. This generally equates to a 10-year operational life of the load control contactor. Continued vigilance around monitoring reasons for faulty meter malfunctions will need to continue to ensure impact to customer referencing faults of no hot water will continue to escalate.

8. Resources & Service Providers

8.1 Field Metering technicians

We use a combination of internal resources sourced via the Mondo Metering business and third-party service providers to deliver the 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 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:
- Asbestos awareness.
- VESI Environmental framework.
- VESI framework
- ESI safety rules.
- Testing of connections
- Manual handling.
- Safe approach distances

Some advanced training and knowledge are required for some of the specialist metering activities, such as installation, testing and inspection of CT meters and LV CTs as well as complex enquiries relating to customers requesting HV metering services, alterations and repairs.

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.

In addition, each installer must undertake a period of mentoring with a senior technician as part of their induction. Thereafter, internal auditors undertake a "Check of Understanding" to ensure the installer can perform the required work. We use the VESI Skills and Training Matrix as a guideline to assess and monitor the performance of the field resources employed.

We have 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 the flexibility for maintaining meter installations in accordance with this strategy and the relevant regulatory obligations.

8.2 Metering Services - Local

Service required to non-communicating and legacy Type 5 and 6 Meters are completed currently by an external contactor. Service Stream currently is contracted to complete all local scheduled quarterly and monthly meter reading services and some meter maintenance activities, under our MP accreditation. (Refer to National Electricity Rules v185 - Sec. 7.3.2(h)(5) Metering Data Services).

Other field services completed by this team include request for re-energisations, de-energisations, reconfigurations, special reads and check reads where remote services are not available, or the metering equipment is not remote capable.

The service provider uses the Multi-Vendor Reading System (MVRS) which is an Itron proprietary meter reading services platform. It is used for obtaining and managing scheduled quarterly and monthly cyclic meter reading. The MVRS solution is maintained by AusNet.

For meter investigation activity where raw data and/or meter events to AMI meters are required, EMPwin+,a proprietary software application provided by Landis & Gyr is used for locally retrieving meter load profile data and investigating and locally programming meters. An accompanying optical probe is also required for this purpose.

The annual volume of localised services is referenced Table 15 below

Table 15: Forecast annual volume of localised services

Service Subcategory	MAM Comments	Meter Type	Installation Type	CY 2017	CY 2018	FY 2019 (2018-19)	CY 2019	CY 2020	CY 2021	FY 2022
Scheduled meter reading	Cyclic Reads	Type 5	MRIM	71,420	89,149	61579 (quarterly reads)	64,829 (quarterly reads)	53,176 (quarterly reads)	51,342 (quarterly reads)	7,125
		Type 6	BASIC	4,116	3,101	2754 (monthly reads)	2, 395 (monthly reads)	1,792 (monthly reads)	1,566 (monthly reads)	45,205
Special meter reading	Field Reads (Re-Energisations)	Type 5	MRIM	31,891	1,678	1,689	768	256	401	152
		Type 4	AMI RRIM	171	7,451	4,571	4,272	4,503	4,095	5,177
		Type 6	BASIC	6,058	1,829	1,080	848	729	768	485
	Field Reads (De-Energisations)	Type 5	MRIM	11,877	316	280	209	44	62	74
		Type 4	AMI RRIM	68	3,732	2,976	2,751	3,085	3,411	3,703
		Type 6	BASIC	1,834	768	591	224	192	234	187
	Special Reads	Type 5	MRIM	1,323	209	310	163	81	133	78
		Type 4	AMI RRIM	121	180	18	82	41	10	237
		Type 6	BASIC	2,557	866	502	353	306	304	196

8.3 Metering Equipment Vendors

AusNet 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 with the required meters and associated metering hardware are listed in Table 16 below.

Table 16: Meter equipment vendors

Vendor	Item Supplied

Landis + Gyr Australia	AMI Electricity meters Load control contactors Meter Refurbishment and recalibration services
WF Energy Controls	LV CTs
Eugaquip	CT Meter test blocks
AusNet Logistics & Procurement	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

8.4 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 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 as shown in Table 17 below.

Table 17: meter testing and refurbishment vendors

Vendor	Service
Landis + Gyr	Meter returns claimed under warranty Defective metering investigations Re-verification of metering Meter refurbishment & meter repair services
Mondo	Specialist quality assurance testing In service high voltage metering transformer testing In service LVCT testing In service meter testing

8.5 Test equipment

We use and maintain a variety of meter test instruments and software to support the activities identified in the asset management strategy. Table 18 below lists the current test equipment.

Table 18: Test equipment vendors

Equipment Type	Model Number	Manufacturer
Meter Test Set	689 Test set and Phantom load	Red Phase Instruments
Meter Test Set	PTS2.3	MTE

CT Test Set	590GV2	Red Phase Instruments

In addition, we 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.

We ensure its testing and reference standard instruments are calibrated and maintained on an annual basis. We 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, we utilise the services of Mondo 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

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 Review2012–15 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 handheld 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	
T	National Electricity Rules, 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.

Appendix B: Meter volume and program matrix

Meter Type Code	Meter Program	No. of Installed Meters	Meter Program
400	4105	87,159	Standard 1Ph1e Light and Power (LP)
	4215	20,570	1Ph 1E LP with Solar
410	4106	173,065	Standard 1Ph1E LP
	4107	89,314	Standard 1Ph1E with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	4108	882	Standard 1Ph1E with load contactor afternoon boost (on at 1pm, off at 5pm, on at 11pm , and off at 7am)
	4109	2,299	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	82,982	Solar 1Ph1E with load contactor switching (on at 11pm, and off at 7am) with 60 minutes random turn on delay
420	4102	85,665	Standard 1Ph 2E with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	4103	5,741	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	3,408	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*	4	Non-standard 1Ph2E with 11pm load contactor switching and 30 minutes random turn on and turn off delay
	4222	19,637	Standard 1Ph 2E with 11pm load contactor switching and 120 minutes random turn on delay
	4232	7,741	Standard 1Ph 2E with 11pm load contactor switching and 120 minutes random turn on delay
430	4306	94,369	Standard 3Ph Direct Connect with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	4307	5,253	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	19	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	31,947	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	3,795	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	11	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	1,134	Solar 3Ph CT meter with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
500	9105	58,335	Production Version for Standard Default 1P 1E w/o LC ; Program created as per U1300 meter type
	9215	16,455	Production Version for Standard Solar 1P 1E w/o LC ; Program created as per U1300 meters
510	9107	13,878	Standard 1Ph1E with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	9108	12	Standard 1Ph1E with load contactor afternoon boost (on at 1pm, off at 5pm, on at 11pm , and off at 7am)
	9109	40	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	3,762	Solar 1Ph1E with load contactor switching (on at 11pm, and off at 7am) with 60 minutes random turn on delay
520	9102	811	Standard 1Ph 2E with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	9103	38	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
	9232	228	Standard 1Ph 2E with 11pm load contactor switching and 120 minutes random turn on delay
	9104	26	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
530	9306	94,369	Standard 3Ph Direct Connect with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	9307	5,253	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
	9308	19	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
	9932	31,947	Solar 3Ph Direct Connect meter with load contactor switching (on at 11pm, and off at 7am) with 60 minutes random turn on delay
5 Minute Programs			
500	5105	1,757	Production Version for 5minute Standard Default 1P 1E w/o LC ; Program created as per U1300 meter type
	5215	23	5 Minute program for Production Version for Standard Solar 1P 1E w/o LC ; Program created as per U1300 meters
510	5107	30	Standard 5-minute program for 1Ph1E with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	5216	3	5 Min Solar program1Ph1E with load contactor switching (on at 11pm, and off at 7am) with 60 minutes random turn on delay
	5108	59	5 Min program for Standard 1Ph1E with load contactor afternoon boost (on at 1pm, off at 5pm, on at 11pm , and off at 7am)

	5109	3	5 Min program for 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
520	5102	76	Standard 5 min program for 1Ph 2E with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	5232	15	Standard 5 min program for 1Ph 2E with 11pm load contactor switching and 120 minutes random turn on delay
	5103	24	Standard 5 min 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
	5104	12	Standard 5 min 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
530	5306	223	Standard 5 min program 3Ph Direct Connect with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay
	5932	13	5 min Solar 3Ph Direct Connect meter with load contactor switching (on at 11pm, and off at 7am) with 60 minutes random turn on delay
	5307	11	Standard 5 min program for 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
	5308	2	Standard 5 min program for 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
450	5950		5 min program for 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
	5952		5 min program for 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
	5951		5 min program for Solar 3Ph CT meter with load contactor switching (on at 11pm, and off at 7am) and 120 minutes random turn on delay

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

Meter Program Volumes

Appendix C: Meter firmware volume and matrix

Meter Type Code	Meter Firmware	Meter Count	Baseline for Logical Conversion
400	S00237-05.05.R26	20643	NO
	S00237-05.05.R31	102	YES
	S00237-05.05.R43	83451	YES
410	S00237-05.05.D17	1	NO
	S00237-05.05.R02	23476	NO
	S00237-05.05.R11	42863	NO
	S00237-05.05.R21	16769	NO
	S00237-05.05.R23	41848	NO
	S00237-05.05.R26	1360	NO
	S00237-05.05.R31	143	YES
	S00237-05.05.R43	213919	YES
	S00237-05.05.R44	1	YES
420	S00237-05.05.R11	3883	NO
	S00237-05.05.R21	1311	NO
	S00237-05.05.R23	9201	NO
	S00237-05.05.R26	1849	NO
	S00237-05.05.R31	90	YES
	S00237-05.05.R43	102265	YES
430	S00237-05.05.R23	9308	NO
	S00237-05.05.R26	5768	NO
	S00237-05.05.R31	162	YES
	S00237-05.05.R43	112056	YES
450	S00237-05.05.R27	473	NO
	S00237-05.05.R31	14	YES
	S00237-05.05.R43	47	YES
	S00237-05.05.R50	4252	YES
500	S00237-05.05.R31	5	YES

	S00237-05.05.R43	88	YES
	S00237-05.05.R44	113	YES
	S00237-05.05.R54	73890	YES
510	S00237-05.05.R43	32	YES
	S00237-05.05.R44	176	YES
	S00237-05.05.R54	16647	YES
520	S00237-05.05.R43	5	YES
	S00237-05.05.R44	15	YES
	S00237-05.05.R54	1071	YES
530	S00237-05.05.R43	132	YES
	S00237-05.05.R44	2	YES
	S00237-05.05.R54	13040	YES
Non-AMI	NA	8406	NO
Total Meters		**808877**	