Network Optimisation

Metering Management Plan

If this plan is a printed version, to ensure compliance, reference must be made to the Process Zone to obtain the latest version.

Abstract: This management plan outlines the treatment of assets for the Asset Class of Metering. This includes meters for revenue purposes to meet compliance and regulatory obligations, as well as non-revenue metering for power quality and statistical purposes. The document provides an overview of the metering equipment, asset condition, maintenance approach and activities, as well as planned replacements.

Keywords: meter assets, meter maintenance, meter management plan, compliance testing, power quality, revenue metering, statistical metering, network monitoring.

Table of Contents

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

1 Overview

1.1 Purpose and scope

The purpose of this document is to describe, for metering and related assets:

- Ergon Energy's approach to asset management, as reflected through its legislative and regulatory obligations, and asset management strategies and standards
- the key projects and programs underpinning its activities for the regulatory control period from 1 July 2015 to 30 June 2020
- the basis upon which Ergon Energy derives its capital expenditure and operational expenditure forecasts.

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Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

2 Inclusions

Metering asset management responsibility applies to the range of revenue and non-revenue metering connected to Ergon Energy's distribution network. For the revenue metering class, this includes a range of metering equipment used for energy measurement and tariff applications. This includes all metering installations where the National Electricity Rules (NER) assign responsibility to Ergon Energy's Meter Provider Category B (MPB) for the provision, installation, and maintenance of metering installation types 1 to 6. For non-revenue metering, this includes the Power Quality (PQ) and statistical metering used for various network monitoring and performance applications. Table 1 shows the metering equipment included in the metering maintenance framework:

Table 1 Metering maintenance framework

Metering equipment	Application
Voltage Transformers (High Voltage)	High Voltage Metering (Revenue and Statistical) Wholesale Metering – Transmission-Distribution Boundary Metering
Current transformers (CTs)	
High Voltage (HV) Low Voltage (LV) Low Voltage (LV) Clamp-on	High Voltage Metering Low Voltage CT Metering Statistical (Transformer Monitoring)
Metering Units (MUs)	High Voltage Metering – 11, 22 & 33 kV
Meters – electromechanical /electronic	
Direct Connect – single phase, two element & three phase Current Transformer (CT) – three phase Instrument Transformer (CT, VT) – three phase	Direct Connect – Small/Medium Customer Loads Used with CTs – Medium/Large Customers Used with CTs, VTs. – Medium –Very Large Customers
Card Operated Meter (COM)	Prepayment Meters used in Designated Remote and Isolated Communities.
Ripple Receivers/Time-switches	Demand side management (DSM) – Load switching for Controlled Tariffs, and Time of Use (TOU) rate control.
Communications Devices	Global System for Mobile (GSM), 3G Modems for type 1-4 Metering.
Power Quality and Statistical Meters	Same equipment used for revenue metering applications with reduced maintenance activities.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

3 References

3.1 Ergon Energy controlled documents

Document number or location (if applicable)	Document name	Document type
STNW0708	Standard for Preventive Maintenance Programs	Standard
STNW3357	Standard for End of Life Meter Equipment	Standard
STNW3358	Standard for In Service Compliance Testing	Standard
STNW3359	Standard for Meter Refurbishment and Disposal	Standard
STNW3360	Standard for Obsolete Metering Equipment	Standard
MN000600R102	Engineering Report Meter Configuration Management System	Engineering Report
NA000901R100	Engineering Report Meter Replacement Program	Engineering Report
SGNW0005	SWER Network Management Strategy	Strategy
PQ Monitoring Strategy 2012-2020	Power Quality Monitoring Strategy 2012-2020	Strategy
Share-point	Substation Design Requirements	Reference Document

3.2 Other documents

Document number or location (if applicable)	Document name	Document type
http://www.aer.gov.au/search/accc_funnelback/REPLEX%20Replacement%20Model%20handbook	AER REPLEX Replacement Model handbook	Reference
	AS 1284.13 - Electricity Metering – In-service Compliance testing	Standard

4 Legislation, regulations, rules, and codes

This document refers to the following:

Legislation, regulations, rules, and codes
Australian Standard AS1284.13 In-Service Compliance Testing
Australian Energy Market Commission (AEMC) Power of Choice Reforms paper
National Electricity Rules Chapter 7
National Measurement Institute (NMI)
National Metrology Procedures Part A
National Association of Testing Authorities (NATA)
Queensland Competition Authority (QCA)/Australian Energy Regulator (AER)
Queensland Electricity Industry Code Chapter 9

5 Definitions, acronyms, and abbreviations

5.1 Definitions

For the purposes of this plan, the following definitions apply:

Term	Definition
Card operated meters (COM)	A meter that contains control equipment that switches on and off in accordance with the amount of credit stored in the meter. Ergon Energy has installed these meters in some remote locations, and in certain areas deemed necessary by the Queensland Government. To meet customers' tariff provisions the card operated meters are either dual or single element electronic single-phase meters. A new card operated meter solution to replace the existing prepaid meters is underway as the current card operated meters are at end-of-life and are no longer supported.
Data collection devices (including power quality monitors)	Used to monitor quantities for statutory reporting and power system performance. Outage and duration quantities are used to derive System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) values.
Direct connected metering	Relates to small to medium usage domestic and business customers supplied at 240/415 volts. These assets account for approximately 98% of the total meter population. A range of single and three phase electro-mechanical and electronic type 5 & 6 meters record a range of tariff applications to meet network and retail requirements. The National Metrology Procedure and Queensland Electricity Industry Code dictates that all non-market and market customers with type 5 or type 6 meters are to be read as (accumulation) meters.
Full Retail Competition (FRC)	Applied in Queensland from 1 July 2007. This is when the majority of customers in Queensland were eligible to obtain a market contract. Ergon Energy was not required to publish customer details to the market under a minimalist transition approach. The start of the next regulatory control period 2015-2020 will potentially see the full publication of customer details enabled.
High voltage (HV) metering installations	Relates to non-market customers supplied directly from the HV network. Current and voltage transformers (instrument transformers) isolate and provide safe metering measurement quantities. The accuracy and metering requirements for these installations relate to types 1-3 metering. Accuracy testing of HV instrument transformers incurs additional costs for the above-mentioned sites and requires a test truck with specialised test equipment to test each of the HV customer metering installations.
Low voltage (LV) current transformer (CT) metering installations	Ergon Energy installs current transformers for customers supplied at 415 volts where the maximum demand is in excess of 100 amps per phase. These installations include current transformer operated meters and current transformers. A replacement program has been undertaken to remove all known electro-mechanical current transformer operated meters over the past 10 years as part of a Current Transformer Meter Upgrade Program.
Responsible Person (RP)	As defined in Clause 7.2.1 of the NER. This includes the provision, installation and maintenance of a metering installation

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Term	Definition
Ripple Control Receivers	Controlled remotely via audio frequency telegrams sent over the power line system. Queensland Government uniform tariff policy in the mid to late 1980's required all historical regions of Ergon Energy to install Ripple Control (AF) systems. The asset age profile (Figure 3) shows installation of large quantities of ripple receivers at this time. Sending commands will reduce demand on the network via direct load switching (also see Tariff control equipment). Ripple control receivers are also used to control mechanical registers on TOU meters; however, electronic meters are replacing these as opportunities arise.
Statistical meters	Installed for a range of non-billing applications to monitor substation, feeder and transformer loads, to provide information for planning and system load growth studies to meet regulatory reporting and network planning requirements. Identifying network quality, reliability and network utilisation.
Tariff control equipment	Used for a range of load switching applications for demand side management (DSM) in accordance with agreed times as per tariff provisions. Loads are predominately hot water systems but can also include air conditioning, and other domestic appliances. Where three phase loads greater than the control equipment's switching capacity are required, then a contractor is provided by the customer in conjunction with the control device to switch the load. Control equipment includes ripple control receivers and time switches.
Time Switches	No longer purchased, but some remain in service for off-peak hot water control where audio frequency telegrams are not available. As opportunities arise, the replacement of time switches with receivers, or electronic meters with internal time clocks is underway.
Type 1-6 Metering	As described in Schedule 7.2 of the NER. The type relates to the method of reading the meters, the energy usage per annum, and the required accuracy of the metering installation. The meter types are as follows: Types 1 – 4 are remotely read meters where: • Type 1 > 1000 GWh pa energy usage • Type 2 >100<=1000 GWh pa • Type 3 > 750MWh <= 100 GWh pa • Type 4 – >= 100 MWh pa Type 5 LV – Probe LP read and Type 6 – < 750 MWH pa LV (basic) cumulative manually read.
Wholesale metering installations	Includes all HV metering installed at the transmission and distribution asset boundary and used for National Electricity Settlements. Ergon Energy owns and/or has responsibility for instrument transformers at 73 Powerlink-Ergon Energy shared wholesale metering installations. All installations include electronic meters, remote communications facilities and most include check meters as required by the National Electricity Rules (NER) for metering types 1 and 2.

5.2 Acronyms and abbreviations

The following abbreviations and acronyms appear in this plan.

Abbreviation or acronym	Definition
ADMD	After Diversity Maximum Demand
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
CDMA	Code Division Multiple Access
COM	Card Operated Meter
CT	Current Transformer
DAP	Distribution Annual Planning
DSM	Demand Side Management
EDMI	Electronic Design and Manufacturing International (Meter Suppler)
FRC	Full Retail Competition
GSM	Global System for Mobile
HV	High Voltage
kV	kilo Volts
L+G	Landis + Gyr (Meter Supplier)
LED	Light Emitting Diode
LV	Low Voltage
LVCT	Low Voltage Compliance Testing
MAMP	Meter Asset Management Plan
MCMS	Meter Configuration Management System
MDI	Maximum Demand Indicator
MPB	Meter Provider Category B
MTBF	Mean time between failures
MU	Metering Unit
NATA	National Association of Testing Authorities
NER	National Electricity Rules
NMI	National Metering Identifier
NMP	National Metrology Procedure
PQ	Power Quality
QCA	Queensland Competition Authority
RIN	Regulatory Information Notice

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Abbreviation or acronym	Definition
RP	Responsible Person
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control and Data Acquisition
TOU	Time of Use
VT	Voltage Transformer

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

6 Summary of preventive maintenance programs

Preventive maintenance comprises scheduled inspection and maintenance activities. Table 2 shows the scheduling of programed time based activities from the meter asset register and the intervals applied. Any work identified from these preventive maintenance activities can result in asset renewal capital expenditure or a need for corrective maintenance.

The following is a summary of the preventive maintenance programs and inspection intervals for metering. The type of maintenance performed relates to the size of the customer and the meter installation type designation (type 1-6). Determination of the inspection and testing interval for revenue metering is in accordance with Schedule 7.3 of the NER. For PQ and statistical metering, the need to perform either battery replacements or operational checks provides the basis for choosing maintenance intervals. Scheduled maintenance for data collection devices occurs only if they have batteries fitted, e.g. PQ monitors with dial-in event information. Otherwise, corrective maintenance occurs based on the failure to contact a device that is remotely interrogated due to a communications or device failure.

For direct connected revenue metering, a random sample testing program based upon meter make and model is used to assess the condition and performance of the meter families and used to determine the requirement for a corrective maintenance program.

For further details on maintenance programs, refer to the current *Standard for Preventive Maintenance Programs*, an annually reviewed document that details the inspection and maintenance programs that will be conducted during the period detailed.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Table 2 shows the current preventive maintenance program while Table 3 indicates the future programs under consideration.

Table 2 Current preventive maintenance programs

Program Name	Interval or Criteria
HV Meter (Revenue) Maintenance Program	
Inspection and Audit	Every 2.5 years
Meter accuracy tests	Every 5 years
HV Instrument Transformer Accuracy Testing Program	
CT and VT calibration check	Every 10 years
LV Revenue Current Transformer (CT) Metering Maintenance Program	
Inspection, audit and meter accuracy test	Every 5 years
LV Revenue Current Transformer (CT) Maintenance Program	
Inspection, audit and meter accuracy test and CT accuracy test	Every 10 years
HV Meter (Statistical) Maintenance Program	
High voltage statistical metering inspection, audit and meter accuracy checks	Every 10 years
LV Meter (Statistical) Maintenance Program	
LV statistical metering inspection, audit (pole, padmount transformers, After Diversity Maximum Demand (ADMD) metering systems)	Every 10 years
Data Collection Devices Maintenance Program	
Inspection, audit and battery replacement (JR1 recorders, PQ metering, ripple strength monitors)	Every 5 years
Direct Connect Metering Maintenance Program	
Inspection and meter replacement	In accordance with Australian Energy Market Operator (AEMO) and Ergon Energy sampling requirements as detailed in the *Standard for In Service Compliance Testing*.
Receiving Inspection Sample Program	
All meter equipment deliveries	Conduct on receipt of delivery
Ripple and Time Control Device Maintenance Program	
Ripple and Time Control Devices	1000 per year

Table 3 Future preventive maintenance programs for consideration

Program Name	Interval or Criteria
LVCT In-service random Compliance Testing	Random Statistical Family Testing of Low Voltage CTs to replace 100% Test Plan.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Under the current preventive maintenance program, all Low Voltage Current Transformers (LVCT) undergo accuracy testing every 10 Years. Ergon Energy has participated in the Current Transformer Testing Working Group with other meter providers and the Responsible Person (RP) as part of the Australian Energy Regulator (AER) compliance bulletin #6 issued December 2011. This aims to provide LV CT test results to assess the acceptance of an alternate CT test plan based on a family (make and model) statistical sampling plan.

On approval of an alternate testing procedure, Ergon Energy may seek Australian Energy Market Operator's (AEMO)s approval to change its registered 'Meter Asset Management Plan' (MAMP) from the current time based LVCT test plan to an alternative test plan based on statistical sampling.

7 Summary of refurbishment and replacement programs

Ergon Energy undertakes refurbishment practices to return metering equipment assets to stock, for reuse if considered economic to do so.

Table 4 is a summary of the replacement programs currently in progress for metering assets.

The Queensland jurisdictional requirements specified in the National Metrology Procedure (NMP) – Part A determines the new and replacement policy for meters. This requires all new and replacement meters to be interval meters with the capability to upgrade to a type 4 (remote read) metering installation without replacing the meter. This policy applied from the start of Full Retail Competition (FRC)[1] in Queensland, and means all removed electromechanical meters are disposed without the option of refurbishment.

LV CT, ripple receivers, and metering units (MUs) are among the other items scheduled for refurbishment.

For further details on the refurbishment and disposal of metering assets refer to the *Standard for Meter Refurbishment and Disposal* which details the guidelines used to determine which assets will be disposed of and refurbished by Ergon Energy's service provider for return to stock for reuse.

This standard recognises the current replacement practices and the low cost nature of meter assets. Section 8.8.2 provides further details on the replacement framework.

Table 4 Refurbishment and replacement programs

Program name
Wide Bay Ripple type E1/E2 Receiver Replacement Program (refer Section 8.8.2.)
South West Region BAZ Meter Family Replacement Program.(refer Section 8.8.2)
Replace family of failing Enermet type K410/TK410 Meters.
Replace EM1000D Time of Use Meters (replaced by Manufacturer under warranty)

1 FRC – Full retail competition commenced in Queensland on 1 July 2007

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

8 Metering lifecycle plan

8.1 Asset description

The following section provides an overview and description of metering assets used for revenue and non-revenue purposes and provides details of the quantities and age profiles. In general, non-revenue metering fundamentally uses the same devices and technology as revenue metering, with reduced preventive maintenance requirements. Revenue metering is highly regulated by the NER with a primary focus on meter performance and compliance. Non-revenue metering provided for network purposes includes the statistical and PQ meters used for system performance and planning purposes.

The majority of revenue meters are still electro-mechanical meters that date back to the 1940s. Electronic meters with more features and functionality began to emerge in the early 1990s. The early use of electronic meters in Ergon Energy predominately used these meters for special tariffs for large customers with three phase supplies and a requirement for higher accuracy. The introduction of FRC in Queensland in 2007 saw electronic meters with interval data and remote communications capability made mandatory, (as defined in the NMP Part A) and used for all classes of revenue metering.

Metering installations can comprise of a number of components depending on the supply voltage, supply capacity, and tariff requirements. In addition to various meter types, metering components which make up a metering installation can include voltage and current transformers inclusive of metering units, communications devices, and ripple receivers (or time-switches). The revenue meters used in isolated and remote communities include prepayment Card Operated Meters (COM). The maintenance of revenue meters used in isolated and excluded locations is applied on the same basis as meters under the NER.

Ergon Energy has an extensive load control capability introduced in the 1980s, and this provides control load switching of hot water and other appliances under special tariffs that require the installation of an additional meter and separate ripple receiver.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Table 5 lists the quantities and types of meters installed in the network for revenue metering applications as at June 2012-2013 Regulatory Information Notice (RIN) Data.

Table 5 Quantities and type of metering equipment

Asset Class	No of Units
Single phase electromechanical	992,893
Single phase electronic (1 and 2 element)	162,695
Card Operated Meters (1 and 2 element)	4,511
Three phase electromechanical	13,063
Three phase electronic	40,446
LV CT Electronic meters (tier 1+2)[2]	8,920
HV Customer Electronic Meters	293
HV Wholesale Electronic meters (most sites have check meters)[3]	73
Total Meters	1,222,894
Time Switches Est.[4]	10,604
Ripple Receivers	419,187
LV Current Transformers	24,219

Non-revenue power quality monitors

Ergon Energy currently has 1,790 PQ monitors installed on its network, which provides indicative power outage and voltage regulation data on 823 distribution feeders. This covers approximately 67 per cent of the number of feeders in the distribution network. Table 6 details the population of PQ monitors.

Table 6 Population of power quality monitors per region

Region	Number of PQ monitors	Total number of feeders with PQ monitors	Total number of feeders without PQ monitors	Total number of feeders
Far North	202	103	39	142
North Queensland	262	186	175	361
Mackay	173	86	59	145
Capricornia	284	123	70	193
Wide Bay	368	130	32	162
South West	501	195	20	215
Total	**1790**	**823**	**395**	**1218**

[2] Quantity varies due to Market transfers and changes to nominated MP – tier 1 + 2 in DNSP area
[3] Full or partial responsibility for testing assets at 73 metering installations at wholesale metering points.
[4] Estimated numbers remaining in the network

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

While Ergon Energy has 1,218 distribution feeders serving at least one customer from approximately 300 zone substations, there remains a total of 395 distribution feeders which are not monitored for PQ issues. Additional feeders are planned to be monitored for the next regulatory control period.

The equipment used for the PQ monitors are revenue meters i.e. types EDMI Mk6 and Mk10 meters. There are 450 monitors based on the EDMI Mk 6 and 1340 based on the EDMI Mk 10.

There are one hundred high-resolution 'Elspec' PQ meters being installed to monitor the connection agreement performance parameters of high voltage industrial and commercial customers.

Non-revenue statistical metering

Ergon Energy's 'Substation Design Requirements' is to install statistical metering in all new and upgraded major substations with installed capacity > 5 MW's. This includes the installation of metering on each transformer output and transmission feeder. The planning and forecasting groups use data from these statistical meters as a primary data source for loading, utilisation and load growth forecasting, as well as to validate other data from Supervisory Control and Data Acquisition (SCADA) sources that is of a lower quality and reliability.

There is a project proposed for the regulatory control period 2015 to 2020 to install improved statistical metering on sub-transmission feeders. The AER has requested Ergon Energy provide improved accuracy of data for Distribution Annual Planning (DAP) reporting. Preliminary details indicate that more than 150 sub-transmission feeders are without any form of metering data.

A trial of 45 statistical meters installed on both pole and pad-mounted low voltage, domestic distribution transformers in the Townsville area is being used to gauge the value of the data collected from each transformer. This will assist in determining After Diversity Maximum Demand (ADMD) values, voltage regulation, load factor (utilisation), phase balance, and the impacts of customer solar inverter systems. The meters also provide supplementary PQ data for outage reporting and total harmonic distortion. The proposal is to use statistical metering to validate export energy balanced against customers' energy consumption, to detect potential theft and/or metering issues.

All new distribution pad-mount transformers will have statistical meters supplied in place of Maximum Demand Indicators (MDIs) to provide the same information as above. These manually read devices provide a historical record of seasonal demand and energy values, and a list of other values such as voltage, current and phase angles. Statistical meters in pad-mount transformers that do not have communications installed can have data manually downloaded to investigate issues should they arise, i.e. transformer overloading, voltage issues. Remote communications is enabled based on business criteria such as location, size and feeder constraints.

8.2 Asset condition

The following graphs detail age profiles for the major revenue equipment categories.

Figure 1 shows single phase electromechanical and electronic meters.

Figure 2 shows three phase electromechanical and electronic meters.

Figure 3 shows ripple receivers.

Note: the meter and ripple receiver age profiles are based on purchase dates which lag the installation date

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

The age profile data is consistent with the information Ergon Energy provided under the asset category 'Other Assets' for the annual RIN submissions for the asset classes of 'single phase meters, three phase meters, ripple receivers and low voltage current transformers.'

The range of sources used for Ergon Energy's aged asset profile and meter equipment family details include:

- new purchase records collected since Ergon Energy's formation
- historical records from suppliers
- internal purchasing
- field surveys
- asset data collected during fieldwork
- data recorded from disposal records.

Continual refinement and updating of the data set entered into the Meter Asset Register supports ongoing asset management excellence.

Estimation of the current data quality is as follows:

- > 98 % reliable for records since Ergon Energy's formation in 1999
- > 90 %for the period 1980-98
- > 75 % for meter assets older than 1970

The estimated overall data quality is greater than 80 per cent.

Table 7 provides some observations based on the meter equipment age profiles which follow in Figures 1 to 4.

Table 7 Quick observations

Asset	Asset condition observation
Single phase meters	Recent peak in single phase meter quantity due to customer installed solar inverter systems. Large quantity > 50 years old
Three phase meters	Recent peak in three phase meter quantity due to customer installed solar inverter systems to meet net energy flow tariff conditions.
Ripple receivers	Early rollout quantities approaching end-of-life. Recent peak quantity due to North Queensland Harmonisation Project
LV current transformers	Quantities over recent years reflect current transformer replacement program

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

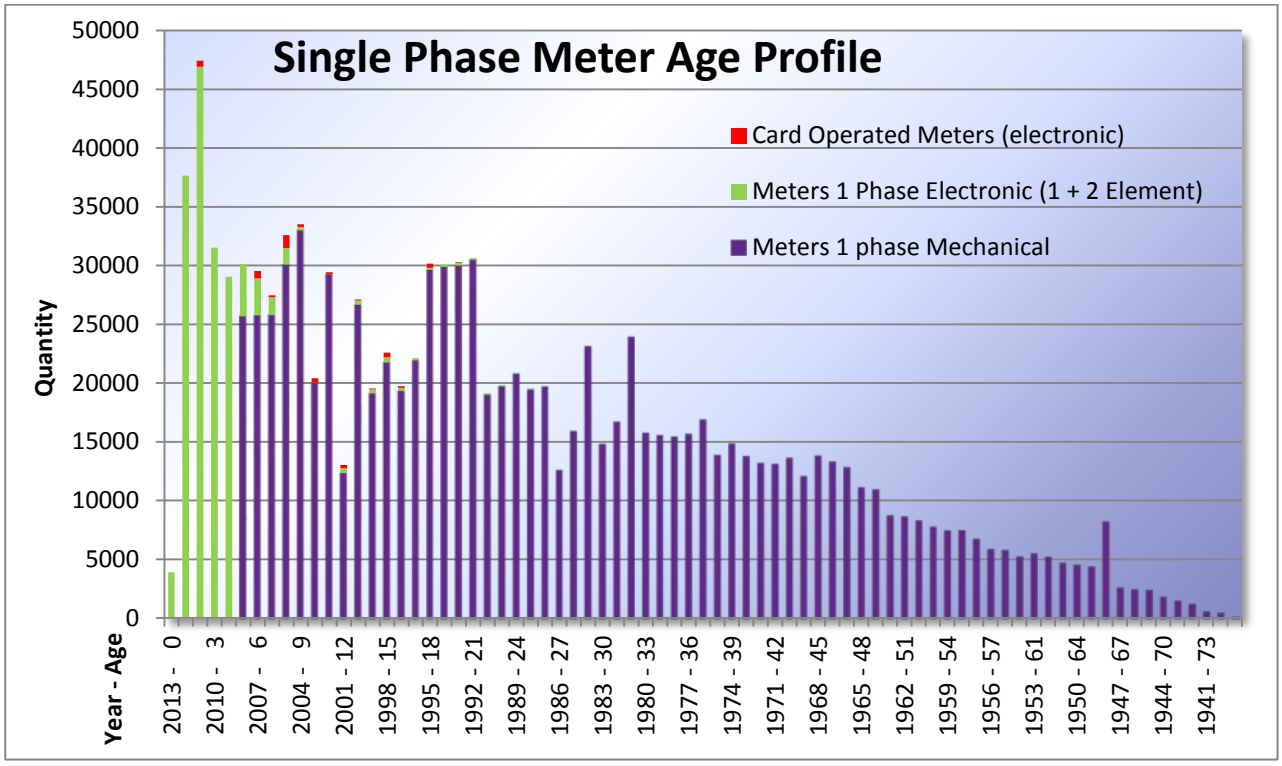

Figure 1 Age profile of single phase electromechanical and electronic meters

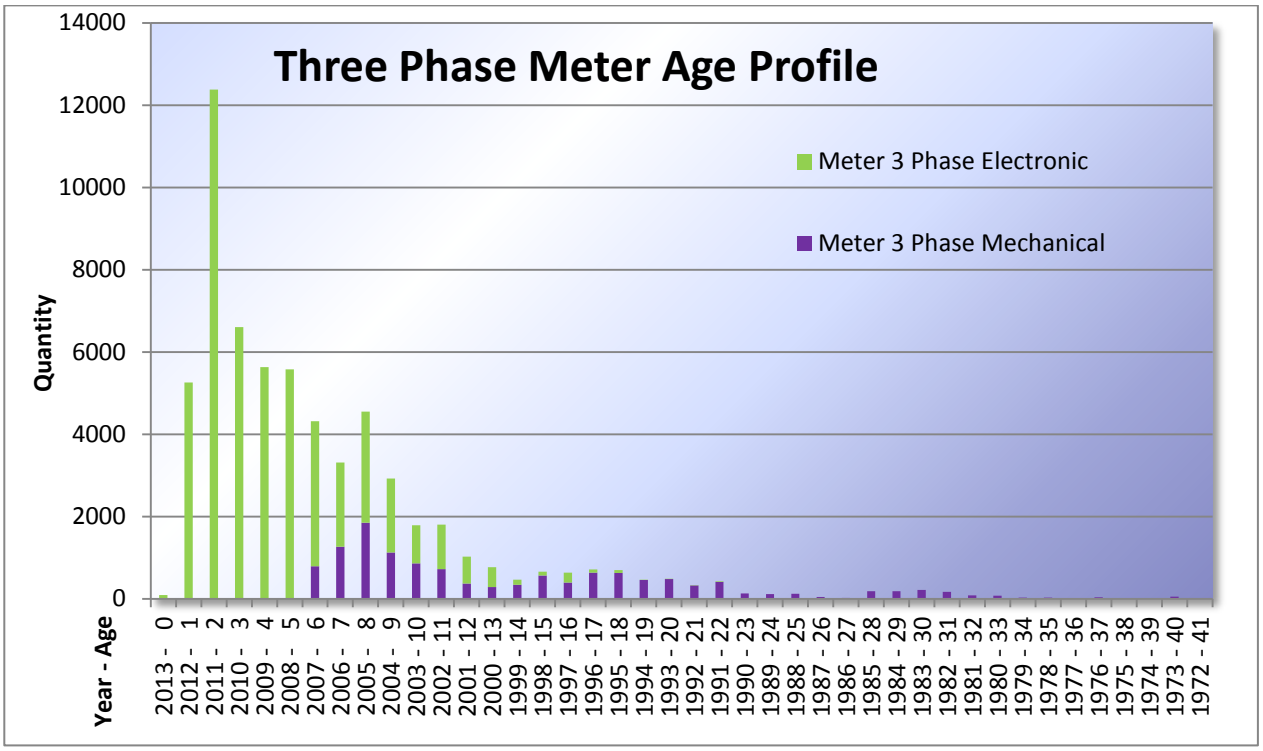

Figure 2 Age profile of three phase electromechanical and electronic meters

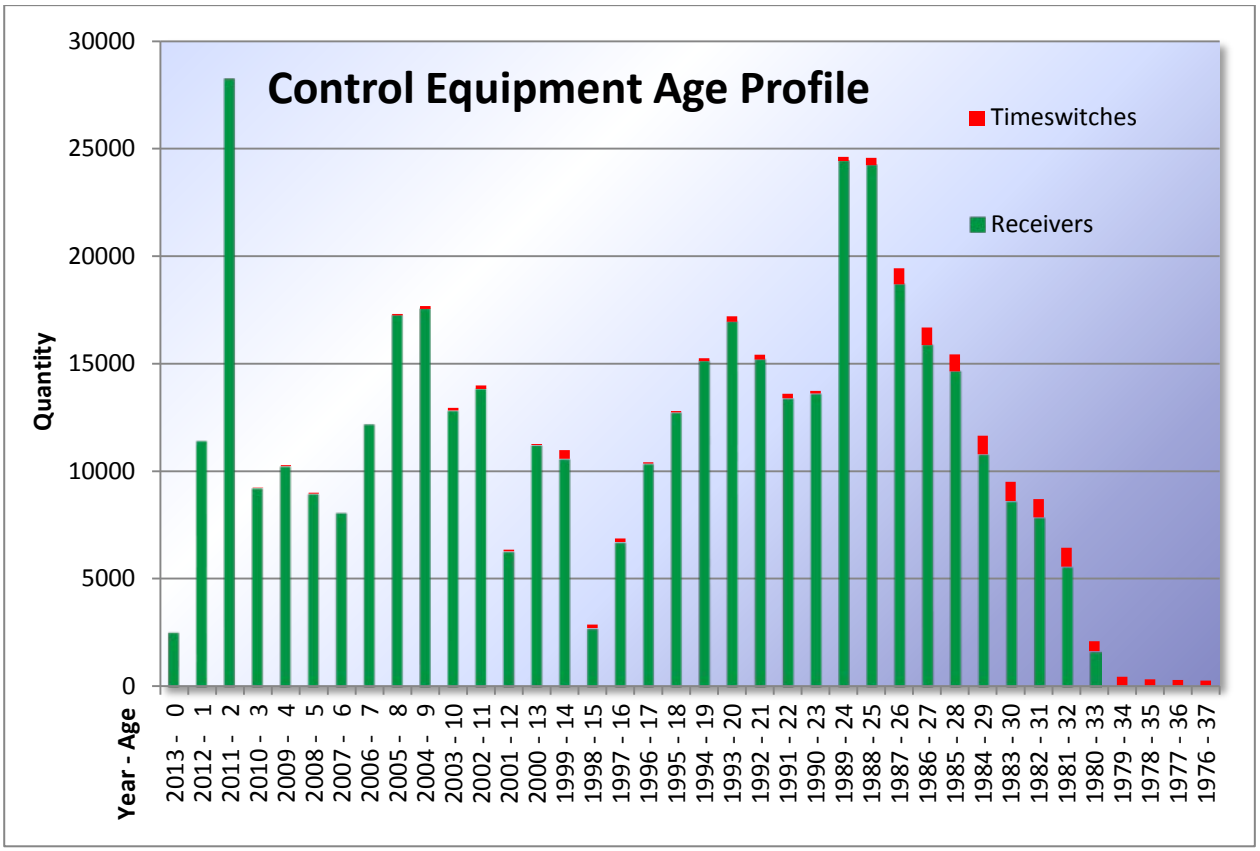

Figure 3 Age profile of ripple receivers and time switches

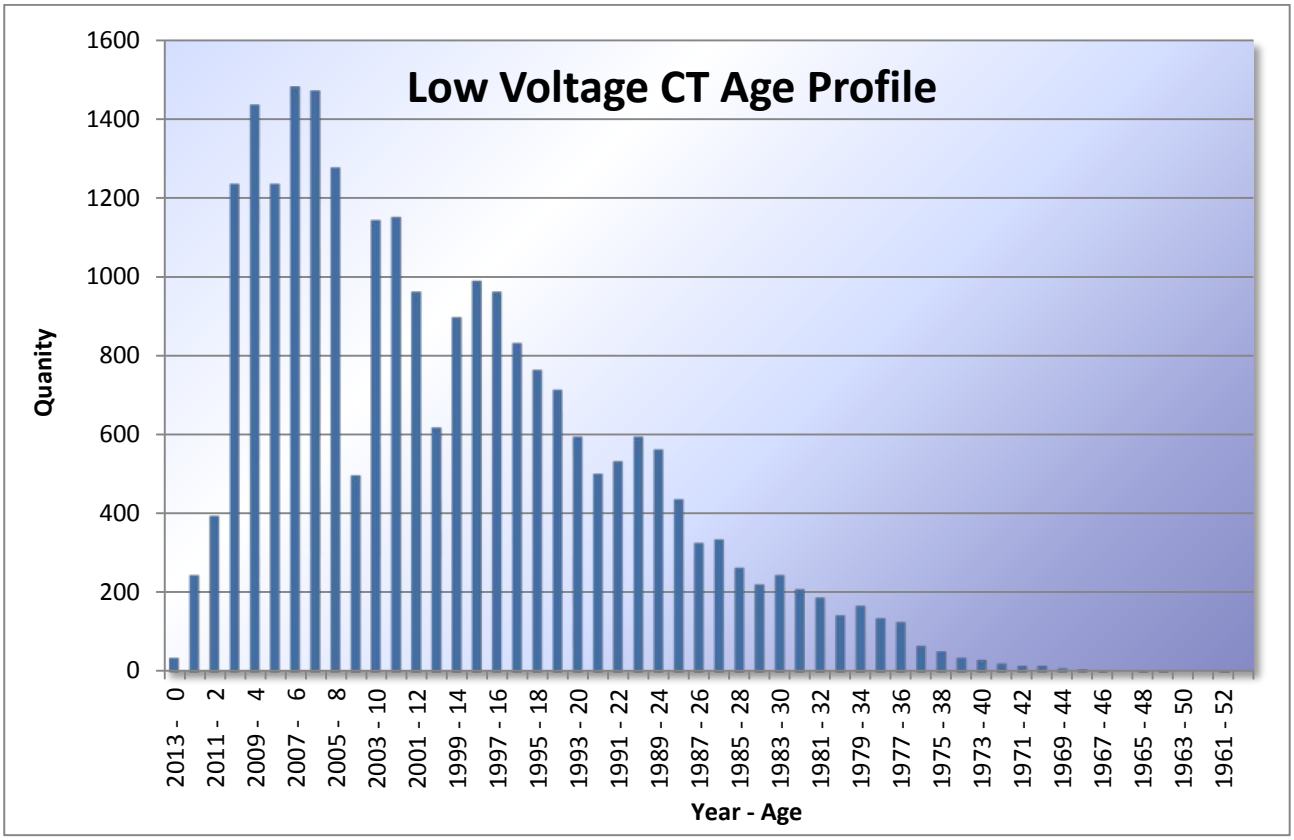

Figure 4 Age profile of low voltage current transformers (three current transformers per site)

8.2.1 Age profile details for power quality monitors

The installation of PQ monitors was delivered in two stages.

Installation of Stage 1 units commenced in mid-2004 and was completed in mid-2006. Stage 1 consisted of approximately 450 PQ monitors.

Stage 2, PQ monitor installation started in April 2009 and was completed in mid-2012. Stage 2 consisted of approximately 1,340 units.

A third stage will commence in the 2015 to 2020 regulatory control period.

8.2.2 Voltage transformers high voltage

For HV metering applications, the periodic scheduled maintenance of Voltage transformers (VT) allows for testing accuracy compliance only. This excludes physical checks on asset condition and oil sampling performed under other asset plans. Voltage transformers are a component of HV type 1 to 3 metering installations and are owned by either the customer or Ergon Energy. The use of status flags, validation checks and meter errors reported in the metering data are used to detect VT failures or blown fuses between routine maintenance periods.

8.2.3 Current transformers - HV, LV and LV clamp-on (statistical)

For HV metering applications, the periodic scheduled maintenance of current transformers (CTs) allows for testing accuracy compliance only. This excludes the physical checks on asset condition and oil sampling performed under other asset plans. CTs are a component of HV type 1 to 3 metering installations and are owned by either the customer or Ergon Energy. The use of status flags, validation checks and meter errors reported in the metering data are used to detect CT failures between routine compliance testing periods. A replacement program of a number of HV CTs on major customers is currently underway due to failed oil sample tests.

Ergon Energy provides CTs for LV installations with loads in excess of 100 Amps per phase. The majority of installations have three CT's per metering installation (one per phase). Periodic scheduled maintenance accuracy testing of these CTs is performed every 10 years. A replacement program over the last 10 years has removed the majority of LV CT's that have bar type CTs or have no nameplate to validate design details (See Figure 4). One hundred percent testing ensures all CT's for revenue applications are compliant and in good condition. The majority of LV CTs are single ratio extended range types.

Clamp-on CTs for overhead transformers are a recent addition used on statistical metering. There has been no assessment of in-service performance made on these.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

8.2.4 Metering units

Metering units (MUs) are a combination of VTs and CTs contained in one three phase unit, and used for HV metering at 11, 22, and 33 kV.

MUs are a component of HV type 1 to 3 metering installations and are owned by either the customer or Ergon Energy. The use of status flags, validation checks and meter errors reported in the metering data are used to detect VT and CT failures between routine compliance testing periods.

Failed and removed MUs undergo an economic assessment to repair, with a view to refurbish and return to service. Each refurbished unit is accuracy tested to ensure compliance and National Association of Testing Authorities (NATA) traceable test results.

8.2.5 Meters (electromechanical/electronic)

Direct Connect – single phase, two-element and three phase

Direct connect meters represent approximately 98 per cent of the total meter population and comprises a mix of electromechanical and electronic meters in various configurations. Due to the large population of direct connect meters; the asset condition is assessed using random sample in-service compliance testing based on make, model and age. Electromechanical meters were installed from the 1920s to 2009 with the quantity of aged electromechanical meters growing faster than meter replacements.

The meters most at risk of non-compliance includes all jewel bearing meters supplied up to 1963. Magnetic bearing meters were supplied after 1963 and generally these are performing well, with the exception of the Warburton Franki makes from 1963 to 1977. A major in-service compliance testing program is scheduled for 2014-15 to shape the Metering Management Plan for future years. This program will be supported with ‘as found’ laboratory testing trends of removed meters, and customer requested meter tests.

The majority of the electronic meter population has been installed in the last six years. While most electronic meters have superior accuracy, they are more likely to suffer component failure that renders them inoperative. Electronic meters between 10 and 20 years old are exhibiting Light-Emitting Diode (LED) displays that go blank, while capacitors and batteries are components most likely to fail.

Instrument transformer CT‑ three phase meters

Current transformer meters are in good asset condition and subject to 100 per cent accuracy testing every five years. All CT meter sites are targeted for upgrading to electronic meters.

Instrument transformer VT, CT‑ three phase meters

High voltage meters are in good asset condition and subject to 100 per cent accuracy testing every five years. All CT and VT meters are electronic meters. All HV CT meters are electronic meters to maximise the time between tests - refer Table 8 for type 1 and 2 installations.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Card-operated meter

Manufacture of the current prepayment COMs has discontinued and these are no longer supported. Alternate replacement prepayment meter solutions are being investigated and trials have started. These electronic meters operate in a harsh environment, in the hot tropics, and are subject to dirt and insect ingress. The oldest COMs currently installed were purchased in 1995, and Ergon Energy has sent 930 meters returned from service to the UK for asset condition assessment and refurbishment to extend their use until a new solution is selected.

8.2.6 Ripple receivers/time-switches

Ripple receivers are electronic devices installed from the 1980s with the earliest installed units now approaching 30 years old and exhibiting component failure, which renders them inoperative and unable to deliver demand response for network load control. Ripple receivers can fail in an open or closed state, and only those that result in customer cold hot water complaints are changed out. Ripple receivers need further ‘as found’ testing to assess the failure rate by family types. The testing of ripple receivers during the next regulatory control period will form part of the preventative maintenance program. Replacement of aging ripple receivers will need to be assessed on the basis of loss of demand response and network capacity impacts based on cost benefit analysis. Time-switches were installed prior to ripple receivers for off peak hot water control and control of time of use (TOU) energy periods on mechanical two rate meters. A small quantity of time-switches remain in service that were not replaced during the rollout of ripple receivers, or left in service in areas where ripple coverage could not be justified. Time-switches are a mix of mechanical and electronic devices, which are replaced with ripple receivers or electronic meters with built-in time clocks as opportunities arise.

8.2.7 Communications devices

Communications modems installed to read meter information on type 1-4 meter installations and power quality monitors are relatively new and low in volume. Closure of the Code Division Multiple Access (CDMA) network led to the replacement of many of these communications modems. The life span for communications devices are largely determined by technology changes and obsolescence. Current practice is to operate communications devices to failure where corrective maintenance occurs when the meter becomes inaccessible for remote acquisition and data delivery. Installation practice is to perform a daily power reset to prevent communications lockup. Data collection problems have been experienced with the Energy Intellect WIP-3G modems. A manufacturer firmware problem was found to be causing an intermittent lockup, which requires an on-site firmware upgrade to correct the issue.

8.2.8 Non-revenue statistical and power quality meters

Meters for statistical and PQ metering are in good condition. Initiation of corrective maintenance occurs where meters that are remotely interrogated via a communications device, suffer a loss of connectivity and may require replacement of the meter or communications modem. Preventive maintenance is applied where the device has a battery that needs to be replaced on a regular basis.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

8.3 Asset creation

A combination of aged asset replacement, failed-in-service replacement, new customer connections, tariff reforms and customer-requested tariff changes provide the direction for asset creation.

Metering technical specifications have been developed jointly with Energex for the joint tendering of meters aimed to standardise meter types and minimise purchasing costs, therefore reducing the overall lifecycle cost of meters.

All new meters supplied have individual NATA traceable test results and comply with pattern approval requirements.

The lifecycle cost of meters includes the following items:

- energy watts loss
- effect on staff and any developments that may offer a safety improvement
- investment in new tools, training and support equipment
- warranty period offered
- expected annual failure rate in year one and subsequent years
- expected operational life.

Evidence provided by the supplier that is an important aspect of expected failure rates and operational life includes:

- Details of reliability studies including reports and the Mean Time Between Failures (MTBF) calculations, performed on the meter.
- Statistics on reliability obtained from field experience and accelerated life tests with the meter or a model of similar design.
- Details of the atmospheric and operational conditions that enable the determination of reliability.

Ergon Energy plans to implement a Meter Configuration Management System (MCMS) in the regulatory control period 2015 to 2020. The key benefit will be the ability to reconfigure electronic meters on site for tariff upgrades which will eliminate the need for an outage to the customer and workshop refurbishments. The implementation of a MCMS will reduce the overall supply chain costs including:

- standardising products kept in stores
- increasing turnover of standardised meters to reduce time sitting in store
- consolidating stock items which will reduce stock on hand levels
- reducing supplier variations of meters
- reducing variations of meters that field staff carry and install
- removing a large component of refurbishment costs by reconfiguring on site
- maximising in-service life of electronic meters

For further details, refer to the ‘Engineering Report Meter Configuration Management System’.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

8.4 Power quality monitors and analysers

Reclosers in the Ergon Energy network allow the separation of feeders into smaller sections to help improve reliability. Many feeders also have regulators to bring the voltage within the required statutory limits. The sections of the network beyond the regulator are essentially a different feeder for PQ purposes that expands the number of feeders to greater than 1,450. For further details, refer to the 'Power Quality Monitoring Strategy 2012-2020'.

Locations analysis of the current PQ monitors with feeders and feeder components indicates the requirement of approximately 620 additional monitors on the three phase network, and more than 500 monitors on the SWER network, depending on communication coverage. Refer to the '*SWER Network Management Strategy'* for further details. Therefore, for the regulatory control period 2015 to 2020 Ergon Energy will require a further 1350 power quality monitors

The 100 high resolution PQ analysers are being installed on all major customer feeders. Ergon Energy plans to install a further 200 in the next regulatory control period 2015 to 2020

8.5 Known and emerging issues or risks

8.5.1 Policy and regulatory environment

Revenue metering operates in a highly regulated and controlled environment that is subject to many policy and regulatory requirements. Changes to policies and regulations can have a large influence on the metering equipment and work programs. Current influences that could influence the direction and programs detailed for the regulatory control period 2015 to 2020 include:

- A number of items in the Australian Energy Market Commission (AEMC) Power of Choice Reforms paper will affect current metering operations. This includes the ability for retailers and demand side participants to offer competitive metering services to customers, which may result in the removal of meter assets and potentially result in stranded assets, removing access to controlled loads. This could also affect meter replacement programs and sample testing plans.
- Tariff reforms in the form of major changes to network and gazetted tariff structures could result in increased customer requests for meter changes where tariffs target certain customer segments. This may also include the removal of existing obsolete tariffs. The introduction of Solar Bonus Schemes has seen substantial requests for meters to measure these tariffs over the past four years.
- Jurisdictional changes will allow greater retail competition in Ergon Energy's distribution area. This will lead to more market customers and a reduction in regulated preventive maintenance, and transfer to non-regulated services.

8.5.2 Mechanical meters

The age profile for single-phase meters shows a significant population of meters aged greater than 50 years old. The number of meters falling into this category increases each year. The new framework for aged asset meter replacement during the regulatory control period 2015 to 2020 will attempt to address these issues. Refer to section 8.8.2 for further details on this framework.

8.5.3 Non-revenue metering - power quality monitors and statistical metering

Power quality and statistical metering use the same technology as revenue metering, without the regulatory environment applied to revenue meters and substantially relaxed maintenance requirements. The use of external communication networks is likely to cause variations to these assets every seven to ten years, due to changes in technology that make these communications channels obsolete, i.e. the closure of CDMA and Global System for Mobile (GSM) telephone networks.

8.5.4 Meter times

As part of routine meter reading collection by meter readers, they are required to report any type 6 electronic meters displaying clock time drifts outside the required +/- 300 second tolerance. Incorrect time settings can affect the recording of energy usage on customers with TOU tariffs.

This issue is largely attributed to time drift while meters are held in storage prior to installation. A corrective action has been put in place requiring field staff to set the meter time at time of installation to minimise reporting and corrective maintenance actions.

8.5.5 Electronic meters

The introduction of electronic meters with reduced life expectancy, compared to electromechanical meters, will increase meter maintenance and replacement programs in the future. Implemented meter management initiatives will:

- reduce the shelf life of stock to preserve battery life
- reduce stock on hand and increase turnover by purchasing standard generic products programmed in the field.
- maximise the in-service warranty period
- identify and track meters by firmware release so if a problem is detected it can be easily ‘reprogrammed’ or replaced
- reduce the risk and liability associated with the need to replace a large meter population due to inherent firmware or design problems after warranties and contracts expire.

Metering manufacturers cite a life expectancy of 12-15 years for electronic meters compared with a typical mechanical meter’s life expectancy of 25 years plus, although many continue to perform accurately after 40 years.

Expectation is that the increased corrective maintenance experienced for type 1-4 metering associated with large customers will extend to type 5 and 6 meters, as the population and age of these meter types increases.

The increasing penetration of electronic metering will likely increase current meter failure rates from approximately 0.5 per cent to 1.0 per cent. Estimates show that communications equipment, if installed, are likely to cause failures associated with the recovery of meter data, to increase current levels by an additional 1.0-1.5 per cent, resulting in overall corrective maintenance increasing to 2.0 per cent.

The expected operational life of electronic meters is 15 to 18 years compared with 25 to 40 years for the current mechanical meter fleet. This means replacement of the electronic meter fleet will likely occur twice as often.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Introduction of asset inspection sampling at the time of delivery will monitor suppliers' contract compliance to ensure that meters supplied for installation are fit for purpose.

Emerging faults in the current regulatory control period 2010 to 2015 include the failure of displays on electronic meters installed in the 1990s, as well as component failures in early 2000 models.

A systemic design issue affecting the battery carryover has emerged in a population of over 50,000 electronic meters after approximately three years' service that has rendered these meters unsuitable for use as load profile and TOU tariff meters. These meters remain suitable for accumulation metering purposes.

8.6 Asset management approach

Ergon Energy actively manages metering systems using a condition-based and time-based approach, including:

- visual inspection of physical condition
- out of service as-found accuracy testing
- in-service compliance testing
- minor maintenance activities performed for efficiency at time of inspection
- identifying physical defects through inspection and testing for repair or assignment to corrective maintenance activities
- failed assets replaced as part of corrective maintenance
- planned replacement programs for meters.

Ergon Energy actively manages PQ monitors using on-line monitoring, with repair or replacement occurring as part of corrective maintenance.

Expectation is that the introduction of Field Force Automation (FFA) for metering activities during the regulatory control period 2015 to 2020 will provide additional reporting capability. This will be coupled with improvements to meter asset register functionality.

8.7 Operation and maintenance

The operation and maintenance of revenue metering systems for both market and non-market customers are determined in accordance with Schedule 7.3 of the NER and the NMP Part A[5]. Preparation and regular reviews of the MAMP[6] is endorsed by AEMO is in accordance with the NER.

Regular audits by AEMO ensure that Ergon Energy:

- complies with and progresses against the MAMP.
- fulfils our role as the responsible person, in addition to meeting the Service Level Provisions (SLPs) published by AEMO.

[5] Available from AEMO's website: http://www.aemo.com.au/Electricity/Policies-and-Procedures/Metrology-Procedures/NEM-Metrology-Procedure

[6] 'Meter Asset Management Plan' Information Paper available from AEMO's website: http://www.aemo.com.au/Electricity/Retail-and-Metering/Metering-Asset-Management-Plan

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Passing these audits is vital to retaining Ergon Energy's accreditation as a Meter Provider. Funding for these maintenance plans is non-discretionary if Ergon Energy is to retain its accreditation as a Meter Provider.

The reference document 'NA000900R102 – Meter Asset Management Plan' provides additional information. This document describes the metering asset management methodology for Ergon Energy's Electricity Metering Asset Class.

The aim of the MAMP is:

- To guide the decisions, processes and systems used to maximise the technical and operational performance and value of Ergon Energy's meter equipment over the asset lifecycle.
- To ensure Ergon Energy is compliant with the requirements of the regulatory bodies that have jurisdiction over electricity meters installed within its distribution network including:
  - Queensland Competition Authority (QCA)/Australian Energy Regulator (AER)
  - Australian Energy Market Operator (AEMO)
  - National Measurement Institute (NMI)

8.7.1 Power quality monitors

Power quality monitors operate continually, recording data on the power quality parameters as per their setup profile. Mk 6 monitors download data weekly and Mk 10 monitors daily. The data is stored and accessed to provide regular reports on the state of the network. Monitors failing to respond as per the established reporting profile initiate a maintenance request with the Metering Operations group, prompting the dispatch of a new or refurbished monitoring unit to replace the failed one. There is no hardware maintenance performed on power quality monitors in the field.

8.7.2 Preventive maintenance

Performance of the preventive maintenance of revenue metering systems is in accordance with the requirements of the NER and the NMP.

Determination of the MAMP is in accordance with the NER or an alternative testing plan approved by AEMO. The aim of the annually reviewed MAMP document is to provide additional detail regarding the maintenance of the metering fleet. The maintenance program employed by Ergon Energy is in line with the following guidelines and regulatory standards:

- The MAMP is endorsed by AEMO
- Schedule S7.3.2 and S7.3.3 of Chapter 7 of the NER

The preventive maintenance program is dependent on the meter type classification[7]. High voltage installations include routine inspections, as well as periodic testing of assets, to confirm the accuracy of the meter and current and voltage transformers. LVCT installations undergo periodic testing only.

[7] type 1 > 1000 GWh pa energy usage, type 2 >100<=1000 GWh pa, type 3 >=100 GWh pa, type 4 – LV Remote read, type 5 LV – Probe LP read, type 6 – LV cumulative read.

Table 8 and Table 9 detail the guidelines followed to maintain regulatory compliance for metering assets used on the network.

Table 8 Maximum period between metering asset tests

Description	Metering Installation Type				
	Type 1	Type 2	Type 3	Type 4	Type 5 & 6
CT	10 years	10 years	10 years	10 years	10 years
VT	10 years	10 years	10 years		
Burden tests	**When meters are tested or when changes are made**				
CT connected Meter (electronic)	5 years	5 years	5 years	5 years	5 years
CT connected Meter (induction)	2.5 years	2.5 years	5 years	5 years	5 years
Whole-current (Direct Connected Meter)	The testing and inspection requirements must be in accordance with an asset management strategy. Recorded guidelines for the development of the asset management strategy must be in the metrology procedure.				

Table 9 Periods between inspections

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

Programing of preventative maintenance testing of direct connected metering systems is in accordance with an in-service compliance-testing program, based on statistical sampling methodology as documented in the *Standard for In-Service Compliance Testing* document. Direct connected meters do not have any routine maintenance carried out in the field.

Due to the large quantities of direct connected meters in service, it is appropriate to determine the accuracy of a meter family by statistical means. Conducting in-service testing uses a sample size determined by the total meter family population. The sample testing based on *Australian Standard AS1284.13 In-Service Compliance Testing*, used inspection by attributes. This testing is also required for new meter types introduced into service.

A process is being established to conduct Receiving Inspection/Testing Inspection (RITI) of one item per meter delivery and to compare and/or test this item against a checklist of purchase requirements. The RITI inspections and tests are intended to confirm that delivered products are fit for purpose and to prevent issues that may affect installation and cause rework once issued from stock.

Regulatory compliance, including accuracy and retention of accreditation as a metering provider, are the major stimuli for the metering preventive maintenance activities. Periodic and in-situ testing of the metering assets in the field ensures Ergon Energy can maintain a compliant fleet of meter assets, and take corrective actions where non-compliances are identified.

Periodic testing programs target individual meter installations with large volumes of energy and revenue impacts, and Ergon Energy bases corrective actions on the results of these tests. Following analysis of the results of the in-service test sample, Ergon Energy will replace a meter population deemed non-compliant, under an Aged Asset Meter Replacement Program, while compliant meter families will remain in service for a further period before requiring further testing.

A systemic design issue has emerged as detailed in Section 8.5.5, that affects the battery carryover on a population of electronic single-phase meters after approximately three years of service. A warranty replacement program has been undertaken by the supplier to correct this defect at approximately 2000 sites with a dependence on time accuracy for TOU tariffs.

There are no other known current firmware defects that require a field upgrade to electronic meters. However, with the deployment of larger populations of electronic meter equipment, the risk of large-scale meter reprograming to correct firmware errors, or replacement to correct defective components increases significantly. As detailed in Section 8.5.5, some emerging issues may warrant bulk meter replacement if failure rates start to affect corrective maintenance activities.

Ergon Energy has attempted to minimise the risk of meter defects by purchasing mature products, maintaining dialogue with other distribution companies, and by early detection of issues. It is critical that the meter asset register is able to identify the location of meter assets in the event of needing to carry out a bulk replacement program or firmware upgrade.

8.7.3 Non-revenue - power quality monitors

Except for a small population the requirement for routine PQ monitor inspections to replace batteries for dial up reporting capability during power outages is no longer required. In general, the majority of these devices only record voltage. Corrective maintenance of power quality monitors occurs only upon report of failure to communicate with the device. The MV90 and multi-drive head end systems provide information such as meter serial numbers and meter types to confirm the remote communications.

The software associated with PQ devices performs regular system checks on each monitor as part of the regular communication with these devices. The software is also capable of making changes to the recorded parameters of the monitors via the communication process. The Network Monitoring and Processing Group undertake maintenance of any PQ monitor failing to respond or provide data for regular periods.

Failure of a PQ monitor will result in corrective maintenance activity to replace the faulty device to restore operation.

8.7.4 Non-revenue - statistical metering

This metering class is allocated a 10-year preventive maintenance period. These meters measure both voltage and current, and maintenance includes an inspection and confirmation of settings to ensure the data is fit for purpose. Setting errors could result in significant planning and forecasting inaccuracy. Scheduling of corrective maintenance occurs only when the equipment data is inaccessible. Currently, there are 473 statistical meters in service.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

8.7.5 Corrective and forced maintenance

The corrective maintenance provision allows for the correction of defective meter equipment, detected between routine meter reads or preventative maintenance visits. This includes meter failures associated with direct connected meters, ripple receivers, low voltage current transformers, high voltage installations, and communications devices that do not respond for data collection. Corrective maintenance caters for a range of conditions such as damaged equipment, missing seals, signs of theft, meter alarms, and condition flags, including low battery and the meter time clock displaying outside limits. Customer-requested meter tests will be actioned as corrective maintenance if the meter test reveals it does not meet accuracy requirements. Meter readers, retailers, customers, billing enquiries together with validation checks from meter data providers and back office systems initiate reactive maintenance. The current number of meters replaced under corrective maintenance for all causes, equals approximately 0.74 per cent per annum.

The main reasons for corrective maintenance are:

- to ensure maintenance of the metering installation is in a safe condition
- to return the metering installation to a compliant state
- to meet General Service Level (GSL)[8] requirements
- to ensure the capture of data in relation to failed assets enables Ergon Energy to identify hardware issues that may be related to a family of meters
- to meet market retail compliance requirements
- to build customer confidence in the type of service provided to them.

[8] GSL – Guaranteed Service Level – Timeframe to repair or correct a problem that affects a meter installation.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

8.8 Refurbishment and replacement

8.8.1 Refurbishment

All items of metering equipment removed from service require re-verification[9] prior to installation at another location. Meter equipment failing within the supplier warranty period is returned to the supplier for quality assurance investigation and is either repaired or replaced. Meter equipment meeting the guidelines for reuse will undergo retesting where it is economical to do so. Where it is uneconomic to repair, the equipment is disposed of. Further details are contained in Ergon Energy's *Standard for Meter Refurbishment and Disposal*.

Ergon Energy uses electronic interval meters for all metering applications as per *Clause 2.4.18 of the NMP Part A*. In comparison to its total meter population, the population of electronic meters installed on Ergon Energy's network is approximately 17.7 per cent.

Some of the impetuses for replacing meters in the field are:

- customers moving to new tariffs including solar
- tariff reform where the introduction of new tariffs makes some existing tariffs obsolete
- meter equipment damage resulting from storms, floods, accidents
- customer switchboard upgrades and relocation, also additions and alterations
- aged asset meter replacement programs initiated for non-complaint and end-of-life assets
- services removed due to demolitions
- metering equipment failure, e.g. component failures i.e. display battery, etc.
- theft and removed seals
- customer initiated accuracy tests, where the meter fails the test[10]

Ergon Energy's practice of replacing meters for customer requested tariff changes is resulting in the refurbishment of a large proportion of meters. The consequence has been a significant number of usable and recoverable assets, which in most cases had been in service for less than five years, ending up in the meter asset return crates. With a supplier endorsed 15-year life, Ergon Energy can reuse any meters that are able to be refurbished.

The proposed project for the regulatory control period 2015 to 2020 of introducing field meter configuration devices to enable meter tariff programs in electronic meters to be changed without removing the meter from service, will lead to a large reduction in the number of meters being refurbished, and many electronic meters remaining in service for their full life expectancy.

[9] Re-verified includes testing to ensure the meter is operational and still within accuracy specification.
[10] The Meter Laboratory normally quarantines and investigates meters removed for theft, electronic meter failures, and customer tests.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Electronic meters removed from service due to tariff upgrades, or other project related work, may return to service if deemed suitable and compliant with the National Measurement Institute's verification process. Currently the meter families Ergon Energy refurbishes are:

- EM1000 – Single Phase meters
- EM1200 – Two element single phase meters
- MK7A – Two element single phase meters
- MK7C – Single phase meters
- MK10A,– Three phase direct connect meters
- Mk10E – Three phase CT meters
- Card Operated Meters
- Ripple Receivers type RO

Power quality monitors

The repair and/or refurbishment of faulty power quality monitoring units swapped in the field are returned to Ergon Energy for repair. These are refurbished and returned to the stores, to be available for distribution to the field for future replacements.

8.8.2 Replacement

For time-based preventive maintenance at individual meter installations, the replacement of non-compliant meters and associated equipment occurs during on site or return corrective maintenance visits.

For large families of direct connected meters, individual meter equipment testing is impractical, and therefore in-service compliance testing is conducted in accordance with *AS1284.13.* This involves scheduling in-service random sample testing of a quantity of meters based on the size of each meter family population. The tests aim to determine the meter family in-service compliance extension period, or if the meter family is non-compliant and will require replacement.

Figure 5 shows a framework for the Aged Asset Meter Replacement Program for the regulatory control period 2015 to 2020 developed and cognisant of the following:

- *Standard for In-Service Compliance Testing*
- *Standard for End of Life Meter Assets*
- *Standard for Obsolete Metering Equipment*

This framework aims to provide a works program that provides funding to replace meter families deemed to be non-compliant. Replacing these meters is non-discretionary and it is required to meet regulatory obligations under the MAMP. Non-compliant meter families receive the highest priority for replacement programmes.

This replacement framework also targets the growing population of meters that meet the definition of end-of-life assets. Programing end-of-life meters approaching non-compliance for replacement allows these to be removed during non-complaint meter replacement. Equally, replacement of these meters can be delayed if; compliance testing unexpectedly determines non-compliant meter families with a higher priority.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

The obsolete meter provision supports both the non-compliance and/or end-of-life meter replacement programs, by providing funding to rearrange difficult meter installations, remove obsolete or redundant meter equipment, and address future maintenance issues that would be more expensive to replace under a corrective maintenance site visit by field technicians. This provision improves the efficiency of targeted replacement meter programs, by addressing additional maintenance issues during a single site visit, and planned customer power outage.

In summary, the framework aims to fund a works program that provides:

- priority one - the replacement of meters deemed as 'non-compliant meters'
- priority two - the replacement of meters deemed as end-of-life.

With provision for replacement of obsolete meters and equipment while on site performing targeted meter replacement associated with priority one and two work.

The 'SWER Network Management Strategy' details this framework.

A brief description of each standard is provided in the commentary below.

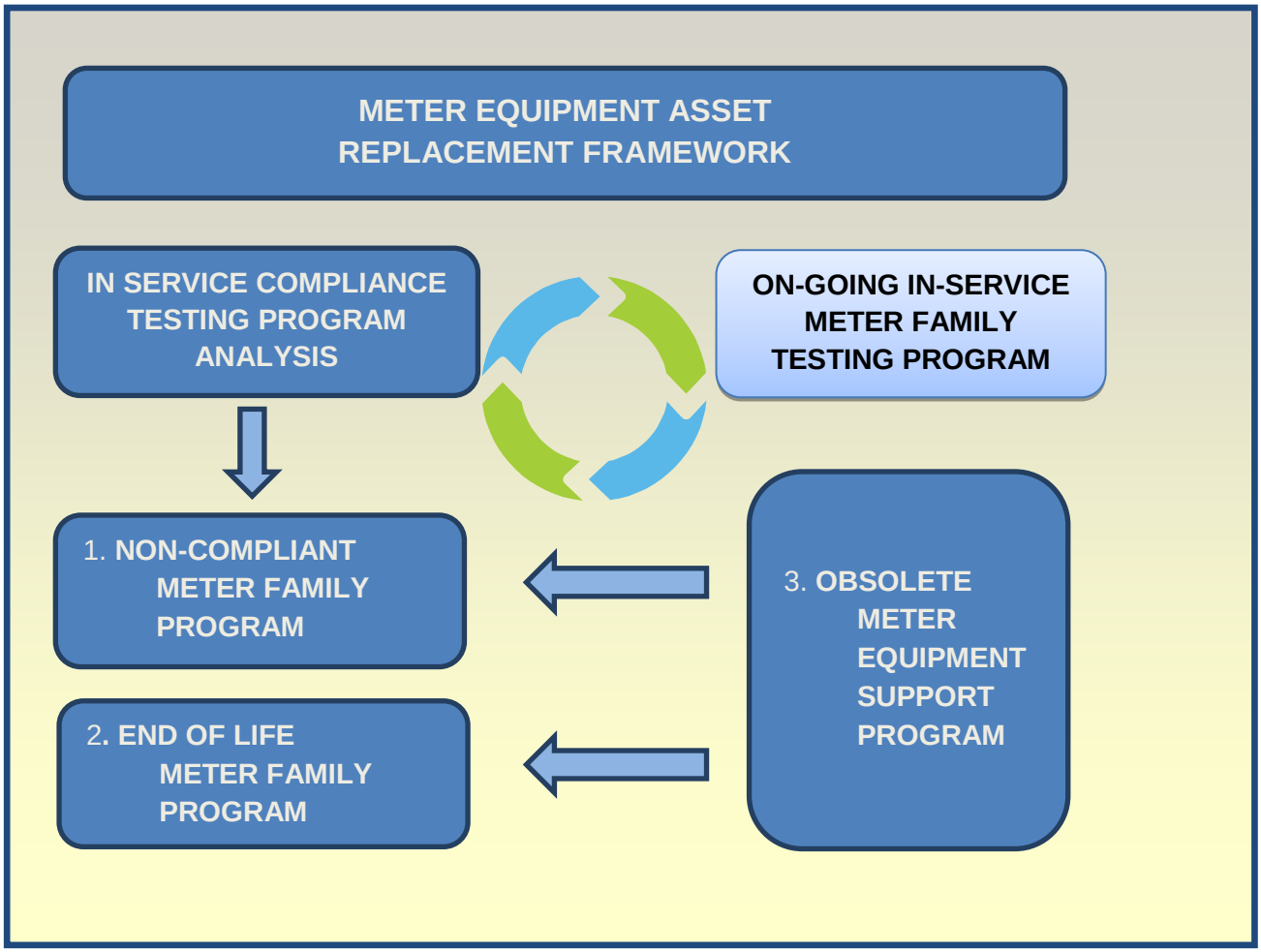

Figure 5 Meter replacement framework

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Non-compliant meter families

The *Standard for In-Service Compliance Testing* outlines the guidelines used for the application of *Australian Standard AS 1284.13*.

The analysis of the test results collected from the in-service compliance testing is used in determining if a meter family's performance is at an acceptable level and able to remain in service for an extended period before requiring additional testing, or if the meter family is non-compliant and requires replacement. For large meter families deemed non-compliant, stratification of the population may limit the aged asset replacement cost.

End-of-Life meter standard

The principals of the 'AER REPLEX Replacement Model handbook' provide the basis for the *'Standard for End of Life Meter Assets'*. Classification of metering equipment as end-of-life occurs when they are twice their recommended economic life and display characteristics of failure. Table 10 shows the quantity of meter assets aged greater than twice their economic life during the next regulatory control period 2015 to 2020.

For electro-mechanical metering equipment, the typical economic life is 25 years and for electronic metering equipment it is 15 years. For the regulatory control period 2015 to 2020 a major end-of-life replacement program will target a total of 119,377 meters older than 1963. This arises from a significant meter design change that occurred in 1963 when meters changed from jewel bearing to magnetic bearing suspension. The pre-1963 design meters appear to be more prone to showing signs of failure. The total end-of-life quantity includes 73,596 non-compliant type BAZ Meters.

Table 10 Meter assets aged greater than twice their economic life during the regulatory control period 2015 to 2020[11]

Meter Type	Year					
	2015	2016	2017	2018	2019	2020
Electro-mechanical Meters > 50 years old	141,502	154,356	167,678	181,521	193,616	207,272
Electronic Meters >30 years old	0	0	16	57	108	181
Ripple Receivers > 30 years old	49,064	64,922	83,612	107,846	132,269	145,876

[11] Based on 2013 RIN data

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Obsolete Metering Standard

The aim of the *Standard for Obsolete Metering Equipment* is to support targeted replacement of non-compliant and end-of-life aged meter equipment, to provide a contingency to fund changes not directly associated with the replacement of a targeted meter. Metering equipment meeting any of the following criteria may be classified as 'Obsolete':

- The end-of-life asset category does not cover the metering equipment and it is less than twice its depreciated life span, which is 50 years for electromechanical meters[12], and less than 30 years for electronic equipment
- The meter vendor no longer supports the metering asset and requires removal to facilitate any targeted asset replacement programs. This could include items that corrective maintenance identified as having a high failure rate, or where only a small quantity remains in service and this provides an opportunity to remove a meter family for asset management excellence. Otherwise the item is redundant due to changed:
  - tariff applications
  - installation standards
  - equipment choices
  - technology.
- Metering assets needing replacement or removal to accommodate any targeted asset replacement[13] program. Examples include:
  - removal of obsolete ripple receivers switching electromechanical meters for TOU tariffs when electronic meters are installed
  - other meters that need to be removed to allow three phase meter installation
  - rearrangement of customer switchgear to allow sufficient space to mount new equipment

BAZ meter family replacement program

Following in-situ testing completed in the financial year 2009-10, the EMMCO Model BAZ meters in the South West region failed the testing criteria under AS 1284.13 making them non-compliant and in need of replacement. In-situ testing aligns with the MAMP for replacement of meter families that fail testing. Project approval and work has commenced to replace the BAZ meters currently installed at approximately 12,377 sites in the South West region in the current regulatory control period 2010 to 2015.

[12] This is twice the asset's depreciated life.
[13] Targeted meter equipment – an item that is being targeted as' non-compliant' or end-of-life.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Ripple receiver replacement program

A recommended work request details the replacement of approximately 12,000 failing Email Ltd Model E1 and E2 ripple receivers used to switch controllable loads, such as hot water systems for load reductions at time of peak system loads. This project will also commence in the current regulatory control period 2010 to 2015, and it is an important part of Ergon Energy's demand reduction strategy.

These receivers are the oldest installed on the Ergon Energy network and date from 1981 to 1987. This targeted work plan provides the opportunity to incorporate the replacement of approximately 5,000 end-of-life meters to maximise the efficiency and effectiveness of the site visits.

8.9 Disposal

All meter equipment assets and PQ monitors removed from the network are collected into repair bins and returned to an external service provider for recording, sorting, and potentially refurbishment or disposal. This is in accordance with the *Standard for Meter Refurbishment and Disposal*. With it no longer possible to install electromechanical meters, Ergon Energy disposes of these meters, irrespective of their age. Ergon Energy's refurbishment service provider sub-contracts meter equipment asset disposal to Sims Metal Management, an accredited metal and electronics recycling company.

8.10 Strategic spares

Ergon Energy holds in stock strategic spares for the metering asset category to meet installation demands. Control of the stock items is by minimum maximum order levels across Ergon Energy's five main stores locations, with each of the 80 depot locations holding small quantities in stock. Our supplier contracts require that each stock item have buffer stocks held to meet short delivery timeframes. Ergon Energy tracks stock levels for critical items on a weekly basis, and can arrange inter-store stock transfers to meet higher demands in a specific area. The option also exists to reconfigure meters in one stock code to meet demand in another.

As part of the summer preparedness plan, higher stock levels are held during supplier Christmas shutdown periods and during the storm season to enable Ergon Energy to cope with unexpected flooding and cyclone events.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802