

Energex Meter Asset Management Plan

October 2018



EXECUTIVE SUMMARY

This Metering Asset Management Plan (MAMP) is an updated version of the 2014/15 MAMP approved by AEMO. This plan has been prepared in line with Energex's vision to become a customer centric organisation by providing accurate energy consumption information for all its customers. One of the goals of this MAMP is to maximise our metering asset economic life without compromising accuracy. This MAMP outlines how Energex will meet the Energex MC Meter Asset Management Strategy (MAMS).

This MAMP covers the asset management of all metering equipment at metering installations for which Energex is the nominated Local Network Service Provider (LNSP), Responsible Person (MC) and Metering Provider (MPB). Energex Limited participant IDs are as follows:

- LNSP/MC = ENERGEXP
- MPB = EGXLTDMP

This MAMP provides an alternative non time based maintenance and inspection strategy for meters and low voltage current transformers as specified in S7.6.1 of the *Rules* and hence is submitted for the approval of Australian Energy Market Operator (AEMO) in accordance with clause S7.6.1 of the *Rules*. The alternative strategy is based on:

- For meters - AS 1284.13 Electricity Metering Part 13 In service compliance testing.
- For low voltage current transformers – AEMO document Alternative Testing Minimum Requirements: Low Voltage Current Transformer Metering Installations.

The remaining two Type 6 high voltage metering installations Energex is responsible for will be maintained as per the *Rules*. Energex as the LNSP provides HV metering instrument transformers to customers and recovers the asset costs through network charges. Energex will arrange for the testing and inspection of these metering instrument transformers as part of their Network Asset Management Plan. Energex as the LNSP has historically provided LV metering instrument transformers to customers, and will continue to recover the asset costs through network charges. This document outlines the inspection and maintenance strategy that will be applied to these assets.

There is an established process of investigating faults, conducting site inspections and regularly auditing different aspects of metering installations and processes, in addition to the sample testing of our meters. This MAMP also covers the procedure to be used where sample testing of an equipment population indicates a population failure.

As asset process owners we confirm that there are sufficient funds allocated for metering equipment; inspection, testing and replacement where necessary, as detailed in this MAMP and we submit this in accordance with the Rules for your approval.

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1.0 PURPOSE AND SCOPE

This document describes the Metering Asset Management methodology for Energex Electricity Metering Asset Classes. This document has been developed to:

1. Meet the Energex MC Meter Asset Management Strategy (MAMS).
2. Guide the decisions, processes and systems that are used in maximising the technical and operational performance of Energex's metering assets over the assets' lifecycle.
3. Ensure compliance with the requirements of the regulatory bodies that have jurisdiction over electricity metering installed within Energex's distribution network including:
 - Queensland Competition Authority [QCA] / Australian Energy Regulator [AER]
 - Australian Energy Market Operator [AEMO]
 - National Measurement Institute [NMI]

2.0 ASSET MANAGEMENT PLAN PURPOSE

The purpose of this Plan is to set out the organisation's approach to the effective asset management of its metering portfolio for the period of 2019 to 2023. This plan is based on a five year cycle and as such will restart in 2023. The Plan will guide the organisation's asset management and maintenance activities, and will also be provided to appropriate external stakeholders e.g. funders and regulators to satisfy their requirements.

3.0 ENERGEX ASSET MANAGEMENT STRATEGY

This plan is a key document that links corporate objectives to asset management strategies to be operationalised within the business (Figure 1). It has been guided in its development by an assessment of business goals and a view of the key drivers of change impacting asset management.

Strategic Planning in Asset Management

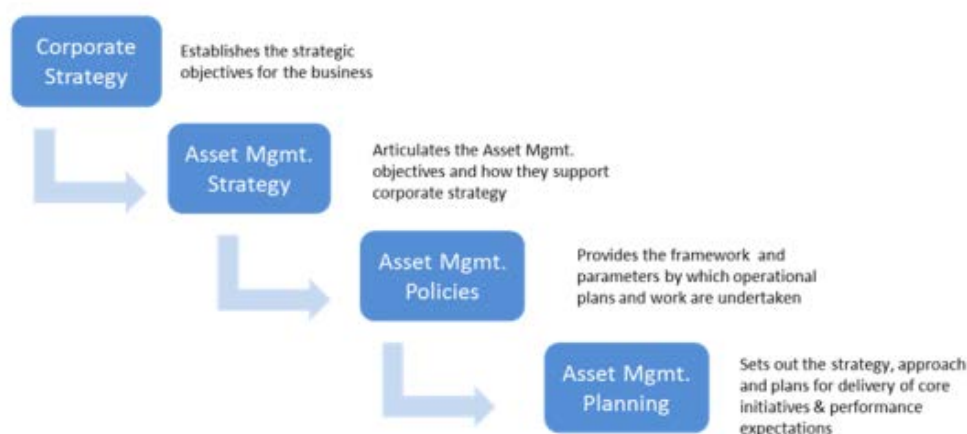


Figure 1: Strategy Planning Process

The Australian electricity market continues to evolve at a rapid pace. Significant increases in the price of electricity in recent times have prompted greater policy and regulatory focus from governments and regulators. Customers are actively identifying ways to reduce their electricity bills. These have included an increased uptake of distributed energy resources such as solar photovoltaic (PV), smart appliances and changes in the way they use energy. This changing

landscape will continue to have implications for all energy market participants. The key issues over the next five to ten years include:

- Technology advances - Continued uptake by customers of alternate energy sources is likely as financial viability improves (e.g. cheaper battery storage and PV panels). This will continue to drive reductions in network owned metering assets.
- Changing customer preferences - As technologies continue to advance, customer behaviours and values are also shifting. Customers are more mobile, more social and more connected which means they are better informed than ever before. Within this context, energy retailers are challenged to reinvent metering services and find innovative means to engage customers. Providers need to tap into social, mobile and local channels to deliver tailored experiences and a more personalised service to customers.
- Regulatory model - Ongoing evolution of the national regulatory environment continues to focus on productivity, economic efficiency, revenue models, customer engagement and service standards. Current and future regulatory changes such as the Power of Choice (POC) have imposed limitation on how the Distribution businesses interact with assets installed post commencement of POC.

4.0 ASSET MANAGEMENT COMMITMENT

The external landscape and electricity industry in which Energex operates continues to evolve at a rapid pace. Energex continues to renew and implement strategies and plans to deliver sustainable business and customer outcomes in response to this change. A set of key drivers is influencing the future direction of asset management within Energex. These drivers include:

- Safety, legislative and regulatory obligations
- Customer and stakeholder expectations
- Technology (customer and network)
- Aging asset base (asset renewal)
- Information systems and data requirements
- Asset management practice
- Workforce capability.

Energex is faced with the challenge of monitoring and maintaining its asset base. Many of Energex's assets were constructed during the 1960s through to the 1980s as a result of growth in south east Queensland. Many of these modern assets are now becoming obsolete and will also require replacement in the same time frame.

To address this challenge, Energex will need to continue to optimise the investment in its existing assets to maintain them to policies and standards and to maintain a level of network performance that complies with network performance obligations. Improving business efficiency through greater optimisation of asset life cycle management will be reliant on improved asset information and decision making.

5.0 DEFINITIONS, ABBREVIATIONS AND ACRONYMS

AMP	Asset Management Plan
CT	Current transformer
EQL	Energy Queensland Limited
FRC	Full Retail Contestability
FRMP	Financial Responsible Market Participant
HV CT	High Voltage Current Transformer
LNSP	Local Network Service Provider
LR	Local Retailer
MAMP	Metering Asset Management Plan
MAMS	Meter Asset Management Strategy
MDP	Meter Data Provider
MPA	Meter Provider category A
MPB	Meter Provider category B
NER	National Electricity Rules
NEM	National Electricity Market
NATA	National Association of Testing Authorities
AEMO	National Electricity Market management Company
ROLR	Retailer of Last Resort
MC	Metering Coordinator
VT	Voltage Transformer

6.0 ASSET AND TEST STRATEGY

6.1 HV VOLTAGE TRANSFORMERS

High voltage voltage transformer shall be tested in accordance with Schedule 7.6 of the NER i.e. Tests is to be completed on a routine test period of 10 yearly basis (Subject to reasonable endeavours to negotiate and arrange outages with customers to gain access to the metering VT's.)

6.1.1 TYPE OF TEST

Voltage transformers will be primary injection tested as per Schedule 7.6 of the NER. Should VT secondary injection be approved for use on single phase VT's then Energex will adopt this form of testing due to the potential cost savings in the near future.

6.1.2 PERIOD AND TEST VOLUMES PER YEAR

High voltage instrument transformer maintenance is to be scheduled from the Works Management System (Ellipse) via the Maintenance Schedule Task (MST) activities based on the following time frame:

- 10 yearly compliance testing on the VT accuracy performance

6.2 HV CURRENT TRANSFORMERS

High voltage current transformer shall be tested in accordance with Schedule 7.6 of the NER i.e. Tests are to be completed on a routine test period of 10 yearly basis (Subject to reasonable endeavours to negotiate and arrange outages with customers to gain access to the metering CT's.)

6.2.1 TYPE OF TEST

The current transformers are to be tested by either of the following methods whichever is deemed the easiest and safest method to test. This will be influenced by access to the primary conductors.

- Primary injection testing as per Schedule 7.6 of the NER will be the test process to be used in all instances but;
- Secondary injection testing can be utilised if there are safety issues accessing the CT's under test whereby the approved secondary injection test process may be used. Secondary injection testing is only to be performed if the primary injection testing cannot be performed.

6.2.2 PERIOD AND TEST VOLUMES PER YEAR

High voltage instrument transformer maintenance tasks will be scheduled from the Works Management System (Ellipse) via Maintenance Schedule Task (MST) activities based on the following time frames:

- 10 yearly compliance testing on the CT accuracy performance.

6.3 TYPE 6 HV ENERGY METERS

Energex will continue to maintain and operate a small number of Type 6 HV metering installations.

6.3.1 TYPE OF TEST

For type 6 HV metering installations, direct injection testing is to be performed on the meter at the point of installation. The meter is to be tested against the class accuracy requirements as per the applicable Australian Standard. Table 1 and Table 2 below shows the test points used for active energy and reactive energy respectively.

Table 1 Accuracy Limits – Active Energy (Watts)

Power Factor (lag)	100% Full Load	50% Full Load	10% Full Load
1.0			
0.866			
0.5	N/A		N/A

Table 2 Accuracy Limits – Reactive Energy (Vars)

Power Factor (lag)	100% Full Load	50% Full Load	10% Full Load
0			
0.866			
0.5	N/A		N/A

6.3.2 PERIOD AND TEST VOLUMES PER YEAR

All high voltage and wholesale metering installations that are type 6 where Energex is the responsible MP shall have the maintenance activities shown below managed directly by the Metering Compliance Manager.

- Inspection on the asset when the meter is tested
- 5 Yearly meter compliance accuracy testing to be performed

6.4 LV CURRENT TRANSFORMERS

Energex as the LNSP is currently responsible for LV CTs installed on Type 6 installations. Energex will provide maintenance and testing services for these assets with the cost for this service is to be recovered through metering services charges.

For LV CT's purchased and installed after the 1st July 2015 the market reclassification of metering services for these assets as an alternative control service (ACS), made it mandatory for the customer to pay an up-front cost for these assets, whereby making them responsible for the costs of any future asset replacement for these installations. Where Energex is the nominated MP in the market till the installation churns to other market MP's, Energex will continue to arrange for the testing and inspection of these instrument transformers.

6.4.1 TYPE OF TEST

Secondary injection testing will be utilised for testing all LV CTs. The accuracy limits to be used are shown below in Table 3. An enhanced site inspection is also to be performed on every LV CT site in the 5 year period.

Table 3 Limits of LV CT error for Compliance

Test Point Name	% Rated Current	Error at 25% Rated Burden	
		Ratio Error Limit (%)	Phase Displacement Error Limit (Minutes)
Energex MAMP	5	±1.5	±90
	20	±0.75	±45
	100	±0.5	±30
	Extended Range (Whatever it may be)	±0.5	±30

6.4.2 PERIOD AND TEST VOLUMES PER YEAR

The number of LV CT's to be tested per year will depend on the population size that the Distribution business is accountable at the period the test sample is being created. Sample testing of the LV CT's will be performed on a 5 yearly basis as per "AEMO document *Alternative Testing Minimum Requirements: Low Voltage Current Transformer Metering Installations*". A draft works plan for the period is shown in Section 10.

6.5 TYPE 6 LV ENERGY METERS

For type 6 metering installation, direct injection testing is to be performed on the meter at the point of installation where possible. Meters shall be tested at the test points specified in Table 4 below. The test points are to be supplemented with other test requirements as per the requirements of AS1284.13.

The test result criteria, for each meter type listed below is reflective to demonstrate the intention of the rules according to Table S7.4.3.1 (maximum allowable error for Type 6 metering installations).

The variation in error criteria is shown in Table 5 below.

Table 4 Tests and Test Points for Meters

Meter Type	Light Load	Full Load 1	Full Load 2	Full Load 3	Creep Test	Register Test
Direct Connected 1 Phase	0.1Ib Unity PF	Ib Unity PF	-	-	√ (mechanical meters only)	√ (for dual rate meters, both registers are tested)
Direct Connected Polyphase	0.1Ib Unity PF	Ib Unity PF	Ib 0.5 Lagging PF	-		
CT Operated	0.05Ib Unity PF	Ib Unity PF	Ib 0.5 Lagging PF	2Ib or I _{max} Whichever is lesser		

Table 5 Required Accuracy Class and Error Limit for meters

Meter Type	Required Accuracy Class	Class Error	Site Error Limit	Rules Meter Error Limit	Chosen Meter Error Limit
Direct Connected	General Purpose	1.5	±2.0	±1.5	*±2.0
CT Connected	(0.5, 1.0 or 1.5) Meter & 0.5 CT	(0.5, 1.0 or 1.5) Meter + 0.5 CT	±2.0	±1.5	Tested at Class

*All of the site error for a direct connected installation is within the meter.

6.5.1 PERIOD AND TEST VOLUMES PER YEAR

The number of LV energy meters to be tested per year will depend on the population size that Energex is accountable at the period the test sample is being created. Sample testing of the LV energy meters will be performed as per AS1284. A draft works plan for the period is shown in Section 10.

6.6 OVERALL ERROR CALCULATIONS

For all High Voltage Metering installations, the overall error calculations will be performed for each metering installation based on the individual CT, VT and Meter accuracy test certificates.

For Low Voltage Current Transformer installations, Energex installs Class 0.5 Low Voltage Current Transformers and Class 1.0 Meters which in practise ensures the overall error meets the requirements of Chapter 7 of the National Electricity Rules. For legacy Class 1.5 LV CT connected meters, the Metering Compliance Manager will review high error sites to determine if overall error calculations are required.

6.7 TEST EQUIPMENT MEASUREMENT UNCERTAINTY & CALIBRATION

To maintain NATA accreditation and ensure data accuracy in the fields of electrical measurement and for site inspections, EQL laboratories maintain test equipment registers and calibration schedules to ensure that:

- Calibration is maintained at frequencies as specified by NATA
- Measurement uncertainties of equipment are maintained to meet the minimum levels of uncertainty specified in the scope of accreditation in line with Table S7.6.1.1 of the Rules.

7.0 EQUIPMENT FAILURES AND NER NON-COMPLIANCES

This section summarises the actions to be taken to rectify equipment failures or NER non-compliances.

Where failure of individual items of equipment is identified through routine progressive monitoring, site inspections, contractor monitoring audits or site investigation visits, a meter fault notification will be raised at the time of the visit or within the timeframes specified in AEMO service level procedures.

Where a failure or Rule non-compliance is deemed critical in that the quality of data delivered to the market is affected or the safety of an installation is jeopardised, all relevant parties shall be advised as quickly as possible. This may include the customer, retailer, MC, LNSP, regulator and/or AEMO.

Where sample testing analysis indicates an equipment population failure, corrective action will be taken as outlined in Section 8 "Equipment Population Failures".

In certain circumstances it may not be possible to replace the equipment in the immediate short term. This may be because of reasons such as:

- Catastrophic failure of equipment in service with possible damage to other parts of the installation
- The lack of availability of replacement equipment e.g. high voltage current and voltage transformers
- The difficulty of gaining access to a site
- The economic viability of customers to sustain a loss of supply

Energex will liaise and negotiate with all relevant stakeholders (customers, retailers, MC, networks, contractors, equipment suppliers, AEMO) in an effort to rectify the issues as quickly as possible.

Where the timeframes specified in service level agreements are clearly going to be exceeded, Distribution Metering will advise the Metering Coordinator and, in conjunction with relevant stakeholders, arrange for the submission of an exemption to AEMO and prepare a rectification or fault repair plan in accordance with AEMO's Exemption Procedure. The rectification or fault repair plan would include some or all of the following:

- A description of the issues and their level of criticality
- The impact on the availability and level of accuracy of metering data
- The general process necessary to rectify the issues and replace equipment
- The resources to be used and the parties involved
- The estimated timescale for rectification dependent on such things as the nature and criticality of the equipment failure, the availability of replacement equipment, the length of outage required and the availability of access
- Possible temporary arrangements for alternate metering or meter data estimation until rectification is completed

- The estimated cost of equipment replacement where relevant to the Metering Coordinator. (This may be outside the responsibility of Energex)
- The relevant parties responsible for taking action throughout the rectification process
- The parties responsible financially for the equipment replacement

The rectification or fault repair plan will be submitted to all relevant parties for endorsement and action. This will include submission to AEMO for possible negotiation over proposed details and endorsement.

8.0 EQUIPMENT POPULATION FAILURES

8.1 INITIAL INVESTIGATION STAGE

Where sample testing of equipment populations indicates a population failure, Distribution Metering will review the sample results and the population details and will develop an investigation plan to determine a breakdown into sub populations generally by year of manufacture and possibly down one further level by delivery batch if appropriate. The investigation plan will identify:

- The additional sample numbers required to cover all sub populations identified
- The method of collecting the test data (In-service testing verses equipment replacement and laboratory testing or combination of both)
- The test methods and test equipment to be used
- The resources to be used
- The timescale for the completion of collecting and analysing sub population test data depending on the size, number and geographical extent of the sub populations and the methods of testing to be adopted

8.2 ASSET REPLACEMENT

Where the sample testing of equipment sub populations indicates a sub population failure, Energex will notify the respective retailer with a meter fault notification.

9.0 FINANCIAL DELEGATIONS

Energex Limited (Energex) is a company incorporated under the *Corporations Act 2001* (Cth), and all of the powers of the company rest with the Board of Directors. Energex is a subsidiary of Energy Queensland Limited (EQL). The EQL Board has adopted the Energy Queensland Group Governance and Delegations Policy which sets out the overarching decision making governance and delegation of authority framework for EQL and its subsidiaries. RED Policy document 00256 operationalises and implements the Energy Queensland Group Governance and Delegations Policy for Energex.

10.0 METERING PROGRAM OF WORK

The current Energex Regulated Metering Program of Work (POW) is set for five years and includes planned testing; it also includes an estimate of customer requested work where the work needs to be performed by the Distribution Authority. Table 6 shows the current draft regulated program of work.

Table 6 Energex Draft Regulated Metering Program of Work

Item	Number of Units Planned or Expected				
OPEX	2019-20	2020-21	2021-22	2022-23	2023-24
In Service Compliance testing - single phase direct connected by sample	2056	2020	2288	1005	205
LV CT test - set of 3 per installation by sample	180	50	315	0	0
LV CT inspect - Enhanced Site Inspection (ESI) / Site Inspection	1280	1280	1280	1280	1280
LV meter test - polyphase Direct Connected (DC)	434	1371	584	0	32
LV meter test - CT meter	368	385	184	0	8
LV meter investigation - unplanned and customer requested	39,270	39,403	39,335	39,369	39,352
LV meter test - unplanned and customer requested	1,000	1,000	1,000	1,000	1,000
HV instrument transformer test	0	0	0	0	0

APPENDIX 1 ORGANISATION AND RESOURCES

CORPORATE FUNCTIONS

Energex is a Distribution business operating under the Energy Queensland Limited business and the distribution business is managed by an Executive General Manager reporting to the Chief Executive Officer. The different business units and their respective high level sub functions are outlined in Figure 2 below, with sub-listings of their functions associated directly with electricity energy metering are briefly outlined below:

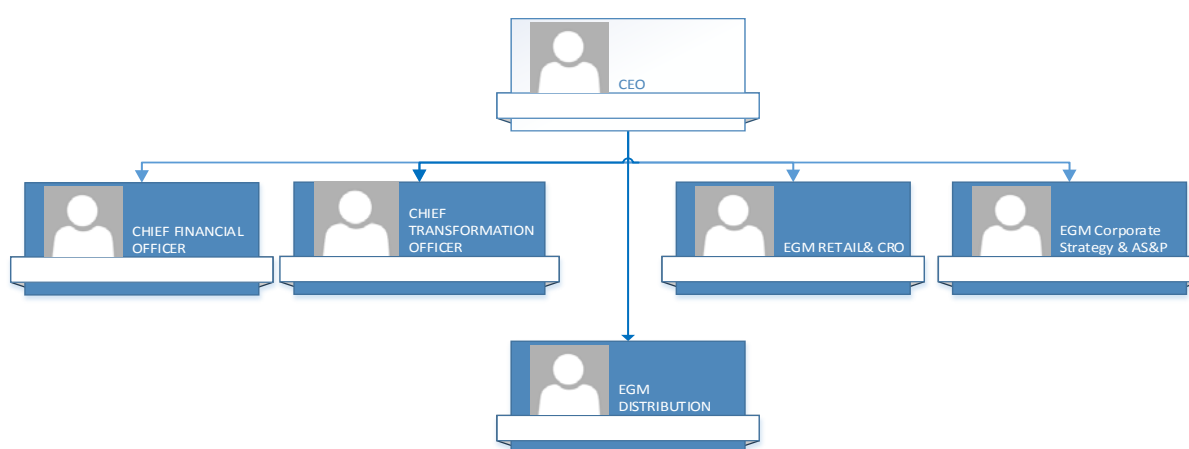


Figure 2 Corporate business structure

CHIEF TRANSFORMATION OFFICER

Specification and contract administration of purchase contracts for metering equipment and contractor services

Human resources recruitment and staff development

Responsible for the legal and auditing functions Corporate quality, safety and environmental auditing and reporting

CHIEF FINANCIAL OFFICER

Responsible for the financial and business performance

EGM ASSET SAFETY & PERFORMANCE

Responsible for the operation of the Energex Regulatory Compliance Program

EGM DISTRIBUTION Operation Field Delivery

Responsible for the field resource capability to support customer market operations functions across EQL

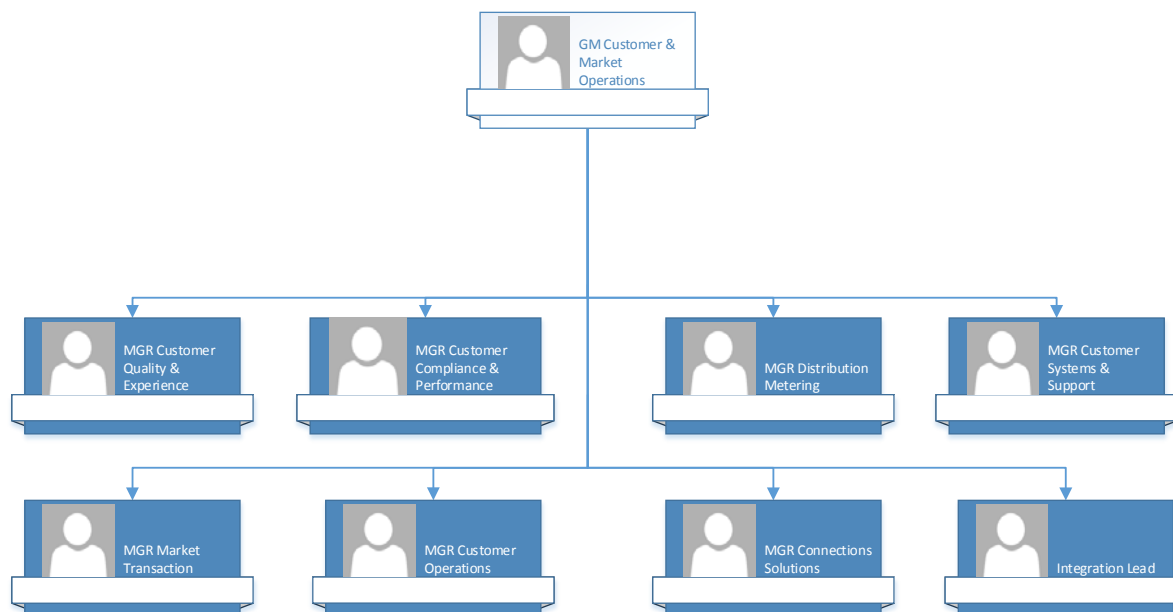


Figure 3 Customer & Market Operations structure

GM Customer & Market Operation

Responsible for the Customer and Market Operations which includes distribution metering functions across EQL

Manager Customer Operations

Scheduling and conducting investigations related to billing complaints and metering faults associated with type 6 metering installations

Establishing and administering operational procedures associated with customer connections to the network

Provision of call centre services for the processing and expediting of all telephone queries and complaints including those associated with billing and metering issues

Manager Market Transaction

Provision of MDP services for the collection, processing and delivery of metering data to the market

NMI allocation and LNSP premise data administration

Provision and administration of systems for the collection, processing and delivery of metering data to the market

Administering market interface issues with Retailers and other market participants

Maintain MDP processes and quality documentation

Manager Distribution Metering

Metering Group –Distribution Metering

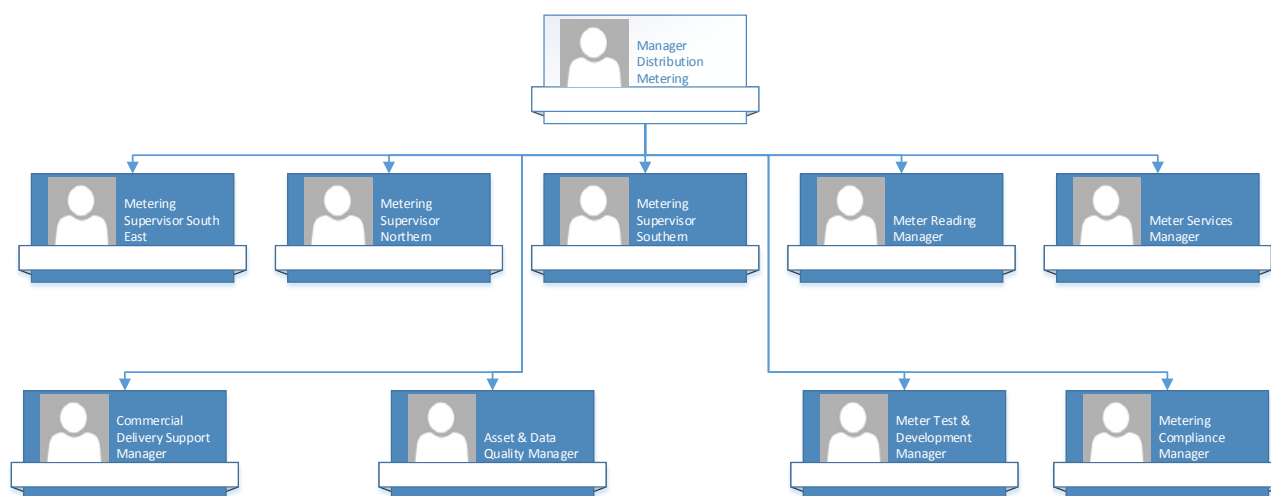


Figure 4 Distribution Metering structure

Meter Reading Manager

Provision of metering services and the delivery of metering data via appropriate communication channels to the metering data warehouse

Meter Services Manager

Administration of contracts for the provision of contract services for the maintenance and testing of type 6 metering installations

Auditing contractors for quality, safety and performance

Commercial Delivery Support Manager

Specification and contract administration of service contracts for the provision of contract services for the installation, investigation, auditing and testing of metering installations

Asset & Data Quality Manager

Ensure processes and the meter register supports the meter asset life cycle.

Overall responsibility for meter register operation and data maintenance ownership

Metering Test & Development Manager

Operation of laboratories and services accredited by NATA (ISO/IEC 17025) to ensure the metrological integrity of all Energex metering equipment and installations

Metering Compliance Manager

Coordination of MC obligations for the LNSP functions for the Energex network.

Accountability for development and review of the Meter Asset Management Plan (MAMP).

Budget and develop meter asset maintenance plan to meet the requirement of the MAMP.

Accountability for overseeing delivery outcomes of MPB 1-6 to satisfy AEMO responsibilities

Management of contracts and SLA's to ensure delivery outcomes.

Performance manage AEMO MPB Service Level Requirements

Maintain MPB processes and quality documentation

Maintain and develop meter installation standards (Queensland Electricity Connection and Metering Manual) and technical specifications for purchasing and external contracting works.

Provision of integrated engineering systems for the overall management and monitoring of the metering fleet

Updating and managing the Queensland Electricity Connections and Metering Manual (QECMM), outlining the physical and design requirements for metering installations in Queensland

Auditing contractors for quality, safety and performance

Skills training of staff and contractors involved in metering operations

Resources

Equipment Operations Calibration and Testing Laboratory

The EQL Standards Laboratory has the following personnel and equipment resources relevant to the testing of metering equipment:

Personnel – Five qualified staff capable of testing metering equipment

Meter testing – Zera Com 3003 reference power meter, and a Fluke 6105A electrical power standard and 2 x 6106A auxiliary supplies

Current transformer testing – Tinsley-Arnold test set and Smith Hobson reference CT

Distribution Metering

The Meter Test and Development team has the following personnel and equipment resources relevant to the testing of metering equipment:

Personnel – Three experienced staff capable of testing metering equipment

Meter testing – Two Zera multi-station (10) meter test benches incorporating Zera EPZ303-5 reference power meters

Current transformer testing – Tettex comparator and electronic burden box. Smith Hobson Reference CT.

The Metering Operations teams have the following personnel and equipment resources relevant to the testing of metering equipment:

Personnel – 10 x Metering Technicians, 10 x Paraprofessional Metering Officers, 15 x Technical Service Person Metering Officers.

Meter testing – 10 x MTE CheckSystem2.3, 3 x MTE PTS3.3C, 21 x MTE PTS 2.3C

Current transformer testing – 6 x Redphase 590G, 15 x Omicron CT Analyser, J.S.Hansom and Smith Hobson Standard CTs. Tettex and Zera comparators and electronic burdens.

Voltage transformer testing – J.S.Hansom Standard VTs. Tettex and Zera comparators and electronic burdens.

The Field Operations teams have the following personnel and equipment resources relevant to the testing of metering equipment:

Personnel - Approximately 450 capable field staff

Meter Testing – 12 x MTE Checksystem2.3, 21 x MTE Checksystem2.1/MTE PTS2.1, 6 x MTE PTS2.3

Substation Services

Personnel – 6 x Test Technicians, 1 x Test Engineering Officer

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Instrument TX Testing – 2 x Omicron CT Analyser, 10 x Zera Standard Voltage Burdens, 3 x Zera WM 3000U, 3 x Ritz 110860025, 2 x Omicron Votano VB02, 2 x Omicron Votano 100, 1 x Hansom STVT 33-3.3, 1 x Ritz GS130, 1 x Hansom S.V.T132, 1 x Hansom SVT 22 – 5.5, 2 x Omicron Ritz KSO1811A, 1 x Omicron Ritz KSZRH 300/1, 2 x Smith Hobson Standard CT, 3 x Koncar Reference VT

APPENDIX 2 ASSET DETAIL AND QUANTITIES WHERE ENERGEX IS THE MPB

Installation History

Energex Limited commenced as an MPB in the NEM in 1997 responsible for metering functions in the South East corner of Queensland. The commencement of FRC in Queensland saw the inclusion of 2 million meters installed at approximately 1.3 million Type 6 metering installations.

Meters Installed at Type 6 Installations

Table 7 Quantities and type of meters that are installed in the Network as at August 2018.

Asset Class	No of Units
Single Phase Whole Current Meter	1,906,856
Polyphase Whole Current Meter	142,545
LV CT Meter	10,937
VT Connected Meter	2
Total Meters	2,060,340

A summary of the number of low voltage current transformers installed for type 6 metering installations by current transformer type is presented in the table below. Note: the table does not represent CT metering installations, but number of individual assets.

Table 8 Number of Current Transformers Installed at Type 6 LV Metering Installations – June 2018

CT Type	Ratios			Total LV CT's
A	150/5	300/5	600/5	483
B	400/5	800/5	1200/5	57
C	1000/5	2000/5	3000/5	30
S	200/5			16,837
T	800/5			1,684
U	2000/5			0
V	4000/5			0
W	1500/5			62
Other	Various			44
Total				19,197
Source MARS and PEACE Database				

"Other" includes CTs where the type is currently not known. Where the enhanced inspection under AEMO document Alternative Testing Minimum Requirements: Low Voltage Current Transformer (LV CT) Metering Installations, identifies the CT type, they will be included in the relevant population.

Where they are not one of the nominated CT types, they will be tested in accordance with Schedule 7.6.1 of the Rules.

CT accuracy requirements for HV installations are the same as defined for type 3 metering installations.

APPENDIX 3 NATA ACCREDITATION AND TESTING CAPABILITY

Energex has a range of testing support that is NATA accredited in the field of electrical measurement (Energy Queensland Limited Accreditation No. 74) as listed on the NATA registration website:

	Accreditation No.	Site No.	Site Name	Address
1.	74	24543	ENERGY QUEENSLAND LIMITED Equipment Operations Calibration and Testing Laboratory	Map
2.	74	24544	ENERGY QUEENSLAND LIMITED Metering Laboratory	524 Bilsen Road , GEEBUNG, QLD 4034, AUSTRALIA Map

Equipment Operations Calibration and Testing Laboratory – Standards Laboratory

Wattmeters with least uncertainties of measurement of -

0.01% up to 1000 V and 100 A on d.c. at 40 Hz to 60 Hz and unity to 0.5 power factor

0.04%/cos ϕ from 63.5 V to 300 V and 5 mA to 20 A and from 240 V to 320 V at 5 mA to 120 A (single phase)

Three phase wattmeters with least uncertainties of -

0.1%/cos ϕ from 63.5 V P-N to 415 V P-P and 5 mA to 60 A (three phase)

Varmeters with least uncertainties of measurement of -

0.2% from 63.5 V to 240 V and 5 mA to 60 A and at 240 V from 5 mA to 10 mA at 50 Hz and -30 ° to -150 ° phase displacement

Electricity meters – Watthour meters at 40 to 60 Hz with least uncertainties of measurement of –

0.01 %/Cos ϕ from 60 V to 300 V and 5 mA to 120 A (single phase) and 60 A (three phase)

Electricity meters – Varhour meters at 50 Hz with least uncertainties of measurement of -

0.05% from 63.5 V to 300 V and 5 mA to 100 A and at Sin ϕ from 1 to 0.25

Current transformers accuracy tests at 50 Hz on transformers with rated primary currents from 0.5 A to 3,000 A and rated secondary currents of 1 and 5 A with least uncertainty of measurement of -

0.02% for current error

0.02 crad for phase angle error

Metering Laboratory – Meter Laboratory

Electricity meters – Watthour meters at 50 Hz with least uncertainties of measurement of -

0.04%/cos ϕ from 63.5 - 250 V, 0.1 A to 100 A single phase and three phases

Electricity meters – Varhour meters at 50Hz with least uncertainties of measurement of –

0.2% from 63.5 to 250 V, 0.1 A to 50A and at sin ϕ = -1 to sin ϕ = -0.25

Current transformers - Accuracy tests at 50 Hz on metering current transformers rated primary currents from 5 to 1,500 A with rated secondary current of 5 A and at 0.5 lagging to unity power-factor burden, with least uncertainties of measurement of –

0.1% for current error

0.15 crad for phase angle error.

Metering Laboratory – Metering Field Services

Electricity meters – Watthour meters at 50 Hz with least uncertainties of measurement of –
0.06%/cos ϕ , from 63.5 to 240 V, 0.2 A to 20 A three phase

Electricity meters – Varhour meters at 50 Hz with least uncertainties of measurement of –
0.5% from 63.5 to 250 V, 0.5 A to 20 A zero to 0.5 power factor lag

Current transformers - Accuracy tests at 50 Hz on transformers with rated primary currents of 1 A to 10,000 A and rated secondary currents of 1 A or 5 A and at 0.5 lagging to unity power-factor burden with least uncertainties of measurement of –

0.04% for current error

0.04 crad for phase angle error

Voltage transformers - Accuracy tests at 50 Hz on transformers with rated primary voltages from 110/ $\sqrt{3}$ V to 132/ $\sqrt{3}$ kV and rated secondary voltages of 110/ $\sqrt{3}$ V or 110 V and at 0.1 lagging to unity power-factor burden with least uncertainties of measurement of –

0.04% for voltage error

0.04 crad for phase angle error

If necessary, Energex may contract testing work to other appropriately NATA accredited organisations

APPENDIX 4 RULES AND REGULATIONS

Document	Information Provided
Electricity Distribution Network Code	Details requirements for operation in the Queensland Electricity Market for metering and GSLs (Metering Chapter 2 & 5)
National Electricity Rules	Details the performance of metering in the National Market. Chapter 7.
National Metrology Procedures Part A for meter Types 5 & 6	Details the performance of metering in the National Market.
Australian Standards:	AS:1284 metering series, AS 62053 metering series, AS 3000 Wiring rules AS 60044 -1 -2007 Instrument Transformers - Current Transformers AS 60044 -2 -2007 Instrument Transformers - Voltage Transformers AS 1199 1988 Sampling procedures and tables for inspection by attributes. AS 1199-1990 Guide to sampling procedures and tables for inspection by attributes. AS 2490 1987 Sampling procedures and charts for inspection by variables for percent non-conforming. ISO 9001 Quality Management Systems ISO 14001 Environmental Management AS4801:2001 Safety Management System
Metering Procedures, Specifications and Work Instructions	Details the guidelines for performing metering tasks
National Measurements Institute.	Statistical sampling plan of previously verified electricity meters. National Measurements Act 1960 (NatMeasure1960.pdf) www.measurement.gov.au
Metering Asset Management Plan (MAMP) Information Paper	AEMO Document No ME_MP1943 V0005
Business and Information Blueprinting Program	Customer and Metering Stream (Options Analysis Deliverable 15th November 2011 – Version 2.7)
NATA	National Association of Testing Authority, Australia
AEMO	Australian Energy Market Operator