RE ### e-FILING REPORT COVER SHEET

REPORT NAME: 2012 Annual Report and Certification to OPUC

COMPANY NAME: Portland General Electric

DOES REPORT CONTAIN CONFIDENTIAL INFORMATION?

X No

If known, please select designation:

X RE (Electric)

Report is required by:

X OPUC Staff

Is this report associated with a specific docket/case?

X No

Key words: 2012 Annual Metering and Inspection Report

If known, please select the PUC Section to which the report should be directed:

X Electric Rates and Planning

Portland General Electric

2012 Annual Report and

Certification to OPUC

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04-30-13

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5-3-13

AVERY READY INDEX 600087

Portland General Electric
2012 Annual Report and Certification to OPUC

1. OVERVIEW

Portland General Electric (PGE) follows the guidelines of ANSI C12.1-1995 Code for Electricity Metering to evaluate the performance and accuracy of new and installed metering systems. PGE's standards, practices and procedures for maintaining the accuracy of electric meters are based on accepted national metering and quality standards, and are maintained in compliance with applicable regulatory requirements and rules. The function of PGE's metering policies, procedures and practices is to properly apply, install and maintain meters and metering systems to ensure accurate measurement of the energy used by each customer.

In addition, PGE uses the meter inventory data base, PowerTrack, the meter reading consumption databases (P+4 and the Meter Data Consolidator), and the Customer Information System (CIS), to monitor the accuracy of installed metering systems and to verify correct customer billing.

In-Service Random Sample and Periodic meter testing are used to evaluate the accuracy of installed metering systems and to detect inaccurate meter groups. Statistical information from this testing is used to determine future maintenance and testing.

PGE follows National Institute of Standards Technology (NIST) requirements to ensure that watt-hour measurement equipment, used to test the accuracy of billing meters, is correctly calibrated. PGE maintains a Standards Laboratory that is responsible for the certification of all watt-hour standards used within PGE.

2. METERING MANAGEMENT REVIEW

The review of PGE metering policies, practices, and procedures shows that PGE is in compliance with the following: ANSI C12.1-1995 Code for Electricity Metering, ANSI Z1.9 Sampling Procedures and Tables, OPUC Electric Utility Metering Policy, and applicable sections of the ORS and OAR.

The PGE Electric Metering Test and Inspection Policy (included in Section 15) outlines the procedures used to direct the electric metering test and verification programs. The standards, practices and procedures for maintaining the accuracy of electric metering systems are based on acceptable national metering and quality standards, and are maintained in compliance with applicable regulatory requirements and rules.

PGE metering practices and programs direct the surveillance of metering systems and customer service facilities. The results of the surveillance efforts are used to determine potential trends in the installed metering systems. Statistical information is then used to determine future maintenance and testing.

All test equipment used to validate metering accuracy is traceable to NIST or other nationally recognized standards organizations or laboratories. Calibration standards are used to verify test equipment accuracy every six months.

3. SUMMARY OF SIGNIFICANT DEFICIENCIES

PGE identified Three (3) wiring errors on existing metering systems. These errors were found while performing quality assurance checks, maintenance activities and meter reading. They are listed on the attached document.

Portland General Electric
2010 Annual Report and Certification to OPUC
Section 3 - Summary of Significant Deficiencies

PROBLEM	DATE FOUND	FOUND DURING	CITY
Ct's miswired, 33% registration since install 10/3/11	01/17/2012	60 day check	TUALATIN
Miswired on install blank display, no usage being recorded	02/03/2012	John Davis on Field Check	Portland
CT's did not update in PowerTrack	02/27/2012	Meter Reader	TUALATIN

4. CORRECTIVE ACTION PLANS

There were no failed lots found among the thirteen (13) Periodic PMGs.

There are no open CAPS for PGE meters.

5. HOMOGENOUS METER GROUPS AND PERIODIC METER GROUPS

For 2012, in-service periodic meter testing and random sample meter testing was performed for all installed meters under the post AMI meter deployment program.

For 2012 PGE had thirteen (13) Periodic PMGs and twenty five (25) Homogenous meter groups. The meter groups are listed on the attached document.

Portland General Electric
2011 Annual Report and Certification to OPUC
Section 5 - Meter Group Listings for HMGs and PMGs

HMG Lots Tested			PMG Lots tested	
0503-IN-ISA2-1			P12-0220	
0503-IN-ISA2-2			P12-0523	
0503-IN-ISA2-3			P12-0525	
0503-IN-ISA3-1			P12-0526	
0503-IN-ISA3-2			P12-0527	
0505-IN-INA2			P12-0528	
0505-IN-INA3			P12-0529	
0506-IN-ISA2			P12-0530	
0507-IN-ISA2-1			P12-0531	
0507-IN-ISA2-10			P12-0615	
0507-IN-ISA2-11			P12-0812	
0507-IN-ISA2-2			P12-0815	
0507-IN-ISA2-3			SubStation	
0507-IN-ISA2-4				
0507-IN-ISA2-5				
0507-IN-ISA2-6				
0507-IN-ISA2-7				
0507-IN-ISA2-8				
0507-IN-ISA2-9				
0508-IN-INA2				
0524-AB-A3TL				
0534-IN-ISA2				
0536-IN-ISA2				
0541-AB-A3TL				
0545-IN-ISA2				

6. SUMMARY OF METERING AUDITS

1) Annual Test and Inspection: Large Commercial and Industrial customers served by substation metering.
2) Bi-annual Test and Inspection: Commercial and Industrial customers with an average load greater than 1.0 Megawatts.
3) 5 Year Test and Inspection: Customers with an average load between 500 kW and 1.0 Megawatts.
4) 12 Year Test and Inspection: Customers with an average load less than 500 kW.

Portland General Electric
2011 Annual Report and Certification to OPUC
Section 6 - Statistical Summaries of Metering Audits for PMGs

1 Lot Number	2 Population	3 Sample Size	4 Number Tested	Average Sample Weighted Average	5 Defects and Cause	6 Revenue Implications Due to Defects
P12-0220	691	73	73	100.01	N/A	N/A
P12-0523	2740	0	0	N/A	N/A	N/A
P12-0525	854	0	0	N/A	N/A	N/A
P12-0526	403	1	1	99.99	N/A	N/A
P12-0527	287	3	3	99.73	N/A	N/A
P12-0528	11523	7	7	99.97	N/A	N/A
P12-0529	2843	11	11	99.97	N/A	N/A
P12-0530	3562	0	0	N/A	N/A	N/A
P12-0531	20159	0	0	N/A	N/A	N/A
P12-0615	462	0	0	N/A	N/A	N/A
P12-0812	353	19	19	99.95	N/A	N/A
P12-0815	1422	23	23	99.94	N/A	N/A
SubStation	75	75	75	99.98	N/A	N/A

2012 Annual Report and Certification to OPUC
Section 6.5 - Summary of Metering Defects for PMGs

Lot Number	Meter ID	Test Date	Failure Code	Pass/Fail	Full Load	Light Load	Weighted Average	Corrective Action
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

7. STATISTICAL SUMMARIES OF INSPECTIONS/TESTS AND CAP RETIREMENTS FOR HMGS

For 2012, in-service random sample meter testing was performed for all installed meters under the post AMI meter deployment program on twenty five (25) HMGS.

There were no CAP retirements required in 2012.

Portland General Electric
2012 Annual Report and Certification to OPUC
Section 7 - Statistical Summaries of Inspections for HMGs

1	2	3	4	5a	5b	6a	6b	7	8	9	10	11	12	13
Lot Number	Population	Sample Size	Number Tested	Average Sample Weighted Average	Standard Deviation Sample Weighted Average	Maximum Sample Weighted Average	Minimum Sample Weighted Average	Number of Meters with Greater than 2% Deviation	Number of Uniquely Defective Meters Excluded	Number of Uniquely Defective Meters Excluded Due to Manufacturer Defects	Excluded Meters	ANSI Z1.9 Conclusions	Number of Meters Below 98%	Number of Meters Exceeding 102%
0503-IN-ISA2-1	60219	150	150	99.93	99.78	100.13	99.73	0	-	0	0	P	0	0
0503-IN-ISA2-2	53773	150	152	99.92	99.85	100.08	99.76	0	-	0	0	P	0	0
0503-IN-ISA2-3	39514	150	150	99.93	99.83	100.16	99.71	0	-	0	0	P	0	0
0503-IN-ISA3-1	36197	150	150	100.05	100.00	100.17	99.94	0	1	0	1	P	0	0
0503-IN-ISA3-2	75523	150	150	100.05	99.97	100.24	99.85	0	-	0	0	P	0	0
0505-IN-INA2	208	15	20	100.12	99.96	100.40	99.83	0	-	0	0	P	0	0
0505-IN-INA3	5596	75	75	100.02	99.98	100.11	99.93	0	-	0	0	P	0	0
0505-IN-ISA2	3151	50	54	100.10	100.02	100.40	99.80	0	1	0	1	P	0	0
0507-IN-ISA2-1	17369	100	99	99.95	99.87	100.20	99.71	0	1	0	3	P	0	0
0507-IN-ISA2-10	65169	150	149	100.02	99.94	100.23	99.82	0	1	0	4	P	0	0
0507-IN-ISA2-11	32721	100	101	99.97	99.87	100.21	99.72	0	-	0	1	P	0	0
0507-IN-ISA2-2	69244	150	152	99.94	99.79	100.48	99.40	0	-	0	0	P	0	0
0507-IN-ISA2-3	13694	100	104	99.94	99.69	100.08	99.81	0	-	0	1	P	0	0
0507-IN-ISA2-4	49424	150	150	99.97	99.91	100.18	99.75	0	-	0	0	P	0	0
0507-IN-ISA2-5	43123	150	151	99.99	99.84	100.20	99.78	0	-	0	2	P	0	0
0507-IN-ISA2-6	61156	150	153	99.93	99.42	100.17	99.70	0	-	0	0	P	0	0
0507-IN-ISA2-7	47513	150	150	99.98	99.92	100.15	99.80	0	-	0	0	P	0	0
0507-IN-ISA2-8	8564	75	76	99.97	99.90	100.15	99.78	0	-	0	0	P	0	0
0507-IN-ISA2-9	89342	150	149	99.99	99.93	100.14	99.85	0	1	0	4	P	0	0
0508-IN-INA2	16986	100	103	100.09	99.73	103.67	96.50	0	-	0	0	P	1	1
0524-AB-A3TL	1000	35	39	99.97	99.85	100.05	99.90	0	-	0	1	P	0	0
0534-IN-ISA2	18272	100	102	100.03	99.72	100.19	99.87	0	1	0	1	P	0	0
0536-IN-ISA2	2422	50	53	100.05	99.99	100.16	99.94	0	1	0	1	P	0	0
0541-AB-A3TL	6655	75	77	99.98	99.95	100.16	99.81	0	-	0	0	P	0	0
0545-IN-ISA2	2452	50	54	100.02	99.96	100.18	99.85	0	-	0	0	P	0	0

8. LISTING OF UNIQUELY DEFECTIVE METERS FOUND IN SAMPLE METER TESTS BY HMG

For 2012, in-service random sample meter testing was performed for all installed meters under the post AMI meter deployment program on twenty five (25) HMGS.

There were seven (7) uniquely defective meters found in Sample Meter Tests for 2012.

Portland General Electric
2012 Annual Report and Certification to OPUC
Section 8 - Sample Meter Test Uniquely Defective Meters

Lot Number	Meter ID	Test Date	Failure Code	Pass/Fail	Full Load	Light Load	Weighted Average	Corrective Action
0503-IN-ISA3-1	26913090IN	N/A	NO TEST	F	0	0	0	UNKNOWN WOULD NOT TEST
0506-IN-ISA2	25954360IN	N/A	NO TEST	F	0	0	0	UNABLE TO TES "CANT CONTROL A PHASE V
0507-IN-ISA2-1	21750103IN	N/A	NO TEST	F	0	0	0	WOULD NOT TEST UNKNOWN REASON
0507-IN-ISA2-10	27400519IN	N/A	NO TEST	F	0	0	0	UNKNOWN WOULD NOT TEST
0507-IN-ISA2-9	26947415IN	N/A	NO TEST	F	0	0	0	UNKNOWN WOULD NOT TEST
0534-IN-ISA2	27296122IN	N/A	NO TEST	F	0	0	0	UNKNOWN WOULD NOT TEST
0536-IN-ISA2	29291331IN	N/A	NO TEST	F	0	0	0	UNKNOWN WOULD NOT TEST

9. LISTING OF METERING HAZARDS, FAILURES, AND MAJOR DEFECTS FOUND IN PERIODIC TEST PROGRAM

No data found on metering hazards, failures, and major defects found in the Periodic Meter Test Program.

10.INSPECTIONS/TESTS AND TARGETED CAP RETIREMENTS

All of the thirteen (13) Periodic lots tested by PGE, passed the ANSI testing. PGE has no meter groups requiring a Corrective Action Plan (CAP) for meters tested in 2012.

11. CHANGES TO PGE METERING PRACTICES

No changes

12.MULTI STATE UTILITIES REPORT

Not Applicable

13.NUMBER OF QUALIFIED METER TECHNICIANS BY CLASSIFICATION

The technical staff in PGE Meter Services consists of:

Meter Foremen – four (4)
Meter Technicians – four (4)
Journeyman Metermen – fifteen (15)
Apprentice Metermen – six (6)

14. ANTICIPATED UTILITY POLICY CHANGES REQUIRING COMMISSION APPROVAL

There are no anticipated policy changes.

Oregon Public Utility Commission
Electric Utility Metering Policy

The Oregon Public Utility Commission has adopted this policy as a reasonable and prudent utility practice to ensure the accuracy and correctness of customer metering and billing.

A. Scope - This document outlines the requirements for Oregon regulated electric utilities to satisfy Oregon Public Utility Commission (OPUC) regulations related to electric meter testing and verification programs, maintenance of watt-hour standards and standardizing equipment, and the annual reporting to the OPUC. (See OAR 860-023-0015 and other related metering regulations in Section D.)

B. General

1. Each customer meter and metering system shall be installed and maintained to accurately measure, register and record the energy used by the customer.
2. Each utility must install and maintain accurate and reliable customer metering systems in compliance with OPUC regulations and prudent utility practice in a manner that is traceable and in conformance with national NIST standards of measurement.
3. Each utility shall have written policies, practices, and programs to ensure the accuracy, proper installation, safety, maintenance, and security of its customer metering devices and systems.
4. Each utility shall report changes in metering policies and practices annually to the OPUC.
5. Each utility's metering policy and revisions shall be approved by the Commission prior to implementation. (See ORS 757.250 and OAR 860-023-0015).

C. Definition of Terms

1. Defective Meter Group – An identified homogeneous group of meters, or distinct subdivision thereof, that has an unacceptable level of performance.
2. Homogeneous Meter Group (HMG) – A group of meters produced by the same manufacturer, having a related type designation, of the same design and the same relationship of parts.
3. Metering System – The entire metering circuit and installation including all sensing, measuring, conversion, totalizing, registering and communication devices as well as enclosures, wiring, and communication links.
4. NIST – National Institute of Standards and Technology, under US Dept. of Commerce
5. Periodic Meter Group (PMG) – A group of metering systems tested, inspected, and verified in a specific year that are on the same test frequency in a Periodic Meter Test Program. *(For example, all metering systems that are tested and verified on 5-year repeat interval and that are evaluated in a specific year shall be included in the same PMG group irrespective of meter manufacturer type or model number.)*
6. Should – Means "shall" (i.e., mandatory) unless a utility has prudent justification for using a higher or equivalent standard practice.
7. Uniquely Defective Meter - A meter selected for random sampling with accuracy performance characteristics greater than $\pm$ 5% resulting from unique physical experience or unique electrical experience and is not representative of other in-service meters in its HMG.
8. Sample Meter Test Program - an established random pattern of testing meters belonging to a HMG whereby each meter has an equal opportunity to be selected for testing each year.
9. Periodic Meter Test Program - an established scheduled pattern of meter site verifications where each site will be selected according to the utility's designated regular time-interval.

D. Applicable Oregon Laws and Administrative Rules (partial list)

1. *ORS 757.250 and 757.255* – Directives for reasonable OPUC rules, standards and policies that address "examination and testing" of utility service installations and measurements.
2. *OAR 860-023-0005, 860-023-0010, 860-023-0015, 860-021-0120, 860-021-0130, & 860-024-0010* – OPUC rules that address minimum standards associated with customer metering and facilities maintenance.
3. *OAR 860-021-0135* – An OPUC rule that covers customer billing adjustments.

E. References - In addition to the Oregon regulations in Section D, each utility should comply with national, state, and industry standards in developing and carrying out its examination and testing programs for customer metering systems. These standards include, but are not limited to, the following:

1. NIST Handbook 44, Section 1.1 (General Code) and Appendix A (Fundamental Considerations) as adopted into State Law by OAR 603-27-635 – Minimum standards for the specification, application, inspection and testing, operation, and maintenance of customer metering systems.
2. ANSI Standard C12.1-1995, Code of Electricity Metering – The minimum standard to be followed by electrical utilities for the examination and testing of customer metering systems and metering devices to ensure traceability to NIST standards.
3. ANSI/ASQC Standards Z1.4 (for attributes) and Z1.9 (for variables) – Random sampling and non-conformance identification methods. Each utility shall use the appropriate sampling method based on the number of variables and attributes evaluated for each HMG.
4. Electric Utility Service Equipment Requirements Committee (EUSERC) Standards - This is the established guideline for each utility related to service entrance requirements for customer owned equipment. Specific applications of EUSERC Standards for each utility shall be described in each utility's publication on electric service requirements.

F. Reference Standards and Standardizing Equipment

1. Utility reference standards equipment (e.g., basic reference, transport, and working apparatus) shall comply with Subsection E.2.
2. Standards equipment and verification schedules shall be addressed in each utility's metering policy and shall be approved by the OPUC. (See OAR 860-023-0015(5).)

G. New Metering Device Acceptance

1. New meters and metering devices shall meet the minimum standards established in Subsection E.2.
2. All new meters, instrument transformers and other metering devices that can affect customer metering or billing accuracy shall be tested by the manufacturer or the utility before being placed into service.
3. If a utility relies on a manufacturer to perform the testing, the utility must have an effective quality assurance program to ensure the accuracy and quality of the new meters.
4. The testing and quality assurance programs covered in subsections 2 and 3 above shall be addressed in each utility's metering policy that is approved by the OPUC.

H. Acceptable Performance for Meters and Metering Devices

1. In-service meters and metering devices shall be maintained with an accuracy performance as specified in OAR 860-23-0015 and Subsection E.2.
2. Meters and metering devices shall be properly applied, installed and maintained to ensure accuracy of customer billings.

I. In-Service Metering System Inspection, Testing, Maintenance, and Verification

1. The frequency of metering system audits, including tests, inspections, maintenance and verification of customer metering systems will be determined by each utility in conformance with OPUC regulations, national standards, manufacturer recommendations, and prudent utility practice giving due consideration to the type of metering systems involved and the consequences for failure.
2. Each utility shall have written practices that address meter system audits with checklists detailing the procedures. Each utility's audit practices shall specifically address meter system safety, accuracy, proper installation and application, security, current diversion prevention, wiring verification, and billing validation issues. Meter system audits should cover the elements addressed in Appendix A.
3. At minimum, the audit schedules of in-service metering systems shall comply with the annual program plans covered in Subsection E.2. and as approved by the OPUC.
4. All transformer-rated metering systems shall be tested, inspected, and verified after installation.

J. Security

1. Metering seals and locking devices shall be conspicuous and reasonably permanent.
2. Each utility shall have established sealing and password protections within its metering systems to prevent unauthorized entry, adjustment, programming, or data acquisition.

K. Revenue Validation Programs - Each utility shall have established procedures/programs for identifying and detecting:

- Incorrect billing;
- Evidence of tampering; and,
- Evidence of current diversion.

L. Meter Groups

1. Each utility shall stratify its meters into appropriate HMGs for the Sample Meter Test Program and PMGs for the Periodic Meter Test Program.

M. Random Sampling Techniques for In-service Metering Systems

1. ANSI/ASQC Standards listed in Subsection E.3. shall, at minimum, be used as the basis for random statistical quality control and random sample selection of meters. Inspection level "General II - Normal" shall be used. A uniquely defective meter may be removed from the sample testing analysis.
2. Acceptable Quality Level (AQL) of 2.5% shall be used annually for determining the acceptability criteria for each HMG.
3. If a randomly sampled HMG is determined to not to meet the acceptability criteria of Subsections M.1. and M.2., it shall be classified as a defective meter group.

N. Corrective Action Plans and Rejections of Metering Devices

1. Each utility shall have effective and expeditious procedures for handling defective meters and metering devices, defective metering systems, and defective meter groups.
2. For each defective meter group a Corrective Action Plan (CAP) shall be submitted to the OPUC in the utility's annual metering report. The plan shall address the following: corrective action schedules and costs; annual testing and verification actions; customer impact; and utility revenue impact.
3. When a HMG fails the acceptability criteria for a second time, the HMG shall be promptly and completely removed from service, within four (4) years unless otherwise approved by OPUC.

O. Continuing Surveillance

Each utility shall have procedures/programs for continuing surveillance of its metering systems and customer service facilities to determine and take appropriate action concerning hazards, failures and defects associated with metering systems and customer service facilities. All utility employees and utility contractors (including, but not limited to, meter readers, meter & service personnel, and other operating employees) who perform work associated with customer metering systems shall be trained and be alert in the normal course of their daily work to identify and report safety, security, revenue, and other metering defect issues.

P. Record keeping

The records of metering inspections and tests shall be retained in accordance with OPUC regulations and prudent utility practice. The retention of records shall be sufficient to identify long-term trends.

Q. Qualified Metering Personnel

Each utility shall only employ or contract with qualified metering personnel who have received sufficient training and have demonstrated competency in the type of metering system to be worked.

R. Annual Metering Management Review

1. Each utility shall annually evaluate the currency of its metering policies, practices and procedures with updated national and state regulations, standards and guidelines.
2. Each utility shall have a documented management review program to ensure compliance with OPUC regulations and established company policies and directives.

S. Annual Report and Certification to OPUC

The annual report and certification to the OPUC shall contain the following information:

1. Overview statement describing the utility's metering programs and practices to ensure metering accuracy and correct customer billing;
2. Narrative of the utility's annual metering management review (see Section R);
3. Summary of any significant deficiencies found related to the utility's metering systems;
4. Submittal and update on metering CAPs, if any;
5. Meter group listings for HMGs and PMGs including significant group modifications;
6. Summaries of metering audits completed in previous year for each PMG in compliance with Appendix B, Section B.;
7. Statistical summaries of inspections/tests and CAP retirements completed in previous year for each HMG shall comply with Appendix B, Section A.;
8. A listing of uniquely defective meters found in the Sample Meter Test Program by HMG that summarize findings, failure cause and company corrective action;
9. A listing of metering hazards, failures, and major defects found in the Periodic Meter Test Program by PMG that summarize findings, failure cause and company corrective action;
10. Summary of inspections/tests and targeted CAP retirements planned for the current year for each HMG and each PMG;
11. Summary of changes to the utility's metering standard practices, if any;
12. For utilities that have multi-state metering programs, provide an Oregon-only breakout report for items 1 through 11 above;
13. Number of qualified meter technicians working in Oregon by job classification; and,
14. Anticipated utility policy changes requiring approval by the Commission.

Adopted by the Oregon Public Utility Commission on July 20, 2000, to become effective on January 1, 2001.

Appendix A

Meter System Audit

The metering system audit assures the correctness of the meter, the installation and associated records. An audit covers the following items as applicable to the meter system and to the tariff rate application involved:

1. Meter testing
2. Demand register testing
3. Correctness of meter application
4. Meter loading
5. Correctness of billing constant (i.e., multiplier)
6. Correctness of wiring
7. Condition of wiring
8. Current transformer sizing
9. Quality and ratio of instrument transformers
10. Current transformer burden tests
11. Voltage measurements
12. Current measurements
13. Phase angle test
14. Instantaneous power factor measurements
15. Security of the metering system and components
16. Accessibility of the meter and other metering devices
17. Safety of the metering system and site
18. Safety and condition of the electric distribution system
19. Current diversion
20. Revenue implications (i.e., customer underbilling or overbilling)

Appendix B – Summaries

A. **HMG Statistical Summaries** to be included in the annual report to the OPUC shall include the following minimum information for each HMG:

1. Meter group description and identification code (For each HMG also include manufacturer, model and subdivision if applicable)
2. Numbers of meters or metering systems included in the group
3. Numbers of metering systems planned to be tested and inspected during the report period
4. Number of meter systems actually tested and inspected during the report period
5. The average metering accuracy and standard deviation found
6. The highest and lowest meter test accuracy found
7. Number of meters that tested more than +/- 2 percent
8. Number of uniquely defective meters excluded from above analysis, items 5 though 7.
9. Number of uniquely defective meters in item 8 above with manufacturer major defects
10. Number of other meters, not including uniquely defective meters, excluded from above analysis, items 5 through 7
11. ANSI/ASQC Z1.4 or Z1.9 analysis conclusions
12. Number of metering systems found including uniquely defective meters with revenue underbilling implications (more that 2 percent slow)
13. Number of metering systems found including uniquely defective meters with revenue overbilling implications (more that 2 percent fast)

B. **PMG Summaries** to be included in the annual report to the OPUC shall include the following minimum information, except each PMG with single-phase, self-contained meters only shall have summaries the same as Section A above.

1. Meter group description and identification code
2. Numbers of metering systems included in the group
3. Numbers of metering systems planned to be audited
4. Number of meter systems actually audited
5. Summary data of meter systems found with major or critical defects by cause.
6. Summary of revenue implications related to item 5 above.

PORTLAND GENERAL ELECTRIC
ELECTRIC METERING TEST AND INSPECTION POLICY

PROCEDURES FOR MAINTAINING THE ACCURACY OF PORTLAND GENERAL ELECTRIC CO STANDARDS, STANDARDIZING EQUIPMENT, METERS AND METERING SYSTEMS

Last Revision - September 1, 2010
Newly Updated – November 19, 2012

1. Scope

This document outlines the procedural requirements of Portland General Electric's (PGE) scheduled electric metering test and verification programs. This policy is submitted to satisfy the Electric Utility Metering Policy issued on July 20, 2000 by the Oregon Public Utility Commission.

This policy revision incorporates changes reflecting PGE's OPUC-approved Advanced Metering Infrastructure (AMI) deployment program which installed new solid-state electronic meters all of which have been tested by the manufacturer prior to shipment and a fixed two-way communications system that allows the automated collection of metering data and for sending signals to the meter.

All (100%) AMI meters have been tested by the manufacturer prior to shipment, and approx 3% were additionally tested by the Company prior to deployment and installation. The installation of AMI meters began in 2008 and concluded at the end of 2010.

2. General

The intent of PGE's metering policies, procedures and practices is to properly apply, install and maintain meters and metering devices to ensue the accuracy of customer metering. No meter or metering device shall be placed in service, or allowed to remain in service, that has an incorrect register constant or watt-hour constant, that is mechanically or electrically defective, incorrectly connected, installed, or applied, or that is outside acceptable performance levels. No device shall be placed on or in a meter or metering system that could adversely affect the accuracy or performance of the meter or metering circuit.

PGE's standards, practices and procedures for maintaining the accuracy of electric meters and metering systems are based on accepted national metering and quality standards, and are maintained in compliance with applicable regulatory requirements and rules.

The company has established practices/programs for continuing surveillance of its metering systems and customer service facilities to determine and take appropriate action concerning hazards, failures and defects associated with metering systems and customer service facilities.

All company employees and company contractors who perform work associated with customer metering systems shall be trained and be alert in the normal course of their daily work to identify and report safety, security, revenue and other metering defect issues.

3. References

This document references the following documents:

- The Company's METER SERVICES PRACTICES shall be used to communicate and implement metering policies, standards and procedures internal to the company and to applicable contractors.
- ORS 757.250 and OAR 860-023-0015 shall be used as minimum legal standards for metering system compliance.
- ANSI C12.1-1995 Code for Electricity Metering shall be used as a minimum maintenance standard for accuracy performance for standardizing equipment and in-service tests and metering devices.
- ANSI/ASQC Z1.9-2008 Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming shall be used as a minimum standard for sample testing.
- PGE's Oregon Electric Service Requirements booklet will be used at the minimum standard for new metering and service installations.
- Public Utility Commission of Oregon Order No. 08-245 in UE 189.

4. Definitions

(a) Defective Meter Group – An identified homogeneous group of meters, or distinct subdivision thereof that has an unacceptable level of performance.
(b) Homogeneous Meter Group (HMG) – A group of meters produced by the same manufacturer, having related type designation, of the same design and the same relationship of parts.
(c) Metering System – The entire metering circuit and installation including all sensing, measuring, conversion, totalizing, registering and communication devices as well as enclosures, wiring and communication links.
(d) NIST – National Institute of Standards and Technology, under US Dept. of Commerce.
(e) Periodic Meter Group (PMG) – A group of metering systems tested, inspected, and verified in a specific year that are on the same test frequency in a Periodic Meter Test Program.
(f) Uniquely Defective Meter – A meter selected for random sampling with accuracy performance characteristics greater than $\pm$ 5% resulting from unique physical experience or unique electrical experience and is not representative of other in-service meters in its HMG.

(g) Sample Meter Test Program – An established random pattern of testing meters belonging to a HMG whereby each meter has an equal opportunity to be selected for testing each year.
(h) Periodic Meter Test Program – An established scheduled pattern of meter testing and site verification where each site will be selected according to a designated regular time-interval.
(i) Company – Portland General Electric.
(j) AMI Meter – a solid-state electronic meter which provides for two-way communications to allow the automated collection of metering data and for sending signals to the meter.

5. Watt-hour Standards and Standardizing Equipment

(a) PURPOSE:
To ensure that watt-hour measurement equipment, used to test the accuracy of billing meters, is correctly calibrated and traceable to the National Institute of Standards Technology (NIST).

(b) RESPONSIBILTY:
Portland General Electric maintains a Standards Laboratory that is responsible for the certification of all portable watt-hour standards used within PGE.

(c) SUMMARY OF METHOD:
PGE uses a Primary traceable Watt-hour standard to which all other Watt-hour standards are compared to ensure revenue meter accuracy. The calibration accuracy of the Primary standard is verified at 6-month intervals to Standard Instruments that are traceable to NIST. The Primary Watt-hour standard is used to certify on an annual basis Secondary or Working Watt-hour Standards. The Primary Watt-hour standard is stored and used in a temperature and humidity controlled environment.

Portable Secondary Watt-hour Standards are certified at six-month intervals by PGE's Instrument Laboratory. The certification is accomplished using a comparison method with a Secondary Watt-hour Standard. 'Calibration-Due" notification is sent to personnel assigned to portable field Watt-hour standards or to the Meter shop Watt-hour standards prior to the Watt-hour standard calibration due date. Field personnel will then exchange their portable standard for a newly calibrated standard of the same type. Meter shop Watt-hour standards are certified in place, at six-month intervals by Instrument Laboratory technicians using the Secondary Standards.

Documentation for all calibrations and for calibration procedures is maintained in a database system. Calibration data for portable field Watt-hour standards and for meter shop Watt-hour standards are maintained in spreadsheet files. A calibrated certification tag is affixed to each Watt-hour standard in a visible location. Each certification tag contains the calibration date, calibration due date, and the calibrating technician initials. Calibrations are performed following the guidance of ANSI C12.a-2001, ANSI code for Electric Metering.

6. Meter Quality Assurance

(a) PURPOSE :
To assure meters meet PGE accuracy requirements before acceptance or installation in accordance to ANSI C12.1 – 1995.

(b) RESPONSIBILTY:
Meter Services is responsible for testing all meters and meter equipment, with the exception of substation metering. The company requires 100% testing of all new meters or meters that were removed from service and returned to stock. The meter manufacturer shall test all new single-phase and three-phase meters before being shipped to PGE. The manufacturer shall also provide certified test data for all new meters received by PGE.

(c) SAMPLING METHOD:
Sample testing of new single-phase, self-contained, non-demand meters is accomplished by randomly selecting 2 pallets from each shipment of 20 pallets received. In the case of shipments of fewer than 20 pallets, 10% of the shipment is randomly selected for test. Testing is then done in accordance with the American National Standard Code for Electricity Metering (ANSI) C12.1 - 1995, Section 5. If none of the sample tests are outside the PGE specifications on either heavy load or light load tests, the shipment will be accepted without further testing.

In the case of small shipments or when the meters represent new technology or special use devices, PGE may elect to test more than 10% of the shipment.

The PGE accuracy requirement for new meters at light and full loads is as follows $\pm$ 0.3% for electronic meters. Any sample test lot found to be outside acceptable accuracy limits would be held from service until repaired or recalibrated.

7. In-Service Random Sample Meter Testing

(a) PURPOSE:
The purpose of this test program is to detect inaccurate meter groups and yield statistical information on which to base future maintenance and testing.

The in-service testing program will include watt-hour meters of the following types:
Self-contained
- Single-phase non-demand
- Network non-demand
- Polyphase non-demand

(b) METHOD:

Random sample of meters will be drawn annually from each applicable Homogeneous Meter Group using PGE's Meter Asset Database, for the sample lots that are scheduled for testing. Sample lots will be created and tested in the following manner:

As a general rule, meters will be grouped by PGE equipment type, manufacturer, and model having the same design and relationship of parts. Exception to the rule will be large homogeneous meter group (HMG) over than 150,000 meters. Large HMG's will be divided into sub-groups no larger than 100,000 meters by serial number range. All meters meeting the defined criteria will represent a lot and will be given a lot name and lot year. From this lot a random sample and alternates will be drawn. All meters in the lot will have the same chance of being selected as a sample item.

Each group's sample size will be based on a table derived from ANSI/ASQC Z1.9-2008 Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming. The statistical sampling method shall be based upon ANSI/ASQC Z1.9, Section B, Part II Double Specification Limit. An Acceptable Quality Level (AQL) is a nominal value expressed in terms of the percent of meters tested outside the specification limits. An acceptable AQL used for analysis will be 2.5 %. The Maximum Allowable Percent Defective (M) for each meter sample lot will be determined from ANSI/ASQC Z1.9, Table B-3, "Normal Inspection". Sub-lots for a single lot will not be created unless a lot fails. In the instance of a failed lot, the lot will be divided not to exceed 5% into sub-lots by chronological age or geographic area. This will be done to determine and localize the failing serial number range. This sub-lot method will continue for all subsequent years until all sub-lots pass the analysis and/or the failed sub-lot(s) are removed from service.

The test results of uniquely defective meters will be excluded from the statistical analysis only if the cause of the error can be attributed to external causes or outside forces (i.e., vandalism, tampering, lightning, corrosive environment, etc).

(c) TEST RESULTS ANALYSIS:

Sample plan test results will be analyzed by a mathematical method based on ANSI/ASQC Z1.9-2008. If the analysis of the sample indicates the Estimated Lot Percent Defective exceeds the Maximum Allowable Percent Defective (M), the unacceptable lot may be further subdivided by age, geographic location, or other factors that might affect accuracy. Additional samples will be drawn on any sub lot that is unacceptable. The other sub lots will require no further testing.

Those sub-lots where the Estimated Lot Percent Defective exceeds the Maximum Allowable Percent Defective (M) on the second sample test will require re-calibration or retirement within four years unless the lot fails due to meters running fast. Fast running meter lots will be removed from service at a more accelerated rate.

The company shall evaluate annually the uniquely defective meters found for each HMG during the previous year sample-testing program. The evaluation will recognize meters with design or manufacturing deficiencies that demonstrate an excessive number of premature failures or are developing a history of poor performance.

8. In-Service Periodic Meter Testing

(a) PURPOSE:

The purpose of this testing and verification program is to identify and correct inaccurate and defective metering systems. Additionally, this program is to detect inaccurate meter groups and yield statistical information on which to base future maintenance and testing.

This in-service program includes watt-hour and demand meters that are self-contained and instrument transformer rated meters equipped with demand registers, including multi-function demand.

(c) METHOD:

Meters and metering systems covered under this test program will be tested and inspected at minimum of 12-year intervals in accordance with ANSI C12.1-1995. Large Commercial/Industrial customers served by substation metering will receive annual meter testing and inspection. Commercial/Industrial customers that have an average load greater than 1 Mw will receive bi- annual meter testing and inspection. The meters on services with an average load between 500 kW and 1 Mw will be tested and inspected every 5 years. Meters will be divided into groups based on PGE equipment type and manufacturer.

An acceptable meter shall be defined as one that yields an as-found average accuracy of 100 $\pm$ 2 percent. ANSI C12.1-1995, Method 1, will be the basis of calculations for weighted percent registration.

All meters with an error greater than $\pm$ 5 % in as-found testing will be declared uniquely defective and removed from service. The test results of these meters will be excluded from the statistical analysis only if the cause of the error can be attributed to external causes or outside forces (i.e., vandalism, tampering, lightning, corrosive environment, etc).

9.Metering Transformers

(a) PURPOSE:

To ensure that metering transformers are accurate in accordance to ANSI C12.1-1995 and ANSI C57.13.

(b) RESPONSIBILITY:

Meter Services is responsible for testing Current and Voltage transformers that are used for revenue metering. Only personnel who have thorough practical and theoretical knowledge and adequate training in the use of transformers shall conduct the tests. Transformer test equipment accuracy will be traceable to National Institute of Standards Technology (NIST).

(c) SUMMARY OF METHOD:

The company requires 100% testing of all transformers, new or returned from service. New transformers will have certified test results from the manufacturer and will be sample tested for quality assurance. The sample will be 10% for all secondary transformers with no less than 4 transformers of any lot to be tested. New primary metering transformers will be 100% tested when received.

(d) TESTING:

Shop Tests will comply with ANSI C12.1-1995, SECTIONS: 5.3.2.1and 5.3.2.2. Metering Transformers will be 0.3 accuracy or better. Transformers that fail ANSI tests will be retired or returned to the manufacturer.

- ANSI C12.1-1995: 5.3.2.1---Pre-installation Test
- ANSI C12.1-1995: 5.3.2.2---Transformers Removed from Service

Field Testing will comply with ANSI C12.1-1995, SECTION: 5.3.3.2, 5.3.3.3, and 5.3.3.4. These tests will be preformed at each meter test. If a transformer fails these tests they will be removed from service as soon as possible and tested in the shop.

- ANSI C12.1-1995: 5.3.3.2---In-Service Inspection
- ANSI C12.1-1995: 5.3.3.3---Heavy Burden Test
- ANSI C12.1-1995: 5.3.3.4---Secondary Voltage Test

10. Testing and Verification Methods

(a) RESPONSIBILITY:

Meter Services is responsible for operating, maintaining, and revising as necessary this metering test and verification program. Meter Services, or an approved contractor for PGE, will perform the tests and verifications (in-field and in-shop) on selected metering systems and record results.

(b) TESTING:

Meters may be field tested or removed and brought back to the Meter Shop for testing. Meter covers shall not be removed prior to an as-found meter test, if possible. The meter tester shall handle meters with care during testing. Watt-hour tests are performed at 100 percent of nameplate test current (FL) and 10 percent of nameplate test current (LL) in accordance with ANSI C12.1-1995.

An acceptable meter shall be defined as one that yields an as-found average accuracy of 100 $\pm$ 2 percent. ANSI C12.1-1995, Method 1, will be the basis of calculations for weighted average percent registration.

(c) CALIBRATION:

Mechanical meters shall be adjusted if the as-found average deviation of watt-hour meter test results exceed ± 1 %.

When adjusted, meters shall be re-calibrated to within a ± 0.5 % error tolerance at full and light load.

(d) VERIFICATION:

Meter system verifications will be preformed on all metering installations when tested; this includes periodic and sample tests along with new, transformer service installations 90 days after the service was energized. The purpose of the verification is to assure the correctness of the meter installation and associated records, it will include the following when applicable:

A. Meter testing
B. Demand register testing
C. Correctness of meter application
D. Meter loading
E. Correctness of billing constant (i.e., multiplier)
F. Correctness of wiring
G. Condition of wiring
H. Current transformer sizing
I. Quality and ratio of instrument transformers(verify nameplate data)
J. Current transformer burden tests
K. Voltage measurements
L. Current measurements
M. Phase angle test
N. Instantaneous power factor measurements
O. Security of the metering system and components
P. Accessibility of the meter and other metering devices
Q. Safety of the metering system and site
R. Safety and condition of the electric distribution system
S. Current diversion
T. Revenue implications (i.e., customer under-billing or over-billing)

11. Security and Revenue Protection

PGE will maintain documented procedures to insure and verify the physical security and safety of metering installations through: training of personal, control of sealing and locking devices, and installation of seals and locking devices for meter system security and integrity. Additional controls will be used for meter information technology security. Password protections will be maintained for programmable meters to prevent unauthorized adjustment, programming or data acquisition.

Revenue validation and protection programs will include training of field and billing personnel and high/low energy usage audits designed to trigger consumption investigations. Qualified personnel are assigned the responsibility to investigate field conditions that may have loss of revenue implications.

12. Electric Service Requirements

Specific applications of the Electric Utility Service Equipment Requirements Committee (EUSERC) manual are described in the PGE's, Oregon Electric Service Requirements booklet. This publication provides an important element in ensuring proper metering installations.

13. Record Keeping

Records will be maintained for all laboratory and field test standards by serial number. Records for standards will be maintained for the life of the equipment plus five years. Test records will be maintained for all meters and auxiliary transformers for the life of the equipment plus one year. All energy diversion investigations will be recorded and records will be maintained for five years.

14. Annual Metering Management Review

PGE will annually evaluate the currency of its metering policies, practices and procedures with updated national and state regulations, standards and guidelines. PGE will maintain a documented management review program to ensure compliance with OPUC regulations and established company policies and directives.

15. Annual Report and Certification to OPUC

Meter Services will submit an annual certification report to the Commission as set out in Section S of the OPUC's Electric utility Metering Policy. Included in the report are:

A. Meter group descriptions
B. Number of meters in the group
C. Number of meters tested per group
D. Mean of the as-found Average Accuracy for each group
E. Standard deviation of the as-found Average Accuracy for each group
F. High/low range of the as-found Average Accuracy for each group
G. Percentage above/below 100 $\pm$ 2 % Average Accuracy for each group
H. Number of meters uniquely defective per HMG group listed by cause and analysis of defects
I. Proposed action for future testing and maintenance based on test results
J. Meter Audit failures listed by cause and analysis of defects for PMG's
K. Nonconformance Revenue Implications
L. The number of qualified personnel employed by PGE
M. Executive Summary of Annual Metering Management Review