

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

ELECTRONIC APPLICATION OF TAYLOR)	
COUNTY RURAL ELECTRIC COOPERATIVE)	CASE NO.
CORPORATION FOR APPROVAL OF SAMPLE)	2021-00181
METER TESTING PROGRAM FOR SINGLE-)	
PHASE METERS)	

ORDER

On April 23, 2021, Taylor County Rural Electric Cooperative Corporation (Taylor County RECC) filed an application seeking approval for the adoption of a sample meter testing program in accordance with 807 KAR 5:041, Section 16, Sample Testing of Single Phase Meters.

Taylor County RECC is a member-owned electric distribution cooperative organized pursuant to KRS Chapter 79 with its principal business office located in Campbellsville, Kentucky. Taylor County RECC provides electric service to approximately 26,883 members in all or portions of Adair, Casey, Cumberland, Green, Hart, Marion, Metcalf, Russell, and Taylor counties in Kentucky.¹ Taylor County RECC completed installation in 2008 and has fully deployed automated meter-reading technology that includes service to all single-phase residential and commercial customers by solid-state digital electronic meters.²

¹ *Annual Report of Taylor County RECC to the Public Service Commission for the Year Ending December 31, 2020* at 32 and 52.

² Responses of Taylor County RECC to Commission Staff's First Request for Information (filed Aug. 2, 2021) Item 8.

In its initial application, Taylor County RECC submitted a description of the methods and procedures it plans to follow when conducting sample testing of single-phase meters. After review of the initial application, Commission Staff issued a request for information on July 19, 2021. Taylor County RECC provided responses and one exhibit on August 2, 2021. There are no intervenors in this proceeding, the record is complete, and the case is ripe for a decision.

For the reasons discussed below the Commission finds that Taylor County RECC should be granted approval to adopt a sample meter testing program in accordance with 807 KAR 5:041, Section 16, and as described in Taylor County RECC's application. In addition, the Commission directs Taylor County RECC to provide reporting related to its sample meter testing program as described in this Order to ensure the accuracy of meters and the overall integrity of Taylor County RECC's metering system.

TAYLOR COUNTY RECC APPLICATION

According to its application, Taylor County RECC intends to utilize the statistical sampling methodology prescribe by the American National Standards Institute/American Society for Quality Control³ (ANSI/ASQC) Z1.9-2008 standard (Sampling Procedures and

³ The American Society for Quality Control is now known as the American Society for Quality (ASQ) and is a members-based organization.

Tables for Inspection).⁴ This standard has been used as the basis for a number of electric utilities' sample meter testing programs.⁵

Taylor County RECC is currently on schedule with its periodic meter testing program as prescribed by 807 KAR 5:041, Section 15, and has a member of staff at their on-site testing facility who performs in-house testing of meters. Taylor County RECC asserts that adopting a sample testing program will result in an estimated operational costs savings of \$691,707 over the eight-year periodic testing cycle without sacrificing meter testing accuracy or the overall integrity of its metering system.⁶

Taylor County RECC has identified the following homogenous test groups that are planned to be utilized for sampling:

Manufacture	Type	Form	Inventory
Itron	Centron	2S	22,500
Landis+Gyr	Focus	2S	2,500
Aclara	I-210	2S	1,000

⁴ ANSI/ASQ Z1.9-2013 is the current version of the standard and includes very minor (typographical) revisions to the 2008 version. ANSI/ASQ Z1.9 is an acceptance sampling system to be used on a continuing stream of lots under inspection for a specified Acceptance Quality Limit ("AQL"). The methodology provides tightened, normal, and reduced inspection plans to be used on populations which have normally distributed test characteristics. Pursuant to the methodology, the variation in measurements may be evaluated by determining the sample's standard deviation, the sample's range or utilizing a known standard deviation of the population. The methodology is applicable only when the normality (Gaussian distribution) of the quality measurements for the group under inspection is assured.

⁵ See generally Case No. 2013-00186, *Application of Farmers Rural Electric Cooperative for Adoption of a Sample Meter Testing Procedure*, (Ky. PSC Aug. 2, 2014) final Order; Case No. 2000-00429, *The Application of Columbia Gas of Kentucky, Inc. for Authority to Implement a Permanent Statistical Meter Sampling Plan for Residential, Industrial and Commercial Class Meters and for Authority to Deviate From 807 KAR 5:006, Section 25(5)(B)* (Ky. PSC Feb. 26, 2001) final Order; Case No. 2005-00276, *Joint Application of Inter-County Energy Cooperative Corp., Kentucky Power Company, Kentucky Utilities Company, Louisville Gas and Electric Company, Owen Electric Cooperative, Inc., Shelby Energy Cooperative, Inc. and The Union Light Heat and Power Company for Approval of a Pilot Meter Testing Plan Pursuant To 807 KAR 5:041, Sections 13, 15, 16, 17, and 22* (Ky. PSC Nov. 10, 2005) final Order.

⁶ It should be noted that Taylor County RECC's analysis presumes the proposed sample testing will not result in unacceptable performance for any lot under inspection, thereby avoiding any estimated expenses associated with further testing that may be required to verify meter accuracies within a group/lot.

Taylor County RECC will employ a computerized system utilizing billing system records to randomly select meter units from each group/lot of installed meters up to the necessary sample size. Non-registering or damaged meters, not due to a manufacturer's defect or abnormal conditions, will be replaced with another randomly selected sample meter from the lot under inspection.⁷ Consistent with ANSI/ASQ Z1.9, each group/lot will be sampled and tested for acceptance at Inspection Level II, which corresponds to a "default" level of normal discrimination deemed appropriate absent circumstances or conditions that might warrant the need for a greater or lesser inspection level.

Taylor County RECC indicates that it intends to use an AQL of 2.5 percent nonconforming (i.e. defective) as the basis for determining the acceptance of all installed meter groups/lots. Taylor County RECC notes the upper and lower two percent limits require the use of the Double Specification Limit method as outlined in the ANSI/ASQ standard. Newly installed meters will also be eligible for selection as a sample from the assigned group/lot in the year following being placed in service. These new meters will be sample tested in lots established just for "new" meter testing and will be subject to a more stringent AQL of 1 percent non-conforming.

Taylor County RECC proposes to use a +/- 2 percent double specification limit for accuracy measurements, i.e., the accuracy of a meter under test will be accepted if its average meter registration falls within the upper limit of 102 percent (fast) and the lower limit of 98 percent (slow). The variability in measured accuracy of the units within the group/ lot under test is assumed to be unknown, and the standard deviation method will

⁷ As noted in Case No. 2013-00186, *Application of Farmers Rural Electric Cooperative for Adoption of a Sample Meter Testing Procedure* (Ky. PSC Aug. 8, 2014) final Order, this approach is a potential area of concern.

be employed to evaluate the estimated percent non-conforming of the lot, which will then be compared to the derived maximum allowable percent non-conforming (based on an AQL of 2.5) to determine acceptance of the lot.

For new meters, Taylor County RECC proposes to use a +/- 1 percent double specification limit with acceptance of the lot being determined based on an AQL of 1.0.

Pursuant to 807 KAR 5:041, Section 14, all meters will be tested at full load (FL), light load (LL), and 50 percent power factor, but only the FL and LL test results will be evaluated to determine the acceptance of the lot. If a sample fails to meet the specified AQL, the entire group/lot will be tested within 18 months. No meter will remain in service for more than 25 years without testing, regardless of the associated group/lot performance, pursuant to and as required by 807 KAR 5:041, Section 16(4)(b).

Taylor County RECC has committed to test a percentage of meters in addition to the samples selected from each group/lot, as prescribed by 807 KAR 5:041, Section 16(4)(a), based on the prior year's test results. These additional meters should be selected from meters in each group/lot longest in service since the last test or may be selected from meter types known to be affecting a group/lot's accuracy performance.

DISCUSSION

The Commission has approved sample testing plans for several jurisdictional electric utilities, and each plan is based on substantially the same methodology and procedures provided for in the current version of ANSI/AQC Z1.9.

Taylor County RECC is currently testing its meters pursuant to 807 KAR 5:041, Section 15, which prescribes the procedures and rules surrounding the testing of electric metering equipment. Most crucially, the regulation requires "[m]etering equipment,

including instrument transformers and demand meters, shall be test for accuracy prior to being placed in service, periodically in accordance with the schedule below, upon complaint, when suspected of being in error, or when removed from service for any cause.”⁸ The regulation requires a period test schedule of eight years for all single-phase electric meters.

807 KAR 5:041, Section 16, allows a utility to request approval for sample testing plans of single-phase electric meters. If a proposed sample testing plan is approved it may be followed in lieu of the testing prescribed in 807 KAR 5:041, Section 15(3). Pursuant to 807 KAR 5:041, Section 16, a proposed sample testing plan must include the following: (1) meters divided into separate groups which recognize different design characteristics, serial number and date of manufacture;⁹ (2) the sampling procedure should be based upon statistical principles;¹⁰ (3) the same sampling procedure shall be applied to each group.¹¹ The regulation also requires that the any utility authorized to test meters by a sample meter-testing plan also test a certain number of meters in addition to the sample.¹² The number of meters tested in addition to the sample is determined by the performance of the meter group in the prior test year.¹³ The regulation requires the utility to take these additional meters from among the meters that have been in service the longest in each group, unless there is a particular meter type known to have performed

⁸ 807 KAR 5:041, Section 15(3).

⁹ 807 KAR 5:041, Section 16(1).

¹⁰ *Id.* at Section 16(2).

¹¹ *Id.* at Section 16(3).

¹² *Id.* at Section, 16(4)(a).

¹³ *Id.*

poorly in the last test year.¹⁴ If there is a particular meter type known to have performed poorly in the prior test year, then the number of additional meters to be tested is drawn from among those meters.¹⁵ The regulation requires that no meter shall remain in service without periodic testing for a period of longer than 25 years;¹⁶ and whenever a meter is found to be more than two percent fast or slow, refunds or back billing shall be made for the period during which the meter error is known to have existed or if not known for the half the time since the last test, but not to exceed three years.¹⁷

Taylor County RECC's proposed sample metering plan divides meters into separate, homogenous groups based on manufacturer and type. These larger groupings will then be divided into smaller groups of approximately 1,000 based upon serial number.¹⁸ The statistical procedure will following the ANSI/ASQ Z1.9-2008 standard and each test group will be randomly sampled through a computer-based process.¹⁹ Taylor County proposed testing existing meters using at ANSI/ASQ at Inspection Level 2, using an AQL of 2.5, and an upper and lower testing limit of two-percent.²⁰ New meters will be tested using a more exacting standard of Inspection Level 1, an AQL of 1.0, and upper and lower testing limit of one-percent.²¹

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ *Id.*, Section 16(4)(a) through (b).

¹⁷ *Id.* at 16, Section 16(5).

¹⁸ Application, Taylor County Rural Cooperative Corporation Proposed Plan to Implement Sample Meter Testing Program on Single-Phase 1S/2S, unnumbered page 2.

¹⁹ *Id.*

²⁰ *Id.* at unnumbered page 3.

²¹ *Id.*

The meters will be tested under full load, light load, and at 50-percent power factor at full load in accordance with the testing protocols prescribed in 807 KAR 5:041, Section 17(1).²² If a selected meter is damaged or non-registering it will be replaced by another random selection. Should an entire lot classify as failing it will be removed from service and re-test within 18 months of failure.²³

One area of concern in Taylor County RECC's application involves the procedure of replacing "non-registering" meters found within a sample with properly registering units and then the continued evaluation for the acceptance of the group/lot. Depending on the frequency and nature of the conditions that render meters non-registering within a sample, it is possible that the occurrence of non-registering meters is indicative of such conditions being found within the group/lot under inspection. ANSI/ASQ Z1.9 at Section A7.2 requires that the "[u]nits of a sample shall be selected at random without regard to the quality," which implies that even if the selection process is entirely random both for the original unit and its replacement, a non-registering meter condition should be accounted for in some manner, as it may well indicate quality issues beyond meter accuracy that should be evaluated by a utility to ensure the integrity of its metering system.

Taylor County RECC also proposes to file annual reports with the Commission showing each lot's performance and a copy of manufacturer's new meter test data.²⁴

²² *Id.*

²³ *Id.*

²⁴ *Id.*

After review of the proposed plan the Commission finds that Taylor County RECC's application for a sample testing plan should be approved with additional reporting requirements to demonstrate that the testing plan effectively assures the accuracy of meters in-service.

IT IS THEREFORE ORDERED that:

1. Taylor County RECC is granted approval to adopt a sample testing program in accordance with 807 KAR 5:041, Section 16, and as provided for in Taylor County RECC's application, submitted on April 23, 2021, and attached as an Appendix to this Order.

2. Taylor County RECC shall comply with all applicable meter-testing requirements contained in 807 KAR 5:006 and 807 KAR 5:041, including maintaining all meter test records related to its sample testing in accordance with 807 KAR 5:006, Section 18.

3. Taylor County RECC shall notify the Commission in writing of any intentions to adjust, alter, amend, or otherwise deviate from the sample testing plan provided for herein, including notice of a decision to abandon sample testing and return to periodic testing of meters as prescribed by 807 KAR 5:041, Section 15.

4. Taylor County RECC shall provide the additional information listed below with its Quarterly Meter Reports, which are required to be filed by 807 KAR 5:006, Section 4(4), in an electronic version compatible with Microsoft Excel.

a. A detailed report in a tabular format that records the following information for each meter, including new meters, tested under the sampling plan:

(1) Serial number;

- (2) Date/Time of test;
- (3) Manufacturer;
- (4) Model/Form/Type;
- (5) Version/Firmware;
- (6) As-found meter registration, FL, LL, and Power Factor test

results;

- (7) As-left meter registration, FL, LL, and Power Factor test

results; and

- (8) Description of any billing adjustment.

b. An “exception” report in a tabular format that lists the following information for each meter removed from a sample and replaced with another unit due to a “non-registering” condition or any other condition that prevents the meter from being tested:

- (1) Serial number of replaced meter;
- (2) Manufacturer;
- (3) Model/Form/Type;
- (4) Version/Firmware;
- (5) Serial number of replacement meter;
- (6) Date of replacement;
- (7) Description of meter condition and suspected cause of

damage/defect; and

- (8) Description of any billing adjustment.

By the Commission

ENTERED
SEP 22 2021 rcs
KENTUCKY PUBLIC
SERVICE COMMISSION

ATTEST:


Executive Director

Case No. 2021-00181

APPENDIX

APPENDIX TO AN ORDER OF THE KENTUCKY PUBLIC SERVICE
COMMISSION IN CASE NO. 2021-00181 DATED SEP 22 2021

SIX PAGES TO FOLLOW

Taylor County Rural Cooperative Corporation Proposed Plan to Implement Sample Meter Testing Program on Single-Phase 1S/2S

Prepared by
Ken Cooper
Power System Engineering Inc.
April 4, 2021

Proposal for Single-Phase 1S/2S Sample Meter Testing Program

Introduction:

Taylor County Rural Electric Cooperative Corporation (TCRECC) is an electric distribution cooperative located in central Kentucky. Serving 27,093 members in Adair, Casey, Cumberland, Green, Hart, Marion, Metcalfe, Russell and Taylor counties. TCRECC is presently using and on schedule with the eight-year meter testing program. Once adopting the sample meter testing program, TCRECC will make significant steps toward maximizing efficiency in their single-phase meter testing program. The purpose of this proposal is to demonstrate the methods used and the cost savings achieved in sample testing.

Rules and Regulations:

Kentucky Public Service Commission (PSC) rules and regulations outline the required method and techniques of sample meter testing. TCRECC will comply with the PSC's requirements related to the sampling and testing of meters as provided in 807 KAR 5:006 and 5:041. TCRECC would like to implement the sample meter testing plan as submitted in this application.

Procedures:

The table below illustrates that meters will be divided into separate homogeneous groups based on manufacturer and type. Due to the large number of meters purchased as TCRECC deployed their AMI system in 2007, this group of meters will be divided into smaller groups of approximately 1,000 meters by serial number.

Manufacture	Type	Form	Inventory
Itron	Centron	2S	22,500
Landis+Gyr	Focus	2S	2,500
Aclara	I-210	2S	1,000

TCRECC statistical meter sample testing will follow the ANSI/ASQC Z1.9-2008 standard (Sampling Procedures and Tables for Inspection). Each test group will be randomly sampled by a computerized process. TCRECC will use their customer information and billing system for this process.

The Acceptance Quality Level (AQL) is defined as the quality level that is the worst tolerable product average when a continuing series of lots are submitted for acceptance sampling.

Due to the +/- 2% limits, the sample groups shall be tested using an AQL of 2.5. This value can be found in Table A-1. The upper and lower 2% limits require the use of the Double Specification Limit method as outlined in this ANSI Standard.

Newly purchased and/or installed meters will be added to the proper group and will be eligible for sample testing the following year. New meters from a different manufacturer or with different characteristics will require the formation of new groups or set of groups. The formation of any new group will adhere to the same maximum lot size of 1,000 and testing methodology outlined within this sample meter testing plan. Table A-2 provides the sample size code letters that are then to be referenced in Table B-3. The "Normal Inspection" portion of the Table B-3 is then used to determine the sample size for each test group.

TCRECC will sample test new meters using an Inspection Level 1 and an AQL 1.0.

Randomly selected meters from each lot will be tested by the meter shop personnel. If a selected meter is damaged or non-registering that are not a manufacturer's defect or the meter was exposed to abnormal conditions, these meters will be replaced by another random selection.

The meters tested are under full load, light load and at 50 percent power factor at full load in accordance with 807 KAR 5:041 Section 17(1).

Procedures (cont.):

Watt-hour meters shall be retired when the error in registration exceeds 1% at either light load or full load.

Each lot, calculation will be based on Double Specification Limit Variability Unknown-Standard Deviation Method. Full load and light load test results will be evaluated based on ANSI/ASQC Z1.9-2008 standards.

Performance shall be deemed acceptable if the full load and light load performance of the meters is within the lot meet acceptability criteria of the ANSI standard. If a lot is classified as failed, TCRECC will test the entire lot of meters within 18 months from them failing the applicable governing standard.

No meter will remain in service without a periodic test for a period longer than twenty-five years.

An annual report (showing each lot's performance) and a copy of manufacturer's new meter test data will be available to the KY PSC.

If TCRECC should suffer an operational hardship due to this requirement, a request for deviations may be filed.

Procedures (cont.):

ANSI Part A7, Sample Selection, from the standard, states that Inspection Level, General II, shall be used for the discrimination level. Unless otherwise required by the KY PSC, this level will be in effect for the TCRECC program.

Table A-1²
AQL Conversion Table

For specified AQL values falling within these ranges			Use this AQL value
–	to	0.109	0.10
0.110	to	0.164	0.15
0.165	to	0.279	0.25
0.280	to	0.439	0.40
0.440	to	0.669	0.65
0.700	to	1.09	1.0
1.10	to	1.64	1.5
1.65	to	2.79	2.5
2.80	to	4.39	4.0
4.40	to	6.99	6.5
7.00	to	10.9	10.0

Table A-2³
Sample Size Code Letters

Lot Size	Inspection Levels					
	Special S3 S4		General I II III			
2 to 8	B	B	B	B	C	
9 to 15	B	B	B	B	D	
16 to 25	B	B	B	C	E	
26 to 50	B	B	C	D	F	
51 to 90	B	B	D	E	G	
91 to 150	B	C	E	F	H	
151 to 280	B	D	F	G	I	
281 to 400	C	E	G	H	J	
401 to 500	C	E	G	I	J	
501 to 1,200	D	F	H	J	K	
1,201 to 3,200	E	G	I	K	L	
3,201 to 10,000	F	H	J	L	M	
10,001 to 35,000	G	I	K	M	N	
35,001 to 150,000	H	J	L	N	P	
150,001 to 500,000	H	K	M	P	P	
500,001 and over	H	K	N	P	P	

Procedures (cont.):

Table B-3⁴

Master Table for Normal and Tightened Inspection for Plans Based on Variability Unknown
(Double Specification Limit and Form 2 – Single Specification Limit)

Sample Size Code Letter	Sample Size	Acceptance Quality Limits (normal inspection)											
		T	.10	.15	.25	.40	.65	1.00	1.50	2.50	4.00	6.50	10.00
		M	M	M	M	M	M	M	M	M	M	M	M
B	3	↓	↓	↓	↓	↓	↓	↓	↓	7.59	18.86	26.94	33.69
C	4	↓	↓	↓	↓	↓	↓	1.49	5.46	10.88	16.41	22.84	29.43
D	5	↓	↓	↓	↓	0.041	1.34	3.33	5.82	9.80	14.37	20.19	26.55
E	7	↓	0.005	0.087	0.421	1.05	2.13	3.54	5.34	8.40	12.19	17.34	23.30
F	10	0.077	0.179	0.349	0.714	1.27	2.14	3.27	4.72	7.26	10.53	15.17	20.73
G	15	0.186	0.311	0.491	0.839	1.33	2.09	3.06	4.32	6.55	9.48	13.74	18.97
H	20	0.228	0.356	0.531	0.864	1.33	2.03	2.93	4.10	6.18	8.95	13.01	18.07
I	25	0.250	0.378	0.551	0.874	1.32	2.00	2.86	3.97	5.98	8.65	12.60	17.55
J	35	0.253	0.373	0.534	0.833	1.24	1.87	2.66	3.70	5.58	8.11	11.89	16.67
K	50	0.243	0.355	0.503	0.778	1.16	1.73	2.47	3.44	5.21	7.61	11.23	15.87
L	75	0.225	0.326	0.461	0.711	1.06	1.59	2.27	3.17	4.83	7.10	10.58	15.07
M	100	0.218	0.315	0.444	0.684	1.02	1.52	2.18	3.06	4.67	6.88	10.29	14.71
N	150	0.202	0.292	0.412	0.636	0.946	1.42	2.05	2.88	4.42	6.56	9.86	14.18
P	200	0.204	0.294	0.414	0.637	0.945	1.42	2.04	2.86	4.39	6.52	9.80	14.11
		.10	.15	.25	.40	.65	1.00	1.50	2.50	4.00	6.50	10.00	
Acceptance Quality Limits (tightened inspection)													

Cost Savings/Conclusions:

A Substantial reduction in cost will be achieved by implementing the sample meter test program. Once the program is established, only a small percentage of the present labor and testing efforts will be required. This reduction results in cost savings without compromising single phase metering accuracy. The comparison below shows the cost for TCRECC when doing testing under both Periodic and Sample testing programs.

Cost Savings to Taylor County RECC due to change to Meter Sample Testing program:

Assumptions:

Current periodic testing would require testing of 4,000 meters annually. Where sample meter testing program will require 1,000 meters annually to be tested.

Annual Periodic Testing Program Cost		
Average Meters Tested Annually	Cost to Test	Annual Cost
3847	\$30.37	\$116,833
Cost of Testing over 8 year cycle		\$934,667
Proposed Sample Meter Program Testing Cost		
Meters to be Tested	Cost to Test	Annual Cost
1000	\$30.37	\$30,370
Cost of Testing over 8 year cycle		\$242,960
Potential Savings over 8 years		\$691,707

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