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ORIGINAL

August 18, 2000

HAND DELIVERED

Ms. Blanca S. Bayo, Director
Division of Records and Reporting
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

undocketed

Re: Load Research Report - Tampa Electric Company

Dear Ms. Bayo:

In compliance with Rule 25-6.0437 enclosed are five copies of Tampa Electric Company's report entitled Load Research Sampling Plan - August 2000.

Please acknowledge receipt and filing of the above by stamping the duplicate copy of this letter and returning same to this writer.

Thank you for your assistance in connection with this matter.

Sincerely,

James D. Beasley

JDB/pp
Enclosures

cc: Angela Llewellyn

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TAMPA ELECTRIC COMPANY

LOAD RESEARCH SAMPLING PLAN

AUGUST 2000

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APPLICABLE RATE CLASSES

Table 1 lists the major rates which Tampa Electric Company has in effect. The third column shows the percent of total annual sales for each rate and indicates the rates for which monitoring is required by the load research rule. The annual sales reported are for the twelve month period ending December 31,1999.

TABLE 1

PERCENT OF ANNUAL MWH SALES BY RATE

RATE	ANNUAL SALES (MWH)	PERCENT OF TOTAL SALES
Residential (RS & RST)	6,949,109	44.0
General Service Non-Demand (GS, GST, TS)	900,395	5.7
General Service Demand (GSD & GSDT)	4,356,220	27.6
General Service Large Demand (GSLD, GSLDT, SBFT)	1,816,798	11.5
Interruptible Service (IS-1, IST-1, IS-3, IST-3, SBIT-1, SBIT-3)	1,624,193	10.3
All Other Rates	158,262	1.0
Total for All Rates	15,804,977	100.0

Each of the rates listed in Table 1 was monitored during 1999 as part of Tampa Electric Company's ongoing load research program. The two overlapping samples for the RS, GS and GSD classes were selected in 1997 and 1998, and in most cases the recording equipment was installed prior to December 31 of the year during which the sample was selected. Samples for the GSLD and IS classes are not necessary since all of the Customers on these rates have recorders installed on their meters for billing purposes. The data collected by these recorders is used for load research purposes as well. Under this plan the collection of load data for the GSLD and IS classes in this manner will continue.

EXISTING SAMPLE DESIGN

The residential sample was pre-stratified by housing type. The three housing type categories are single family detached, multi-family, and mobile home. The primary reasons for using this stratification was that the load patterns for the three housing types are dissimilar and the percentage of mobile homes in the population changes significantly with the seasons. The percentage ranged from a high of 13% in the winter to a low of 12.3% in the summer. The housing type stratification allows corresponding changes to be made in stratum weights (since inter-strata migration is not a concern) on a month by month basis when estimating class demands. The estimated demands thus reflect the seasonal changes in the housing type mix.

The sample points were allocated to the strata using Neyman allocation with stratum variances estimated from previous sample results. A minimum sample size of 50 was used in the multi-family and mobile home categories to allow generating more accurate data for these sub-populations. The resulting allocation is shown in Table 2.

TABLE 2

RESIDENTIAL SAMPLE

Stratum	Sample Size 1997	Sample Size 1998	Total
Single Family Detached	87	88	175
Multi Family	25	25	50
Mobile Home	25	25	50
Total	137	138	275

The general service non-demand class was stratified on the basis of annual kilowatt-hour consumption at the time of sample selection. Two strata were used with the boundary being 15,000 KWH. The sample points were allocated to the strata using Neyman allocation with stratum variances estimated from the previous sample results. The allocation is shown in Table 3.

TABLE 3

GENERAL SERVICE NON-DEMAND SAMPLE

Stratum	Sample Size 1997	Sample Size 1998	Total
0 – 14,999 kWh	128	129	257
15,000 – infinity kWh	121	122	243
Total	249	251	500

The general service demand class was stratified by several different variables. The first variable was service voltage level; the GSD class contains Customers served at either primary voltage or secondary voltage. Voltage level stratification was used to facilitate analysis required for performing cost of service studies. All Customers served and/or metered at primary voltage were included in the sample. Among secondary Customers an additional 100% sampled stratum was included in the sample design; Customers having demands over 400 KW are included in this stratum. During the course of the data collection for this sample, new Customers meeting the criteria of these 100% sampled strata were added to the sample. The remaining GSD Customers were stratified into two strata on the basis of their highest demand in the twelve month period prior to sample selection. The stratum boundary used was 200 KW. Sample points were allocated to these two strata using Neyman allocation with variances being estimated from the preceding sample. The allocation shown in Table 4 reflects the sample as of December 1999.

TABLE 4

GENERAL SERVICE DEMAND SAMPLE

Stratum	Sample Size 1997	Sample Size 1998	Total
Primary Metered/Primary Served	75 (100%)		75
Primary Metered/Secondary Served	43 (100%)		43
Secondary under 400 kW			
0 – 199 kW	35	35	70
200 – 399 kW	35	35	70
Secondary over 399 kW	577 (100%)		577
Total	835	835	835

EXISTING SAMPLE ACCURACY

As a first step in formulating a sampling plan for Tampa Electric Company the accuracy achieved for the three sampled classes was calculated for each month's coincident peak for 1999 and for the average of the twelve monthly coincident peaks as well. The class accuracies were calculated in the conventional manner for combined ratio analysis. The resulting accuracies are shown in Table 5.

TABLE 5

1999 COINCIDENT PEAK PERCENTAGE ACCURACIES AT 90% CONFIDENCE LEVEL USING COMBINED RATIO ESTIMATION

Month	RS	GS	GSD
January	5.0	9.5	7.6
February	7.1	10.6	6.3
March	7.6	10.3	4.8
April	5.3	5.3	4.5
May	4.8	5.0	4.0
June	5.3	4.8	3.4
July	4.6	5.1	4.0
August	3.6	4.6	4.2
September	5.0	5.2	3.7
October	5.5	5.1	3.9
November	6.2	6.5	4.3
December	7.4	1.2	4.9
12 Coincident Peak Average	2.6	3.7	2.6

The 1999 annual system winter peak occurred in January, and the summer peak occurred in August. All three samples achieved at least the target 10% accuracy at the 90% confidence limit for the winter coincident peak, the summer coincident peak and for the 12 coincident peak average.

PROPOSED SAMPLING PLAN

The RS and GS samples both met the required levels of accuracy for 1999; therefore, no changes in these sample designs are required. Sample allocations for these classes remain the same as filed in the 1998 Load Research Sampling Plan and are shown in the tables below.

TABLE 6

RESIDENTIAL SAMPLE

Stratum	Sample Size 1999	Sample Size 2000	Total
Single Family Detached	87	88	175
Multi Family	25	25	50
Mobile Home	25	25	50
Total	137	138	275

TABLE 7

GENERAL SERVICE NON-DEMAND SAMPLE

Stratum	Sample Size 1999	Sample Size 2000	Total
0 – 14,999 kWh	128	129	257
15,000 – infinity kWh	121	122	243
Total	249	251	500

The GSD sample also met the required levels of accuracy for 1999, but the sample design for this class was modified somewhat. As of the end of 1999 the threshold for 100% sampling was lowered to 300 kW.

Based on current GSD Customer usage levels, the resulting proposed sample design is shown in the table below.

TABLE 8

GENERAL SERVICE DEMAND SAMPLE

Stratum	Sample Size 1999	Sample Size 2000	Total
1. Secondary 0 – 199 kW	35	35	70
2. Secondary 200 –300 kW	35	35	70
3. Secondary over 300 kW	886 (100%)		886
4. Primary Metered/Primary Served	74 (100%)		74
5. Primary Metered/Secondary Served	41 (100%)		41
Total	1141	1141	1141

CONTINUOUS OVERLAPPING SAMPLES

As outlined in the 1998 Tampa Electric Company Load Research Sampling Plan, we are proposing to continue using the overlapping sampling methodology for all three of the sampled rate classes, RS, GS and GSD.

The half-sized RS, GS, and GSD samples selected and installed in 1998 will be removed and replaced with samples selected and installed prior to December 31, 2000. This follows the schedule of data being collected from each half-sample for twenty-four months. Once the new, independent samples are fully installed and data collection has begun, the oldest previously selected samples will be retired and removed. Thus, for any given month, two independent samples will be available to produce population estimates. For computing annual statistics, in particular the average of the twelve coincident peaks, estimates from two or three independent, overlapping samples will be combined. The sample size for each new sample will be sufficiently large, when used in combination with the existing sample(s), to achieve an expected accuracy of ±10% at the 90% confidence level for the summer and winter coincident peaks and for the average of the twelve monthly coincident peaks.

FORMULAS AND DEFINITIONS

Combined Ratio Estimate

$$\hat{R}_c = \frac{\sum_h W_h \bar{y}_h}{\sum_h W_h \bar{x}_h}$$

Where

$\hat{R}_c$ = *combined ratio estimate*
W_h = *stratum weight for stratum h*
$\bar{Y}_h$ = *mean coincident demand for stratum h*
$\bar{X}_h$ = *mean billed energy for stratum h*

Coincident Peak Estimate

$$\hat{Y}_{rc} = \hat{R}_c X$$

Where

$\hat{R}_c$ = *combined ratio estimate*
$\hat{Y}_{rc}$ = *estimated class total coincident peak*
X = *class total billed energy*

Standard Deviation of Sample Residuals

$$s_{dh}^2 = \frac{\sum_{i=1}^{n_h} (y_{hi} - \hat{R}_c x_{hi})^2}{n_h - 1}$$

Where

$\hat{R}_c$ = *combined ratio estimate*
n_h = *sample size for stratum h*
s_{dh} = *standard deviation of sample residuals*
y_{hi} = *coincident demand for sample Customer i of stratum h*
x_{hi} = *billed energy for Customer i of stratum h*

Variance of Coincident Peak Estimate

$$\hat{V}(\hat{Y}_{rc}) = \sum_{h} \frac{N_h^2 \left(1 - \frac{n_h}{N_h}\right)}{n_h} s_{dh}^2$$

Where

$\hat{V}(\hat{Y}_{rc})$ = *variance of coincident estimate*
N_h = *population size for stratum h*
n_h = *sample size for stratum h*
s_{dh} = *standard deviation of sample residuals*

Accuracy at 90% Confidence Level

$$A = \frac{1.645\sqrt{\hat{V}(\hat{Y}_{rc})}}{\hat{Y}_{rc}}$$

Where

$\hat{Y}_{rc}$ = *estimated class total coincident peak*
$\hat{V}(\hat{Y}_{rc})$ = *variance of coincident estimate*
A = *accuracy at 90% confidence level*

Sample Size

$$n = \frac{(\sum_{h} W_h s_{dh})^2}{\left(\frac{d}{1.645}\right)^2 \left(\frac{\hat{Y}_{rc}}{N}\right)^2}$$

Where

W_h = *stratum weight for stratum h*
$\hat{Y}_{rc}$ = *estimated class total coincident peak*
N = *population size*
s_{dh} = *standard deviation of sample residuals*
n = *total sample size*
d = *desired relative accuracy*

Sample Allocation (Neyman)

$$n_h = n\frac{W_h S_{dh}}{\sum_h W_h S_{dh}}$$

Where

W_h = *stratum weight for stratum h*
n_h = *sample size for stratum h*
s_{dh} = *standard deviation of sample residuals*
n = *total sample size*

TWELVE COINCIDENT PEAK ESTIMATE

$$12\hat{C}P = \frac{1}{12}\sum_{m=1}^{12}\hat{Y}_{rcm}$$

WHERE

$\hat{Y}_{rcm}$ = *Coincident Peak Estimate for Month M*

VARIANCE OF TWELVE COINCIDENT PEAK

$$VAR(12\hat{C}P) = \left(\frac{1}{12}\right)^2\left(\sum_{m=1}^{12}\hat{V}(\hat{Y}_{rcm}) + 2\sum_{m=1}^{12}\sum_{k<m}\hat{C}(\hat{Y}_{rcm},\hat{Y}_{rck})\right)$$

WHERE

$\hat{V}(\hat{Y}_{rcm})$ = *Variance of Coincident Peak Estimate Month m*
$\hat{C}(\hat{Y}_{rcm},\hat{Y}_{rck})$ = *Covariance of Month m and Month k Estimates*

MONTH TO MONTH COVARIANCE

$$\hat{C}(\hat{Y}_{rcm},\hat{Y}_{rck}) = \sum_{h=1}^{l} \frac{N_{hm}\, N_{hk}}{n_{hmk}} (fpc_{mk})\, s_{hd_m d_k}$$

WHERE

N_{hm} = *Population Size in Month m*

N_{hk} = *Population Size in Month k*

n_{hmk} = *Sample Size with good data in Month m and k*

$$fpc_{mk} = 1 - \min\left(\frac{n_m}{N_m}, \frac{n_k}{N_k}\right)$$

$$s_{hd_m d_k} = \sum_{i=1}^{n_{hmk}} \frac{(y_{hmi} - \hat{R}_m x_{hmi})(y_{hki} - \hat{R}_k x_{hki})}{n_{hmk} - 1}$$

COMBINING ESTIMATES FROM TWO SAMPLES

$$\hat{Y}_{rc} = \alpha\, \hat{Y}_{rcA} + (1 - \alpha)\, \hat{Y}_{rcB}$$

WHERE

$\hat{Y}_{rcA}$ = *Sample A Estimate*

$\hat{Y}_{rcB}$ = *Sample B Estimate*

α = *Weighting factor*

COMBINING VARIANCES FROM TWO SAMPLES

$$\hat{V}(\hat{Y}_{rc}) = \alpha^2 \hat{V}(\hat{Y}_{rcA}) + (1 - \alpha)^2 \hat{V}(\hat{Y}_{rcB})$$

WHERE

$\hat{V}(\hat{Y}_{rcA})$ = *Variance of Sample A Estimate*

$\hat{V}(\hat{Y}_{rcB})$ = *Variance of Sample B Estimate*

α = *Weighting factor*

WEIGHT TO OBTAIN MINIMUM VARIANCE

$$\alpha = \frac{\hat{V}(\hat{Y}_{rcA})}{\hat{V}(\hat{Y}_{rcA}) + \hat{V}(\hat{Y}_{rcB})}$$

WHERE

$$\hat{V}(\hat{Y}_{rcA}) = Variance\ of\ Sample\ A\ Estimate$$
$$\hat{V}(\hat{Y}_{rcB}) = Variance\ of\ Sample\ B\ Estimate$$
$$\alpha = Weighting\ factor$$

TWELVE COINCIDENT PEAK -- THREE SAMPLES EQUAL / WEIGHTING

$$12\hat{C}P = \left(\frac{1}{24}\right)\left(\sum_{m=1}^{l} \hat{Y}_{mA} + \sum_{m=1}^{12} \hat{Y}_{mB} + \sum_{m=l+1}^{12} \hat{Y}_{mC} \right)$$

WHERE

Sample A is in place for the first l months, sample B is in place for all 12 months and sample C is in place for the last 12 - l months.

$$\hat{Y}_{mA} = Sample\ A\ Estimate\ for\ Month\ m$$
$$\hat{Y}_{mB} = Sample\ B\ Estimate\ for\ Month\ m$$
$$\hat{Y}_{mC} = Sample\ C\ Estimate\ for\ Month\ m$$

VARIANCE OF TWELVE COINCIDENT PEAK

$$VAR(12\hat{C}P) = \left(\frac{1}{24}\right)^2 \{ \sum_{m=1}^{l} \hat{V}(\hat{Y}_{rcmA}) + 2 \sum_{m=1k<m}^{l} \sum \hat{C}(\hat{Y}_{rcmA}, \hat{Y}_{rckA}) \}$$
$$+ \left(\frac{1}{24}\right)^2 \{ \sum_{m=1}^{12} \hat{V}(\hat{Y}_{rcmB}) + 2 (\sum_{m=1k<m}^{12} \sum \hat{C}(\hat{Y}_{rcmB}, \hat{Y}_{rckB}) \}$$
$$+ \left(\frac{1}{24}\right)^2 \{ \sum_{m=l+1}^{12} \hat{V}(\hat{Y}_{rcmC}) + 2 \sum_{m=l+1k<m}^{12} \sum \hat{C}(\hat{Y}_{rcmC}, \hat{Y}_{rckC}) \}$$