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September 30, 2020

Via Electronic Filing Clerk
Florida Public Service Commission
2540 Shumard Oak Blvd.
Tallahassee, FL 32399-0850

RE: Gulf Power Company's 2020 Load Research Sampling Plan Filing

Dear Mr. Teitzman:

In compliance with FPSC Rule 25-6.0437, enclosed is Gulf Power Company's 2020 Load Research Sampling Plan for approval of sample deployments for the years 2020 to 2022.

If you have any questions or require additional information about this filing, please call me at (561) 691-2391.

Sincerely,

/s/ *Tara B. DuBose*
Tara B. DuBose
Manager, Cost and Load Research

CC: Elisabeth Draper, Chief, Division of Economics (via electronic mail)

# GULF POWER COMPANY

Load Research Sampling Plan
FPSC Rule 25-6.0437

September 30, 2020

Rates and Tariff Administration Department
Load Research Section

**GULF POWER COMPANY**

**2021 Load Research Sampling Plan**

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## I. INTRODUCTION

Gulf Power Company (GPC) filed its last Load Research Sampling Plan on July 28, 2017. The Commission Staff approved the 2018 Plan by letter on October 13, 2017. This 2021 Load Research Sampling Plan is being submitted by GPC in compliance with Rule 25-6.0437, Florida Administrative Code (Rule). The Rule applicable to electric utilities that provide electric service to more than 50,000 retail customers at the end of any calendar year requires those utilities to sample all rate classes that account for more than 1 percent of a utility's annual retail sales. The Rule further provides that the sampling plan shall be designed to provide estimates of the averages of the 12 monthly coincident peaks for each class within plus or minus 10 percent at the 90 percent confidence level. The sampling plan shall also be designed to provide estimates of the summer and winter peak demands for each rate class within plus or minus 10 percent at the 90 percent confidence level, except for the General Service Non-Demand rate class. The sampling plan shall be designed to provide estimates of the summer and winter peak demands for the General Service Non-Demand rate class within plus or minus 15 percent at the 90 percent confidence level. The Rule also requires the filing of a revised sampling plan to the Commission no less often than every three years after the most recent sampling plan was required to be submitted.

This report summarizes GPC's proposed 2020 sample plan designs for the following rate classes:

**RS/RSVP:** Residential Service (RS & RSVP)
**GSD:** General Service Demand (GSD & GSTOU)
**GS:** General Service Non-Demand (GS)

As shown on Table 1, all other rate classes meeting the "more than 1%" of annual retail sales criterion are 100% metered with recording meters for billing purposes and therefore do not require statistical sampling.

## II. PROPOSED SAMPLING PLAN DESIGN METHODOLOGY

The sampling plan methodology proposed in this plan utilizes a three-year replacement cycle for the load research sampling points in the RS, GSD, and GS rate class samples.

The proposed sampling plan was developed using GPC's most currently available load research data and seasonal peak information. To ensure that a sufficient number of sample points would be selected, sample sizes were calculated for every month starting January 2019 through December 2019. The month with the largest number of required sample points over this period was selected for each rate class.

Based on the results obtained from this data GPC proposes to use of the following types of sample designs:

A one-dimensional stratified random design based on the annual average monthly energy for the RS, GSD, and GS rate classes.

The sample sizes reported herein are designed to meet Florida Public Service Commission

("FPSC" or the "Commission") accuracy requirements based on the requisite confidence level and expected data loss factors, while simultaneously minimizing costs.

**RS/RSVP** Residential Service (RS & RSVP)

A one dimensional stratified random sample design process was used for the RS/RSVP rate class. The customer population was stratified on the basis of average monthly energy consumption (kWh) for the year ended July 2020.

Stratum breakpoints were defined using the Dalenius-Hodges method. This process generated four strata based on energy consumption:

1. 0 to 663 kWh
2. 664 to 1,196 kWh
3. 1,197 to 1,976 kWh
4. 1,977 kWh and Above

**GSD** General Service Demand (GSD & GSTOU)

A one dimensional stratified random sample design process was used for the GSD rate class. The customer population was stratified on the basis of average monthly energy consumption (kWh) for the year ended July 2020.

Stratum breakpoints were defined using the Dalenius-Hodges method. The process generated three strata based on energy consumption, which are as follows:

1. 0 to 6,080 kWh
2. 6,081 to 18,560 kWh
3. 18,561 to 48,960 kWh
4. 48,961 kWh and Above

**GS** General Service Non-Demand (GS)

A one dimensional stratified random sample design process was used for the GS rate class. The customer population was stratified on the basis of average monthly energy consumption (kWh) for the year ended July 2020.

Stratum breakpoints were defined using the Dalenius-Hodges method. This process generated four strata based on energy consumption:

1. 0 to 500 kWh
2. 501 to 1,400 kWh
3. 1,401 to 3,400 kWh
4. 3,401 kWh and Above

## III. PROPOSED SAMPLING PLAN SUMMARY

The following table lists the expected number of sample points and deployment year for each rate class:

| Rate Class | Sample Points | Deployment Year | Detailed Design Statistics |
|---|---|---|---|
| GS | 561 | 2021 | See Table 2 |
| GSD | 190 | 2021 | See Table 3 |
| RS/RSVP | 345 | 2021 | See Table 4 |

Please refer to Table 5 for definitions of variables and indices and Table 6 for formulas used in the design and estimation of these samples.

**TABLE 1**

| GPC Retail Sales Rate Class | 2019 Annual Retail Billed Sales | | Data Collection Process |
|---|---|---|---|
| | **MWH** | **Percent** | |
| RS/RSVP Residential Service: RS and RSVP | 384,277 | 49.13% | Sampling Plan |
| GSD General Service Demand: GSD and GSTOU | 175,850 | 22.48% | Sampling Plan |
| Major Accounts: RTP, CSA and PXT | 124,671 | 15.94% | 100% Sampled |
| LP Large Power: LP and LPT | 61,553 | 7.87% | 100% Sampled |
| GS General Service Non-Demand: GS-1 and GST-1 | 22,846 | 2.92% | Sampling Plan |
| All Other Rate Classes[1] | 13,030 | 1.67% | Not Applicable |
| Total | | 100% | |

1. Each rate class in this category falls below the 1% of annual retail sales criterion. Thus, load research sampling plans are not required.

**TABLE 2**

**PROPOSED GS SAMPLE DESIGN**

Rate Classes : GS
Deployment Year : 2021
Sample Design : One Dimensional Stratified Random Sample - Combined Ratio Estimation,
Dalenius-Hodges Procedure, Neyman Allocation, With Finite Population Correction
Design Precision(P) : 15%
Design Confidence : 90% ( 1.645 )
Stratification Variable : Annual Monthly Mean Energy (KWH)

| [1] | [2] | [3] | [4] | [4]x[5] | [3]x[4] | [4]x([3]^2) | [6] | [7] |
|---|---|---|---|---|---|---|---|---|
| Strata | Sample Size | SDRh | Wh | Nh | Wh(SDRh) | Wh(SDRh)^2 | Neyman Alloc. of n with losses (nh) | Proposed Sample |
| 1 | 55 | 1.737 | 0.54315 | 18,077 | 0.943 | 1.639 | 141.068 | 142 |
| 2 | 45 | 2.478 | 0.29130 | 9,695 | 0.722 | 1.789 | 107.932 | 108 |
| 3 | 54 | 2.962 | 0.14486 | 4,821 | 0.429 | 1.271 | 64.155 | 65 |
| 4 | 47 | 3.504 | 0.02069 | 689 | 0.072 | 0.254 | 10.840 | 30 |
| Sum(S) | 201 | | 1.00000 | 33,281 | 2.167 | 4.952 | 323.994 | 345 |
| Combined | | 2.705 | | [5] | | | | |

CALCULATIONS

YBAR = 1.8622

n = (ΣWh*SDRh)^2/((P*YBAR/Z)^2+(ΣWh(SDRh)^2/SNh))
= 161.997

n(with losses) = n / 0.5 = 323.994

NOTES:

A) The most current load research data available was obtained from Oracle Utilities Load Analysis (Gulf's Load Research System) for the period January 2019 to December 2019.

B) The above calculations were performed for every month of 2019. November 2019 load research data produced the largest sample size requirement and was therefore selected.

C) The strata break points and weights were defined on the basis of average monthly energy consumption (KWH) for the year

DEFINITIONS:

[1] Strata Break Points (KWH)
Strata 1 = 0 - 500
Strata 2 = 501 - 1,400
Strata 3 = 1,401 - 3,400
Strata 4 = 3,401 & Above

[2] Number of valid sample points in Oracle Utilties Load Analysis for the month of November 2019 (Refer to Note B)

[3] Standard deviation for the month of November 2019 coincident peak, per Oracle Utilties Load Analysis (Refer to Note B)

[4] Percent of customers per strata for the summer and winter peak months from FPL's Customer Information System (Refer to Note C)

[5] Total number of customers for the month of November 2019 from Gulf's Customer Information System (Refer to Note B)

[6] nh = Wh(SDRh)/ΣWh(SDRh)

[7] Based on Neyman Allocation of n with losses. Minimum strata size = 30, via central limit theorem

**TABLE 3**

**PROPOSED GSD SAMPLE DESIGN**

Rate Classes : GSD & GSTOU
Deployment Year : 2021
Sample Design : One Dimensional Stratified Random Sample - Combined Ratio Estimation,
Dalenius-Hodges Procedure, Neyman Allocation, With Finite Population Correction
Design Precision(P) : 10%
Design Confidence : 90% ( 1.645 )
Stratification Variable : Annual Monthly Mean Energy (KWH)

| [1] | [2] | [3] | [4] | [4]x[5] | [3]x[4] | [4]x([3]^2) | [6] | [7] |
|---|---|---|---|---|---|---|---|---|
| Strata | Sample Size | SDRh | Wh | Nh | Wh(SDRh) | Wh(SDRh)^2 | Neyman Alloc. of n with losses (nh) | Proposed Sample |
| 1 | 52 | 5.762 | 0.55094 | 8,278 | 3.175 | 18.291 | 66.235 | 67 |
| 2 | 40 | 8.284 | 0.28759 | 4,321 | 2.382 | 19.736 | 49.709 | 50 |
| 3 | 41 | 17.371 | 0.11816 | 1,775 | 2.053 | 35.655 | 42.827 | 43 |
| 4 | 49 | 32.268 | 0.04331 | 651 | 1.397 | 45.093 | 29.158 | 30 |
| Sum(S) | 182 | | 1.00000 | 15,025 | 9.007 | 118.776 | 187.928 | 190 |
| Combined | | 19.156 | | [5] | | | | |

CALCULATIONS

YBAR = 15.2148

n = (ΣWh*SDRh)^2/((P*YBAR/Z)^2+(ΣWh(SDRh)^2/SNh))
= 93.964

n(with losses) = n / 0.5 = 187.928

NOTES:

A) The most current load research data available was obtained from Oracle Utilities Load Analysis (Gulf's Load Research System) for the period January 2019 to December 2019.

B) The above calculations were performed for every month of 2019. March 2019 load research data produced the largest sample size requirement and was therefore selected.

C) The strata break points and weights were defined on the basis of average monthly energy consumption (KWH) for the year

DEFINITIONS:

[1] Strata Break Points (KWH)
Strata 1 = 0 - 6,080
Strata 2 = 6,081 - 18,560
Strata 3 = 18,561 - 48,960
Strata 4 = 48,961 & Above

[2] Number of valid sample points in Oracle Utilties Load Analysis for the month of March 2019 (Refer to Note B)

[3] Standard deviation for the month of coincident peak, per Oracle Utilties Load Analysis (Refer to Note B)

[4] Percent of customers per strata for the summer and winter peak months from FPL's Customer Information System (Refer to Note C)

[5] Total number of customers for the month of March 2019 from Gulf's Customer Information System (Refer to Note B)

[6] nh = Wh(SDRh)/ΣWh(SDRh)

[7] Based on Neyman Allocation of n with losses. Minimum strata size = 30, via central limit theorem

**TABLE 4**

**PROPOSED RS/RSVP SAMPLE DESIGN**

Rate Classes : RS & RSVP
Installation Year : 2020
Sample Design : One Dimensional Stratified Random Sample - Combined Ratio Estimation,
Dalenius-Hodges Procedure, Neyman Allocation, With Finite Population Correction
Design Precision(P) : 10%
Design Confidence : 90% ( 1.645 )
Stratification Variable : Annual Monthly Mean Energy (KWH)

| [1] | [2] | [3] | [4] | [4]x[5] | [3]x[4] | [4]x([3]^2) | [6] | [7] |
|---|---|---|---|---|---|---|---|---|
| Strata | Sample Size | SDRh | Wh | Nh | Wh(SDRh) | Wh(SDRh)^2 | Neyman Alloc. of n with losses (nh) | Proposed Sample |
| 1 | 48 | 2.365 | 0.30332 | 116,190 | 0.717 | 1.697 | 208.527 | 209 |
| 2 | 45 | 1.505 | 0.36885 | 141,293 | 0.555 | 0.835 | 161.369 | 162 |
| 3 | 51 | 1.908 | 0.25237 | 96,674 | 0.482 | 0.919 | 139.974 | 140 |
| 4 | 43 | 2.256 | 0.07546 | 28,906 | 0.170 | 0.384 | 49.487 | 50 |
| Sum(Σ) | 187 | | 1.00000 | 383,063 | 1.924 | 3.835 | 559.357 | 561 |
| Combined | | 2.019 | | [5] | | | | |

CALCULATIONS

YBAR = 1.8920

n = (ΣWh*SDRh)^2/((P*YBAR/Z)^2+(ΣWh(SDRh)^2/ΣNh))
= 279.679

n(with losses) = n / 0.5 = 559.357

NOTES:

A) The most current load research data available was obtained from Oracle Utilities Load Analysis (Gulf's Load Research System) for the period January 2019 to December 2019.

B) The above calculations were performed for every month of 2019. March 2019 load research data produced the largest sample size requirement and was therefore selected.

C) The strata break points and weights were defined on the basis of average monthly energy consumption (KWH) for the year ended July 2020.

DEFINITIONS:

[1] Strata Break Points (KWH)
Strata 1 = 0 - 663
Strata 2 = 664 - 1,196
Strata 3 = 1,197 - 1,976
Strata 4 = 1,899 & Above

[2] Number of valid sample points in Oracle Utilties Load Analysis for the month of March 2019 (Refer to Note B)

[3] Standard deviation for the month of March 2019 coincident peak, per Oracle Utilties Load Analysis (Refer to Note B)

[4] Percent of customers per strata for the summer and winter peak months from FPL's Customer Information System (Refer to Note C)

[5] Total number of customers for the month of March 2019 from Gulf's Customer Information System (Refer to Note B)

[6] nh = Wh(SDRh)/ΣWh(SDRh)

[7] Based on Neyman Allocation of n with losses. Minimum strata size = 30, via central limit theorem

**TABLE 5**

DEFINITIONS OF VARIABLES AND INDICES

| | | |
|---|---|---|
| $YBAR$ | = | Existing sample mean coincident demand (kW) |
| $XBAR$ | = | Existing sample mean energy (kWh) |
| $R$ | = | Ratio of mean coincident demand to mean energy for the existing sample |
| $h$ | = | Index for each strata within the sample |
| $i$ | = | Index for each customer |
| $Y_{hi}$ | = | Coincident demand for each customer “I” in stratum “h” |
| $X_{hi}$ | = | Energy for each customer “i” in stratum “h” |
| $nc_h$ | = | Number of customers in the existing sample in stratum “h” |
| $SDR_h$ | = | Standard deviation of the residuals in stratum “h” |
| $W_h$ | = | Stratum “h” weight |
| $P$ | = | Precision (0.10 for RS and GSD and 0.15 for GS) |
| $Z_{\alpha/2}$ | = | Two tailed normal variate (1.645 for 90% confidence) |
| $n$ | = | Required new sample size |
| $N_h$ | = | Stratum “h” population (customers) |
| $n_h$ | = | Required new sample size for stratum “h” |

**TABLE 6**

FORMULAS USED IN SAMPLE DESIGNS

I. Calculations using rate load research data (Refer to Table 6 for definitions):

$$YBAR = \sum_h W_h x \left[ \frac{\sum_i Y_{hi}}{nc_h} \right] \qquad XBAR = \sum_h W_h x \left[ \frac{\sum_i X_{hi}}{nc_h} \right] \qquad R = \frac{YBAR}{XBAR}$$

$$SDR_h = \sqrt{\frac{\sum_i (Y_{hi} - Rx\, X_{hi})^2}{nc_h - 1}}$$

II. Sample size calculation (Refer to Table 6 for definitions):

$$n = \frac{\left[ \sum_h (W_h x\, SDR_h) \right]^2}{\left[ \frac{PxYBAR}{Z_{\alpha/2}} \right]^2 + \frac{\sum_h (W_h x\, SDR_h^2)}{\sum_h N_h}}$$

$$n_h = \left[ \frac{W_h x\, SDR_h}{\sum_h W_h x\, SDR_h} \right] xn$$