STATE OF NEW HAMPSHIRE
BEFORE THE
PUBLIC UTILITIES COMMISSION

Docket No. DE 19-064

Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities
Distribution Service Rate Case

DIRECT TESTIMONY

OF

MELISSA F. BARTOS

April 30, 2019

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I. INTRODUCTION

Q. Please state your name, address, employer, position, and professional qualifications.

A. My name is Melissa F. Bartos. I am an Assistant Vice President with Concentric Energy Advisors, 293 Boston Post Road West, Suite 500, Marlborough, Massachusetts. My professional qualifications and experience have been provided in Attachment MFB-11.

II. SCOPE OF TESTIMONY

Q. What is your responsibility in this proceeding?

A. In this proceeding I am responsible for preparing the Marginal Cost Study for Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities ("Granite State" or "the Company").

Q. Please summarize your testimony concerning the Marginal Cost Study.

A. I have prepared a Marginal Cost Study ("MCS"), which is contained in Attachments MFB-1 through MFB-10. The marginal costs that I have calculated are derived from data and special studies obtained from the Company.

As also shown on Attachment MFB-10, the estimated annual marginal distribution costs by rate class are summarized in Table 1 below.

Table 1: Total Marginal Costs by Rate Class ($000)

	D	D-10	G-1	G-2	G-3	M	T	V	Total
Customer	$ 13,596	$ 209	$ 145	$ 674	$ 3,215	$ -	$ 397	$ 8	$ 18,246
Capacity	$ 8,385	$ 114	$ 8,180	$ 4,663	$ 2,954	$ -	$ 281	$ 10	$ 24,588
Lighting	-	-	-	-	-	$ 609	-	-	$ 609
Total	$ 21,981	$ 323	$ 8,326	$ 5,338	$ 6,169	$ 609	$ 679	$18	$ 43,443
	50.60%	0.74%	19.16%	12.29%	14.20%	1.40%	1.56%	0.04%	100.00%

III. MARGINAL COST STUDY

A. Economic Theory and Marginal Costs

Q. Please provide an economist's view of marginal cost.

A. "Marginal Cost" is an economic concept; it is a measure of the additional cost that a firm incurs to provide an additional unit of a good or a service. A well-established principle of economic theory is that the price of a good that is sold in a perfectly competitive market will be set at the marginal cost to produce that good. It is a further well-established principle of economic theory that the best allocation of resources will occur, and the best consumption decisions will be made, in an economy in which the prices of goods are set at marginal costs.

It has been the Commission's rate-design policy and precedent since the mid-1980s to apply the concepts of marginal cost pricing in a rate case (a) to determine the share of total rate case revenue requirement for which each rate class is responsible, and (b) to set base distribution rates to promote appropriate price signals and, therefore, proper energy consumption decisions. The basis for the Company's current allocation of revenue requirement to classes, rate design, and current rate classifications was approved by the Commission in Order No. 26,005 (April 12, 2017) in the Company's 2016 rate case filing, Docket No. DE 16-383.

Q. Although the allocation methodology was approved in that proceeding, did the Commission Staff ("Staff") express any concerns with the methodology?

A. Yes. In that proceeding, Staff questioned the extent to which the Company's marginal cost study relied on three year historical average costs rather than the results of regression analyses.

Q. Did the Company commit in the Settlement Agreement in DE 16-383 to meet with Staff and the Office of the Consumer Advocate ("OCA") to discuss the marginal cost study methodology before Liberty's next rate case?

A. Yes.

Q. Are you aware if such a meeting took place and, if so, did you participate in the meeting?

A. Yes. A teleconference was held on January 30, 2019, in which I participated along with representatives of the Company, Staff, and the OCA. During that meeting, Staff's concerns related to the marginal cost study filed in DE 16-383 were reviewed.

Q. Have you addressed those concerns in this current marginal cost study?

A. Yes. While the marginal cost study filed in DE 16-383 used three year historical average costs for 11 out of 14 cost categories because the results of the regression analyses were not considered to be reasonable, in this marginal cost study regression analyses were used for all 14 cost categories, as described in more detail below.

B. Marginal Cost Study Methodology

1. Overview

Q. Please describe the components of the Company's marginal costs that you estimated.

A. I prepared calculations and analyses to estimate the marginal Distribution Function-related costs that the Company would incur to serve (a) additional demand when the Company is experiencing peak conditions, and (b) additional customers. In general terms, to estimate the costs that the Company would incur to serve additional peak demand, I calculated (1) the additional capacity-related distribution plant costs, and (2) the additional Operations and Maintenance ("O&M") costs that would be caused by an increment to peak demand. I also calculated (3) the additional general plant-related costs associated with the additions to capacity-related distribution plant, (4) the additional Administrative and General ("A&G") expenses associated with the additional O&M expenses, and (5) the additional materials and supplies ("M&S") and prepayment costs associated with the additional plant. Lastly, I calculated additional factors to account for the effects of bad debt and working capital on the calculated marginal costs.

Q. Please describe the data used to develop your estimates of the Company's marginal costs.

A. The Company provided Concentric with (a) distribution plant and general plant balances and (b) distribution, customer, customer accounting, A&G, and Materials and Supplies and Prepayments Expenses, for the period 1997 to the present. In addition, the Company

provided Concentric with historical system peak, normalized peak, and customer count data for the years 2000 to the present.[1]

Q. Please describe each new data series that you created using data that the Company provided.

A. I created the following types of new data series:

1. I adjusted the Company's data using an appropriate price index. I used a Handy-Whitman index to restate plant additions in 2018 constant dollars, and I used the Implicit Price Deflator for Gross Domestic Product, published by Bureau of Economic Analysis, to restate expenses in constant 2018 dollars.
2. The Company provided two separate analyses that were used to (1) identify the amount of the capacity-related distribution plant additions related to growth, and (2) classify the growth-related plant additions as being related to either the primary distribution system, secondary distribution system, or line transformers.
3. The Company provided an analysis of expense accounts that was used to functionalize distribution Operations expenses and Maintenance expenses as either capacity-related or customer-related, and also to classify the capacity-related expenses as being related to either the primary distribution system, secondary distribution system, or line transformers.

[1] The historical data for a few of the data series was obtained from SNL Financial, which compiles historical FERC Form 1 data.

Q. Please describe the primary types of analysis that you used to calculate the components of marginal cost.

A. For many of the marginal cost components, I used a statistical process for estimating the relationship between a specific "Cost Variable" (i.e., measure of costs)[2] and a specific "Cost Driver" variable.[3] The general form of the regression equations that I estimated is as follows[4]:

$$Cost\ Variable = a\ + b\ x\ Cost\ Driver\ variable$$

Regression analyses are often used to estimate components of marginal costs because the regression coefficient, the term "b" in the equation above, sometimes referred to as the slope of the equation, is the estimated marginal cost of the Cost Variable that is associated with a small change in the Cost Driver variable.[5]

Q. Please describe the general approach used in performing the marginal cost study regression analyses.

A. I reviewed the regression equations that I developed to ensure that the estimates were reasonable and that they did not violate important statistical requirements.

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2 Some of the Cost Variables that I used include capacity-related distribution plant, customer-related O&M expense, and A&G Expense.

3 Some of the "Cost Driver" variables that I used include normalized peak demand and number of customers.

4 This is a simplified version of the regression equations that were estimated. Each of the regression equations that are provided in Attachments MFB-MCS-1, 4, 5, and 6 may include more than one cost driver and/or dummy variables.

5 The term "a" is the intercept of the equation. It is the level of the Cost Variable that is constant, regardless of the level of the Cost Driver variable.

Specifically, I tested each equation to ensure that there is no statistically significant level of autocorrelation in the regression equation. Autocorrelation is a violation of the requirements of regression analysis,[6] which, if not corrected, would inappropriately affect the regression statistics. The statistical software that I used, SPSS, can identify and correct for autocorrelation.

I also tested each equation to look for "structural shifts," which are changes in the relationship between the Cost Variable and Cost Driver variable starting in a specific year and continuing for a number of years. I specifically looked for structural shifts that might have been related to the 2012 acquisition of Granite State by Liberty. If I determined that there was a structural shift, I tested additional regression equations that allowed the slope and intercept terms to be different for the time periods before and after the time of the structural shift. If a regression equation with terms addressing the structural shift was superior to other regression equations, I used the slope coefficient of the structural shift regression equation as the marginal cost estimate.

Q. What criteria did you use to accept or reject a regression equation?

A. To assess whether a regression equation provided a reliable estimate of the marginal cost component, I reviewed the regression equation statistics. Specifically, I reviewed:

- The reasonableness of the regression equation results. I considered that an equation was reasonable if the slope coefficient had the "right sign"[7] and was the

[6] Autocorrelation is a violation of the assumption that the regression equation error terms are uncorrelated. In the presence of autocorrelation, the regression does not produce Best Linear Unbiased Estimates.

[7] The slope coefficient is the "right" sign if the coefficient is positive. A negative slope would mean, for example, that as peak demand increased, capacity related distribution plant additions would decrease.

"right size."[8]

- The explanatory power of the regression equation as a whole, as measured by the R-squared statistic.
- The explanatory power of the slope coefficient, as well as other variables included in the model, as measured by the t statistic.

C. Marginal Cost Study Results

1. Overview

Q. Please describe how you have organized the marginal cost study.

A. The schedules that make up the Marginal Cost Study are provided in the List of Attachments. Table 2 provides a summary of the Marginal Cost Study schedules.

Table 2: Summary of Marginal Cost Study Schedules

Attachment	Pages	Topics
MFB-1	1–3	Calculation of marginal Capacity-related Plant Additions
MFB-2	1	Calculation of marginal Customer-related Plant Additions
MFB-3	1–5	Calculation of marginal cost of Outdoor Lighting
MFB-4	1–6	Calculation of marginal Distribution Capacity-related Expenses
MFB-5	1–5	Calculation of marginal Customer-related Expenses
MFB-6	1–3	Development of loading factors
MFB-7	1–13	Calculation of Levelized Fixed Charge Rates
MFB-8	1–3	Summary of Marginal Capacity Costs
MFB-9	1	Summary of Marginal Customer Costs
MFB-10	1	Summary of Marginal Cost Estimates

[8] The "right size" is a subjective test to ensure that the slope coefficient is not implausibly large or small.

2. Marginal Distribution Capacity-related Plant Addition Costs

Q. Please explain how you prepared regression analyses to estimate the marginal cost of capacity-related distribution plant additions attributed to growth.

A. I prepared regression analyses to estimate the statistical relationship between normalized peak demand and the following types of growth-related distribution plant addition costs: (1) capacity-related primary distribution plant additions, (2) capacity-related secondary distribution plant additions, and (3) capacity-related line transformer plant additions. The regression results are located on Attachment MFB-1, pages 1 through 3.

Q. In summary, what is the marginal cost of distribution capacity-related plant additions attributed to growth?

A. The total marginal cost of distribution capacity-related plant additions attributed to growth is summarized in Table 3 below.

Table 3: Marginal Cost of Distribution Capacity-related Plant Additions

Marginal Plant additions Component	$ per MW	Source
Primary	$115,690	MFB-1 page 1
Secondary	$82,116	MFB-1 page 2
Line Transformers	$84,022	MFB-1 page 3
Total cost of Marginal Plant additions	$281,828	

3. Marginal Customer-related Plant Addition Costs

Q. Please explain how you estimated marginal Customer-related plant addition costs.

A. Marginal Customer-related plant addition costs measure the marginal cost to connect a customer, which includes the current installed cost of a meter and a service. Because the cost of a meter and a service is generally correlated with the size of the customer, I asked the Company to provide an analysis of the current installed cost of a meter and installed cost of a service that is typical for each rate class. The customer-related plant additions analysis is provided in Attachment MFB-2.

Q. In summary, what is the marginal cost of customer-related plant additions?

A. The total marginal cost of customer-related plant additions is summarized in Table 4 below.

Table 4: Marginal Cost of Customer-Related Plant Additions

	D	D-10	G-1	G-2	G-3	T	V
Service	$693.29	$693.29	$ 759.17	$759.17	$ 693.29	$693.29	$ 693.29
Meter	$105.00	$360.20	$1,605.00	$900.80	$ 630.20	$195.20	$ 290.20
Total	$798.29	$1,053.49	$2,364.17	$1,659.97	$1,323.49	$888.49	$983.49

Source: MFB-2, Page 1, Lines 4, 8, 9

4. Marginal Outdoor Lighting Costs

Q. Please explain how you estimated the total Marginal Cost of Outdoor Lighting.

A. Marginal outdoor lighting costs measure the marginal cost to provide service to outdoor lighting customers, which includes the current installed costs of the luminaire and of the pole and accessories. Because the cost of a luminaire and of a pole is dependent on the size and type of luminaire and pole that is installed, I asked the Company to provide an

analysis of the current installed cost for each size and type of (a) luminaire, and (b) pole and accessory listed in the Company's tariff. The Company's analysis is provided in Attachment MFB-3.

I estimated the total marginal cost for outdoor lighting by applying the fixed carrying charge rate (as discussed below) to the marginal cost for each size and type of (a) luminaire, and (b) pole and accessory to develop a levelized annual cost, which was then adjusted for inflation. The calculated levelized annual costs were multiplied by the total number of luminaires and poles and accessories by size and type to arrive at a total marginal cost for outdoor lighting, which is provided in Attachment MFB-3, pages 1 through 5.

5. Marginal Distribution Capacity-related Operations and Maintenance Expense

Q. Please explain how you estimated the Marginal Cost of Capacity-related Distribution Operations and Maintenance Expense.

A. I prepared six regression analyses to estimate the statistical relationship between normalized peak demand and the following types of capacity-related distribution operations and maintenance expense: (1) primary operations expense, (2) secondary operations expense, (3) line transformers operations expense, (4) primary maintenance expense, (5) secondary maintenance expense, and (6) line transformers maintenance expense. The regression results are summarized on Attachment MFB-4, pages 1 through 6.

6. Marginal Customer-related Operations and Maintenance Expense

Q. Please explain how you estimated Marginal Customer-related Distribution Operations and Maintenance Expenses.

A. I prepared a regression analysis to estimate the statistical relationship between (a) the customer-related distribution operations and maintenance expense associated with operating and maintaining customer meters and services, and (b) the number of annual customers based on historical data that the Company provided. The regression results are summarized on Attachment MFB-5, page 1.

I prepared an additional analysis, which is provided in Attachment MFB-5, page 2, to allocate the customer-related O&M expense to rate classes in a way that reflects that the cost to maintain meters and services is related to the size of the meter and service, which varies by rate class. As shown in Attachment MFB-5, page 2 column (C), the marginal customer-related O&M expense was allocated to rate classes based on the marginal service and meter plant per customer, from Attachment MFB-2, page 1. The results of this allocation process are shown in Attachment MFB-5, page 2 column (G).

7. Marginal Customer Accounting Expenses

Q. Please explain how you estimated Marginal Customer Accounting Expenses.

A. I prepared a regression analysis to estimate the statistical relationship between (a) customer accounting expenses, excluding bad debt expense, and (b) the number of annual customers, based on historical data that the Company provided. The regression results are summarized on Attachment MFB-5, page 3.

I prepared an additional analysis, which is provided in Attachment MFB-5, page 4, where the Company provided the relative weighting factors for each rate class to allocate the customer accounting expenses. The results of this allocation process are shown in Attachment MFB-5, page 4 column (F).

Lastly, I prepared Attachment MFB-5, page 5, to calculate the pro forma bad debt expense rate by rate class, based on data provided by the Company.

8. Marginal Loading Factors and Adjustment Factors

Q. Please explain how you estimated Marginal Loading Factors.

A. I calculated several loading factors to account for the following four cost components that are relatively small or for which it is difficult to develop marginal cost-type statistical relationships: (a) plant-related A&G expense, (b) non-plant-related A&G expense, (c) M&S and prepayments, and (d) general plant. For each of these loading factors I prepared regression analyses using the loading factor cost component as the dependent variable, and an appropriate measure of cost, utility plant, or total O&M expense as the independent variable. The loading factor analyses are provided in Attachment MFB-6, pages 1 through 3.

Q. Please explain why you used loss factors to adjust the marginal capacity-related costs.

A. The measures of capacity-related marginal cost that are used in the MCS are calculated unit costs per kW of normalized peak demand, measured at customers' meters. The total distribution system demand is greater than the demand measured at customers' meters

because some energy is lost in the process of transmitting and distributing electricity to customers. Losses are greatest for those customers taking service at secondary voltage, and somewhat less for customers that are taking service at primary or higher voltages. The Company provided separate loss factors for primary and secondary service. I developed an analysis to apply the loss factors to the marginal capacity-related costs, which is provided in Attachment MFB-8, page 2.

9. Fixed Carrying Charge Rate

Q. Please explain how you calculated the Fixed Carrying Charge Rates.

A. The marginal cost that I calculated for primary and secondary capacity-related distribution plant, line transformers, services, meters, and street lighting is the initial cost of an asset that is placed into service. Fixed carrying charge rates ("FCCR") are used to convert the marginal cost of plant additions from a cost that represents the estimated marginal investment into the levelized annual cost of that investment. Attachment MFB-7, page 1, is a summary of the FCCRs for (a) primary and secondary capacity-related distribution plant, (b) line transformers, (c) services, (d) meters, and (e) street lighting. This page shows Economist's and Engineer's FCCR results.

An Economist's FCCR is based on annual streams of costs that are fixed in real dollars, and therefore vary in nominal dollars. An Engineer's FCCR is based on annual streams of costs that are constant in nominal dollars, and therefore vary in real dollars. However, the present values of the Economist's and Engineer's costs and revenues are identical. For marginal cost analyses, the Economist's FCCR calculations are generally accepted as

being the appropriate version because the Economist's FCCR appropriately accounts for the reduced value of the revenue requirements of that plant addition in future years, due to price inflation, and therefore better reflects the economic and financial implications of regulated ratemaking.

Attachment MFB-7, pages 1 through 13, provides the assumptions that were used in the calculation of the FCCR and the detailed calculations of the five FCCRs. The calculations of the FCCR follow standard rate making principles to determine revenue requirements associated with plant additions, including return, taxes, depreciation, salvage value, etc.

D. Summary of Marginal Cost Study Results

Q. Please explain the schedules that you have prepared to summarize the Marginal Cost results.

A. Attachment MFB-8, page 1, shows the calculation of unit marginal distribution capacity costs, including all loading factors and adjustments.

Attachment MFB-8, page 2, shows the calculation of the loss-adjusted marginal capacity costs.

Attachment MFB-8, page 3, shows the calculation of the loss-adjusted marginal capacity costs by rate class.

Attachment MFB-9, page 1, shows the calculation of unit marginal customer costs, including all loading factors and adjustments.

Attachment MFB-10, page 1, shows the calculation of unit marginal customer and capacity costs, adjusted for bad debts. Attachment MFB-10, page 1, also shows the calculation of total marginal costs by rate class, which is used in designing the Company's proposed base distribution rates in this proceeding to allocate the Company's requested distribution revenue requirement to firm rate classes.

Q. Does this conclude your testimony?

A. Yes, it does.