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

REBUTTAL TESTIMONY

OF

MELISSA F. BARTOS

January 30, 2020

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I. INTRODUCTION

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

A. My name is Melissa F. Bartos. I am a Vice President with Concentric Energy Advisors, 293 Boston Post Road West, Suite 500, Marlborough, Massachusetts.

Q. On whose behalf are you testifying today?

A. I am testifying on behalf of Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities ("Granite State" or "the Company").

Q. Have you previously submitted testimony in this proceeding?

A. Yes. I submitted Direct Testimony as part of the Company's April 30, 2019, rate filing. My professional background and qualifications are contained in my Direct Testimony.

II. PURPOSE AND OVERVIEW OF REBUTTAL TESTIMONY

Q. What is the purpose of your rebuttal testimony?

A. The purpose of my rebuttal testimony is to respond to the Direct Testimony of Agustin J. Ros, Principal at the Brattle Group on behalf of the New Hampshire Public Utility Commission Staff ("Staff"), and Ron Nelson, Senior Manager of Strategen Consulting on behalf of the Office of the Consumer Advocate ("OCA"), filed December 6, 2019, related to the Company's marginal cost study and results.[1]

[1] My silence on any issues raised by Staff, the OCA, or other parties and their consultants should not be taken as agreement.

Q. How is the remainder of your rebuttal testimony organized?

A. In Section III, I provide a brief overview of the as filed marginal cost study. In Section IV, I discuss Staff's comments and recommendations related to the marginal cost study, and in Section V, I discuss the OCA's comments and recommendations related to the marginal cost study.

III. OVERVIEW OF THE AS FILED MARGINAL COST STUDY

Q. Please summarize the Company's Marginal Cost Study.

A. The Company's Marginal Cost Study ("MCS"), which is contained in Attachments MFB-1 through MFB-10, was prepared using approaches and methodologies that are consistent with Commission precedent for electric marginal cost studies. Specifically, using data provided to me by the Company, I prepared calculations and analyses to estimate the marginal Distribution Function-related costs that the Company would incur to serve additional demand when the Company is experiencing peak conditions, and 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. What methodology did you use to estimate the relationship between specific "Cost Variables" and "Cost Driver" variables?

A. I used regression analysis to estimate the relationship between a specific Cost Variable and a specific Cost Driver variable for all 14 cost categories included in the marginal cost study.[2]

Q. Is your use of regression analysis to develop the relationship between a specific Cost Variable and a specific Cost Driver variable consistent with previous marginal cost studies filed by the Company?

A. Yes. The marginal cost study filed in Granite State's sister company's last natural gas rate case, EnergyNorth Natural Gas, Docket No. DG 17-048, used regression analysis to develop the relationship between Cost Variables and Cost Drivers. In Order No. 26,122 (April 27, 2018), the Commission approved a rate increase for EnergyNorth in that case without criticizing or rejecting any aspects of the marginal cost study.

The marginal cost study filed in the Company's last electric rate case, Docket No. 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. The marginal cost study in that case was based on regression analysis for the remaining three cost

[2] As correctly noted by Witness Ros, the 14 cost categories produce a total of 15 marginal cost inputs because the A&G model produces two inputs.

categories. The Settlement Agreement in that case was approved by the Commission in Order No. 26,005 (April 12, 2017).

Q. Did the Settlement Agreement in Docket No. DE 16-383 address the marginal cost study methodology?

A. Yes. In the Docket No. DE 16-383 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. Pursuant to the Settlement Agreement in Docket No. DE 16-383, 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 Docket No. DE 16-383 were reviewed.

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

A. Yes. In this marginal cost study as filed, regression analyses were used for all 14 cost categories, consistent with direction received from Staff related to Docket No. DE 16-383 as well as the marginal cost studies filed in the Company's other previous natural gas and electric rate cases.

IV. STAFF'S COMMENTS AND RECOMMENDATIONS RELATED TO THE MARGINAL COST STUDY

Q. Please summarize Witness Ros's evaluation of the marginal cost study on behalf of Staff.

A. As explained in his testimony, Witness Ros conducted several analyses to evaluate the marginal cost study.[3] First, Witness Ros utilized the regression data to attempt to replicate the filed regression models and was able to replicate all aspects of the 14 regression models as filed. Second, Witness Ros tested the robustness of the as filed regression results by extensively reviewing and estimating additional regression models using several different specifications and estimation techniques. In all cases, Witness Ros did not find regression models that were superior to the as filed models. Lastly, Witness Ros conducted additional analysis related to the O&M related variables, which led him to recommend changes to the O&M cost components used in the marginal cost study.

Q. Please summarize Witness Ros's recommendations related to the marginal cost study.

A. With respect to the regressions involving the three plant-related investment categories (i.e., primary, secondary, and line transformers), as well as the three marginal loading factors (i.e., A&G, General Plant, and M&S), Witness Ros concluded that the as filed

[3] See Ros Direct Testimony at 13–26.

regression models and results are reasonable and recommended using the results of these six models as filed.[4]

With respect to the eight regressions involving O&M expenses (i.e., primary operations, secondary operations, line transformers operations, primary maintenance, secondary maintenance, line transformer maintenance, customer O&M, and customer accounts), Witness Ros was not able to find quality regression model specifications that he believed produced plausible results. Witness Ros concluded that because the O&M data are particularly "noisy" with high variability and with data observations that appear to be outliers or anomalies, an average per-unit approach is recommended as regression analysis can be more difficult, complex, and potentially less robust. Based on his analysis of various specifications of per-unit O&M expenses as well as various specifications of regression models, Witness Ros ultimately recommended using five-year average per-unit costs for each of the eight O&M cost categories.[5]

While Witness Ros recommended changes to some of the study inputs related to O&M, Witness Ros did not criticize the overall marginal cost study approach or calculations. In fact, he input his recommended changes to the O&M cost factors into the as filed marginal cost study to produce revised results.[6]

[4] See Ros Direct Testimony at 22–23 and 26.
[5] See Ros Direct Testimony at 23–26.
[6] See Ros Direct Testimony at 26.

Q. Do you agree with Witness Ros's recommendation that the O&M expenses be based on a five-year per unit average instead of regression results?

A. No. Staff made it clear in the previous Granite State Electric case as well as during the January 30, 2019, teleconference that using per unit historical averages for 11 of 14 cost categories was undesirable because the marginal cost study relied too much on historical averages and not enough on regression analysis. While Witness Ros's recommendations result in relying on regression analysis for three more components than in the last case, I do not believe that continuing to use per unit historical averages for eight of 14 cost categories complies with Staff's direction and the Settlement Agreement in the previous case.

Q. Please compare your as filed marginal cost study results with revised marginal cost study results that are produced by Witness Ros's recommended changes to the O&M cost categories.

A. Overall, Witness Ros's recommended changes to the O&M cost components result in lowering the overall marginal cost study results from $43.443 million as filed to $28.196 million; however, as noted by Witness Ros, the resulting class allocation produced from his recommended marginal cost study are very similar to the allocations produced by the as filed marginal cost study. For example, the Domestic (D) class allocation as filed was 50.60%, while Witness Ros's version produces 51.76%. Similarly, the General TOU (G-1) class allocation as filed was 19.16%, whereas Witness Ros's version produces 17.17%. A full comparison of the marginal cost study results recommended by Witness Ros with

the as filed marginal cost study results is contained in Witness Ros's Attachment AJR-6 and reproduced below.

Figure 1 – Comparison of As Filed and Witness Ros Total Marginal Costs by Rate Class ($000)

As Filed	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%
AJR-6	D	D-10	G-1	G-2	G-3	M	T	V	Total
Customer	$ 9,480	$ 149	$ 105	$ 486	$ 2,337	$ -	$ 280	$ 6	$ 12,844
Capacity	$ 5,114	$ 70	$ 4,737	$ 2,843	$ 1,802	$ -	$ 172	$ 6	$ 14,743
Lighting	-	-	-	-	-	$ 609	-	-	$ 609
Total	$ 14,595	$ 219	$ 4,842	$ 3,329	$ 4,139	$ 609	$ 452	$12	$ 28,196
	51.76%	0.78%	17.17%	11.81%	14.68%	2.16%	1.60%	0.04%	100.00%

V. OCA'S COMMENTS AND RECOMMENDATIONS RELATED TO THE MARGINAL COST STUDY

Q. Please summarize Witness Nelson's recommendations related to the marginal cost study on behalf of the OCA.

A. Witness Nelson recommends that the Company be required to use a planning approach to estimate marginal costs instead of the regression and averaging approaches used by the Company. Witness Nelson also recommends that cost studies directed by the Company be relied upon as directional indicators as opposed to point estimates. In addition, Witness Nelson recommends that more transparency of the marginal cost study be required through a stakeholder process or direct oversight from Staff or the OCA. Lastly,

Witness Nelson recommends that the Commission incorporate lessons learned from its locational value of DER project into utility marginal cost studies. Ultimately, Witness Nelson ignores the as filed marginal cost study results and instead advocates for equal rate increases across all rate classes.[7]

Q. Please explain Witness Nelson's reasoning for ignoring the results of the as filed marginal cost study.

A. Witness Nelson appears to reject the as filed marginal cost study results for two primary reasons: (1) because the Company used a regression approach in this case, whereas it used an averaging approach in the last rate case, and (2) because he has concerns with the Company's theoretical approach to the regression analysis.

Q. Do you think the as filed marginal cost study based on regressions should be ignored because the Company advocated for an averaging approach in the last rate case?

A. No, using regressions to develop the as filed marginal cost study was reasonable and appropriate for several reasons. Witness Nelson, like Witness Ros, acknowledges that the regression approach used in the current case is consistent with the Settlement Agreement approved by the Commission in the last rate case.[8] Filing a marginal cost study based on averages would have violated that Settlement Agreement. In addition, Witness Nelson fails to recognize that in the last case there was consensus that a regression approach was preferred, and that the averaging approach was used and supported as a secondary approach when the regression approach in that case did not

[7] See Nelson Direct Testimony at 7–8.
[8] See Nelson Direct Testimony at 54.

produce reasonable results due to the circumstances that existed at the time.[9] Also, in this case, additional data were available that were unavailable in the last case due to the passage of time, allowing developing regression models that produced reasonable results to be possible in this case. Because regression models that produced reasonable results were developed in this case, there was no requirement to perform the secondary averaging approach. Therefore, it is perfectly reasonable and appropriate for the as filed marginal cost study to be based on regression results, even though in the last case the Company advocated for using an averaging approach due to the circumstances that existed at the time.

Q. What are Witness Nelson's concerns with the Company's theoretical approach to the regression analysis?

A. Witness Nelson's concerns with the Company's theoretical approach to the regression analysis include: (1) relying on regression analysis which is judgmental and subjective by nature, (2) the potential use of data mining, (3) using variations of peak demand in various models, and (4) unnecessarily adding dummy variables and autoregressive terms.

Q. Please explain Witness Nelson's concern regarding the Company relying on regression analysis which is judgmental and subjective by nature.

A. Witness Nelson appears to have concerns that because the regression analyses in the marginal cost study involve some subjectivity, that the entire analysis should be ignored.

[9] See Docket No. DE 16-383, Direct Testimony of Heather M. Tebbetts and James D. Simpson as well as Rebuttal Testimony of Heather M. Tebbetts and James D. Simpson.

He states "[c]learly, using creativity and innovation when specifying regressions requires subjective decisions that are unrelated to economic theory."[10]

Q. Do agree with Witness Nelson's claim that, due to the subjective nature of the regressions in the marginal cost study, they should be ignored?

A. No. First, while there is some level of subjectivity in developing regression analyses, it should be noted that all of the as filed regressions are based on relevant data, are statistically sound, and are consistent with economic theory. On pages 4–8 (Bates II-396 to II-400) of my Direct Testimony, I explain the methodology, data, approach, and criteria I used to develop the regression equations. Objectively following this process and using these criteria removes some of the subjectivity by requiring that models fulfill all of the stated criteria. In addition, Witness Ros reviewed the as filed regression models and independently determined that the as filed models were reasonable, but for the recommendation to use averages for the O&M models as discussed previously. Witness Ros specifically states that the plant models that Witness Nelson criticizes are reasonable. Further, the class allocations produced by Witness Ros's recommended changes to the O&M cost factors are very similar to the as filed allocations. If the analysis was entirely subjective, it would be unlikely that an independent witness would achieve very similar results.

Second, all cost analyses, rate design, and rate policy decisions require some level of subjectivity. Otherwise, rates could be derived from formulas and there would be no

[10] See Nelson Direct Testimony at 54–55.

need to have multiple parties participate in a rate case. Concepts that are often discussed in rate orders such as gradualism, cost causation, and ensuring rates are just and reasonable all require some level of subjectivity. In fact, the studies that Witness Nelson advocates should be required in future rate cases also involve subjectivity. In addition, the residential customer charge recommended by Witness Nelson is entirely subjective and not based on any analysis. Therefore, the level of subjectivity required to perform a marginal cost study should not be grounds to ignore it.

Q. Please explain Witness Nelson's concerns about the potential use of data mining.

A. Witness Nelson states that "[t]he wildly different regression specifications suggest data mining" and provides as an example that "the Company uses different regression specifications on primary and secondary distribution equipment" and that "[e]conomic theory would suggest similar, if not the same, variables as predictors of these costs."[11]

Q. Do you agree that the different regression specifications of primary and secondary distribution equipment suggest data mining?

A. No. The as filed primary and secondary distribution models are very similar to one another. Witness Nelson does not identify the specific primary and secondary regressions to which he is referring. There are three sets of cost items that have separate regressions for primary and secondary distribution equipment in the marginal cost study: plant additions, operations expenses, and maintenance expenses. The table below shows the independent variables included in these three sets of regressions.

[11] See Nelson Direct Testimony at 59.

Figure 2: Independent Variables Included in Primary and Secondary Models

	Primary	Secondary
Plant Additions	*Source: MFB-1 p.1*	*Source: MFB-1 p.2*
	Constant	Constant
	Normalized Peak Rolling 2 Year Average	Normalized Peak Rolling 2 Year Average
	Annual Trend	Interactive: Trend for 2011 to 2018
	Autoregressive Term Lag 4	Autoregressive Term Lag 4
		Dummy: Year 2010
Operations Expense	*Source: MFB-4 p.1*	*Source: MFB-4 p.2*
	Constant	Constant
	Normalized Peak Rolling 2 Year Average	Normalized Peak Rolling 2 Year Average
	Dummy: 2014	Dummy: Year 2014
	Dummy: 2005	
	Dummy: 2006	
	Interactive: Trend for 2001 to 2012	
		Dummy: Year 2002
		Dummy: Year 2001
		Dummy: Year 2013
		Dummy: Years 2003 to 2012
Maintenance Expense	*Source: MFB-4 p.4*	*Source: MFB-4 p.5*
	Constant	Constant
	1 Year Lag in Normal Peak	2 Year Lag in Normal Peak
	1 Year Lag in SAIFI	1 Year Lag in SAIFI
	Dummy: Years 2013 to 2015	Dummy: Years 2013 to 2015
	Dummy: 2010	Dummy: 2010
	Dummy: 2005	

As shown in the table, the majority of the independent variables for the primary and secondary models are identical or very similar to one another, which contradicts Witness Nelson's claim of "wildly different regression specifications." The independent variables related to normalized peak and reliability are in fact identical across all three sets of primary and secondary models, except for maintenance expense where the primary model uses a one-year lag in normal peak while the secondary model uses a two-year lag in normal peak, which is overall consistent with Witness Nelson's assertion that economic

theory would suggest similar, if not the same, variables as predictors of these costs. Further, most of the differences between the primary and secondary models relate to dummy variables, which result from various anomalies in the underlying data. Therefore, I do not agree that the specifications of the primary and secondary models suggest data mining.

Q. Please explain Witness Nelson's concerns about using variations of peak demand in various models.

A. Witness Nelson identified that the Company used different versions of peak demand in numerous regressions, such as lagged and two-year averaged peak, and criticized the Company for not providing any discussion or justification of these variables in its testimony. In addition, Witness Nelson claims that because ordinary last squares regression is a measure of variance, averaging an independent variable necessarily inflates the R-squared (emphasis added).[12]

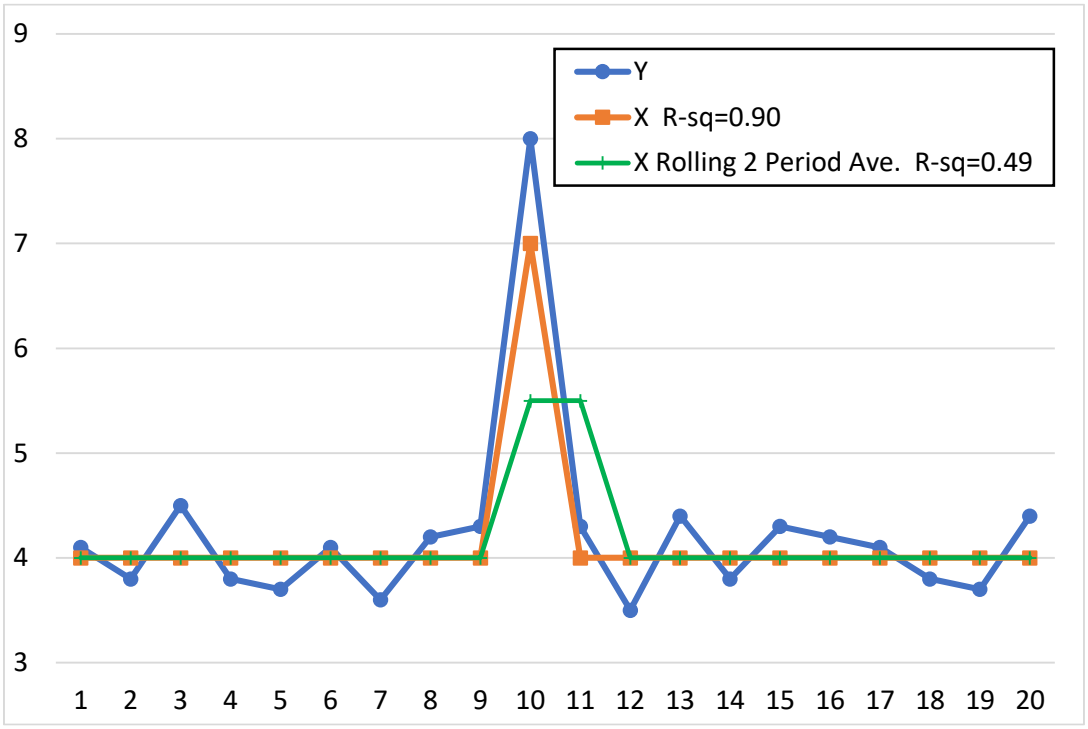
Q. Do you agree with Witness Nelson's concerns about using variations of peak demand in various models?

A. No. The use of lagged and rolling average independent variables was identified and justified in the Company's marginal cost study. Each independent variable used in every regression model, including any lagged and rolling average versions of peak demand, as well as the coefficient and statistics demonstrating its statistical significance, was clearly presented in Attachments MFB-1 through MFB-6.

[12] See Nelson Direct Testimony at 59–60.

In addition, Witness Nelson's claim that averaging an independent variable necessarily inflates the R-squared in an ordinary least squares regression is false. Averaging an independent variable will produce a lower R-squared if the averaged independent variable explains a lower proportion of the dependent variable than the original independent variable. A simple example illustrates this point. As shown in the following figure, the dependent (Y) variable in blue has a larger value in period 10 compared to the rest of the data. The independent (X) variable in orange also has a larger value in period 10 compared to the rest of the data, resulting in an R-squared of 0.90. The rolling two period average of the independent (X) variable in green shows a muted increase in period 10 as well as an increase in period 11 from the effect of period 10 on the rolling average for period 11. The R-squared associated with the rolling average of the independent variable is 0.49, which is significantly lower than the R-squared of the original independent variable. This example demonstrates that Witness Nelson's claim that averaging an independent variable necessarily inflates the R-squared is false.

Figure 3 – Comparison of Original and Rolling Average Independent Variables



Therefore, it is reasonable and appropriate to use lags and rolling averages of peak demand to explain changes in distribution plant and expenses over time.

Q. Do you agree with Witness Nelson's assertion that unnecessarily adding dummy variables and autoregressive terms inflates the R-squared and can give analysts a false sense that the independent variables explain the variance of the dependent variable?[13]

A. Yes. However, excluding necessary dummy variables and not addressing autocorrelation in a regression creates problems that are just as critical, which is why it is important not to blindly rely on R-squared in selecting a regression model. As discussed in my Direct

[13] See Nelson Direct Testimony at 60.

Testimony at pages 6–8 (Bates II-398 to II-400), I examined each regression equation for autocorrelation, structural shifts, the reasonableness of the sign and magnitude of each coefficient, and the explanatory power of individual coefficients, in addition to examining the R-squared to ensure the reasonableness of the selected models. Witness Ros also reviewed each of the as filed regression models and did not identify any dummy variables or autoregressive terms that were unnecessary. Therefore, the as filed models appropriately use dummy variables and autoregressive terms as necessary.

Q. Witness Nelson quotes a Massachusetts Department of Public Utilities ("MA DPU") order from a 2017 Eversource rate case where the MA DPU discusses the use of dummy variables and autoregressive terms.[14] Did the MA DPU reject the marginal cost study in that case due to the inappropriate use of dummy variables and autoregressive terms?

A. No. The MA DPU accepted the marginal cost study in that case and acknowledged that there are situations where the use of dummy variables and autoregressive terms in regression analyses are reasonable. Witness Nelson failed to include the portion of the MA DPU Order which states, "While the record in the instant case indicates that Eversource also used a majority of dummy variables and autoregressive terms, the Department is satisfied with the Companies' explanation for their use and, as such, accepts their results."[15]

[14] See Nelson Direct Testimony at 62.
[15] MA DPU, Order Establishing Eversource's Rate Structure, D.P.U. 17-05-B, January 5, 2018, at 14.

Witness Nelson also failed to include the portion of the MA DPU Order in the 2017 Eversource rate case that explains, contrary to his recommendations, that the MA DPU requires the use of regression analysis for marginal cost studies.

> In Fitchburg Gas and Electric Light Company, D.T.E. 02-24/25, at 243-244, in determining marginal costs, we directed companies to use multiple variable regression equations when regressing historical plant investment on customer load without differentiating among customer classes. We also directed companies to test for multicollinearity, heteroscedasticity, and autocorrelation, and apply remedial procedures as necessary. In addition, we required that companies perform a check of theoretical consistency. D.T.E. 02-24/25, at 243-244. The Department has reviewed the Companies' proposal and finds that it is in compliance with these directives (Exhs. ES-MCOS-2, Schs. MCOS-1, at 1-2, MCOS-2, at 1-4, MCOS-3, at 1-3; DPU-4-9; DPU-4-11; Tr. 17, at 3524-3525).[16]

Q. Do you believe the as filed marginal cost study based on regressions should be ignored because of Witness Nelson's concerns with the Company's theoretical approach to the regression analysis?

A. No. As demonstrated, Witness Nelson's concerns with the as filed regression analysis are unfounded and incorrect. In addition, Witness Ros independently confirmed that six of the as filed regressions were reasonable, and the changes he made to use averages for the O&M cost factors only resulted in minor allocation changes to specific rate classes. Therefore, I believe that the as filed marginal cost study is reasonable.

Q. Does this conclude your testimony?

A. Yes, it does.

[16] MA DPU, Order Establishing Eversource's Rate Structure, D.P.U. 17-05-B, January 5, 2018, at 13.