

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Distribution Plant-Related Costs: Primary System**

1 Regression Results

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3 **Selected Model:** Primary Distribution Plant Additions 2022\$ = F(Normalized Peak Rolling 2 Year Average, Trend, Dummy<sub>2004</sub>, Lag 4)

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Dependent Variable				
Total Cumulative Annual Distribution Capacity Additions 2022\$ <sub>(2001 - 2022)</sub>				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-9,456,112	-3.848	0.0010
Annual Trend	Trend	2,519,744	159.065	<.001
Normalized Peak Rolling 2 Year Average	Norm_pk_R2	108,329	8.030	<.001
Dummy: Year 2004	D_2004	-1,379,970	-2.297	0.0350
Autoregressive Term Lag 4	Lag 4	-0.7470	-5.2760	<.001
Model Statistics		Model 1.1		
R Squared		0.9990		
Adjusted R Squared		0.9988		
Mean Absolute % Error (MAPE)		1.4910		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Primary Distribution Plant Additions} = - \$ 9,456,112 + \$ 2,519,744 \times \text{Trend} + \$ 108,329 \times \text{Norm\_pk\_R2} + - \$ 1,379,970 \times \text{D\_2004} + - \$ 0.7470 \times \text{Lag 4}$$

$$\partial \text{ Primary Distribution Plant} / \partial \text{ Normalized Peak Demand} = \$ 108,329 \text{ per MW}$$

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Distribution Plant-Related Costs: Secondary System**

1 Regression Results

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3 **Selected Model:** Secondary Distribution Plant Additions 2022\$ = F(Normalized Peak Rolling 2 Year Average, Trend<sub>2015-2022</sub>,  
Dummy<sub>2005</sub>, Dummy<sub>2013</sub>)

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Dependent Variable				
Total Cumulative Annual Distribution Capacity Additions 2022\$ <sub>(2001 - 2022)</sub>				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-23,181,050	-5.83	0.0000
Normalized Peak Rolling 2 Year Average	Norm_pk_R2	156,699	7.28	0.0000
Dummy: Year 2013	D_2013	2,156,702	2.16	0.0451
Dummy: Year 2005	D_2005	-2,090,565	-2.11	0.0500
Interactive: Trend for 2015 to 2022	I_Trendx2015_After	336,251	14.51	0.0000
Model Statistics		<b>Model 1.2</b>		
R Squared		0.9468		
Adjusted R Squared		0.9343		
Mean Absolute % Error (MAPE)		10.6012		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Secondary Distribution Plant Additions} = - \$ 23,181,050 + \$ 156,699 \times \text{Norm\_pk\_R2} + \$ 2,156,702 \times \text{D\_2013} + - \$ 2,090,565 \times \text{D\_2005} + \$ 336,251 \times \text{I\_Trendx2015\_After}$$

$$\partial \text{Secondary Distribution Plant} / \partial \text{Normalized Peak Demand} = \$ 156,699 \text{ per MW}$$

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Distribution Plant-Related Costs: Line Transformers**

1 Regression Results

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3 **Selected Model:** Line Transformers Plant Additions 2022\$ = F(Normalized Peak Rolling 2 Year Average, Trend, Dummy<sub>2007</sub>, Dummy<sub>2012</sub>,  
Dummy<sub>2014</sub>, Dummy<sub>2022</sub>, Lag 3)

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Dependent Variable				
Total Cumulative Annual Distribution Capacity Additions 2022\$ <sub>(2001 - 2022)</sub>				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-13,780,553	-8.49	0.0000
Normalized Peak Rolling 2 Year Average	Norm_pk_R2	111,351	12.33	0.0000
Annual Trend	Trend	630,246	55.40	0.0000
Dummy: Year 2007	D_2007	1,519,462	4.38	0.0006
Dummy: Year 2014	D_2014	-1,580,634	-4.28	0.0008
Dummy: Year 2012	D_2012	-1,143,769	-3.11	0.0077
Dummy: Year 2022	D_2022	-1,562,657	-3.64	0.0027
Autoregressive Term Lag 3	Lag 3	-0.684	-3.22	0.0062
Model Statistics		<b>Model 1.0</b>		
R Squared		0.9947		
Adjusted R Squared		0.9921		
Mean Absolute % Error (MAPE)		2.5837		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Line Transformers Additions} = - \$ 13,780,553 + \$ 111,351 \times \text{Norm\_pk\_R2} + \$ 630,246 \times \text{Trend} + \$ 1,519,462 \times \text{D\_2007} + - \$ 1,580,634 \times \text{D\_2014} + - \$ 1,143,769 \times \text{D\_2012} + - \$ 1,562,657 \times \text{D\_2022} + - \$ 0.684 \times \text{Lag 3}$$

$$\partial \text{ Line Transformers} / \partial \text{ Normalized Peak Demand} = \$ 111,351 \text{ per MW}$$

**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study  
Services and Meters Plant**

Line No.	Description	Domestic D	Domestic- Opt. Peak D-10	Domestic - Opt Battery Pilot Pricing D-11	General TOU G-1	General Long Hour G-2	General Service G-3	Outdoor Lighting M	Limited All Electric T	Ltd Comm Space V	Explanation
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1	<b>Service Costs</b>										
2	Representative Cost	\$741.11	\$741.11	\$741.11	\$821.47	\$821.47	\$741.11		\$820.61	\$741.11	Company Data
3	Customers per Service	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	Company Data
4	Average Service Cost per Customer	\$ 741.11	\$ 741.11	\$ 741.11	\$ 821.47	\$ 821.47	\$ 741.11		\$ 820.61	\$ 741.11	Line 2 / Line 3
5	<b>Meter Costs</b>										
6	Current Unit Cost for Metering	\$ 158.20	\$ 185.20	\$ 185.20	\$ 1,267.37	\$ 1,267.37	\$ 244.72		\$ 158.20	\$ 244.72	Company Data
7	Meters per Customer	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	Company Data
8	Average Meter Cost per Customer	\$ 158.20	\$ 185.20	\$ 185.20	\$ 1,267.37	\$ 1,267.37	\$ 244.72		\$ 158.20	\$ 244.72	Line 6 x Line 7
9	<b>Total</b>	\$899.31	\$926.31	\$926.31	\$2,088.84	\$2,088.84	\$985.83		\$978.81	\$985.83	Line 4 + Line 8

**Liberty Utilities (Granite State Electric) Corp.**  
**Marginal Cost Study**  
**Street Lighting - Luminaires**

Line No.	Luminaires Type	Sodium Vapor	Sodium Vapor	Sodium Vapor	Sodium Vapor	Sodium Vapor
	Size of Street Light Lumnes	4000	9600	27500	50000	9,600 (Post Top)
	Description	LUM HPS RWY 50W	LUM HPS RWY 100W	LUM HPS RWY 250W	LUM HPS RWY 400W	LUM HPS POST 100W
	Replacement Luminaire Type	LUM HPS RWY 50W	LUM HPS RWY 100W	LUM HPS RWY 250W	LUM HPS RWY 400W	LUM HPS POST 100W
	(A)	(B)	(C)	(D)	(E)	(F)
1	<b>Installation Costs</b>					
2	Total Installation Costs	\$ 613.41	\$ 611.69	\$ 659.03	\$ 710.00	\$ 663.63
3	Fixed Charge Rate	11.07%	11.07%	11.07%	11.07%	11.07%
4	Annualized Cost	\$ 67.89	\$ 67.70	\$ 72.94	\$ 78.59	\$ 73.45
5	Escalator to Adjust to 2023/24 Rate Year	3.99%	3.99%	3.99%	3.99%	3.99%
6	Adjusted Annualized Cost	\$ 70.60	\$ 70.41	\$ 75.85	\$ 81.72	\$ 76.38
7	Installed Luminaires	1,933	1,450	415	42	402
8	Total Annual Marginal Cost	\$ 136,476.63	\$ 102,088.06	\$ 31,479.58	\$ 3,432.28	\$ 30,706.31

**Liberty Utilities (Granite State Elec  
Marginal Cost Study  
Street Lighting - Luminaires**

Line No.	Luminaires Type	Sodium Vapor	Sodium Vapor	Incandescent	Mercury Vapor	Mercury Vapor	Mercury Vapor	Mercury Vapor
	Size of Street Light Lumnes	27,500 (Flood)	50,000 (Flood)	1000	4000	8000	22000	63000
	Description	LUM HPS FLD 250W	LUM HPS FLD 400W	LUM INC RWY 103W	LUM MV RWY 100W	LUM MV RWY 175W	LUM MV RWY 400W	LUM MV RWY 1000W
	Replacement Luminaire Type	LUM HPS FLD 250W	LUM HPS FLD 400W	LUM HPS RWY 50W	LUM HPS RWY 50W	LUM HPS RWY 100W	LUM HPS RWY 250W	LUM HPS RWY 400W
	(A)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
1	<b>Installation Costs</b>							
2	Total Installation Costs	\$ 749.47	\$ 776.93	\$ 613.41	\$ 611.69	\$ 659.03	\$ 710.00	\$ 663.63
3	Fixed Charge Rate	11.07%	11.07%	11.07%	11.07%	11.07%	11.07%	11.07%
4	Annualized Cost	\$ 82.95	\$ 85.99	\$ 67.89	\$ 67.70	\$ 72.94	\$ 78.59	\$ 73.45
5	Escalator to Adjust to 2023/24 Rate Year	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%
6	Adjusted Annualized Cost	\$ 86.26	\$ 89.42	\$ 70.60	\$ 70.41	\$ 75.85	\$ 81.72	\$ 76.38
7	Installed Luminaires	228	366	23	50	94	46	1
8	Total Annual Marginal Cost	\$ 19,668.20	\$ 32,729.44	\$ 1,623.88	\$ 3,520.28	\$ 7,130.31	\$ 3,759.17	\$ 76.38

**Liberty Utilities (Granite State Elec  
Marginal Cost Study  
Street Lighting - Luminaires**

Line No.	Luminaires Type	Mercury Vapor	LED	LED	LED	LED	LED	LED	LED	LED	LED	Total Outdoor Lighting (Luminaires)	Explanation
	Size of Street Light Lumnes	22,000 (Flood) LUM MV FLD	16000 Full-Night Service	21000 Full-Night Service	3000 Full-Night Service	5000 Full-Night Service	5000 Undergroun Res Full-Night Service	14600 Flood Full-Night Service	9400 Flood Full-Night Service	4800 Barn Part-Night Service			
	Description	400W LUM HPS FLD	LED 130	LED 190	LED 30	LED 50	LED 50 URD	LED 130 Flood	LED 90 Flood	LED 50 Barn			
	Replacement Luminaire Type	250W	LED 130	LED 190	LED 30	LED 50	LED 50 URD	LED 130 Flood	LED 90 Flood	LED 50 Barn			
	(A)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(P)	
1	<b>Installation Costs</b>												
2	Total Installation Costs	\$ 749.47	\$ 790.60	\$ 851.84	\$ 604.02	\$ 662.33	\$ 857.70	\$ 903.44	\$ 800.08	\$ 564.26			Company Data
3	Fixed Charge Rate	11.07%	11.07%	11.07%	11.07%	11.07%	11.07%	11.07%	11.07%	11.07%			Att MFB-7 p1, Col (C), Line 7
4	Annualized Cost	\$ 82.95	\$ 87.51	\$ 94.29	\$ 66.86	\$ 73.31	\$ 94.93	\$ 100.00	\$ 88.56	\$ 62.45			Line 2 x Line 3
5	Escalator to Adjust to 2023/24 Rate Year	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%			Inflation from Revenue Requirement
6	Adjusted Annualized Cost	\$ 86.26	\$ 91.00	\$ 98.05	\$ 69.52	\$ 76.23	\$ 98.72	\$ 103.99	\$ 92.09	\$ 64.95			Line 4 x (1 + Line 5)
7	Installed Luminaires	17	190	1	179	339	16	53	20	192	6,057		Company Data
8	Total Annual Marginal Cost	\$ 1,466.49	\$ 17,289.64	\$ 98.05	\$ 12,444.57	\$ 25,843.40	\$ 1,579.54	\$ 5,511.26	\$ 1,841.79	\$ 12,469.70	\$ 451,235		Line 6 x Line 7

**Liberty Utilities (Granite State Electric) Corp.**  
**Marginal Cost Study**  
**Street Lighting - Poles and Accessories**

Line No.	Poles and Accessories	Overhead Service	Non-Metallic Standard	Non-Metallic Standard	Non-Metallic Standard
	Poles and Accessories Type Description Replacement Pole and Accessory Type	Wood Poles POLE - WOOD POLE - WOOD	Fiberglass - Direct Embedded POLE FIBER PT < 25FT POLE FIBER PT < 25FT	Fiberglass with Foundation < 25 ft. POLE FIBER RWY < 25FT POLE FIBER RWY < 25FT	Fiberglass With Foundation >= 25 Ft. POLE FIBER RWY => 25 POLE FIBER RWY => 25
	(A)	(B)	(C)	(D)	(E)
1	<b>Installation Costs</b>				
2	Total Installation Costs	\$ 1,393.64	\$ 1,960.06	\$ 2,527.57	\$ 2,936.93
3	Fixed Charge Rate	11.07%	11.07%	11.07%	11.07%
4	Annualized Cost	\$ 154.25	\$ 216.95	\$ 279.76	\$ 325.07
5	Escalator to Adjust to 2023/2024 Rate Year	3.99%	3.99%	3.99%	3.99%
6	Adjusted Annualized Cost	\$ 160.41	\$ 225.60	\$ 290.92	\$ 338.04
7	Installed Luminaires	118	289	129	57
8	Total Annual Marginal Cost	\$ 18,928.15	\$ 65,199.28	\$ 37,529.13	\$ 19,268.33



**Liberty Utilities (Granite State Electric) Corp.**  
**Marginal Cost Study**  
**Street Lighting - Poles and Accessories**

Line No.	Poles and Accessories	Metallic Standard		Total Outdoor Lighting (Poles and Accessories)	Explanation
	Poles and Accessories Type Description Replacement Pole and Accessory Type	Metal Poles - Direct Embedded POLE METAL EMBEDDED POLE METAL EMBEDDED	Metal Poles with Foundation POLE METAL POLE METAL		
	(A)	(F)	(G)	(H)	(I)
1	<b>Installation Costs</b>				
2	Total Installation Costs	\$ 1,960.06	\$ 2,936.93		Company Data
3	Fixed Charge Rate	11.07%	11.07%		Att MFB-7 p1, Col (C), Line 7 Line 2 x Line 3
4	Annualized Cost	\$ 216.95	\$ 325.07		
5	Escalator to Adjust to 2023/2024 Rate Year	3.99%	3.99%		Inflation from Revenue Requirement
6	Adjusted Annualized Cost	\$ 225.60	\$ 338.04		Line 4 x (1 + Line 5)
7	Installed Luminaires	128	79	800	Company Data
8	Total Annual Marginal Cost	\$ 28,877.19	\$ 26,705.23	\$ 196,507	Line 6 x Line 7

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Distribution Operations Expense: Primary System**

1 Regression Results

2

3 **Selected Model:** Primary Distribution Non-Customer Operations Expense 2022\$ = F(Normalized Peak Rolling 2 Year Average, Dummy<sub>2014</sub>, Dummy<sub>2005</sub>,  
Dummy<sub>2017</sub>, Trend<sub>2002-2012</sub>)

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Dependent Variable				
Primary Distribution Non-Customer Operations Expense 2022\$ (2002 - 2022)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-8,504,969	-4.09	<.001
Normalized Peak Rolling 2 Year Average	Norm_pk R2	54,040	4.78	<.001
Dummy: 2014	D_2014	1,091,598	3.15	0.0070
Dummy: 2005	D_2005	-1,097,457	-3.59	0.0030
Dummy: 2017	D_2017	690,993	2.22	0.0420
Interactive: Trend for 2002 to 2012	Trend_2002_2012	-119,309	-5.96	<.001
Model Statistics		<b>Model 2.1</b>		
R Squared		0.8790		
Adjusted R Squared		0.8387		
Mean Absolute % Error (MAPE)		17.8610		
Passes ACF/PACF		Yes		

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Marginal Cost Calculation

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$$\text{Primary Distribution Non-Customer Operations Expense} = - \$ 8,504,969 + \$ 54,040 \times \text{Norm\_pk\_R2} + \$ 1,091,598 \times \text{D\_2014} + - \$ 1,097,457 \times \text{D\_2005} + \$ 690,993 \times \text{D\_2017} + - \$ 119,309 \times \text{Trend\_2002\_2012}$$

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$$\partial \text{ Primary Distribution Non-Customer Operations Expense} / \partial \text{ Normalized Peak Demand} = \$ 54,040 \text{ per MW}$$

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Distribution Operations Expense: Secondary System**

1 Regression Results

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3 **Selected Model:** Secondary Distribution Non-Customer Operations Expense 2022\$ = F(Normalized Peak Rolling 2 year average, Dummy<sub>2003-2012</sub>, Dummy<sub>2014</sub>,  
Dummy<sub>2013</sub>)

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Dependent Variable				
Secondary Distribution Non-Customer Operations Expense 2022\$ (2002 - 2022)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-1,362,909	-1.86	0.0810
Normalized Peak Rolling 2 year average	Norm_pk_R2	9,871	2.49	0.0241
Dummy: Years 2003 to 2012	D_2003_2012	-345,943	-6.46	0.0000
Dummy: Year 2014	D_2014	538,251	4.17	0.0007
Dummy: Year 2013	D_2013	260,515	2.14	0.0484
Model Statistics	<b>Model 2.0</b>			
R_Squared	0.8726			
Adjusted R_Squared	0.8407			
Mean Absolute % Error (MAPE)	31.5373			
Passes ACF/PACF	Yes			

Marginal Cost Calculation

$$\text{Secondary Distribution Non-Customer Operations Expense} = - \$ 1,362,909 + \$ 9,871 \times \text{Norm\_pk\_R2} + - \$ 345,943 \times \text{D\_2003\_2012} + \$ 538,251 \times \text{D\_2014} + \$ 260,515 \times \text{D\_2013}$$

$$\partial \text{ Secondary Distribution Non-Customer Operations Expense} / \partial \text{ Normalized Peak Demand} = \$ 9,871 \text{ per MW}$$

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Distribution Operations Expense: Line Transformers**

1 Regression Results

2

3 **Selected Model:** Line Transformers Non-Customer Operations Expense 2022\$ = F(Normalized Peak Rolling 2 year average, Dummy<sub>2004-2011</sub>, Dummy<sub>2012</sub>,  
Dummy<sub>2013</sub>, Dummy<sub>2014</sub>)

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Dependent Variable				
Line Transformers Non-Customer Operations Expense 2022\$ (2002 - 2022)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-547,418	-3.88	0.0015
Normalized Peak Rolling 2 year average	Norm_pk_R2	3,567	4.64	0.0003
Dummy: Years 2004 to 2011	D_2004_2011	-82,409	-8.05	0.0000
Dummy: 2012	D_2012	-188,194	-8.50	0.0000
Dummy: 2013	D_2013	90,573	4.26	0.0007
Dummy: 2014	D_2014	182,848	7.95	0.0000
Model Statistics		<b>Model 1.0</b>		
R_Squared		0.9571		
Adjusted R_Squared		0.9428		
Mean Absolute % Error (MAPE)		19.4532		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Line Transformers Non-Customer Operations Expense} = - \$ 547,418 + \$ 3,567 \times \text{Norm\_pk\_R2} + - \$ 82,409 \times \text{D\_2004\_2011} + - \$ 188,194 \times \text{D\_2012} + \$ 90,573 \times \text{D\_2013} + \$ 182,848 \times \text{D\_2014}$$

$$\partial \text{Line Transformers Non-Customer Operations Expense} / \partial \text{Normalized Peak Demand} = \$ 3,567 \text{ per MW}$$

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Distribution Maintenance Expense: Primary System**

1 Regression Results

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3 **Selected Model:** Primary Distribution Non-Customer Maintenance Expense 2022\$ = F(1 Year Lag in Normal Peak, 1 Year Lag in SAIFI, Dummy<sub>2013-2015</sub>, Dummy<sub>2010</sub>, Dummy<sub>2005</sub>, Trend<sub>2018-2022</sub>)

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Dependent Variable				
Primary Distribution Non-Customer Maintenance Expense 2022\$ (2001 - 2022)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-3,038,786	-2.03	0.0607
1 Year Lag in Normal Peak	Norm_pk L1	23,056	3.00	0.0089
1 Year Lag in SAIFI	SAIFI L1	585,762	2.69	0.0168
Dummy: Years 2013 to 2015	D_2013_2015	-747,252	-2.60	0.0199
Dummy: 2010	D_2010	-873,285	-1.93	0.0733
Dummy: 2005	D_2005	-849,022	-1.96	0.0688
Interactive: Trend for 2018 to 2022	Trendx2018_After	60,263	3.91	0.0014
Model Statistics		<b>Model 3.1</b>		
R Squared		0.7423		
Adjusted R Squared		0.6393		
Mean Absolute % Error (MAPE)		11.9144		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Primary Distribution Non-Customer Maintenance Expense} = - \$ 3,038,786 + \$ 23,056 \times \text{Norm\_pk\_L1} + \$ 585,762 \times \text{SAIFI\_L1} + - \$ 747,252 \times \text{D\_2013\_2015} + - \$ 873,285 \times \text{D\_2010} + - \$ 849,022 \times \text{D\_2005} + \$ 60,263 \times \text{Trendx2018\_After}$$

$$\partial \text{ Primary Distribution Non-Customer Maintenance Expense} / \partial \text{ Normalized Peak Demand} = \$ 23,056 \text{ per MW}$$

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Distribution Maintenance Expense: Secondary System**

1 Regression Results

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3 **Selected Model:** Secondary Distribution Non-Customer Maintenance Expense 2022\$ = F(2-Year Lag in Normal Peak, 1 Year Lag in SAIFI, Dummy<sub>2013-2015</sub>,  
Dummy<sub>2010</sub>, Dummy<sub>2018-2022</sub>)

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Dependent Variable				
Secondary Distribution Non-Customer Maintenance Expense 2022\$ (2002 - 2022)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-1,461,419	-2.71	0.0161
2 Year Lag in Normal Peak	Norm_pk_L2	9,654	3.57	0.0028
1 Year Lag in SAIFI	SAIFI_L1	212,714	2.81	0.0131
Dummy: Years 2013 to 2015	D_2013_2015	-279,938	-2.88	0.0115
Dummy: 2010	D_2010	-361,978	-2.35	0.0328
Dummy: Years 2018 to 2022	D_2018_After	413,407	3.98	0.0012
Model Statistics		<b>Model 4.0</b>		
R Squared		0.7336		
Adjusted R Squared		0.6447		
Mean Absolute % Error (MAPE)		12.1872		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Secondary Distribution Non-Customer Maintenance Expense} = - \$ 1,461,419 + \$ 9,654 \times \text{Norm\_pk\_L2} + \$ 212,714 \times \text{SAIFI\_L1} + - \$ 279,938 \times \text{D\_2013\_2015} + - \$ 361,978 \times \text{D\_2010} + \$ 413,407 \times \text{D\_2018\_After}$$

$$\partial \text{ Secondary Distribution Non-Customer Maintenance Expense} / \partial \text{ Normalized Peak Demand} = \$ 9,654 \text{ per MW}$$

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Distribution Maintenance Expense: Line Transformers**

1 Regression Results

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3 **Selected Model:** Line Transformers Non-Customer Maintenance Expense 2022\$ = F(2-Year Lag in Normal Peak, 1 Year Lag in SAIFI, Dummy<sub>2012</sub>, Trend<sub>2018-2022</sub>)

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Dependent Variable				
Line Transformers Non-Customer Maintenance Expense 2022\$ (2002 - 2022)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-616,606	-2.41	0.0285
2 Year Lag in Normal Peak	Norm_pk_L2	3,580	2.88	0.0109
1 Year Lag in SAIFI	SAIFI_L1	162,594	4.30	0.0006
Dummy: 2012	D_2012	222,383	2.99	0.0087
Interactive: Trend for 2018 to 2022	Trendx2018_After	15,190	5.68	0.0000
Model Statistics		<b>Model 1.0</b>		
R Squared		0.7041		
Adjusted R Squared		0.6301		
Mean Absolute % Error (MAPE)		15.9777		
Passes ACF/PACF		Yes		

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Marginal Cost Calculation

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$$\text{Line Transformers Non-Customer Maintenance Expense} = - \$ 616,606 + \$ 3,580 \times \text{Norm\_pk\_L2} + \$ 162,594 \times \text{SAIFI\_L1} + \$ 222,383 \times \text{D\_2012} + \$ 15,190 \times \text{Trendx2018\_After}$$

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$$\partial \text{ Line Transformers Non-Customer Maintenance Expense} / \partial \text{ Normalized Peak Demand} = \$ 3,580 \text{ per MW}$$

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Distribution Operations and Maintenance Expense: Customer Related**

1 Regression Results

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3 **Selected Model:** Customer Related Operations and Maintenance Expense 2022\$ = F(Customers Lagged 1 Year, Trend<sub>2001-2011</sub>, Dummy<sub>2012</sub>,  
Dummy<sub>2013</sub> )

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Dependent Variable				
Customer Related Operations and Maintenance Expense 2022\$ (2001 - 2022)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-2,445,262	-1.03	0.3180
Customers Lagged 1 Year	Customer L1	132	2.32	0.0330
Interactive: Trend for 2001 to 2011	Trend 2001 2011	-72,519	-2.91	0.0100
Dummy: 2012	D 2012	-1,592,054	-3.60	0.0020
Dummy: 2013	D 2013	-1,665,706	-3.77	0.0020
Model Statistics		<b>Model 1.0</b>		
R Squared		0.6480		
Adjusted R Squared		0.5652		
Mean Absolute % Error (MAPE)		10.6790		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Customer Related Operations and Maintenance Expense} = - \$ 2,445,262 + \$ 132 \times \text{Customer\_L1} + - \$ 72,519 \times \text{Trend\_2001\_2011} + - \$ 1,592,054 \times \text{D\_2012} + - \$ 1,665,706 \times \text{D\_2013}$$

$$\partial \text{ Customer Related Operations and Maintenance Expense} / \partial \text{ Customer} = \$ 132.3 \text{ per Customer}$$



**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study  
Class Weighted Customer Plant Related Expense**

Customer Weightings					Customer Weightings		
Line No.	Customer Groups	Test Year Number of Customers	Service and Meter Plant per customer	Total Cost	Relative Weight Per Customer	System Average Marginal Cost per Customer	Weighted Marginal Cost Per Customer
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
		Company Data	Att MFB-2 p1, Line 9	Col (B) x Col (C)	Col (C) Line (n) / Line 11	Col (G) Line 10	Col (E) x Col (F)
1	D	37,286	\$ 899.31	\$ 33,532,090	0.955	\$ 132.3	\$126.40
2	D-10	440	\$ 926.31	\$ 407,876	0.984	\$ 132.3	\$130.20
3	D-11	98	\$ 926.31	\$ 90,598	0.984	\$ 132.3	\$130.20
4	G-1	152	\$ 2,088.84	\$ 317,833	2.219	\$ 132.3	\$293.59
5	G-2	972	\$ 2,088.84	\$ 2,031,250	2.219	\$ 132.3	\$293.59
6	G-3	5,876	\$ 985.83	\$ 5,792,808	1.047	\$ 132.3	\$138.56
7	M	N/A					
8	T	854	\$ 978.81	\$ 835,775	1.040	\$ 132.3	\$137.57
9	V	16	\$ 985.83	\$ 15,796	1.047	\$ 132.3	\$138.56
10	Total	45,695		\$ 43,024,027			\$132.34
11	Avg Cost per Customer		\$941.54				

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Customer Accounts**

1 Regression Results

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3 **Selected Model:** Customer Accounts 2022\$ = F(Customers 2 Year Rolling Average, Trend<sub>2003-2011</sub>, Dummy<sub>2015</sub>, Dummy<sub>2012</sub>, Trend<sub>2018-2022</sub>, Lag 3)

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Dependent Variable				
Customer Accounts 2022\$ (2003 - 2022)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-2,612,231	-1.46	0.1690
Customers 2 Year Rolling Average	Customer_L2	124	2.85	0.0140
Interactive: Trend for 2003 to 2011	Trend_2003_2011	-62,506	-3.17	0.0070
Dummy: 2015	D_2015	966,736	3.49	0.0040
Dummy: 2012	D_2012	-1,175,755	-4.07	0.0010
Interactive: Trend for 2018 to 2022	Trend_2018_After	-39,827	-4.12	0.0010
Autoregressive Term Lag 3	Lag_3	-0.5700	-1.84	0.0880
<b>Model Statistics</b>		<b>Model 4.0</b>		
R_Squared		0.8200		
Adjusted R_Squared		0.7369		
Mean Absolute % Error (MAPE)		8.3250		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Customer Accounts} = - \$ 2,612,231 + \$ 124 \times \text{Customer\_L2} + - \$ 62,506 \times \text{Trend\_2003\_2011} + \$ 966,736 \times \text{D\_2015} + - \$ 1,175,755 \times \text{D\_2012} + - \$ 39,827 \times \text{Trend\_2018\_After} + - \$ 0.570 \times \text{Lag 3}$$

$$\partial \text{Customer Accounts} / \partial \text{Customer} = \$ 124.3 \text{ per Customer}$$

**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study  
Class Weighted Customer Accounting & Marketing Expense**

Line No.	Customer Groups	Test Year Number of Customers	% of total Customers	Relative Weight Per Customer	Marginal Unit Cost	Marginal Cost Per Customer
	(A)	(B)	(C)	(D)	(E)	(F)
		Att MFB-5 p2, Col (B)	Col (B) Line (n) / Col (B) Line 10	Company Data	Att MFB-5 p3, Line 25	Col (D) x Col (E)
1	D	37,286	81.60%	1.00	\$ 124.30	\$ 124.30
2	D-10	440	0.96%	1.00	\$ 124.30	\$ 124.30
3	D-11	98	0.21%	1.00	\$ 124.30	\$ 124.30
4	G-1	152	0.33%	2.00	\$ 124.30	\$ 248.60
5	G-2	972	2.13%	1.50	\$ 124.30	\$ 186.45
6	G-3	5,876	12.86%	1.00	\$ 124.30	\$ 124.30
7	M	N/A				
8	T	854	1.87%	1.00	\$ 124.30	\$ 124.30
9	V	16	0.04%	1.00	\$ 124.30	\$ 124.30
10	Total	45,695			\$ 124.30	

**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study**  
**Class Weighted Bad Debt Accounts Expense**

Line No.	Customer Groups	2022 Write Offs	Percent of Total	Bad Debt Accounts Expense	Total Normalized Distribution Revenues	Bad Debt Expense Percentage
	(A)	(B)	(C)	(D)	(E)	(F)
		Company Data	Col (B) Line (n) / Col (B) Line 10	Col (C) Line (n) x Col (D) Line 10	Company Data	Col (D) / Col (E)
1	D	\$ 379,002	89.08%	\$ 147,505	\$ 23,791,700	0.62%
2	D-10	\$ 1,555	0.37%	\$ 605	\$ 338,301	0.18%
3	D-11	\$ -	0.00%	\$ -	\$ 65,562	0.00%
4	G-1	\$ 17,951	4.22%	\$ 6,987	\$ 9,960,196	0.07%
5	G-2	\$ 8,238	1.94%	\$ 3,206	\$ 5,671,774	0.06%
6	G-3	\$ 16,255	3.82%	\$ 6,326	\$ 5,628,419	0.11%
7	M	\$ 1,724	0.41%	\$ 671	\$ 995,309	0.07%
8	T	\$ 742	0.17%	\$ 289	\$ 768,409	0.04%
9	V	\$ -	0.00%	\$ -	\$ 17,351	0.00%
10	Total	\$ 425,467	100.00%	\$ 165,589	\$ 47,237,019	0.35%

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal Administrative and General Expense - Marginal Loading Factors**

1 Regression Results

2

3 **Selected Model:** Administrative and General Expense 2022\$ = F(Total O&M Expense Excl. A&G, Real 2022\$, Total Utility Plant, Trend, Dummy<sub>2002</sub>,  
4 Dummy<sub>2009</sub>, Dummy<sub>2010-2011</sub>, Dummy<sub>2012</sub>, Dummy<sub>2013</sub>, Dummy<sub>2014</sub>, Dummy<sub>2019-2022</sub>)

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Dependent Variable				
Total Administrative and General Expense 2022\$ <sub>(2001 - 2022)</sub>				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-2,398,433	-1.44	0.1770
Total O&M Expense Excl. A&G, Real 2022\$	OM_Real_xAG	0.0483	3.66	0.0038
Total Utility Plant	Util_Plt	0.0402	2.83	0.0163
Annual Trend	Trend	-423,769	-2.88	0.0150
Dummy: 2002	D_2002	1,489,969	2.15	0.0551
Dummy: 2009	D_2009	2,558,785	3.78	0.0030
Dummy: Years 2010 - 2011	D_2010_2011	4,463,062	7.37	0.0000
Dummy: 2012	D_2012	12,067,287	13.80	0.0000
Dummy: 2013	D_2013	9,935,631	11.70	0.0000
Dummy: 2014	D_2014	3,215,301	4.62	0.0007
Dummy: Years 2019 to 2022	D_2019_2022	-4,157,731	-6.39	0.0001
<b>Model Statistics</b>		<b>Model 2.0</b>		
R Squared		0.9839		
Adjusted R Squared		0.9692		
Mean Absolute % Error (MAPE)		29.5696		
Passes ACF/PACF		Yes		

**Marginal Cost Calculation**

$$\text{Total Administrative and General Expense} = - \$ 2,398,433 + \$ 0.0483 \times \text{OM\_Real\_xAG} + \$ 0.0402 \times \text{Util\_Plt} + - \$ 423,769 \times \text{Trend} +$$

$$\$ 1,489,969 \times \text{D\_2002} + \$ 2,558,785 \times \text{D\_2009} + \$ 4,463,062 \times \text{D\_2010\_2011} + \$ 12,067,287 \times \text{D\_2012} + \$ 9,935,631 \times \text{D\_2013} +$$

$$\$ 3,215,301 \times \text{D\_2014} + - \$ 4,157,731 \times \text{D\_2019\_2022}$$

$$\partial \text{ Total Administrative and General Expense} / \partial \text{ O\&M excl. A\&G} = \$ 0.0483 \text{ per } \$ \text{ of O\&M (2022\$)}$$

$$\partial \text{ Total Administrative and General Expense} / \partial \text{ Plant} = \$ 0.0402 \text{ per } \$ \text{ of Plant (2022\$)}$$

**Liberty Utilities (Granite State Electric) Corp.  
 Marginal Cost Study**

**Summary of Marginal Materials and Supplies Expense - Marginal Loading Factors**

1 Regression Results

2  
 3 **Selected Model:** Materials and Supplies 2022\$ = F(Total Electric Plant In Service , Dummy<sub>2009</sub>, Dummy<sub>2011</sub>)

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Dependent Variable				
Materials and Supplies Expense 2022\$ (2001 - 2022)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-728,482	-1.85	0.0810
Total Electric Plant In Service	Util_Plt	0.0190	9.09	<.001
Dummy: 2009	D_2009	10,574,995	14.11	<.001
Dummy: 2011	D_2011	2,040,401	2.73	0.0140
Model Statistics	<b>Model 1.0</b>			
R_Squared		0.9330		
Adjusted R_Squared		0.9218		
Mean Absolute % Error (MAPE)		63.7130		
Passes ACF/PACF		Yes		

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 19 Marginal Cost Calculation  
 20 Materials and Supplies Expense = - \$ 728,482 + \$ 0.0190 x Util\_Plt + \$ 10,574,995 x D\_2009 + \$ 2,040,401 x D\_2011

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 22  $\partial$  Materials and Supplies Expense /  $\partial$  Plant = \$ 0.0190 per \$ Plant (2022\$)

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Summary of Marginal General Plant - Marginal Loading Factors**

1 Regression Results

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3 **Selected Model:** General Plant = F(Total Utility Plant, excluding General Plant, Dummy<sub>2006-2008</sub>, Dummy<sub>2009-2013</sub>, Dummy<sub>2021</sub>)

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Dependent Variable				
General Plant (2001 - 2022)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-3,394,675	-4.70	<.001
Total Utility Plant, excluding General Plant	Util Plt xGen Plt	0.1040	26.51	<.001
Dummy: 2006 - 2008	D 2006 2008	-1,872,762	-2.64	0.0170
Dummy: 2009 - 2013	D 2009 2013	-3,691,330	-6.45	<.001
Dummy: 2021	D 2021	-3,863,832	-3.30	0.0040
Model Statistics		<b>Model 1.0</b>		
R Squared		0.9850		
Adjusted R Squared		0.9815		
Mean Absolute % Error (MAPE)		6.6150		
Passes ACF/PACF		Yes		

20 Marginal Cost Calculation  
21 General Plant = - \$ 3,394,675 + \$ 0.1040 x Util\_Plt\_xGen\_Plt + - \$ 1,872,762 x D\_2006\_2008 + - \$ 3,691,330 x D\_2009\_2013 +  
22 \$ 3,863,832 x D\_2021  
23  $\partial$  General Plant /  $\partial$  Plant excl. General Plant = \$ 0.1040 per \$ Plant

**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study**

**Summary of Levelized Fixed Charge Rates**

Line No.	Description	Engineer's Fixed Charge Rate	Economist's Fixed charge Rate	Explanation
	(A)	(B)	(C)	(D)
1	Fixed Charge Rate Results			
2	Levelized Cost for:		Over Book Life	
3	Primary and Secondary Cap-related Dist.	13.42%	10.14%	Att MFB-7 p3, Line 13
4	Line Transformers Investment	13.75%	11.02%	Att MFB-7 p4, Line 13
5	Services Investment	13.10%	9.88%	Att MFB-7 p5, Line 13
6	Meters Investment	16.13%	14.29%	Att MFB-7 p6, Line 13
7	Street Lighting Investment	13.80%	11.07%	Att MFB-7 p7, Line 13
8	Cost of Capital			
9	Debt	6.03%	45.00%	Company Data
10	Preferred	0.00%	0.00%	Company Data
11	Common	10.35%	55.00%	Company Data
12	Other	0.00%	0.00%	Company Data
13	Weighted Cost of Capital		8.41%	
14	After Tax Cost of New Capital		7.68%	Line 13 - (Line 19 Col (B) * Col (C ))*Line 15
15	Incremental Tax Rate		26.93%	Tax Rate from Revenue Requirement
16	Tax Effectuated Cost of Capital		10.51%	[Col (B) line 9 * Col (C ) line 9]+ [Col (B) line 11*(1/(1-Line 15))* Col (C ) Line 11]
17	Property Tax Rate		3.02%	Company Data
18	Gross Receipts Tax Rate		0.00%	Company Data
19	Inflation Rate		2.10%	BCFF Long-Range Consensus US Economic Projections, GDP Chained Price Index. December 2, 2022, at 14.
20	Property Tax Escalation Rate		2.50%	Company Data



**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study**  
**Levelized Fixed Charge Analysis, Input Data**

Line No.	Variable	Primary and Secondary Capacity - Related Distribution Plant	Line Transformers	Services	Meters	Street Lighting	Explanation
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
1	Plant Data						
2	Capitalized Cost	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	
3	Book Life	54	33	55	15	33	Att MFB-7 p13, Col (C)
4	Salvage Value	-46%	-30%	-75%	-25%	-25%	Att MFB-7 p13, Col (D)
5	MACRS Life	20	20	20	10	20	
6	Capital Structure						
7	Debt Ratio	45.00%	45.00%	45.00%	45.00%	45.00%	Att MFB-7 p1, Col (C), Line 9
8	Preferred Ratio	0.00%	0.00%	0.00%	0.00%	0.00%	Att MFB-7 p1, Col (C), Line 10
9	Common Ratio	55.00%	55.00%	55.00%	55.00%	55.00%	Att MFB-7 p1, Col (C), Line 11
10	Other	0.00%	0.00%	0.00%	0.00%	0.00%	Att MFB-7 p1, Col (C), Line 12
11	Cost of Capital						
12	Debt Cost	6.03%	6.03%	6.03%	6.03%	6.03%	Att MFB-7 p1, Col (B), Line 9
13	Preferred Cost	0.00%	0.00%	0.00%	0.00%	0.00%	Att MFB-7 p1, Col (B), Line 10
14	Common Cost	10.35%	10.35%	10.35%	10.35%	10.35%	Att MFB-7 p1, Col (B), Line 11
15	Other	0.00%	0.00%	0.00%	0.00%	0.00%	Att MFB-7 p1, Col (B), Line 12
16	Wtd Cost Of Capital	8.41%	8.41%	8.41%	8.41%	8.41%	(Line 7 x Line 12) + (Line 8 x Line 13) + (Line 9 x Line 14) + (Line 10 x Line 15)
17	After Tax Cost of Capital	7.68%	7.68%	7.68%	7.68%	7.68%	Att MFB-7 p1, Col (C), Line 14
18	Tax Data						
19	Tax Rate	26.93%	26.93%	26.93%	26.93%	26.93%	Att MFB-7 p1, Col (C), Line 15
20	Property Tax Rate	3.02%	3.02%	3.02%	3.02%	3.02%	Att MFB-7 p1, Col (C), Line 17
21	Property Insurance	0.53%	0.53%	0.53%	0.53%	0.53%	Company Data
22	Property Tax Basis	Dep Bal	Dep Bal	Dep Bal	Dep Bal	Dep Bal	
23	Misc. Data						
24	Inflation Rate	2.10%	2.10%	2.10%	2.10%	2.10%	Att MFB-7 p1, Col (C), Line 19
25	Prop Tax Escalation Rate	2.50%	2.50%	2.50%	2.50%	2.50%	Att MFB-7 p1, Col (C), Line 20
26	Return on Rate Base calculation	EOY	EOY	EOY	EOY	EOY	

**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study**  
**Levelized Fixed Charge Analysis**  
**Primary and Secondary Capacity Related Distribution**

Line No.	Item	-- Current Dollars -- (Engineer's FCR)		-- Constant Dollars -- (Economist's FCR)	
		Current Levelized Dollars	Percent Of Capital Investment	Constant Levelized Dollars	Percent Of Capital Investment
	(A)	(B) Att MFB-7 p8	(C) Col (B) x 0.001	(D) Att MFB-7 p8	(E) Col (D) x 0.001
1	Interest On Debt	\$16.19	1.62%	\$12.23	1.22%
2	Return On Preferred	\$0.00	0.00%	\$0.00	0.00%
3	Return On Common	\$33.93	3.39%	\$25.65	2.56%
4	Return	\$50.12	5.01%	\$37.88	3.79%
5	Depreciation	\$26.93	2.69%	\$20.35	2.04%
6	Income Tax	\$8.68	0.87%	\$6.56	0.66%
7	Deferred Taxes	\$3.82	0.38%	\$2.89	0.29%
8	Income Tax	\$12.50	1.25%	\$9.45	0.95%
9	Revenue Tax	\$0.00	0.00%	\$0.00	0.00%
10	Property Tax	\$38.24	3.82%	\$28.91	2.89%
11	Property Insurance	\$6.36	0.64%	\$4.81	0.48%
12	Other	\$44.60	4.46%	\$33.71	3.37%
13	Total Revenue Required	\$134.15	13.42%	\$101.40	10.14%

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**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study**  
**Levelized Fixed Charge Analysis**  
**Line Transformers Investment**

Line No.	Item	Current Dollars (Engineer's FCR)		Constant Dollars (Economist's FCR)	
		Current Levelized Dollars	Percent Of Capital Investment	Constant Levelized Dollars	Percent Of Capital Investment
	(A)	(B) Att MFB-7 p9	(C) Col (B) x 0.001	(D) Att MFB-7 p9	(E) Col (D) x 0.001
1	Interest On Debt	\$14.86	1.49%	\$11.92	1.19%
2	Return On Preferred	\$0.00	0.00%	\$0.00	0.00%
3	Return On Common	\$31.16	3.12%	\$24.99	2.50%
4	Return	\$46.03	4.60%	\$36.91	3.69%
5	Depreciation	\$39.39	3.94%	\$31.59	3.16%
6	Income Tax	\$9.77	0.98%	\$7.83	0.78%
7	Deferred Taxes	\$1.71	0.17%	\$1.37	0.14%
8	Income Tax	\$11.48	1.15%	\$9.21	0.92%
9	Revenue Tax	\$0.00	0.00%	\$0.00	0.00%
10	Property Tax	\$34.73	3.47%	\$27.85	2.78%
11	Property Insurance	\$5.85	0.58%	\$4.69	0.47%
12	Other	\$40.58	4.06%	\$32.54	3.25%
13	Total Revenue Required	\$137.48	13.75%	\$110.24	11.02%

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**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study**  
**Levelized Fixed Charge Analysis**  
**Services Investment**

Line No.	Item	Current Dollars (Engineer's FCR)		Constant Dollars (Economist's FCR)	
		Current Levelized Dollars	Percent Of Capital Investment	Constant Levelized Dollars	Percent Of Capital Investment
	(A)	(B) Att MFB-7 p10	(C) Col (B) x 0.001	(D) Att MFB-7 p10	(E) Col (D) x 0.001
1	Interest On Debt	\$14.87	1.49%	\$11.22	1.12%
2	Return On Preferred	\$0.00	0.00%	\$0.00	0.00%
3	Return On Common	\$31.18	3.12%	\$23.53	2.35%
4	Return	\$46.05	4.61%	\$34.75	3.47%
5	Depreciation	\$31.82	3.18%	\$24.01	2.40%
6	Income Tax	\$8.89	0.89%	\$6.71	0.67%
7	Deferred Taxes	\$2.60	0.26%	\$1.96	0.20%
8	Income Tax	\$11.49	1.15%	\$8.67	0.87%
9	Revenue Tax	\$0.00	0.00%	\$0.00	0.00%
10	Property Tax	\$35.66	3.57%	\$26.91	2.69%
11	Property Insurance	\$5.96	0.60%	\$4.50	0.45%
12	Other	\$41.63	4.16%	\$31.41	3.14%
13	Total Revenue Required	\$130.99	13.10%	\$98.83	9.88%

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**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study**  
**Levelized Fixed Charge Analysis**  
**Metering Equipment**

Line No.	Item	Current Dollars (Engineer's FCR)		Constant Dollars (Economist's FCR)	
		Current Levelized Dollars	Percent Of Capital Investment	Constant Levelized Dollars	Percent Of Capital Investment
	(A)	(B)	(C)	(D)	(E)
		Att MFB-7 p11	Col (B) x 0.001	Att MFB-7 p11	Col (D) x 0.001
1	Interest On Debt	\$11.69	1.17%	\$10.35	1.04%
2	Return On Preferred	\$0.00	0.00%	\$0.00	0.00%
3	Return On Common	\$24.50	2.45%	\$21.71	2.17%
4	Return	\$36.19	3.62%	\$32.06	3.21%
5	Depreciation	\$83.33	8.33%	\$73.82	7.38%
6	Income Tax	\$7.92	0.79%	\$7.01	0.70%
7	Deferred Taxes	\$1.11	0.11%	\$0.99	0.10%
8	Income Tax	\$9.03	0.90%	\$8.00	0.80%
9	Revenue Tax	\$0.00	0.00%	\$0.00	0.00%
10	Property Tax	\$27.95	2.79%	\$24.76	2.48%
11	Property Insurance	\$4.80	0.48%	\$4.25	0.42%
12	Other	\$32.74	3.27%	\$29.01	2.90%
13	Total Revenue Required	\$161.30	16.13%	\$142.89	14.29%

11-791

**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study**  
**Levelized Fixed Charge Analysis**  
**Street Lighting Investment**

Line No.	Item	Current Dollars (Engineer's FCR)		Constant Dollars (Economist's FCR)	
		Current Levelized Dollars	Percent Of Capital Investment	Constant Levelized Dollars	Percent Of Capital Investment
	(A)	(B)	(C)	(D)	(E)
		Att MFB-7 p12	Col (B) x 0.001	Att MFB-7 p12	Col (D) x 0.001
1	Interest On Debt	\$15.19	1.52%	\$12.18	1.22%
2	Return On Preferred	\$0.00	0.00%	\$0.00	0.00%
3	Return On Common	\$31.85	3.19%	\$25.54	2.55%
4	Return	\$47.05	4.70%	\$37.72	3.77%
5	Depreciation	\$37.88	3.79%	\$30.37	3.04%
6	Income Tax	\$9.71	0.97%	\$7.79	0.78%
7	Deferred Taxes	\$2.02	0.20%	\$1.62	0.16%
8	Income Tax	\$11.74	1.17%	\$9.41	0.94%
9	Revenue Tax	\$0.00	0.00%	\$0.00	0.00%
10	Property Tax	\$35.42	3.54%	\$28.40	2.84%
11	Property Insurance	\$5.96	0.60%	\$4.78	0.48%
12	Other	\$41.38	4.14%	\$33.18	3.32%
13	Total Revenue Required	\$138.04	13.80%	\$110.68	11.07%

11-792

Liberty Utilities (Granite State Electric) Corp. - Development of Revenue Requirements Stream  
Primary and Secondary Capacity Related Distribution

Year No.	Rate Base (A)	Interest On Debt (B)	Return On Preferred (C)	Return On Common (D)	Tax Depreciation (E)	Tax Depreciation Rate (F)	Book Depreciation (G)	Deferred Taxes (H)	Taxable Income (I)	Income Tax Payable (J)	Revenue Tax (K)	Property Tax (L)	Property Insurance (M)	Annual	% of	Present	
														Revenue Requirements (N)	Original Investment Revenue (O)	Worth Of Revenue (P)	
1	1000.00						0.00	0.00									
2	970.20	26.34	0.00	55.23	37.50	3.750%	26.97	2.84	65.05	17.51		30.19	5.27	164.35	16.44%	152.64	
3	931.05	25.28	0.00	53.00	72.19	7.219%	26.97	12.18	27.31	7.35		30.95	5.38	161.11	16.11%	138.95	
4	893.37	24.26	0.00	50.85	66.77	6.677%	26.97	10.72	29.79	8.02		31.72	5.50	158.03	15.80%	126.59	
5	857.03	23.27	0.00	48.79	61.77	6.177%	26.97	9.37	31.96	8.61		32.51	5.61	155.12	15.51%	115.40	
6	821.94	22.32	0.00	46.79	57.13	5.713%	26.97	8.12	33.87	9.12		33.32	5.73	152.37	15.24%	105.27	
7	788.00	21.40	0.00	44.86	52.85	5.285%	26.97	6.97	35.50	9.56		34.16	5.85	149.76	14.98%	96.09	
8	755.13	20.50	0.00	42.99	48.88	4.888%	26.97	5.90	36.91	9.94		35.01	5.97	147.28	14.73%	87.76	
9	723.25	19.64	0.00	41.17	45.22	4.522%	26.97	4.91	38.09	10.26		35.89	6.10	144.93	14.49%	80.20	
10	691.53	18.78	0.00	39.37	44.62	4.462%	26.97	4.75	36.22	9.75		36.78	6.23	142.63	14.26%	73.30	
11	659.81	17.92	0.00	37.56	44.61	4.461%	26.97	4.75	33.76	9.09		37.70	6.36	140.34	14.03%	66.98	
12	628.09	17.05	0.00	35.75	44.62	4.462%	26.97	4.75	31.28	8.42		38.65	6.49	138.09	13.81%	61.21	
13	596.37	16.19	0.00	33.95	44.61	4.461%	26.97	4.75	28.82	7.76		39.61	6.63	135.86	13.59%	55.93	
14	564.65	15.33	0.00	32.14	44.62	4.462%	26.97	4.75	26.33	7.09		40.60	6.77	133.66	13.37%	51.10	
15	532.94	14.47	0.00	30.34	44.61	4.461%	26.97	4.75	23.87	6.43		41.62	6.91	131.48	13.15%	46.68	
16	501.21	13.61	0.00	28.53	44.62	4.462%	26.97	4.75	21.39	5.76		42.66	7.05	129.33	12.93%	42.65	
17	469.50	12.75	0.00	26.73	44.61	4.461%	26.97	4.75	18.93	5.10		43.72	7.20	127.22	12.72%	38.96	
18	437.78	11.89	0.00	24.92	44.62	4.462%	26.97	4.75	16.45	4.43		44.82	7.35	125.13	12.51%	35.59	
19	406.06	11.03	0.00	23.11	44.61	4.461%	26.97	4.75	13.99	3.77		45.94	7.51	123.07	12.31%	32.51	
20	374.34	10.16	0.00	21.31	44.62	4.462%	26.97	4.75	11.51	3.10		47.09	7.66	121.04	12.10%	29.69	
21	342.62	9.30	0.00	19.50	44.61	4.461%	26.97	4.75	9.05	2.44		48.26	7.83	119.05	11.91%	27.12	
22	316.90	8.60	0.00	18.04	22.31	2.231%	26.97	(1.25)	29.34	7.90		49.47	7.99	117.72	11.77%	24.91	
23	297.20	8.07	0.00	16.92	0.00		26.97	(7.26)	50.12	13.49		50.71	8.16	117.05	11.71%	23.00	
24	277.49	7.53	0.00	15.80	0.00		26.97	(7.26)	48.58	13.08		51.98	8.33	116.42	11.64%	21.24	
25	257.78	7.00	0.00	14.67	0.00		26.97	(7.26)	47.05	12.67		53.27	8.50	115.83	11.58%	19.63	
26	238.08	6.46	0.00	13.55	0.00		26.97	(7.26)	45.51	12.25		54.61	8.68	115.27	11.53%	18.14	
27	218.37	5.93	0.00	12.43	0.00		26.97	(7.26)	43.98	11.84		55.97	8.87	114.75	11.47%	16.77	
28	198.66	5.39	0.00	11.31	0.00		26.97	(7.26)	42.44	11.43		57.37	9.05	114.26	11.43%	15.51	
29	178.96	4.86	0.00	10.19	0.00		26.97	(7.26)	40.91	11.01		58.81	9.24	113.81	11.38%	14.35	
30	159.25	4.32	0.00	9.07	0.00		26.97	(7.26)	39.37	10.60		60.28	9.44	113.41	11.34%	13.28	
31	139.54	3.79	0.00	7.94	0.00		26.97	(7.26)	37.84	10.19		61.78	9.63	113.04	11.30%	12.29	
32	119.83	3.25	0.00	6.82	0.00		26.97	(7.26)	36.30	9.77		63.33	9.84	112.72	11.27%	11.38	
33	100.13	2.72	0.00	5.70	0.00		26.97	(7.26)	34.77	9.36		64.91	10.04	112.44	11.24%	10.54	
34	80.42	2.18	0.00	4.58	0.00		26.97	(7.26)	33.23	8.95		66.53	10.25	112.20	11.22%	9.77	
35	60.71	1.65	0.00	3.46	0.00		26.97	(7.26)	31.70	8.53		68.20	10.47	112.01	11.20%	9.06	
36	41.01	1.11	0.00	2.33	0.00		26.97	(7.26)	30.16	8.12		69.90	10.69	111.87	11.19%	8.40	
37	21.30	0.58	0.00	1.21	0.00		26.97	(7.26)	28.63	7.71		71.65	10.91	111.77	11.18%	7.80	
38	1.59	0.04	0.00	0.09	0.00		26.97	(7.26)	27.09	7.29		73.44	11.14	111.72	11.17%	7.24	
39	(18.11)	(0.49)	0.00	(1.03)	0.00		26.97	(7.26)	25.56	6.88		0.00	0.00	25.07	2.51%	1.51	
40	(37.82)	(1.03)	0.00	(2.15)	0.00		26.97	(7.26)	24.02	6.47		0.00	0.00	22.99	2.30%	1.28	
41	(57.53)	(1.56)	0.00	(3.27)	0.00		26.97	(7.26)	22.49	6.05		0.00	0.00	20.92	2.09%	1.09	
42	(77.23)	(2.10)	0.00	(4.40)	0.00		26.97	(7.26)	20.95	5.64		0.00	0.00	18.85	1.89%	0.91	
43	(96.94)	(2.63)	0.00	(5.52)	0.00		26.97	(7.26)	19.42	5.23		0.00	0.00	16.78	1.68%	0.75	
44	(116.65)	(3.17)	0.00	(6.64)	0.00		26.97	(7.26)	17.88	4.81		0.00	0.00	14.71	1.47%	0.61	
45	(136.36)	(3.70)	0.00	(7.76)	0.00		26.97	(7.26)	16.35	4.40		0.00	0.00	12.64	1.26%	0.49	
46	(156.06)	(4.24)	0.00	(8.88)	0.00		26.97	(7.26)	14.81	3.99		0.00	0.00	10.57	1.06%	0.38	
47	(175.77)	(4.77)	0.00	(10.01)	0.00		26.97	(7.26)	13.28	3.57		0.00	0.00	8.50	0.85%	0.28	
48	(195.48)	(5.31)	0.00	(11.13)	0.00		26.97	(7.26)	11.74	3.16		0.00	0.00	6.43	0.64%	0.20	
49	(215.18)	(5.84)	0.00	(12.25)	0.00		26.97	(7.26)	10.21	2.75		0.00	0.00	4.36	0.44%	0.13	
50	(234.89)	(6.38)	0.00	(13.37)	0.00		26.97	(7.26)	8.67	2.33		0.00	0.00	2.29	0.23%	0.06	
51	(254.60)	(6.91)	0.00	(14.49)	0.00		26.97	(7.26)	7.14	1.92		0.00	0.00	0.22	0.02%	0.01	
52	(274.30)	(7.45)	0.00	(15.61)	0.00		26.97	(7.26)	5.60	1.51		0.00	0.00	(1.85)	-0.18%	(0.04)	
53	(294.01)	(7.98)	0.00	(16.74)	0.00		26.97	(7.26)	4.06	1.09		0.00	0.00	(3.92)	-0.39%	(0.08)	
54	(313.72)	(8.52)	0.00	(17.86)	0.00		26.97	(7.26)	2.53	0.68		0.00	0.00	(5.99)	-0.60%	(0.12)	
55	0.00	0.00	0.00	0.00	429.31		0.00	115.59	(429.31)	(115.59)		0.00	0.00	0.00	0.00%	0.00	
Total		\$ 352.92	\$ -	\$ 739.88	\$ 1,429.31		\$ 1,429.31	\$ (0.00)	\$ 1,012.49	\$ 272.61	\$ -	\$ 1,803.40	\$ 290.64	\$ 4,888.75	488.88%	\$ 1,715.36	
Present Worth		\$206.96	\$ -	\$ 433.88	\$ 525.90		\$ 344.33	\$ 48.89	\$ 412.18	\$ 110.98	\$ -	\$ 488.99	\$ 81.34	\$ 1,715.36	171.54%	\$ 928.80	
Levelized Payment		\$16.19	\$ -	\$ 33.93	\$ 41.13		\$ 26.93	\$ 3.82	\$ 32.24	\$ 8.68	\$ -	\$ 38.24	\$ 6.36	\$ 134.15	13.42%		
Current \$																	
Levelized Payment		\$ 12.23	\$ -	\$ 25.65	\$ 31.09		\$ 20.35	\$ 2.89	\$ 24.36	\$ 6.56	\$ -	\$ 28.91	\$ 4.81	\$ 101.40	10.14%		
Constant \$																	

**Liberty Utilities (Granite State Electric) Corp. - Development of Revenue Requirements Stream  
Line Transformers Investment**

Year No.	Rate Base	Interest On Debt	Return On Preferred	Return On Common	Tax Depreciation	Tax Depreciation Rate	Book Depreciation	Deferred Taxes	Taxable Income	Income Tax Payable	Revenue Tax	Property Tax	Property Insurance	Annual	% of	Present
														Revenue Requirements	Original Investment Revenue	Worth Of Revenue
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)
	1000.00						0.00	0.00								
1	961.12	26.10	0.00	54.71	37.50	3.750%	39.39	(0.51)	76.76	20.67		30.19	5.27	175.82	17.58%	163.29
2	912.89	24.79	0.00	51.97	72.19	7.219%	39.39	8.83	38.32	10.32		30.95	5.38	171.62	17.16%	148.02
3	866.13	23.52	0.00	49.30	66.77	6.677%	39.39	7.37	40.09	10.80		31.72	5.50	167.60	16.76%	134.25
4	820.71	22.28	0.00	46.72	61.77	6.177%	39.39	6.02	41.56	11.19		32.51	5.61	163.73	16.37%	121.80
5	776.54	21.09	0.00	44.20	57.13	5.713%	39.39	4.78	42.76	11.51		33.32	5.73	160.03	16.00%	110.56
6	733.52	19.92	0.00	41.76	52.85	5.285%	39.39	3.62	43.68	11.76		34.16	5.85	156.46	15.65%	100.39
7	691.57	18.78	0.00	39.37	48.88	4.888%	39.39	2.55	44.39	11.95		35.01	5.97	153.03	15.30%	91.19
8	650.61	17.67	0.00	37.04	45.22	4.522%	39.39	1.57	44.86	12.08		35.89	6.10	149.73	14.97%	82.86
9	609.81	16.56	0.00	34.71	44.62	4.462%	39.39	1.41	42.28	11.38		36.78	6.23	146.47	14.65%	75.27
10	569.01	15.45	0.00	32.39	44.61	4.461%	39.39	1.40	39.11	10.53		37.70	6.36	143.23	14.32%	68.36
11	528.21	14.34	0.00	30.07	44.62	4.462%	39.39	1.41	35.92	9.67		38.65	6.49	140.02	14.00%	62.07
12	487.41	13.23	0.00	27.75	44.61	4.461%	39.39	1.40	32.75	8.82		39.61	6.63	136.84	13.68%	56.33
13	446.61	12.13	0.00	25.42	44.62	4.462%	39.39	1.41	29.56	7.96		40.60	6.77	133.68	13.37%	51.11
14	405.81	11.02	0.00	23.10	44.61	4.461%	39.39	1.40	26.40	7.11		41.62	6.91	130.55	13.06%	46.35
15	365.01	9.91	0.00	20.78	44.62	4.462%	39.39	1.41	23.21	6.25		42.66	7.05	127.45	12.75%	42.03
16	324.21	8.80	0.00	18.46	44.61	4.461%	39.39	1.40	20.04	5.40		43.72	7.20	124.38	12.44%	38.09
17	283.41	7.70	0.00	16.13	44.62	4.462%	39.39	1.41	16.85	4.54		44.82	7.35	121.34	12.13%	34.51
18	242.61	6.59	0.00	13.81	44.61	4.461%	39.39	1.40	13.68	3.68		45.94	7.51	118.33	11.83%	31.25
19	201.81	5.48	0.00	11.49	44.62	4.462%	39.39	1.41	10.50	2.83		47.09	7.66	115.35	11.53%	28.29
20	161.01	4.37	0.00	9.17	44.61	4.461%	39.39	1.40	7.33	1.97		48.26	7.83	112.40	11.24%	25.61
21	126.22	3.43	0.00	7.19	22.31	2.231%	39.39	(4.60)	26.92	7.25		49.47	7.99	110.11	11.01%	23.30
22	97.43	2.65	0.00	5.55	0.00		39.39	(10.61)	46.98	12.65		50.71	8.16	108.49	10.85%	21.32
23	68.65	1.86	0.00	3.91	0.00		39.39	(10.61)	44.74	12.05		51.98	8.33	106.91	10.69%	19.51
24	39.86	1.08	0.00	2.27	0.00		39.39	(10.61)	42.50	11.44		53.27	8.50	105.36	10.54%	17.85
25	11.07	0.30	0.00	0.63	0.00		39.39	(10.61)	40.26	10.84		54.61	8.68	103.85	10.38%	16.34
26	(17.72)	(0.48)	0.00	(1.01)	0.00		39.39	(10.61)	38.01	10.24		0.00	0.00	103.85	3.75%	5.49
27	(46.50)	(1.26)	0.00	(2.65)	0.00		39.39	(10.61)	35.77	9.63		0.00	0.00	103.85	3.45%	4.68
28	(75.29)	(2.04)	0.00	(4.29)	0.00		39.39	(10.61)	33.53	9.03		0.00	0.00	103.85	3.15%	3.97
29	(104.08)	(2.83)	0.00	(5.92)	0.00		39.39	(10.61)	31.29	8.42		0.00	0.00	103.85	2.85%	3.33
30	(132.86)	(3.61)	0.00	(7.56)	0.00		39.39	(10.61)	29.04	7.82		0.00	0.00	103.85	2.54%	2.77
31	(161.65)	(4.39)	0.00	(9.20)	0.00		39.39	(10.61)	26.80	7.22		0.00	0.00	103.85	2.24%	2.26
32	(190.44)	(5.17)	0.00	(10.84)	0.00		39.39	(10.61)	24.56	6.61		0.00	0.00	103.85	1.94%	1.82
33	(300.00)	(8.15)	0.00	(17.08)	300.00		39.39	70.17	(283.98)	(76.46)		0.00	0.00	103.85	0.79%	0.69
Total		\$ 281.10	\$ -	\$ 589.33	\$ 1,300.00		\$ 1,300.00	\$ 0.00	\$ 806.47	\$ 217.14	\$ -	\$ 1,031.24	\$ 171.06	\$ 3,589.88	358.99%	\$ 1,634.94
Present Worth		\$ 176.77	\$ -	\$ 370.59	\$ 544.12		\$ 468.47	\$ 20.37	\$ 431.49	\$ 116.18	\$ -	\$ 413.04	\$ 69.53	\$ 1,634.94	163.49%	\$ 954.17
Levelized Payment																
Current \$		\$ 14.86	\$ -	\$ 31.16	\$ 45.76		\$ 39.39	\$ 1.71	\$ 36.28	\$ 9.77	\$ -	\$ 34.73	\$ 5.85	\$ 137.48	13.75%	
Levelized Payment		\$ 11.92	\$ -	\$ 24.99	\$ 36.69		\$ 31.59	\$ 1.37	\$ 29.09	\$ 7.83	\$ -	\$ 27.85	\$ 4.69	\$ 110.24	11.02%	
Constant \$																





**Liberty Utilities (Granite State Electric) Corp. - Development of Revenue Requirements Stream  
Metering Equipment**

Year No.	Rate Base	Interest On Debt	Return On Preferred	Return On Common	Tax Depreciation	Tax Depreciation Rate	Book Depreciation	Deferred Tax	Taxable Income	Income Tax Payable	Revenue Tax	Property Tax	Property Insurance	Annual	% of	Present
														Revenue Requirements	Original Investment Revenue	Worth Of Revenue
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)
	1000.00						0.00	0.00								
1	918.91	24.95	0.00	52.31	75.00	7.500%	83.33	(2.24)	79.92	21.52		30.19	5.27	215.33	21.53%	199.98
2	820.64	22.28	0.00	46.72	138.80	13.880%	83.33	14.93	8.46	2.28		30.95	5.38	205.87	20.59%	177.56
3	728.00	19.77	0.00	41.44	117.90	11.790%	83.33	9.31	22.14	5.96		31.72	5.50	197.03	19.70%	157.82
4	640.13	17.38	0.00	36.44	100.20	10.020%	83.33	4.54	33.00	8.88		32.51	5.61	188.70	18.87%	140.38
5	555.70	15.09	0.00	31.63	87.40	8.740%	83.33	1.09	39.22	10.56		33.32	5.73	180.77	18.08%	124.88
6	471.27	12.80	0.00	26.83	87.40	8.740%	83.33	1.09	32.65	8.79		34.16	5.85	172.85	17.28%	110.90
7	386.84	10.50	0.00	22.02	87.40	8.740%	83.33	1.09	26.07	7.02		35.01	5.97	164.96	16.50%	98.29
8	302.41	8.21	0.00	17.21	87.40	8.740%	83.33	1.09	19.49	5.25		35.89	6.10	157.09	15.71%	86.93
9	217.99	5.92	0.00	12.41	87.40	8.740%	83.33	1.09	12.91	3.48		36.78	6.23	149.24	14.92%	76.70
10	133.56	3.63	0.00	7.60	87.40	8.740%	83.33	1.09	6.34	1.71		37.70	6.36	141.43	14.14%	67.50
11	60.90	1.65	0.00	3.47	43.70	4.370%	83.33	(10.67)	44.38	11.95		38.65	6.49	134.87	13.49%	59.78
12	(0.00)	(0.00)	0.00	(0.00)	0.00		83.33	(22.44)	83.33	22.44		0.00	0.00	83.33	8.33%	34.31
13	(60.90)	(1.65)	0.00	(3.47)	0.00		83.33	(22.44)	78.59	21.16		0.00	0.00	76.94	7.69%	29.41
14	(121.79)	(3.31)	0.00	(6.93)	0.00		83.33	(22.44)	73.85	19.88		0.00	0.00	70.54	7.05%	25.05
15	(250.00)	(6.79)	0.00	(14.23)	250.00		83.33	44.88	(186.14)	(50.12)		0.00	0.00	57.07	5.71%	18.82
Total		\$ 130.43	\$ -	\$ 273.45	\$ 1,250.00		\$ 1,250.00	\$ 0.00	\$ 374.20	\$ 100.75	\$ -	\$ 376.88	\$ 64.49	\$ 2,196.01	219.60%	\$ 1,408.31
Present Worth		\$ 102.05	\$ -	\$ 213.95	\$ 763.69		\$ 727.59	\$ 9.72	\$ 256.69	\$ 69.11	\$ -	\$ 244.01	\$ 41.88	\$ 1,408.31	140.83%	\$ 972.42
Levelized Payment Current \$		\$ 11.69	\$ -	\$ 24.50	\$ 87.47		\$ 83.33	\$ 1.11	\$ 29.40	\$ 7.92	\$ -	\$ 27.95	\$ 4.80	\$ 161.30	16.13%	
Levelized Payment Constant \$		\$ 10.35	\$ -	\$ 21.71	\$ 77.48		\$ 73.82	\$ 0.99	\$ 26.04	\$ 7.01	\$ -	\$ 24.76	\$ 4.25	\$ 142.89	14.29%	

**Liberty Utilities (Granite State Electric) Corp. - Development of Revenue Requirements Stream  
Street Lighting Investment**

Year No.	Rate Base	Interest On Debt	Return On Preferred	Return On Common	Tax Depreciation	Tax Depreciation Rate	Book Depreciation	Deferred Tax	Taxable Income	Income Tax Payable	Revenue Tax	Property Tax	Property Insurance	Annual	% of	Present
														Revenue Requirements	Original Investment Revenue	Worth Of Revenue
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)
	1000.00						0.00	0.00								
1	962.22	26.13	0.00	54.77	37.50	3.750%	37.88	(0.10)	75.34	20.28		30.19	5.27	174.43	17.44%	161.99
2	915.11	24.85	0.00	52.09	72.19	7.219%	37.88	9.24	36.98	9.96		30.95	5.38	170.34	17.03%	146.92
3	869.45	23.61	0.00	49.49	66.77	6.677%	37.88	7.78	38.84	10.46		31.72	5.50	166.43	16.64%	133.31
4	825.14	22.40	0.00	46.97	61.77	6.177%	37.88	6.43	40.39	10.87		32.51	5.61	162.69	16.27%	121.02
5	782.07	21.24	0.00	44.52	57.13	5.713%	37.88	5.18	41.67	11.22		33.32	5.73	159.09	15.91%	109.91
6	740.16	20.10	0.00	42.13	52.85	5.285%	37.88	4.03	42.69	11.49		34.16	5.85	155.64	15.56%	99.86
7	699.32	18.99	0.00	39.81	48.88	4.888%	37.88	2.96	43.48	11.71		35.01	5.97	152.33	15.23%	90.77
8	659.47	17.91	0.00	37.54	45.22	4.522%	37.88	1.98	44.03	11.86		35.89	6.10	149.14	14.91%	82.53
9	619.77	16.83	0.00	35.28	44.62	4.462%	37.88	1.82	41.54	11.18		36.78	6.23	146.00	14.60%	75.03
10	580.08	15.75	0.00	33.02	44.61	4.461%	37.88	1.81	38.46	10.35		37.70	6.36	142.88	14.29%	68.19
11	540.39	14.67	0.00	30.76	44.62	4.462%	37.88	1.82	35.35	9.52		38.65	6.49	139.79	13.98%	61.96
12	500.70	13.60	0.00	28.50	44.61	4.461%	37.88	1.81	32.27	8.69		39.61	6.63	136.72	13.67%	56.28
13	461.00	12.52	0.00	26.24	44.62	4.462%	37.88	1.82	29.17	7.85		40.60	6.77	133.68	13.37%	51.11
14	421.31	11.44	0.00	23.98	44.61	4.461%	37.88	1.81	26.09	7.02		41.62	6.91	130.67	13.07%	46.39
15	381.62	10.36	0.00	21.72	44.62	4.462%	37.88	1.82	22.99	6.19		42.66	7.05	127.68	12.77%	42.10
16	341.93	9.28	0.00	19.46	44.61	4.461%	37.88	1.81	19.90	5.36		43.72	7.20	124.73	12.47%	38.20
17	302.23	8.21	0.00	17.20	44.62	4.462%	37.88	1.82	16.80	4.52		44.82	7.35	121.80	12.18%	34.64
18	262.54	7.13	0.00	14.95	44.61	4.461%	37.88	1.81	13.72	3.69		45.94	7.51	118.91	11.89%	31.41
19	222.85	6.05	0.00	12.69	44.62	4.462%	37.88	1.82	10.62	2.86		47.09	7.66	116.04	11.60%	28.46
20	183.16	4.97	0.00	10.43	44.61	4.461%	37.88	1.81	7.54	2.03		48.26	7.83	113.21	11.32%	25.79
21	149.47	4.06	0.00	8.51	22.31	2.231%	37.88	(4.19)	27.21	7.33		49.47	7.99	111.04	11.10%	23.49
22	121.79	3.31	0.00	6.93	0.00		37.88	(10.20)	47.37	12.75		50.71	8.16	109.54	10.95%	21.52
23	94.11	2.56	0.00	5.36	0.00		37.88	(10.20)	45.21	12.17		51.98	8.33	108.07	10.81%	19.72
24	66.43	1.80	0.00	3.78	0.00		37.88	(10.20)	43.05	11.59		53.27	8.50	106.64	10.66%	18.07
25	38.75	1.05	0.00	2.21	0.00		37.88	(10.20)	40.90	11.01		54.61	8.68	105.24	10.52%	16.56
26	11.07	0.30	0.00	0.63	0.00		37.88	(10.20)	38.74	10.43		55.97	8.87	103.88	10.39%	15.18
27	(16.61)	(0.45)	0.00	(0.95)	0.00		37.88	(10.20)	36.59	9.85		0.00	0.00	36.13	3.61%	4.90
28	(44.29)	(1.20)	0.00	(2.52)	0.00		37.88	(10.20)	34.43	9.27		0.00	0.00	33.23	3.32%	4.19
29	(71.97)	(1.95)	0.00	(4.10)	0.00		37.88	(10.20)	32.27	8.69		0.00	0.00	30.32	3.03%	3.55
30	(99.65)	(2.71)	0.00	(5.67)	0.00		37.88	(10.20)	30.12	8.11		0.00	0.00	27.41	2.74%	2.98
31	(127.33)	(3.46)	0.00	(7.25)	0.00		37.88	(10.20)	27.96	7.53		0.00	0.00	24.50	2.45%	2.47
32	(155.01)	(4.21)	0.00	(8.82)	0.00		37.88	(10.20)	25.80	6.95		0.00	0.00	21.59	2.16%	2.03
33	(250.00)	(6.79)	0.00	(14.23)	250.00		37.88	57.11	(231.60)	(62.36)		0.00	0.00	11.62	1.16%	1.01
Total		\$ 298.34	\$ -	\$ 625.45	\$ 1,250.00		\$ 1,250.00	\$ 0.00	\$ 855.91	\$ 230.45	\$ -	\$ 1,087.21	\$ 179.93	\$ 3,671.38	367.14%	\$ 1,641.57
Present Worth		\$ 180.69	\$ -	\$ 378.81	\$ 539.76		\$ 450.45	\$ 24.05	\$ 429.07	\$ 115.53	\$ -	\$ 421.22	\$ 70.83	\$ 1,641.57	164.16%	\$ 951.22
Levelized Payment		\$ 15.19	\$ -	\$ 31.85	\$ 45.39		\$ 37.88	\$ 2.02	\$ 36.08	\$ 9.71	\$ -	\$ 35.42	\$ 5.96	\$ 138.04	13.80%	
Current \$																
Levelized Payment		\$ 12.18	\$ -	\$ 25.54	\$ 36.39		\$ 30.37	\$ 1.62	\$ 28.93	\$ 7.79	\$ -	\$ 28.40	\$ 4.78	\$ 110.68	11.07%	
Constant \$																

**Liberty Utilities (Granite State Electric) Corp. Marginal Cost Study**  
**Development of Weighted Plant Book Lives and Salvage**

Line No.	Description	2022 Plant Balance	Average Service Life	Net Salvage Value
	(A)	(B) Company Data	(C) Company Data	(D) Company Data
1	<b>Distribution Investment - Primary and Secondary Capacity Related</b>			
2	360 Land and Land Rights	\$ 3,172,947	0	0%
3	361 Structures and Improvements	\$ 1,965,160	60	-5%
4	362 Station Equipment	\$ 42,392,278	60	-15%
5	363 Storage Battery Equipment	\$0	0	0%
6	364 Poles, Towers and Fixtures	\$ 61,851,834	55	-70%
7	365 Overhead Conductors and Devices	\$ 87,883,301	50	-50%
8	366 Underground Conduit	\$ 7,098,394	65	-10%
9	367 Underground Conductors and Devices	\$ 20,580,041	55	-40%
10	Total Distribution Primary and Secondary Capacity-Related	\$224,943,954	54	-46%
11	368 Line Transformers		33	-30%
12	369 Services		55	-75%
13	370 Meters		15	-25%
14	373 Street Lighting and signal systems		33	-25%

Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study

Summary of Marginal Capacity Costs

Line No.		Primary - Peak Demand	Source	Secondary - Peak Demand	Source	Line Transformers - Peak Demand	Source
1	Plant Investment						
2	Marginal Distribution Capacity Costs	\$108,329	Att MFB-1 p1, Line 23	\$156,699	Att MFB-1 p2, Line 23	\$111,351	Att MFB-1 p3, Line 26
3	Marginal General Plant Loading Factor	10.40%	Att MFB-6 p3, Line 23	10.40%	Att MFB-6 p3, Line 23	10.40%	Att MFB-6 p3, Line 23
4							
5	Total Marginal Plant Investment	\$119,595	Line 2 x (1 + Line 3)	\$172,996	Line 2 x (1 + Line 3)	\$122,932	Line 2 x (1 + Line 3)
6							
7	Fixed Carrying Charge Rate	10.14%	Att MFB-7 p1, Col (C), Line 3	10.14%	Att MFB-7 p1, Col (C), Line 3	11.02%	Att MFB-7 p1, Col (C), Line 4
8							
9	Levelized, Annualized Cost of Marginal Plant Investment	\$12,127	Line 5 x Line 7	\$17,542	Line 5 x Line 7	\$13,552	Line 5 x Line 7
10							
11	Operations and Maintenance Expenses						
12	Marginal Operating Expense	\$54,040	Att MFB-4 p1, Line 24	\$9,871	Att MFB-4 p2, Line 23	\$3,567	Att MFB-4 p3, Line 24
13	Marginal Maintenance Expense	\$23,056	Att MFB-4 p4, Line 25	\$9,654	Att MFB-4 p5, Line 24	\$3,580	Att MFB-4 p6, Line 23
14							
15	Total Marginal O&M Expense	\$77,095	Line 12 + Line 13	\$19,525	Line 12 + Line 13	\$7,148	Line 12 + Line 13
16							
17	Administrative and General Expenses						
18	Marginal Plant related A&G per \$ of Marginal Plant Investment	4.02%	Att MFB-6 p1, Line 31	4.02%	Att MFB-6 p1, Line 31	4.02%	Att MFB-6 p1, Line 31
19	Plant related A&G Expense	\$4,813	Line 5 x Line 18	\$6,962	Line 5 x Line 18	\$4,947	Line 5 x Line 18
20							
21	Marginal Non-Plant related A&G per \$ of Marginal O&M Expense	4.83%	Att MFB-6 p1, Line 29	4.83%	Att MFB-6 p1, Line 29	4.83%	Att MFB-6 p1, Line 29
22	Non-Plant related A&G Expense	\$3,720	Line 15 x Line 21	\$942	Line 15 x Line 21	\$345	Line 15 x Line 21
23							
24	Total A&G Expense	\$8,533	Line 19 + Line 22	\$7,904	Line 19 + Line 22	\$5,292	Line 19 + Line 22
25							
26	Marginal Working Capital Calculations						
27	Marginal M&S and Prepayments per \$ of Marginal Plant Investment	1.90%	Att MFB-6 p2, Line 22	1.90%	Att MFB-6 p2, Line 22	1.90%	Att MFB-6 p2, Line 22
28	M&S Cost	\$2,272	Line 5 x Line 27	\$3,287	Line 5 x Line 27	\$2,336	Line 5 x Line 27
29							
30	Cash Working Capital Allowance Rate	7.56%	27.6 Days / 365	7.56%	27.6 Days / 365	7.56%	27.6 Days / 365
31	Working Cash O&M Allowance	\$5,826	Line 15 x Line 30	\$1,475	Line 15 x Line 30	\$540	Line 15 x Line 30
32			(Line 28 + Line 31) x Tax Effected Cost of Capital, Att MFB-7 p1, Col (C), Line 16		(Line 28 + Line 31) x Tax Effected Cost of Capital, Att MFB-7 p1, Col (C), Line 16		(Line 28 + Line 31) x Tax Effected Cost of Capital, Att MFB-7 p1, Col (C), Line 16
33	Revenue Requirement for Working Capital	\$851		\$500		\$302	
34	Total Marginal Cost per MW	\$98,606	Σ Lines 9, 15, 24, 32	\$45,471	Σ Lines 9, 15, 24, 32	\$26,294	Σ Lines 9, 15, 24, 32
35	Escalator to Adjust to 2023/24 Rate Year	3.99%	((1 + Att MFB-7 p1, Col (C), Line 19)^2) - 1	3.99%	((1 + Att MFB-7 p1, Col (C), Line 19)^2) - 1	3.99%	Inflation from Revenue Requirement
36	<b>Total Adjusted Marginal Cost per MW</b>	<b>\$102,540</b>	Line 34 x (1 + Line 35)	<b>\$47,285</b>	Line 34 x (1 + Line 35)	<b>\$27,343</b>	Line 34 x (1 + Line 35)

**Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study**

**Calculation of Loss-Adjusted Marginal Costs**

Line No.	Description	Marginal Costs	Explanation
1	Loss Factors		
2	Distribution - Primary	3.80%	Company Data
3	Distribution - Secondary	6.90%	Company Data
4			
5	Marginal Costs to Serve - Transmission Level per kW		
6	Distribution - Primary	\$102.54	Att MFB-8 p1, Line 36 / 1000
7	Distribution - Secondary	\$47.28	Att MFB-8 p1, Line 36 / 1000
8	Distribution - Line Transformers	\$27.34	Att MFB-8 p1, Line 36 / 1000
9			
10	Marginal Costs to Serve per kW: Distribution Primary Customer		
11	Distribution - Primary Component	\$106.44	(1 + Line 2) x Line 6
12	<b>Total</b>	<b>\$106.44</b>	
13			
14	Marginal Costs to Serve per kW: Distribution Secondary Customer		
15	Distribution - Primary Component	\$109.62	(1 + Line 3) x Line 6
16	Distribution - Secondary Component	\$50.55	(1 + Line 3) x Line 7
17	Distribution - Line Transformer Component	\$29.23	(1 + Line 3) x Line 8
18	<b>Total</b>	<b>\$189.39</b>	$\Sigma$ Lines 15 - 17

Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study

Calculation of Marginal Capacity Costs by Rate Class (Peak Demand)

Line No.	Description	Domestic D	Domestic-Opt. Peak D-10	Domestic - Opt Battery Pilot Pricing D-11	General TOU G-1	General Long Hour G-2	General Service G-3	Outdoor Lighting M	Limited All Electric T	Ltd Comm Space V	Explanation
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1	<b>Marginal Capacity Costs</b>										
2	Marginal Costs to Serve per kW: Distribution Primary Customer										
3	Distribution - Primary Component	\$ 106.44	\$ 106.44	\$ 106.44	\$ 106.44	\$ 106.44	\$ 106.44		\$ 106.44	\$ 106.44	Att MFB-8 p2, Line 11
4	Distribution - Secondary Component	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	
5	Distribution - Line Transformer Component	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	
6	<b>Total</b>	\$ 106.44	\$ 106.44	\$ 106.44	\$ 106.44	\$ 106.44	\$ 106.44	N/A	\$ 106.44	\$ 106.44	Σ Lines 3 - 5
7	Marginal Costs to Serve per kW: Distribution Secondary Customer										
8	Distribution - Primary Component	\$ 109.62	\$ 109.62	\$ 109.62	\$ 109.62	\$ 109.62	\$ 109.62		\$ 109.62	\$ 109.62	Att MFB-8 p2, Line 15
9	Distribution - Secondary Component	\$ 50.55	\$ 50.55	\$ 50.55	\$ 50.55	\$ 50.55	\$ 50.55		\$ 50.55	\$ 50.55	Att MFB-8 p2, Line 16
10	Distribution - Line Transformer Component	\$ 29.23	\$ 29.23	\$ 29.23	\$ 29.23	\$ 29.23	\$ 29.23		\$ 29.23	\$ 29.23	Att MFB-8 p2, Line 17
11	<b>Total</b>	\$ 189.39	\$ 189.39	\$ 189.39	\$ 189.39	\$ 189.39	\$ 189.39	N/A	\$ 189.39	\$ 189.39	Σ Lines 8 - 10
12	<b>Voltage Weighting Analysis</b>										
13	Non coincident peak (kW) served at:										
14	Primary Voltage	-	-	-	32,469	116	-	-	-	-	- Company Data
15	Secondary Voltage	75,239	576	6	33,794	23,053	18,390	4	1,148	57	Company Data
16	<b>Total</b>	75,239	576	6	66,263	23,169	18,390	4	1,148	57	Σ Lines 14 - 15
17	Percent of Non coincident peak (kW)										
18	Primary Voltage	0.00%	0.00%	0.00%	49.00%	0.50%	0.00%	0.00%	0.00%	0.00%	Line 14 / Line 16
19	Secondary Voltage	100.00%	100.00%	100.00%	51.00%	99.50%	100.00%	100.00%	100.00%	100.00%	Line 15 / Line 16
20	<b>Total</b>	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	Σ Lines 18 - 19
21	<b>Voltage Weighted Marginal Capacity Costs</b>										
22	Marginal Costs to Serve per kW: Distribution Customer										
23	Distribution - Primary Component	109.62	109.62	109.62	\$ 108.06	\$ 109.60	\$ 109.62		\$ 109.62	\$ 109.62	Line 3 x Line 18 + Line 8 x Line 19
24	Distribution - Secondary Component	50.55	50.55	50.55	\$ 25.78	\$ 50.29	\$ 50.55		\$ 50.55	\$ 50.55	Line 4 x Line 18 + Line 9 x Line 19
25	Distribution - Line Transformer Component	\$ 29.23	\$ 29.23	\$ 29.23	\$ 14.91	\$ 29.08	\$ 29.23		\$ 29.23	\$ 29.23	Line 5 x Line 18 + Line 10 x Line 19
26	<b>Total</b>	\$ 189.39	\$ 189.39	\$ 189.39	\$ 148.74	\$ 188.98	\$ 189.39	N/A	\$ 189.39	\$ 189.39	Σ Lines 23 - 25

Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study

Summary of Marginal Customer Costs

Line No.	Description	Domestic D	Domestic-Opt. Peak D-10	Domestic - Opt Battery Pilot Pricing D-11	General TOU G-1	General Long Hour G-2	General Service G-3	Outdoor Lighting M	Limited All Electric T	Ltd Comm Space V	Explanation
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
	<b>Plant Investment</b>										
1	Meters	\$ 158.20	\$ 185.20	\$ 185.20	\$ 1,267	\$ 1,267.37	\$ 244.72		\$ 158.20	\$ 244.72	Att MFB-2 p1, Line 8
2	General Plant Loading Factor	10.40%	10.40%	10.40%	10.40%	10.40%	10.40%		10.40%	10.40%	Att MFB-6 p3, Line 23
3	Unit Costs and Loading Factor	\$ 174.65	\$ 204.46	\$ 204.46	\$ 1,399	\$ 1,399.18	\$ 270.17		\$ 174.65	\$ 270.17	Line 1 + (Line 1 x Line 2)
4	Fixed Charge Rate	14.29%	14.29%	14.29%	14.29%	14.29%	14.29%		14.29%	14.29%	Att MFB-7 p1, Col (C), Line 6
5	Meter Carrying Costs	\$ 24.96	\$ 29.22	\$ 29.22	\$ 199.93	\$ 199.93	\$ 38.60		\$ 24.96	\$ 38.60	Line 3 x Line 4
6	Services	\$ 741.11	\$ 741.11	\$ 741.11	\$ 821.47	\$ 821.47	\$ 741.11		\$ 820.61	\$ 741.11	Att MFB-2 p1, Line 4
7	General Plant Loading Factor	10.40%	10.40%	10.40%	10.40%	10.40%	10.40%		10.40%	10.40%	Att MFB-6 p3, Line 23
8	Unit Costs and Loading Factor	\$ 818.19	\$ 818.19	\$ 818.19	\$ 906.90	\$ 906.90	\$ 818.19		\$ 905.95	\$ 818.19	Line 6 + (Line 6 x Line 7)
9	Fixed Charge Rate	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%		9.88%	9.88%	Att MFB-7 p1, Col (C), Line 5
10	Services Carrying Costs	\$ 80.86	\$ 80.86	\$ 80.86	\$ 89.63	\$ 89.63	\$ 80.86		\$ 89.54	\$ 80.86	Line 8 x Line 9
11	Total Plant Carrying Costs	\$ 105.82	\$ 110.08	\$ 110.08	\$ 289.56	\$ 289.56	\$ 119.47		\$ 114.49	\$ 119.47	Line 5 + Line 10
12	A&G Exp Plant-Related Loading Factor	4.02%	4.02%	4.02%	4.02%	4.02%	4.02%		4.02%	4.02%	Att MFB-6 p1, Line 31
13	Annualized Cost	\$ 145.77	\$ 151.23	\$ 151.23	\$ 382.36	\$ 382.36	\$ 163.27	N/A	\$ 157.98	\$ 163.27	(Line 12) x (Line 3 + Line 8) + Line 11
	<b>Operating Expenses</b>										
14	Plant Related O&M \$/Customer	\$ 126.40	\$ 130.20	\$ 130.20	\$ 293.59	\$ 293.59	\$ 138.56		\$ 137.57	\$ 138.56	Att MFB-5 p2, Col (G)
15	Customer Acctg & Mkg Expenses	\$ 124.30	\$ 124.30	\$ 124.30	\$ 248.60	\$ 186.45	\$ 124.30		\$ 124.30	\$ 124.30	Att MFB-5 p4, Col (F)
16	A&G Exp Non-Plant Loading Factor	4.83%	4.83%	4.83%	4.83%	4.83%	4.83%		4.83%	4.83%	Att MFB-6 p1, Line 29
17	Total O&M Expense	\$ 262.80	\$ 266.78	\$ 266.78	\$ 568.36	\$ 503.21	\$ 275.55	N/A	\$ 274.51	\$ 275.55	Line 15 + Line 16 + ((Line 15 + Line 16) x Line 17)
18											
	<b>Working Capital- \$/Customer</b>										
19	Materials & Supplies + Prepayments Rate	1.90%	1.90%	1.90%	1.90%	1.90%	1.90%		1.90%	1.90%	Att MFB-6 p2, Line 22
20	M&S Cost	\$ 18.86	\$ 19.43	\$ 19.43	\$ 43.82	\$ 43.82	\$ 20.68		\$ 20.53	\$ 20.68	Line 20 x (Line 3 + Line 8)
21	Working Cash O&M Allowance	\$ 19.86	\$ 20.16	\$ 20.16	\$ 42.95	\$ 38.02	\$ 20.82		\$ 20.74	\$ 20.82	(Line 18) x (Att MFB-8 p1, Line 30)
22	Total Working Capital	\$ 38.72	\$ 39.59	\$ 39.59	\$ 86.76	\$ 81.84	\$ 41.50		\$ 41.28	\$ 41.50	Line 21 + Line 22
23											
24	Working Capital Rev. Requirement	\$ 4.07	\$ 4.16	\$ 4.16	\$ 9.11	\$ 8.60	\$ 4.36	N/A	\$ 4.34	\$ 4.36	Line 23 x (Att MFB-7 p1, Col (C), Line 16)
25	Annual Customer Related Cost \$/Customer	\$ 412.64	\$ 422.17	\$ 422.17	\$ 959.84	\$ 894.17	\$ 443.17	N/A	\$ 436.83	\$ 443.17	Line 13 + Line 18 + Line 24
26	Escalator to Adjust to 2023/24 Rate Year	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%		3.99%	3.99%	Inflation from Revenue Requirement
27	<b>Annual Customer Related Cost</b>	\$429.10	\$439.01	\$439.01	\$998.13	\$929.84	\$460.85	N/A	\$454.26	\$460.85	Line 25 x (1 + Line 26)



Liberty Utilities (Granite State Electric) Corp.  
Marginal Cost Study

Summary of Marginal Cost Estimates

Line No.	Description	Domestic D	Domestic-Opt. Peak D-10	Domestic - Opt Battery Pilot Pricing D-11	General TOU G-1	General Long Hour G-2	General Service G-3	Outdoor Lighting M	Limited All Electric T	Ltd Comm Space V	Total Company	Explanation
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	
1	Uncollectible Factor	0.62%	0.18%	0.00%	0.07%	0.06%	0.11%		0.04%	0.00%		Att MFB-5 p5, Col (F)
2	Customer Charge \$'s per month											
3	Monthly Customer Charge w/o Uncollectibles	\$ 35.76	\$ 36.58	\$ 36.58	\$ 83.18	\$ 77.49	\$ 38.40		\$ 37.85	\$ 38.40		(Att MFB-9 p1, Line 27)/12
4	Adjustment for Uncollectibles	0.22	0.07	0.00	0.06	0.04	0.04		0.01	0.00		Line 1 x Line 3
5	Monthly Customer Charge Incl. Uncollectibles	\$ 35.98	\$ 36.65	\$ 36.58	\$83.24	\$77.53	\$38.45		\$37.87	\$ 38.40		Line 3 + Line 4
6	Demand Charge \$'s per kW											
7	Distribution Demand Charge - Primary Component	109.62	109.62	109.62	108.06	109.60	109.62		109.62	109.62		Att MFB-8 p3, Line 23
8	Distribution Demand Charge - Secondary Component	50.55	50.55	50.55	25.78	50.29	50.55		50.55	50.55		Att MFB-8 p3, Line 24
9	Distribution Demand Charge - Line Transformer Component	29.23	29.23	29.23	14.91	29.08	29.23		29.23	29.23		Att MFB-8 p3, Line 25
10	Adjustment for Uncollectibles	\$1.17	\$0.34	\$0.00	\$0.10	\$0.11	\$0.21		\$0.07	\$0.00		(Line 7 + Line 8 + Line 9) x Line 1
11	Demand Charge Incl. Uncollectibles	\$190.57	\$189.73	\$189.39	\$148.85	\$189.08	\$189.60		\$189.46	\$189.39		Σ line 7 to Line 10
12	Billing Determinants											
13	Customers	37,286	440	98	152	972	5,876	0	854	16	45,695	Company Data
14	Non coincident peak (kW)	75,239	576	6	66,263	23,169	18,390	4	1,148	57	184,852	Company Data
15	<b>Total Marginal Costs</b>											
16	Total Customer-related	\$16,098,935	\$193,653	\$42,938	\$151,979	\$904,717	\$2,711,049		\$388,021	\$7,384	\$20,498,676	Line 5 x Line 13 x 12
17	Total Capacity-related: Demand											
18	Demand Distribution Primary	8,298,474	63,251	658	7,165,248	2,540,743	2,018,090		125,886	6,248	20,218,598	(1 + Line 1) x Line 7 x Line 14
19	Demand Distribution Secondary	3,826,718	29,167	303	1,709,398	1,165,929	930,612		58,050	2,881	7,723,060	(1 + Line 1) x Line 8 x Line 14
20	Demand Distribution Line Transformer	2,212,814	16,866	175	988,466	674,203	538,130		33,568	1,666	4,465,887	(1 + Line 1) x Line 9 x Line 14
21	Total Capacity-related: Demand	\$ 14,338,006	\$ 109,285	\$ 1,136	\$ 9,863,112	\$ 4,380,874	\$ 3,486,833		\$ 217,504	\$ 10,795	\$ 32,407,545	Σ line 18 to Line 20
22	Customer Subtotal	\$16,098,935	\$193,653	\$42,938	\$151,979	\$904,717	\$2,711,049		\$388,021	\$7,384	\$20,498,676	Line 16
23	Distribution Subtotal	14,338,006	109,285	1,136	9,863,112	4,380,874	3,486,833		217,504	10,795	32,407,545	Line 18 + Line 19 + Line 20
24	Marginal Cost for Fixtures							647,742			647,742	Att MFB-3 p1, 2,3, Line 8 + Att MFB-3 p4,5, Line 8
25	<b>Total Annual Marginal Cost Excl. Fixtures</b>	\$ 30,436,941	\$ 302,938	\$ 44,074	\$ 10,015,091	\$ 5,285,591	\$ 6,197,882	\$ -	\$ 605,524	\$ 18,180	\$ 52,906,221	Σ line 22 to Line 23
26	<b>Share of Total Annual Marginal Cost Excl. Fixtures</b>	57.5%	0.6%	0.1%	18.9%	10.0%	11.7%	0.0%	1.1%	0.0%	100.00%	Col (n) / Col (K)
27	<b>Total Annual Marginal Cost Incl. Fixtures</b>	\$ 30,436,941	\$ 302,938	\$ 44,074	\$ 10,015,091	\$ 5,285,591	\$ 6,197,882	\$ 647,742	\$ 605,524	\$ 18,180	\$ 53,553,963	Σ line 22 to Line 24
27	<b>Share of Total Annual Marginal Cost Incl. Fixtures</b>	56.83%	0.57%	0.08%	18.70%	9.87%	11.57%	1.21%	1.13%	0.03%	100.0%	Col (n) / Col (K)

## **MELISSA F. BARTOS**

Vice President

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Ms. Bartos is a financial and economic consultant with 25 years of experience in the energy industry. In the last several years, she has focused on natural gas markets issues, including helping natural gas utilities navigate industry changes related to decarbonization policies, conducting comprehensive market assessments for various clients considering infrastructure investments, and developing detailed demand forecasts for several gas distribution companies. Ms. Bartos has also designed, built, and enhanced numerous financial and statistical models to support clients in asset-based transactions, energy contract negotiations, reliability studies, asset and business valuations, rate and regulatory matters, cost-of-service analysis, and risk management. Ms. Bartos has also provided expert testimony on multiple occasions regarding natural gas demand forecasting and supply planning issues, natural gas markets, and marginal cost studies.

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## **REPRESENTATIVE PROJECT EXPERIENCE**

### Future of Natural Gas Industry

- Assisted the New York Joint LDCs with strategy and preparation of joint comments in the Gas Planning Proceeding (Case No. 20-G-0131), which seeks to evaluate the future role of New York's gas utilities in light of the state's climate goals.
- Collaborating with a Massachusetts LDC to develop utility-specific proposal for filing in a policy proceeding before the Massachusetts Department of Public Utilities related to the role of natural gas local distribution companies as the Commonwealth works to achieve its net-zero by 2050 climate goals (D.P.U. 20-80).
- Presented at a Northeast Gas Association conference regarding the impact of decarbonization activities on the natural gas industry in the Northeast.

### Natural Gas Market Assessments

- Reviewed and evaluated long-term natural gas supply and demand, existing natural gas pricing dynamics, and future implications associated with new natural gas infrastructure in New England, New York, and New Jersey.
- Provided an analysis of the existing Gulf Coast natural gas market, the client's natural gas pipeline competitors, changing flows, and how those factors may affect transportation values to the client going forward.
- Prepared a comprehensive study examining the costs associated with improving natural gas pipeline access from western Canada and the eastern U.S. to Atlantic Canada.
- Produced a report on the benefits associated with incremental natural gas supplies delivered to New York City.



- Prepared an independent natural gas supply and pipeline transportation route assessment associated with natural gas for the client's proposed LNG export terminal.

#### Natural Gas Expansion

- Conducted a study that examined potential commercial and industrial conversions from oil-based fuels to natural gas in various east coast U.S. markets.
- Produced a report that identified growth potential in off-system stationary and mobile markets in the mid-west that could be served by compressed natural gas or liquefied natural gas.
- Performed an external audit and filed expert testimony associated with two natural gas utilities' hurdle rate/contribution in aid of construction calculations for new off main customers.
- Produced a report that identified and reviewed innovative cost model approaches that utilities and regulators are using across the U.S. that allow expansion of gas distributions systems to new communities.
- Assisted in developing a strategy to identify residential natural gas growth opportunities within the client's franchise area.
- Presented at two Northeast Gas Association conferences regarding "Regulatory Policy and Residential Main Extensions".

#### Demand Forecasting

- Filed expert testimony regarding the development of demand forecast models for use in determining future billing determinants as well as weather normalization in rate cases for several natural gas and electric utilities.
- Filed expert testimony regarding the development of demand forecast models and the evaluation of natural gas resource plans for several northeast gas utilities.
- Provided detailed due diligence analysis regarding expectations for utility-specific future gas demand in many different transactions involving the potential purchase of natural gas utilities.
- Provided litigation support regarding demand forecasting techniques with respect to certain natural gas pipeline and storage decisions for a mid-west gas utility.
- Reviewed demand forecasting practices and procedures and recommended certain changes to improve the methodology and accuracy of the forecast for a multi-state utility.
- For a mid-west gas utility, developed a natural gas demand forecast that was utilized for supply and capacity decisions.

#### Ratemaking and Utility Regulation

- Participated in the rate case of a large North American gas distribution company, which determined the client's five-year incentive regulation plan, including performing benchmarking and productivity analyses that were filed with the regulator.
- Developed a marginal cost study, including data collection, analysis and testimony development, in support of rate case filings for a number of New England utilities.



- Provided comprehensive analysis, drafted testimony and provided litigation support regarding the appropriate return on equity for a New England water utility, and for proposed wind and coal electric generation facility additions for a mid-west combination utility.
- Performed a detailed analysis of the components included in the client's lost and unaccounted for gas calculation.
- Conducted multiple natural gas portfolio asset optimization analyses to evaluate performance of the client's asset manager for regulatory purposes.
- On behalf of multiple New England gas companies, participated in the 2009 Avoided Energy Supply Cost Study Group (for New England), which worked with third-party consultants to develop the marginal energy supply costs that will be avoided due to reductions in the use of electricity, natural gas, and other fuels resulting from energy efficiency programs.
- Conducted a study to determine the cost of significantly reducing peak day natural gas demand for a northeast gas utility through energy efficiency, conservation and demand management measures. Project involved researching natural gas energy efficiency plans in multiple U.S. states and Canadian provinces, reviewing energy efficiency potential studies, and exploring geothermal, peak pricing and direct load control options.

## **PROFESSIONAL HISTORY**

### **Concentric Energy Advisors, Inc. (2002 – Present)**

Vice President

Assistant Vice President

Project Manager

Senior Consultant

### **Navigant Consulting, Inc. (1996 – 2002)**

Senior Consultant

## **EDUCATION**

### **University of Massachusetts at Lowell**

M.S., Mathematics (Statistics), 2003

### **College of the Holy Cross**

B.S., Mathematics and Psychology, *magna cum laude*, 1998

## **PROFESSIONAL ASSOCIATIONS**

Member of the American Statistical Association

Member of the Northeast Energy and Commerce Association

Member of the Northeast Gas Association



<b>SPONSOR</b>	<b>DATE</b>	<b>CASE/APPLICANT</b>	<b>DOCKET NO.</b>	<b>SUBJECT</b>
<b>Connecticut Public Utilities Regulatory Authority</b>				
Connecticut Natural Gas Corporation & Southern Connecticut Gas Company	2014	Connecticut Natural Gas Corporation & Southern Connecticut Gas Company	Docket No. 13-06-02	CIAC Hurdle Rate Calculation
<b>Federal Energy Regulatory Commission</b>				
PennEast Pipeline Company, LLC	2015	PennEast Pipeline Company, LLC	Docket No. CP15-558	Market Conditions/Need
PennEast Pipeline Company, LLC	2016	PennEast Pipeline Company, LLC	Docket No. CP15-558	Market Conditions/Need
Millennium Pipeline Company, LLC	2017	Millennium Pipeline Company, LLC	Docket No. CP16-486	Market Conditions/Need
Laclede Gas Company	2017	Spire STL Pipeline, LLC	Docket No. CP17-40	Market Conditions/Need
Spire Missouri Inc. (Laclede Gas Company)	2021	Spire STL Pipeline, LLC	Docket No. CP17-40	Market Conditions/Need
<b>Indiana Utility Regulatory Commission</b>				
Northern Indiana Public Service Company LLC (Gas)	2021	Northern Indiana Public Service Company LLC (Gas)	Cause # 45621	Weather Normalization; Demand Forecast
Northern Indiana Public Service Company LLC (Electric)	2022	Northern Indiana Public Service Company LLC (Electric)	Cause #45772	Weather Normalization Demand Forecast
<b>Kentucky Public Service Commission</b>				
Columbia Gas of Kentucky, Inc.	2021	Columbia Gas of Kentucky, Inc.	Case No. 2021-00183	Demand Forecast
<b>Maine Public Utilities Commission</b>				
Northern Utilities, Inc.	2011	Northern Utilities	Docket No. 2011-526	Integrated Resource Plan; Demand Forecast
Versant Power	2022	Versant Power	Docket No. 2022-00255	Sales Forecast
<b>Massachusetts Department of Public Utilities</b>				
New England Gas Company	2008	New England Gas Company	D.P.U. 08-11	Integrated Resource Plan; Demand Forecast; Supply Planning
New England Gas Company	2010	New England Gas Company	D.P.U. 10-61	Integrated Resource Plan; Demand Forecast; Supply Planning



<b>SPONSOR</b>	<b>DATE</b>	<b>CASE/APPLICANT</b>	<b>DOCKET NO.</b>	<b>SUBJECT</b>
Berkshire Gas Company	2010	Berkshire Gas Company	D.P.U. 10-100	Integrated Resource Plan; Demand Forecast
New England Gas Company	2012	New England Gas Company	D.P.U. 12-41	Integrated Resource Plan; Demand Forecast; Supply Planning
Berkshire Gas Company	2012	Berkshire Gas Company	D.P.U. 12-62	Integrated Resource Plan; Demand Forecast
NSTAR Gas Company	2014	NSTAR Gas Company	D.P.U. 14-63	Integrated Resource Plan; Demand Forecast
Berkshire Gas Company	2014	Berkshire Gas Company	D.P.U. 14-98	Integrated Resource Plan; Demand Forecast
Liberty Utilities (New England Gas Company)	2015	Liberty Utilities (New England Gas Company)	D.P.U. 15-75	Marginal Cost of Service Study
Berkshire Gas Company	2016	Berkshire Gas Company	D.P.U. 16-103	Integrated Resource Plan; Demand Forecast
Eversource Energy	2017	Eversource Energy (NSTAR Electric and WMECO)	D.P.U. 17-05	Marginal Cost of Service Study
National Grid (Boston Gas Company and Colonial Gas Company)	2017	National Grid (Boston Gas Company and Colonial Gas Company)	D.P.U. 17-170	Marginal Cost of Service Study
Bay State Gas Company d/b/a/ Columbia Gas of Massachusetts	2018	Bay State Gas Company d/b/a/ Columbia Gas of Massachusetts	D.P.U. 18-45	Marginal Cost of Service Study
Berkshire Gas Company	2018	Berkshire Gas Company	D.P.U. 18-40	Marginal Cost of Service Study
Berkshire Gas Company	2018	Berkshire Gas Company	D.P.U. 18-107	Integrated Resource Plan; Demand Forecast
NSTAR Gas Company	2019	NSTAR Gas Company	D.P.U. 19-120	Marginal Cost of Service Study
Bay State Gas Company d/b/a Columbia Gas of Massachusetts	2019	Bay State Gas Company d/b/a Columbia Gas of Massachusetts	D.P.U. 19-135	Integrated Resource Plan; Demand Forecast
Berkshire Gas Company	2020	Berkshire Gas Company	D.P.U. 20-139	Integrated Resource Plan; Demand Forecast
Boston Gas d/b/a National Grid	2020	Boston Gas d/b/a National Grid	D.P.U. 20-120	Marginal Cost Study



<b>SPONSOR</b>	<b>DATE</b>	<b>CASE/APPLICANT</b>	<b>DOCKET NO.</b>	<b>SUBJECT</b>
Berkshire Gas Company	2022	Berkshire Gas Company	D.P.U. 20-80	Future of Gas
Berkshire Gas Company	2022	Berkshire Gas Company	D.P.U. 22-20	Marginal Cost Study
Berkshire Gas Company	2022	Berkshire Gas Company	D.P.U. 22-148	Integrated Resource Plan; Demand Forecast
<b>New Hampshire Public Utilities Commission</b>				
Northern Utilities, Inc.	2011	Northern Utilities	DG 2011-290	Integrated Resource Plan; Demand Forecast
Liberty Utilities (EnergyNorth Natural Gas)	2017	Liberty Utilities (EnergyNorth Natural Gas)	DG 17-048	Marginal Cost of Service Study
Liberty Utilities (Granite State Electric)	2019	Liberty Utilities (Granite State Electric)	De 19-064	Marginal Cost of Service Study
<b>New Jersey Board of Public Utilities</b>				
South Jersey Gas Company	2015	South Jersey Gas Company	GR15010090	Energy Efficiency Cost Benefit Analysis
<b>New York State Public Service Commission</b>				
Liberty Utilities (St. Lawrence Gas) Corp.	2022	Liberty Utilities (St. Lawrence Gas) Corp.	Case 21-G-0577	Demand Forecast
<b>Ontario Energy Board</b>				
Enbridge Gas Distribution	2012	Enbridge Gas Distribution	EB-2011-0354	Industry Benchmarking Study
Enbridge Gas Distribution	2013	Enbridge Gas Distribution	EB-2012-0459	Incentive Rate Making
<b>Pennsylvania Public Utility Commission</b>				
Columbia Gas of Pennsylvania, Inc.	2021	Columbia Gas of Pennsylvania, Inc	R-2021-3024296	Weather Normalization; Demand Forecast
Columbia Gas of Pennsylvania, Inc.	2022	Columbia Gas of Pennsylvania, Inc	R-2022-3031211	Weather Normalization; Demand Forecast
<b>Public Utilities Commission of Ohio</b>				
Columbia Gas of Ohio, Inc.	2021	Columbia Gas of Ohio, Inc.	Case No. 21-637-GA-AIR	Adjustments to Demand
<b>Régie de l'énergie du Québec</b>				



<b>SPONSOR</b>	<b>DATE</b>	<b>CASE/APPLICANT</b>	<b>DOCKET NO.</b>	<b>SUBJECT</b>
TransCanada Pipelines Ltd.	2014	TransCanada Pipelines Ltd.	R-3900-2014	Natural Gas Market Assessment
<b>Washington Utilities and Transportation Commission</b>				
Puget Sound Energy, Inc.	2015	Puget Sound Energy, Inc.	UG-151663	Distributed LNG Market Assessment