

**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 2018\$ = F(Normalized Peak Rolling 2 Year Average, Trend, Lag 4)

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Dependent Variable				
Total Cumulative Annual Distribution Capacity Additions 2018\$ (2002 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-10,287,978	-2.81	0.0147
Normalized Peak Rolling 2 Year Average	Norm_pk_R2	115,690	5.72	0.0001
Annual Trend	Trend	2,046,881	79.10	0.0000
Autoregressive Term Lag 4	Lag 4	-0.8825	-7.96	0.0000
Model Statistics	Model 2.0			
R Squared		0.9974		
Adjusted R Squared		0.9967		
Mean Absolute % Error (MAPE)		1.9200		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Primary Distribution Plant Additions} = - \$ 10,287,978 + \$ 115,690 \times \text{Norm_pk_R2} + \$ 2,046,881 \times \text{Trend} + - \$ 0.8825 \times \text{Lag 4}$$

$$\partial \text{ Primary Distribution Plant} / \partial \text{ Normalized Peak Demand} = \$ 115,690 \text{ per MW}$$

**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 2018\$ = F(Normalized Peak Rolling 2 Year Average, Trend₂₀₁₁₋₂₀₁₈,
Dummy₂₀₁₀, Lag 4)

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Dependent Variable				
Total Cumulative Annual Distribution Capacity Additions 2018\$ (2001 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-11,133,387	-3.72	0.0026
Normalized Peak Rolling 2 Year Average	Norm_pk_R2	82,116	5.01	0.0002
Interactive: Trend for 2011 to 2018	TrendxD 2011 After	286,528	15.00	0.0000
Dummy: Year 2010	D 2010	1,435,004	2.58	0.0229
Autoregressive Term Lag 4	Lag 4	(0.7068)	-3.12	0.0082
Model Statistics		Model 2.0		
R Squared		0.9646		
Adjusted R Squared		0.9537		
Mean Absolute % Error (MAPE)		8.5215		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Secondary Distribution Plant Additions} = - \$ 11,133,387 + \$ 82,116 \times \text{Norm_pk_R2} + \$ 286,528 \times \text{TrendxD_2011_After} + \$ 1,435,004 \times \text{D_2010} - \$ 0.7068 \times \text{Lag 4}$$

$$\partial \text{Secondary Distribution Plant} / \partial \text{Normalized Peak Demand} = \$ 82,116 \text{ per MW}$$

**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 2018\$ = F(Normalized Peak Rolling 2 Year Average, Trend, Dummy₂₀₀₇, Dummy₂₀₁₄)

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Dependent Variable				
Total Cumulative Annual Distribution Capacity Additions 2018\$ _(2001 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-10,407,873	-5.22	0.0002
Normalized Peak Rolling 2 Year Average	Norm_pk_R2	84,022	7.32	0.0000
Annual Trend	Trend	463,545	20.19	0.0000
Dummy: Year 2007	D_2007	901,471	2.31	0.0380
Dummy: Year 2014	D_2014	-1,046,876	-2.62	0.0210
Model Statistics		Model 1.0		
R Squared		0.9890		
Adjusted R Squared		0.9856		
Mean Absolute % Error (MAPE)		3.2888		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Line Transformers Additions} = - \$ 10,407,873 + \$ 84,022 \times \text{Norm_pk_R2} + \$ 463,545 \times \text{Trend} + \$ 901,471 \times \text{D_2007} - \$ 1,046,876 \times \text{D_2014}$$

$$\partial \text{Line Transformers} / \partial \text{Normalized Peak Demand} = \$ 84,022 \text{ per MW}$$

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

Line No.	Description	Domestic D	Domestic-Opt. Peak D-10	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)
1	Service Costs									
2	Representative Cost	\$693.29	\$693.29	\$759.17	\$759.17	\$693.29		\$693.29	\$693.29	Company Data
3	Customers per Service	1.00	1.00	1.00	1.00	1.00		1.00	1.00	Company Data
4	Average Service Cost per Customer	\$ 693.29	\$ 693.29	\$ 759.17	\$ 759.17	\$ 693.29		\$ 693.29	\$ 693.29	Line 2 / Line 3
5	Meter Costs									
6	Current Unit Cost for Metering	\$ 105.00	\$ 360.20	\$ 1,605.00	\$ 900.80	\$ 630.20		\$ 195.20	\$ 290.20	Company Data
7	Meters per Customer	1.00	1.00	1.00	1.00	1.00		1.00	1.00	Company Data
8	Average Meter Cost per Customer	\$ 105.00	\$ 360.20	\$ 1,605.00	\$ 900.80	\$ 630.20		\$ 195.20	\$ 290.20	Line 6 x Line 7
9	Total	\$798.29	\$1,053.49	\$2,364.17	\$1,659.97	\$1,323.49		\$888.49	\$983.49	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 Lumens	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	Installation Costs					
2	Equipment, Line Truck Costs					
3	Cost	38.50	38.50	38.50	44.00	55.00
4	Burden	7.41	7.41	7.41	8.47	10.59
5	Total Equipment, Line Truck Costs	\$ 45.91	\$ 45.91	\$ 45.91	\$ 52.47	\$ 65.59
6	Inventory, Street Light Materials Costs					
7	Cost	305.45	309.54	335.09	358.01	304.01
8	Burden	94.69	95.96	103.88	110.98	94.24
9	Total Inventory, Street Light Materials Costs	\$ 400.14	\$ 405.50	\$ 438.97	\$ 468.99	\$ 398.25
10	Payroll, Lineworker Costs					
11	Cost	35.09	35.09	35.09	40.10	50.13
12	Burden	52.11	52.11	52.11	59.55	74.44
13	Total Payroll, Lineworker Costs	\$ 87.20	\$ 87.20	\$ 87.20	\$ 99.65	\$ 124.57
14	Total Installation Costs	\$ 533.25	\$ 538.61	\$ 572.08	\$ 621.11	\$ 588.41
15	Fixed Charge Rate	11.97%	11.97%	11.97%	11.97%	11.97%
16	Annualized Cost	\$ 63.81	\$ 64.46	\$ 68.46	\$ 74.33	\$ 70.42
17	Escalator to Adjust to 2020 Rate Year	3.84%	3.84%	3.84%	3.84%	3.84%
18	Adjusted Annualized Cost	\$ 66.26	\$ 66.93	\$ 71.09	\$ 77.18	\$ 73.12
19	Installed Luminaires	2,426	1,829	497	72	402
20	Total Annual Marginal Cost	\$ 160,753.52	\$ 122,412.83	\$ 35,330.68	\$ 5,556.99	\$ 29,393.07

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

Line No.	Luminaires Type Size of Street Light Lumnes Description Replacement Luminaire Type	Sodium Vapor 27,500 (Flood) LUM HPS FLD 250W	Sodium Vapor 50,000 (Flood) LUM HPS FLD 400W	Incandescent 1000 LUM INC RWY 103W	Mercury Vapor 4000 LUM MV RWY 100W	Mercury Vapor 8000 LUM MV RWY 175W	Mercury Vapor 22000 LUM MV RWY 400W
	(A)	(G)	(H)	(I)	(J)	(K)	(L)
1	Installation Costs						
2	Equipment, Line Truck Costs						
3	Cost	38.50	38.50	38.50	38.50	38.50	38.50
4	Burden	7.41	7.41	7.41	7.41	7.41	7.41
5	Total Equipment, Line Truck Costs	\$ 45.91	\$ 45.91	\$ 45.91	\$ 45.91	\$ 45.91	\$ 45.91
6	Inventory, Street Light Materials Costs						
7	Cost	413.38	497.46	305.45	305.45	309.54	335.09
8	Burden	128.15	154.21	94.69	94.69	95.96	103.88
9	Total Inventory, Street Light Materials Costs	\$ 541.53	\$ 651.67	\$ 400.14	\$ 400.14	\$ 405.50	\$ 438.97
10	Payroll, Lineworker Costs						
11	Cost	35.09	35.09	35.09	35.09	35.09	35.09
12	Burden	52.11	52.11	52.11	52.11	52.11	52.11
13	Total Payroll, Lineworker Costs	\$ 87.20	\$ 87.20	\$ 87.20	\$ 87.20	\$ 87.20	\$ 87.20
14	Total Installation Costs	\$ 674.64	\$ 784.78	\$ 533.25	\$ 533.25	\$ 538.61	\$ 572.08
15	Fixed Charge Rate	11.97%	11.97%	11.97%	11.97%	11.97%	11.97%
16	Annualized Cost	\$ 80.74	\$ 93.92	\$ 63.81	\$ 63.81	\$ 64.46	\$ 68.46
17	Escalator to Adjust to 2020 Rate Year	3.84%	3.84%	3.84%	3.84%	3.84%	3.84%
18	Adjusted Annualized Cost	\$ 83.83	\$ 97.52	\$ 66.26	\$ 66.26	\$ 66.93	\$ 71.09
19	Installed Luminaires	255	420	23	59	111	50
20	Total Annual Marginal Cost	\$ 21,377.21	\$ 40,983.75	\$ 1,524.04	\$ 3,909.50	\$ 7,429.10	\$ 3,554.39

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

Line No.	Luminaires Type Size of Street Light Lumnes Description Replacement Luminaire Type	Mercury Vapor 63000 LUM MV RWY 1000W LUM HPS RWY 400W	Mercury Vapor 22,000 (Flood) LUM MV FLD 400W LUM HPS FLD 250W	Total Outdoor Lighting (Luminaires)	Explanation
	(A)	(M)	(N)	(O)	(P)
1	Installation Costs				
2	Equipment, Line Truck Costs				
3	Cost	44.00		38.50	Company Data
4	Burden	8.47		7.41	Company Data
5	Total Equipment, Line Truck Costs	\$ 52.47	\$	45.91	Line 3 + Line 4
6	Inventory, Street Light Materials Costs				
7	Cost	358.01		413.38	Company Data
8	Burden	110.98		128.15	Company Data
9	Total Inventory, Street Light Materials Costs	\$ 468.99	\$	541.53	Line 7 + Line 8
10	Payroll, Lineworker Costs				
11	Cost	40.10		35.09	Company Data
12	Burden	59.55		52.11	Company Data
13	Total Payroll, Lineworker Costs	\$ 99.65	\$	87.20	Line 11 + Line 12
14	Total Installation Costs	\$ 621.11	\$	674.64	Line 5 + Line 9 + Line 13
15	Fixed Charge Rate	11.97%		11.97%	Att MFB-7 p1, Col (C), Line 7
16	Annualized Cost	\$ 74.33	\$	80.74	Line 14 x Line 15
17	Escalator to Adjust to 2020 Rate Year	3.84%		3.84%	$((1 + \text{Att MFB-7 p1, Col (C), Line 19})^2) - 1$
18	Adjusted Annualized Cost	\$ 77.18	\$	83.83	Line 16 x (1 + Line 17)
19	Installed Luminaires	1		20	Company Data
20	Total Annual Marginal Cost	\$ 77.18	\$	1,676.64	\$ 433,979 Line 18 x Line 19

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
	Poles and Accessories Type	Wood Poles	Fiberglass - Direct Embedded	Fiberglass with Foundation < 25 ft.
	Description	POLE - WOOD	POLE FIBER PT < 25FT	POLE FIBER RWY < 25FT
	Replacement Pole and Accessory Type	POLE - WOOD	POLE FIBER PT < 25FT	POLE FIBER RWY < 25FT
	(A)	(B)	(C)	(D)
1	Installation Costs			
2	Equipment, Line Truck Costs			
3	Cost	187.00	192.00	175.00
4	Burden	36.00	36.96	33.69
5	Total Equipment, Line Truck Costs	\$ 223.00	\$ 228.96	\$ 208.69
6	Inventory, Street Light Materials Costs			
7	Cost	206.61	613.26	1,033.11
8	Burden	64.05	190.11	320.26
9	Total Inventory, Street Light Materials Costs	\$ 270.66	\$ 803.37	\$ 1,353.37
10	Payroll, Lineworker Costs			
11	Cost	305.60	255.19	259.42
12	Burden	453.81	378.96	385.24
13	Total Payroll, Lineworker Costs	\$ 759.41	\$ 634.15	\$ 644.66
14	Total Installation Costs	\$ 1,253.07	\$ 1,666.48	\$ 2,206.72
15	Fixed Charge Rate	11.97%	11.97%	11.97%
16	Annualized Cost	\$ 149.96	\$ 199.43	\$ 264.08
17	Escalator to Adjust to 2020 Rate Year	3.84%	3.84%	3.84%
18	Adjusted Annualized Cost	\$ 155.71	\$ 207.08	\$ 274.21
19	Installed Luminaires	114	245	142
20	Total Annual Marginal Cost	\$ 17,750.84	\$ 50,734.69	\$ 38,938.07

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

Line No.	Poles and Accessories Type Description Replacement Pole and Accessory Type	Metallic Standard Metal Poles - Direct Embedded POLE METAL EMBEDDED	Metallic Standard Metal Poles with Foundation POLE METAL POLE METAL	Total Outdoor Lighting (Poles and	Explanation
	(A)	(E)	(F)	(G)	(H)
1	Installation Costs				
2	Equipment, Line Truck Costs				
3	Cost	192.00	224.00		Company Data
4	Burden	36.96	43.12		Company Data
5	Total Equipment, Line Truck Costs	\$ 228.96	\$ 267.12		Line 3 + Line 4
6	Inventory, Street Light Materials Costs				
7	Cost	613.26	1,576.77		Company Data
8	Burden	190.11	488.80		Company Data
9	Total Inventory, Street Light Materials Costs	\$ 803.37	\$ 2,065.57		Line 7 + Line 8
10	Payroll, Lineworker Costs				
11	Cost	255.19	186.78		Company Data
12	Burden	378.96	277.37		Company Data
13	Total Payroll, Lineworker Costs	\$ 634.15	\$ 464.15		Line 11 + Line 12
14	Total Installation Costs	\$ 1,666.48	\$ 2,796.84		Line 5 + Line 9 + Line 13
15	Fixed Charge Rate	11.97%	11.97%		Att MFB-7 p1, Col (C), Line 7
16	Annualized Cost	\$ 199.43	\$ 334.70		Line 14 x Line 15
17	Escalator to Adjust to 2020 Rate Year	3.84%	3.84%		$((1 + \text{Att MFB-7 p1, Col (C), Line 19})^2) - 1$
18	Adjusted Annualized Cost	\$ 207.08	\$ 347.54		Line 16 x (1 + Line 17)
19	Installed Luminaires	162	98	761	Company Data
20	Total Annual Marginal Cost	\$ 33,547.02	\$ 34,059.05	\$ 175,030	Line 18 x Line 19

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

Summary of Marginal Distribution Operations Expense: Primary System

1 Regression Results

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3 **Selected Model:** Primary Distribution Non-Customer Operations Expense 2018\$ = F(Normalized Peak Rolling 2 Year Average, Dummy₂₀₁₄, Dummy₂₀₀₅,
Dummy₂₀₀₆, Trend₂₀₀₁₋₂₀₁₂)

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Dependent Variable				
Primary Distribution Non-Customer Operations Expense 2018\$ (2001 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-5,175,908	-4.91	0.0004
Normalized Peak Rolling 2 Year Average	Norm_pk_R2	35,927	6.16	0.0000
Dummy: 2014	D_2014	790,435	3.04	0.0103
Dummy: 2005	D_2005	-1,003,370	-4.30	0.0010
Dummy: 2006	D_2006	-583,428	-2.49	0.0285
Interactive: Trend for 2001 to 2012	Trend_2001_2012	-101,220	-6.98	0.0000
Model Statistics		Model 1.0		
R Squared		0.9211		
Adjusted R Squared		0.8882		
Mean Absolute % Error (MAPE)		20.4350		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Primary Distribution Non-Customer Operations Expense} = - \$ 5,175,908 + \$ 35,927 \times \text{Norm_pk_R2} + \$ 790,435 \times \text{D_2014} - \$ 1,003,370 \times \text{D_2005} - \$ 583,428 \times \text{D_2006} + - \$ 101,220 \times \text{Trend_2001_2012}$$

$$\partial \text{ Primary Distribution Non-Customer Operations Expense} / \partial \text{ Normalized Peak Demand} = \$ 35,927 \text{ per MW}$$

**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 2018\$ = F(Normalized Peak Rolling 2 year average, Dummy₂₀₀₃₋₂₀₁₂,
Dummy₂₀₁₄, Dummy₂₀₀₂, Dummy₂₀₀₁, Dummy₂₀₁₃)

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Dependent Variable				
Secondary Distribution Non-Customer Operations Expense 2018\$ (2001 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-73,748	-0.24	0.8126
Normalized Peak Rolling 2 year average	Norm_pk_R2	3,410	2.12	0.0576
Dummy: Years 2003 to 2012	D_2003_2012	-430,838	-20.16	0.0000
Dummy: Year 2014	D_2014	490,516	11.45	0.0000
Dummy: Year 2002	D_2002	-393,189	-7.80	0.0000
Dummy: Year 2001	D_2001	-329,723	-4.87	0.0005
Dummy: Year 2013	D_2013	179,078	4.40	0.0011
Model Statistics		Model 1.1		
R_Squared		0.9903		
Adjusted R_Squared		0.9849		
Mean Absolute % Error (MAPE)		12.2651		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Secondary Distribution Non-Customer Operations Expense} = - \$ 73,748 + \$ 3,410 \times \text{Norm_pk_R2} - \$ 430,838 \times \text{D_2003_2012} + \$ 490,516 \times \text{D_2014} - \$ 393,189 \times \text{D_2002} - \$ 329,723 \times \text{D_2001} + \$ 179,078 \times \text{D_2013}$$

$$\partial \text{Secondary Distribution Non-Customer Operations Expense} / \partial \text{Normalized Peak Demand} = \$ 3,410 \text{ per MW}$$

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

Summary of Marginal Distribution Operations Expense: Line Transformers

1 Regression Results

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3 **Selected Model:** Line Transformers Non-Customer Operations Expense 2018\$ = F(Normalized Peak Rolling 2 year average, Dummy₂₀₀₄₋₂₀₁₁, Dummy₂₀₁₂,
Dummy₂₀₁₃, Dummy₂₀₁₄, Trend, Lag 2)

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Dependent Variable				
Line Transformers Non-Customer Operations Expense 2018\$ (2002 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-215,021	-2.39	0.0402
Normalized Peak Rolling 2 year average	Norm_pk_R2	1,458	2.62	0.0276
Dummy: Years 2004 to 2011	D_2004_2011	-39,651	-5.17	0.0006
Dummy: 2012	D_2012	-136,634	-16.53	0.0000
Dummy: 2013	D_2013	96,844	11.76	0.0000
Dummy: 2014	D_2014	195,435	21.24	0.0000
Annual Trend	Trend	1,592	2.04	0.0721
Autoregressive Term Lag 2	Lag 2	-0.7952	-3.90	0.0036
Model Statistics		Model 1.1		
R Squared		0.9963		
Adjusted R Squared		0.9934		
Mean Absolute % Error (MAPE)		8.2472		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Line Transformers Non-Customer Operations Expense} = - \$ 215,021 + \$ 1,458 \times \text{Norm_pk_R2} - \$ 39,651 \times \text{D_2004_2011} + - \$ 136,634 \times \text{D_2012} + \$ 96,844 \times \text{D_2013} + \$ 195,435 \times \text{D_2014} + \$ 1,592 \times \text{Trend} + - \$ 0.795 \times \text{Lag 2}$$

$$\partial \text{Line Transformers Non-Customer Operations Expense} / \partial \text{Normalized Peak Demand} = \$ 1,458 \text{ per MW}$$

**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 2018\$ = F(1 Year Lag in Normal Peak, 1 Year Lag in
SAIFI, Dummy₂₀₁₃₋₂₀₁₅, Dummy₂₀₁₀, Dummy₂₀₀₅)

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Dependent Variable				
Primary Distribution Non-Customer Maintenance Expense 2018\$ (2001 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-1,792,424	-1.75	0.1060
1 Year Lag in Normal Peak	Norm_pk_L1	16,349	3.09	0.0094
1 Year Lag in SAIFI	SAIFI_L1	307,772	2.22	0.0462
Dummy: Years 2013 to 2015	D_2013_2015	-622,628	-3.20	0.0077
Dummy: 2010	D_2010	-769,943	-2.51	0.0273
Dummy: 2005	D_2005	-688,355	-2.32	0.0386
Model Statistics		Model 1.0		
R Squared		0.6953		
Adjusted R Squared		0.5684		
Mean Absolute % Error (MAPE)		10.7278		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Primary Distribution Non-Customer Maintenance Expense} = - \$ 1,792,424 + \$ 16,349 \times \text{Norm_pk_L1} + \$ 307,772 \times \text{SAIFI_L1} - \$ 622,628 \times \text{D_2013_2015} - \$ 769,943 \times \text{D_2010} - \$ 688,355 \times \text{D_2005}$$

$$\partial \text{ Primary Distribution Non-Customer Maintenance Expense} / \partial \text{ Normalized Peak Demand} = \$ 16,349 \text{ per MW}$$

**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 2018\$ = F(2-Year Lag in Normal Peak, 1 Year Lag in SAIFI, Dummy₂₀₁₃₋₂₀₁₅,
Dummy₂₀₁₀)

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Dependent Variable				
Secondary Distribution Non-Customer Maintenance Expense 2018\$ (2002 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-1,401,231	-3.20	0.0076
2 Year Lag in Normal Peak	Norm_pk L2	9,625	4.36	0.0009
1 Year Lag in SAIFI	SAIFI L1	182,684	3.19	0.0078
Dummy: Years 2013 to 2015	D 2013 2015	-287,407	-3.68	0.0032
Dummy: 2010	D 2010	-387,144	-3.15	0.0084
Model Statistics		Model 1.0		
R Squared		0.7502		
Adjusted R Squared		0.6669		
Mean Absolute % Error (MAPE)		11.8537		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Secondary Distribution Non-Customer Maintenance Expense} = - \$ 1,401,231 + \$ 9,625 \times \text{Norm_pk_L2} + \$ 182,684 \times \text{SAIFI_L1} - \$ 287,407 \times \text{D_2013_2015} - \$ 387,144 \times \text{D_2010}$$

$$\partial \text{Secondary Distribution Non-Customer Maintenance Expense} / \partial \text{Normalized Peak Demand} = \$ 9,625 \text{ per MW}$$

**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 2018\$ = F(2-Year Lag in Normal Peak, 1 Year Lag in SAIFI, Dummy₂₀₁₂)

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Dependent Variable				
Line Transformers Non-Customer Maintenance Expense 2018\$ (2002 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-410,080	-1.50	0.1566
2 Year Lag in Normal Peak	Norm_pk_L2	2,846	2.12	0.0537
1 Year Lag in SAIFI	SAIFI_L1	102,526	2.71	0.0180
Dummy: 2012	D_2012	162,136	2.05	0.0611
Model Statistics	Model 1.0			
R Squared	0.4777			
Adjusted R Squared	0.3572			
Mean Absolute % Error (MAPE)	19.8946			
Passes ACF/PACF	Yes			

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Marginal Cost Calculation

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$$\text{Line Transformers Non-Customer Maintenance Expense} = - \$ 410,080 + \$ 2,846 \times \text{Norm_pk_L2} + \$ 102,526 \times \text{SAIFI_L1} + \$ 162,136 \times \text{D_2012}$$

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$$\partial \text{ Line Transformers Non-Customer Maintenance Expense} / \partial \text{ Normalized Peak Demand} = \$ 2,846 \text{ per MW}$$

**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 2018\$ = F(Customers Lagged 1 Year, Trend₂₀₀₁₋₂₀₁₁,
 Dummy₂₀₁₂, Dummy₂₀₁₃)

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Dependent Variable				
Customer Related Operations and Maintenance Expense 2018\$ (2001 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-2,689,671	-0.95	0.3590
Customers Lagged 1 Year	Customer_L1	132.4	1.91	0.0790
Interactive: Trend for 2001 to 2011	I_Trendx2001_2011	-64,709	-2.34	0.0361
Dummy: 2012	D_2012	-1,380,942	-2.98	0.0107
Dummy: 2013	D_2013	-1,503,282	-3.23	0.0065
Model Statistics	Model 1.0			
R Squared		0.5705		
Adjusted R Squared		0.4384		
Mean Absolute % Error (MAPE)		11.9110		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Customer Related Operations and Maintenance Expense} = - \$ 2,689,671 + \$ 132.4 \times \text{Customer_L1} - \$ 64,709 \times \text{I_Trendx2001_2011} - \$ 1,380,942 \times \text{D_2012} - \$ 1,503,282 \times \text{D_2013}$$

$$\partial \text{ Customer Related Operations and Maintenance Expense} / \partial \text{ Customer} = \$ 132.4 \text{ per Customer}$$

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 10	Col (G) Line 9	Col (E) x Col (F)
1	D	35,382	\$ 798.29	\$ 28,244,829	0.893	\$ 132.4	\$118.17
2	D-10	440	\$ 1,053.49	\$ 463,307	1.178	\$ 132.4	\$155.95
3	G-1	138	\$ 2,364.17	\$ 326,728	2.644	\$ 132.4	\$349.96
4	G-2	907	\$ 1,659.97	\$ 1,505,268	1.856	\$ 132.4	\$245.72
5	G-3	5,670	\$ 1,323.49	\$ 7,504,221	1.480	\$ 132.4	\$195.91
6	M	N/A					
7	T	964	\$ 888.49	\$ 856,318	0.994	\$ 132.4	\$131.52
8	V	18	\$ 983.49	\$ 17,301	1.100	\$ 132.4	\$145.58
9	Total	43,518		\$ 38,917,972			\$132.38
10	Avg Cost per Customer		\$894.30				

**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 2018\$ = F(Customers 2 Year Rolling Average, Trend₂₀₀₃₋₂₀₁₁, Dummy₂₀₁₅, Dummy₂₀₁₂, Lag 3)

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Dependent Variable				
Customer Accounts 2018\$ _(2003 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-2,383,823	-1.74	0.1129
Customers 2 Year Rolling Average	Customer_R2	109.6	3.33	0.0076
Interactive: Trend for 2003 to 2011	I_Trendx2003_2011	-56,906	-4.95	0.0006
Dummy: 2015	D_2015	662,473	4.02	0.0025
Dummy: 2012	D_2012	-842,860	-5.82	0.0002
Autoregressive Term Lag 3	Lag 3	-0.8664	-4.51	0.0011
Model Statistics		Model 1.0		
R_Squared		0.8922		
Adjusted R_Squared		0.8384		
Mean Absolute % Error (MAPE)		6.1611		
Passes ACF/PACF		Yes		

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Marginal Cost Calculation

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$$\text{Customer Accounts} = - \$ 2,383,823 + \$ 109.6403 \times \text{Customer_R2} + - \$ 56,906 \times \text{I_Trendx2003_2011} + \$ 662,473 \times \text{D_2015} + - \$ 842,860 \times \text{D_2012} - \$ 0.866 \times \text{Lag 3}$$

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$$\partial \text{ Customer Accounts} / \partial \text{ Customer} = \$ 109.6 \text{ per Customer}$$

**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 9	Company Data	Att MFB-5 p3, Line 24	Col (D) x Col (E)
1	D	35,382	81.30%	1.00	\$ 109.64	\$ 109.64
2	D-10	440	1.01%	1.00	\$ 109.64	\$ 109.64
3	G-1	138	0.32%	2.00	\$ 109.64	\$ 219.28
4	G-2	907	2.08%	1.50	\$ 109.64	\$ 164.46
5	G-3	5,670	13.03%	1.00	\$ 109.64	\$ 109.64
6	M	N/A				
7	T	964	2.21%	1.00	\$ 109.64	\$ 109.64
8	V	18	0.04%	1.00	\$ 109.64	\$ 109.64
9	Total	43,518			\$ 109.64	

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

Line No.	Customer Groups	2018 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 9	Col (C) Line (n) x Col (D) Line 9	Company Data	Col (D) / Col (E)
1	D	\$ 539,475	89.40%	\$ 218,572	\$ 18,987,618	1.15%
2	D-10	\$ 7,204	1.19%	\$ 2,919	\$ 283,841	1.03%
3	G-1	\$ -	0.00%	\$ -	\$ 8,954,512	0.00%
4	G-2	\$ 25,204	4.18%	\$ 10,212	\$ 4,951,610	0.21%
5	G-3	\$ 28,429	4.71%	\$ 11,518	\$ 4,867,118	0.24%
6	M	\$ 377	0.06%	\$ 153	\$ 940,058	0.02%
7	T	\$ 2,549	0.42%	\$ 1,033	\$ 755,506	0.14%
8	V	\$ 174	0.03%	\$ 70	\$ 17,957	0.39%
9	Total	\$ 603,412	100.00%	\$ 244,477	\$ 39,758,220	0.61%

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

Summary of Marginal Administrative and General Expense - Marginal Loading Factors

1 Regression Results

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3 **Selected Model:** Administrative and General Expense 2018\$ = F(Total O&M Expense Excl. A&G, Real 2018\$, Total Utility Plant, Trend, Dummy₂₀₀₂,
Dummy₂₀₀₉, Dummy₂₀₁₀₋₂₀₁₁, Dummy₂₀₁₂, Dummy₂₀₁₃, Dummy₂₀₁₄)

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Dependent Variable				
Total Administrative and General Expense 2018\$ _(2001 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-1,034,594	-0.60	0.5677
Total O&M Expense Excl. A&G, Real 2018\$	OM_Real_xAG	0.0373	2.64	0.0297
Total Utility Plant	Util_Plt	0.0353	2.67	0.0282
Annual Trend	Trend	-370,053	-2.85	0.0216
Dummy: 2002	D_2002	1,196,806	2.49	0.0375
Dummy: 2009	D_2009	2,204,081	4.36	0.0024
Dummy: Years 2010 - 2011	D_2010_2011	3,813,212	7.52	0.0001
Dummy: 2012	D_2012	10,311,674	13.58	0.0000
Dummy: 2013	D_2013	8,505,148	11.87	0.0000
Dummy: 2014	D_2014	2,939,619	6.08	0.0003
Model Statistics		Model 1.0		
R Squared		0.9880		
Adjusted R Squared		0.9745		
Mean Absolute % Error (MAPE)		4.9504		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{Total Administrative and General Expense} = - \$ 1,034,594 + \$ 0.0373 \times \text{OM_Real_xAG} + \$ 0.0353 \times \text{Util_Plt} + - \$ 370,053 \times \text{Trend} + \\
\$ 1,196,806 \times \text{D_2002} + \$ 2,204,081 \times \text{D_2009} + \$ 3,813,212 \times \text{D_2010_2011} + \$ 10,311,674 \times \text{D_2012} + \$ 8,505,148 \times \text{D_2013} + \\
\$ 2,939,619 \times \text{D_2014}$$

$$\partial \text{ Total Administrative and General Expense} / \partial \text{ O\&M excl. A\&G} = \$ 0.0373 \text{ per } \$ \text{ of O\&M (2018\$)}$$

$$\partial \text{ Total Administrative and General Expense} / \partial \text{ Plant} = \$ 0.0353 \text{ per } \$ \text{ of Plant (2018\$)}$$

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

Summary of Marginal Materials and Supplies Expense - Marginal Loading Factors

1 Regression Results

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3 **Selected Model:** Materials and Supplies 2018\$ = F(Total Electric Plant In Service , Dummy₂₀₀₉, Dummy₂₀₁₁)

Dependent Variable				
Materials and Supplies Expense 2018\$ _(2000 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-1,160,105	-3.01	0.0088
Total Electric Plant In Service	Util_Plt	0.0207	7.95	0.0000
Dummy: 2009	D 2009	9,187,554	15.49	0.0000
Dummy: 2011	D 2011	1,733,634	2.93	0.0104
Model Statistics	Model 1.0			
R Squared	0.9510			
Adjusted R Squared	0.9412			
Mean Absolute % Error (MAPE)	56.7788			
Passes ACF/PACF	Yes			

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19 Marginal Cost Calculation
20 Materials and Supplies Expense = - \$ 1,160,105 + \$ 0.0207 x Util_Plt + \$ 9,187,554 x D_2009 + \$ 1,733,634 x D_2011
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22 ∂ Materials and Supplies Expense / ∂ Plant = \$ 0.0207 per \$ Plant (2018\$)

**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, Dummy₂₀₀₆₋₂₀₀₈, Dummy₂₀₀₉₋₂₀₁₃)

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Dependent Variable				
General Plant (2001 - 2018)				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-3,063,081	-3.86	0.0017
Total Utility Plant, excluding General Plant	Util Plt xGen Plt	0.1016	19.43	0.0000
Dummy: 2006 - 2008	D 2006 2008	-1,954,440	-2.96	0.0103
Dummy: 2009 - 2013	D 2009 2013	-3,724,921	-6.99	0.0000
Model Statistics		Model 2.0		
R Squared		0.9732		
Adjusted R Squared		0.9674		
Mean Absolute % Error (MAPE)		7.0003		
Passes ACF/PACF		Yes		

Marginal Cost Calculation

$$\text{General Plant} = - \$ 3,063,081 + \$ 0.1016 \times \text{Util_Plt_xGen_Plt} - \$ 1,954,440 \times \text{D_2006_2008} - \$ 3,724,921 \times \text{D_2009_2013}$$

$$\partial \text{ General Plant} / \partial \text{ Plant excl. General Plant} = \$ 0.1016 \text{ per } \$ \text{ Plant}$$

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.	13.69%	10.84%	Att MFB-7 p3, Line 13
4	Line Transformers Investment	13.91%	11.21%	Att MFB-7 p4, Line 13
5	Services Investment	13.24%	10.44%	Att MFB-7 p5, Line 13
6	Meters Investment	15.30%	13.15%	Att MFB-7 p6, Line 13
7	Street Lighting Investment	14.47%	11.97%	Att MFB-7 p7, Line 13
8	Cost of Capital			
9	Debt	5.97%	45.00%	WP MFB-7 Page 1, Line 1
10	Preferred	0.00%	0.00%	WP MFB-7 Page 1, Line 2
11	Common	10.00%	55.00%	WP MFB-7 Page 1, Line 3
12	Other	0.00%	0.00%	WP MFB-7 Page 1, Line 4
13	Weighted Cost of Capital		8.19%	
14	After Tax Cost of New Capital		7.46%	WP MFB-7 Page 1, Line 10
15	Incremental Tax Rate		27.08%	WP MFB-7 Page 1, Line 6
16	Tax Effectd Cost of Capital		10.23%	WP MFB-7 Page 1, Line 5
17	Property Tax Rate		3.48%	WP MFB-7 Page 1, Line 9
18	Gross Receipts Tax Rate		0.00%	WP MFB-7 Page 1, Line 11
19	Inflation Rate		1.90%	WP MFB-7 Page 1, Line 12
20	Property Tax Escalation Rate		2.50%	WP MFB-7 Page 1, Line 13

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	43	37	45	22	30	Att MFB-7 p13, Col (C)
4	Salvage Value	-39%	-30%	-75%	-10%	-10%	Att MFB-7 p13, Col (D)
5	MACRS Life	20	20	20	20	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	5.97%	5.97%	5.97%	5.97%	5.97%	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	10.00%	10.00%	10.00%	10.00%	10.00%	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	8.19%	8.19%	8.19%	8.19%	8.19%	(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	7.46%	7.46%	7.46%	7.46%	7.46%	Att MFB-7 p1, Col (C), Line 14
18	Tax Data						
19	Tax Rate	27.08%	27.08%	27.08%	27.08%	27.08%	Att MFB-7 p1, Col (C), Line 15
20	ITC Rate	0.00%	0.00%	0.00%	0.00%	0.00%	WP MFB-7 Page 1, Line 7
21	Revenue Tax Rate	0.00%	0.00%	0.00%	0.00%	0.00%	WP MFB-7 Page 1, Line 8
22	Property Tax Rate	3.48%	3.48%	3.48%	3.48%	3.48%	Att MFB-7 p1, Col (C), Line 17
23	Property Insurance	0.50%	0.50%	0.50%	0.50%	0.50%	WP MFB-7 Page 2, Line 3
24	Property Tax Basis	Dep Bal	Dep Bal	Dep Bal	Dep Bal	Dep Bal	
25	Misc. Data						
26	Inflation Rate	1.90%	1.90%	1.90%	1.90%	1.90%	Att MFB-7 p1, Col (C), Line 19
27	Prop Tax Escalation Rate	2.50%	2.50%	2.50%	2.50%	2.50%	Att MFB-7 p1, Col (C), Line 20
28	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	\$15.05	1.50%	\$11.92	1.19%
2	Return On Preferred	\$0.00	0.00%	\$0.00	0.00%
3	Return On Common	\$30.81	3.08%	\$24.41	2.44%
4	Return	\$45.86	4.59%	\$36.33	3.63%
5	Depreciation	\$32.38	3.24%	\$25.65	2.57%
6	Income Tax	\$8.70	0.87%	\$6.89	0.69%
7	Deferred Taxes	\$2.74	0.27%	\$2.17	0.22%
8	Income Tax	\$11.44	1.14%	\$9.06	0.91%
9	Revenue Tax	\$0.00	0.00%	\$0.00	0.00%
10	Property Tax	\$41.59	4.16%	\$32.94	3.29%
11	Property Insurance	\$5.62	0.56%	\$4.45	0.45%
12	Other	\$47.21	4.72%	\$37.40	3.74%
13	Total Revenue Required	\$136.89	13.69%	\$108.44	10.84%

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	\$14.97	1.50%	\$12.07	1.21%
2	Return On Preferred	\$0.00	0.00%	\$0.00	0.00%
3	Return On Common	\$30.65	3.07%	\$24.71	2.47%
4	Return	\$45.63	4.56%	\$36.78	3.68%
5	Depreciation	\$35.14	3.51%	\$28.33	2.83%
6	Income Tax	\$9.02	0.90%	\$7.27	0.73%
7	Deferred Taxes	\$2.37	0.24%	\$1.91	0.19%
8	Income Tax	\$11.38	1.14%	\$9.18	0.92%
9	Revenue Tax	\$0.00	0.00%	\$0.00	0.00%
10	Property Tax	\$41.33	4.13%	\$33.32	3.33%
11	Property Insurance	\$5.60	0.56%	\$4.52	0.45%
12	Other	\$46.93	4.69%	\$37.84	3.78%
13	Total Revenue Required	\$139.08	13.91%	\$112.12	11.21%

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	\$13.29	1.33%	\$10.48	1.05%
2	Return On Preferred	\$0.00	0.00%	\$0.00	0.00%
3	Return On Common	\$27.21	2.72%	\$21.45	2.14%
4	Return	\$40.50	4.05%	\$31.92	3.19%
5	Depreciation	\$38.89	3.89%	\$30.65	3.07%
6	Income Tax	\$8.95	0.90%	\$7.06	0.71%
7	Deferred Taxes	\$1.15	0.12%	\$0.91	0.09%
8	Income Tax	\$10.10	1.01%	\$7.96	0.80%
9	Revenue Tax	\$0.00	0.00%	\$0.00	0.00%
10	Property Tax	\$37.80	3.78%	\$29.80	2.98%
11	Property Insurance	\$5.15	0.52%	\$4.06	0.41%
12	Other	\$42.95	4.30%	\$33.86	3.39%
13	Total Revenue Required	\$132.45	13.24%	\$104.39	10.44%

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) Att MFB-7 p11	(C) Col (B) x 0.001	(D) Att MFB-7 p11	(E) Col (D) x 0.001
1	Interest On Debt	\$15.02	1.50%	\$12.90	1.29%
2	Return On Preferred	\$0.00	0.00%	\$0.00	0.00%
3	Return On Common	\$30.74	3.07%	\$26.41	2.64%
4	Return	\$45.76	4.58%	\$39.31	3.93%
5	Depreciation	\$50.00	5.00%	\$42.96	4.30%
6	Income Tax	\$11.06	1.11%	\$9.50	0.95%
7	Deferred Taxes	\$0.36	0.04%	\$0.31	0.03%
8	Income Tax	\$11.42	1.14%	\$9.81	0.98%
9	Revenue Tax	\$0.00	0.00%	\$0.00	0.00%
10	Property Tax	\$40.31	4.03%	\$34.64	3.46%
11	Property Insurance	\$5.55	0.55%	\$4.76	0.48%
12	Other	\$45.86	4.59%	\$39.40	3.94%
13	Total Revenue Required	\$153.03	15.30%	\$131.49	13.15%

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) Att MFB-7 p12	(C) Col (B) x 0.001	(D) Att MFB-7 p12	(E) Col (D) x 0.001
1	Interest On Debt	\$15.62	1.56%	\$12.93	1.29%
2	Return On Preferred	\$0.00	0.00%	\$0.00	0.00%
3	Return On Common	\$31.99	3.20%	\$26.46	2.65%
4	Return	\$47.61	4.76%	\$39.39	3.94%
5	Depreciation	\$36.67	3.67%	\$30.33	3.03%
6	Income Tax	\$9.53	0.95%	\$7.88	0.79%
7	Deferred Taxes	\$2.35	0.24%	\$1.94	0.19%
8	Income Tax	\$11.88	1.19%	\$9.83	0.98%
9	Revenue Tax	\$0.00	0.00%	\$0.00	0.00%
10	Property Tax	\$42.70	4.27%	\$35.33	3.53%
11	Property Insurance	\$5.80	0.58%	\$4.80	0.48%
12	Other	\$48.50	4.85%	\$40.12	4.01%
13	Total Revenue Required	\$144.66	14.47%	\$119.67	11.97%

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									
1	966.23	25.96	0.00	53.14	37.50	3.750%	32.38	1.39	67.76	18.35		34.84	5.02	171.07	17.11%	159.20	
2	923.07	24.80	0.00	50.77	72.19	7.219%	32.38	10.78	29.81	8.07		35.71	5.11	167.62	16.76%	145.16	
3	881.38	23.68	0.00	48.48	66.77	6.677%	32.38	9.31	32.09	8.69		36.60	5.21	164.35	16.43%	132.45	
4	841.04	22.59	0.00	46.26	61.77	6.177%	32.38	7.96	34.05	9.22		37.52	5.31	161.24	16.12%	120.92	
5	801.95	21.54	0.00	44.11	57.13	5.713%	32.38	6.70	35.74	9.68		38.45	5.41	158.28	15.83%	110.46	
6	764.03	20.53	0.00	42.02	52.85	5.285%	32.38	5.54	37.16	10.06		39.42	5.51	155.46	15.55%	100.96	
7	727.18	19.54	0.00	39.99	48.88	4.888%	32.38	4.47	38.35	10.38		40.40	5.62	152.78	15.28%	92.34	
8	691.32	18.57	0.00	38.02	45.22	4.522%	32.38	3.48	39.30	10.64		41.41	5.73	150.23	15.02%	84.49	
9	655.63	17.61	0.00	36.06	44.62	4.462%	32.38	3.31	37.21	10.08		42.45	5.83	147.73	14.77%	77.32	
10	619.94	16.65	0.00	34.10	44.61	4.461%	32.38	3.31	34.53	9.35		43.51	5.94	145.25	14.52%	70.74	
11	584.24	15.70	0.00	32.13	44.62	4.462%	32.38	3.31	31.83	8.62		44.59	6.06	142.80	14.28%	64.72	
12	548.55	14.74	0.00	30.17	44.61	4.461%	32.38	3.31	29.15	7.89		45.71	6.17	140.37	14.04%	59.21	
13	512.85	13.78	0.00	28.21	44.62	4.462%	32.38	3.31	26.44	7.16		46.85	6.29	137.98	13.80%	54.16	
14	477.16	12.82	0.00	26.24	44.61	4.461%	32.38	3.31	23.76	6.43		48.02	6.41	135.62	13.56%	49.54	
15	441.46	11.86	0.00	24.28	44.62	4.462%	32.38	3.31	21.06	5.70		49.22	6.53	133.29	13.33%	45.31	
16	405.77	10.90	0.00	22.32	44.61	4.461%	32.38	3.31	18.38	4.98		50.45	6.66	131.00	13.10%	41.44	
17	370.08	9.94	0.00	20.35	44.62	4.462%	32.38	3.31	15.67	4.24		51.72	6.78	128.73	12.87%	37.89	
18	334.38	8.98	0.00	18.39	44.61	4.461%	32.38	3.31	12.99	3.52		53.01	6.91	126.51	12.65%	34.65	
19	298.69	8.02	0.00	16.43	44.62	4.462%	32.38	3.31	10.29	2.79		54.33	7.04	124.31	12.43%	31.69	
20	263.00	7.07	0.00	14.46	44.61	4.461%	32.38	3.31	7.61	2.06		55.69	7.18	122.15	12.22%	28.98	
21	233.34	6.27	0.00	12.83	22.31	2.231%	32.38	(2.73)	27.67	7.49		57.09	7.31	120.65	12.06%	26.63	
22	209.73	5.63	0.00	11.54	0.00		32.38	(8.77)	48.20	13.05		58.51	7.45	119.80	11.98%	24.61	
23	186.12	5.00	0.00	10.24	0.00		32.38	(8.77)	46.42	12.57		59.97	7.59	118.99	11.90%	22.75	
24	162.50	4.37	0.00	8.94	0.00		32.38	(8.77)	44.64	12.09		61.47	7.74	118.21	11.82%	21.03	
25	138.89	3.73	0.00	7.64	0.00		32.38	(8.77)	42.86	11.61		63.01	7.88	117.48	11.75%	19.45	
26	115.28	3.10	0.00	6.34	0.00		32.38	(8.77)	41.08	11.12		64.59	8.03	116.79	11.68%	17.99	
27	91.67	2.46	0.00	5.04	0.00		32.38	(8.77)	39.30	10.64		66.20	8.19	116.15	11.61%	16.65	
28	68.05	1.83	0.00	3.74	0.00		32.38	(8.77)	37.51	10.16		67.86	8.34	115.54	11.55%	15.41	
29	44.44	1.19	0.00	2.44	0.00		32.38	(8.77)	35.73	9.68		69.55	8.50	114.98	11.50%	14.28	
30	20.83	0.56	0.00	1.15	0.00		32.38	(8.77)	33.95	9.19		71.29	8.66	114.47	11.45%	13.22	
31	(2.78)	(0.07)	0.00	(0.15)	0.00		32.38	(8.77)	32.17	8.71		0.00	0.00	32.10	3.21%	3.45	
32	(26.39)	(0.71)	0.00	(1.45)	0.00		32.38	(8.77)	30.39	8.23		0.00	0.00	29.68	2.97%	2.97	
33	(50.01)	(1.34)	0.00	(2.75)	0.00		32.38	(8.77)	28.61	7.75		0.00	0.00	27.27	2.73%	2.54	
34	(73.62)	(1.98)	0.00	(4.05)	0.00		32.38	(8.77)	26.83	7.27		0.00	0.00	24.85	2.49%	2.15	
35	(97.23)	(2.61)	0.00	(5.35)	0.00		32.38	(8.77)	25.05	6.78		0.00	0.00	22.44	2.24%	1.81	
36	(120.84)	(3.25)	0.00	(6.65)	0.00		32.38	(8.77)	23.27	6.30		0.00	0.00	20.02	2.00%	1.50	
37	(144.46)	(3.88)	0.00	(7.95)	0.00		32.38	(8.77)	21.49	5.82		0.00	0.00	17.60	1.76%	1.23	
38	(168.07)	(4.52)	0.00	(9.24)	0.00		32.38	(8.77)	19.70	5.34		0.00	0.00	15.19	1.52%	0.99	
39	(191.68)	(5.15)	0.00	(10.54)	0.00		32.38	(8.77)	17.92	4.85		0.00	0.00	12.77	1.28%	0.77	
40	(215.29)	(5.78)	0.00	(11.84)	0.00		32.38	(8.77)	16.14	4.37		0.00	0.00	10.36	1.04%	0.58	
41	(238.91)	(6.42)	0.00	(13.14)	0.00		32.38	(8.77)	14.36	3.89		0.00	0.00	7.94	0.79%	0.42	
42	(262.52)	(7.05)	0.00	(14.44)	0.00		32.38	(8.77)	12.58	3.41		0.00	0.00	5.53	0.55%	0.27	
43	(392.39)	(10.54)	0.00	(21.58)	392.39		32.38	97.49	(389.60)	(105.50)		0.00	0.00	(7.76)	-0.78%	(0.35)	
Total		\$ 306.12	\$ -	\$ 626.70	\$ 1,392.39		\$ 1,392.39	\$ 0.00	\$ 859.44	\$ 232.74	\$ -	\$ 1,529.45	\$ 200.43	\$ 4,287.83	428.78%	\$ 1,751.97	
Present Worth		\$ 192.60	\$ -	\$ 394.31	\$ 543.95		\$ 414.44	\$ 35.07	\$ 411.23	\$ 111.36	\$ -	\$ 532.26	\$ 71.93	\$ 1,751.97	175.20%	\$ 984.30	
Levelized		\$ 15.05	\$ -	\$ 30.81	\$ 42.50		\$ 32.38	\$ 2.74	\$ 32.13	\$ 8.70	\$ -	\$ 41.59	\$ 5.62	\$ 136.89	13.69%	\$ -	
Payment Current \$																	
Levelized		\$ 11.92	\$ -	\$ 24.41	\$ 33.67		\$ 25.65	\$ 2.17	\$ 25.45	\$ 6.89	\$ -	\$ 32.94	\$ 4.45	\$ 108.44	10.84%	\$ -	
Payment 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	964.22	25.90	0.00	53.03	37.50	3.750%	35.14	0.64	70.36	19.05		34.84	5.02	173.62	17.36%	161.57
2	919.05	24.69	0.00	50.55	72.19	7.219%	35.14	10.03	32.26	8.74		35.71	5.11	169.97	17.00%	147.19
3	875.35	23.52	0.00	48.14	66.77	6.677%	35.14	8.57	34.39	9.31		36.60	5.21	166.49	16.65%	134.17
4	833.01	22.38	0.00	45.82	61.77	6.177%	35.14	7.21	36.19	9.80		37.52	5.31	163.17	16.32%	122.37
5	791.91	21.27	0.00	43.56	57.13	5.713%	35.14	5.96	37.74	10.22		38.45	5.41	160.00	16.00%	111.67
6	751.98	20.20	0.00	41.36	52.85	5.285%	35.14	4.80	39.00	10.56		39.42	5.51	156.98	15.70%	101.95
7	713.12	19.16	0.00	39.22	48.88	4.888%	35.14	3.72	40.04	10.84		40.40	5.62	154.10	15.41%	93.13
8	675.26	18.14	0.00	37.14	45.22	4.522%	35.14	2.73	40.85	11.06		41.41	5.73	151.34	15.13%	85.12
9	637.55	17.13	0.00	35.07	44.62	4.462%	35.14	2.57	38.60	10.45		42.45	5.83	148.63	14.86%	77.79
10	599.85	16.12	0.00	32.99	44.61	4.461%	35.14	2.57	35.77	9.69		43.51	5.94	145.95	14.59%	71.08
11	562.15	15.10	0.00	30.92	44.62	4.462%	35.14	2.57	32.92	8.91		44.59	6.06	143.29	14.33%	64.94
12	524.45	14.09	0.00	28.84	44.61	4.461%	35.14	2.57	30.08	8.15		45.71	6.17	140.66	14.07%	59.33
13	486.75	13.08	0.00	26.77	44.62	4.462%	35.14	2.57	27.23	7.37		46.85	6.29	138.07	13.81%	54.19
14	449.04	12.06	0.00	24.70	44.61	4.461%	35.14	2.57	24.39	6.61		48.02	6.41	135.50	13.55%	49.49
15	411.34	11.05	0.00	22.62	44.62	4.462%	35.14	2.57	21.54	5.83		49.22	6.53	132.97	13.30%	45.20
16	373.64	10.04	0.00	20.55	44.61	4.461%	35.14	2.57	18.71	5.07		50.45	6.66	130.47	13.05%	41.27
17	335.94	9.02	0.00	18.48	44.62	4.462%	35.14	2.57	15.85	4.29		51.72	6.78	128.00	12.80%	37.68
18	298.24	8.01	0.00	16.40	44.61	4.461%	35.14	2.57	13.02	3.53		53.01	6.91	125.56	12.56%	34.39
19	260.53	7.00	0.00	14.33	44.62	4.462%	35.14	2.57	10.17	2.75		54.33	7.04	123.16	12.32%	31.40
20	222.83	5.99	0.00	12.26	44.61	4.461%	35.14	2.57	7.33	1.99		55.69	7.18	120.80	12.08%	28.66
21	191.17	5.14	0.00	10.51	22.31	2.231%	35.14	(3.47)	27.24	7.38		57.09	7.31	119.09	11.91%	26.29
22	165.55	4.45	0.00	9.11	0.00		35.14	(9.51)	47.62	12.90		58.51	7.45	118.03	11.80%	24.25
23	139.93	3.76	0.00	7.70	0.00		35.14	(9.51)	45.69	12.37		59.97	7.59	117.02	11.70%	22.37
24	114.31	3.07	0.00	6.29	0.00		35.14	(9.51)	43.76	11.85		61.47	7.74	116.04	11.60%	20.64
25	88.69	2.38	0.00	4.88	0.00		35.14	(9.51)	41.82	11.33		63.01	7.88	115.10	11.51%	19.06
26	63.07	1.69	0.00	3.47	0.00		35.14	(9.51)	39.89	10.80		64.59	8.03	114.21	11.42%	17.59
27	37.45	1.01	0.00	2.06	0.00		35.14	(9.51)	37.96	10.28		66.20	8.19	113.35	11.34%	16.25
28	11.82	0.32	0.00	0.65	0.00		35.14	(9.51)	36.03	9.76		67.86	8.34	112.54	11.25%	15.01
29	(13.80)	(0.37)	0.00	(0.76)	0.00		35.14	(9.51)	34.09	9.23		0.00	0.00	33.72	3.37%	4.19
30	(39.42)	(1.06)	0.00	(2.17)	0.00		35.14	(9.51)	32.16	8.71		0.00	0.00	31.10	3.11%	3.59
31	(65.04)	(1.75)	0.00	(3.58)	0.00		35.14	(9.51)	30.23	8.19		0.00	0.00	28.48	2.85%	3.06
32	(90.66)	(2.44)	0.00	(4.99)	0.00		35.14	(9.51)	28.30	7.66		0.00	0.00	25.86	2.59%	2.59
33	(116.28)	(3.12)	0.00	(6.40)	0.00		35.14	(9.51)	26.36	7.14		0.00	0.00	23.24	2.32%	2.16
34	(141.90)	(3.81)	0.00	(7.80)	0.00		35.14	(9.51)	24.43	6.62		0.00	0.00	20.62	2.06%	1.79
35	(167.52)	(4.50)	0.00	(9.21)	0.00		35.14	(9.51)	22.50	6.09		0.00	0.00	18.00	1.80%	1.45
36	(193.14)	(5.19)	0.00	(10.62)	0.00		35.14	(9.51)	20.57	5.57		0.00	0.00	15.38	1.54%	1.15
37	(300.00)	(8.06)	0.00	(16.50)	300.00		35.14	71.73	(287.49)	(77.85)		0.00	0.00	4.45	0.44%	0.31
Total	\$ 305.47	\$ -	\$ -	\$ 625.38	\$ 1,300.00		\$ 1,300.00	\$ 0.00	\$ 857.62	\$ 232.24	\$ -	\$ 1,388.61	\$ 183.27	\$ 4,034.96	403.50%	\$ 1,734.34
Present Worth	\$ 186.72	\$ -	\$ -	\$ 382.26	\$ 547.10		\$ 438.15	\$ 29.50	\$ 415.27	\$ 112.45	\$ -	\$ 515.39	\$ 69.87	\$ 1,734.34	173.43%	\$ 989.92
Levelized																
Payment Current	\$ 14.97	\$ -	\$ -	\$ 30.65	\$ 43.87		\$ 35.14	\$ 2.37	\$ 33.30	\$ 9.02	\$ -	\$ 41.33	\$ 5.60	\$ 139.08	13.91%	
Levelized	\$ 12.07	\$ -	\$ -	\$ 24.71	\$ 35.37		\$ 28.33	\$ 1.91	\$ 26.85	\$ 7.27	\$ -	\$ 33.32	\$ 4.52	\$ 112.12	11.21%	
Payment Constant																

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

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								
1	961.49	25.83	0.00	52.88	37.50	3.750%	38.89	(0.38)	73.91	20.01		34.84	5.02	177.10	17.71%	164.80
2	913.58	24.54	0.00	50.25	72.19	7.219%	38.89	9.02	35.61	9.64		35.71	5.11	173.16	17.32%	149.96
3	867.14	23.30	0.00	47.69	66.77	6.677%	38.89	7.55	37.52	10.16		36.60	5.21	169.40	16.94%	136.52
4	822.06	22.08	0.00	45.21	61.77	6.177%	38.89	6.20	39.12	10.59		37.52	5.31	165.80	16.58%	124.34
5	778.23	20.91	0.00	42.80	57.13	5.713%	38.89	4.94	40.46	10.96		38.45	5.41	162.36	16.24%	113.31
6	735.56	19.76	0.00	40.46	52.85	5.285%	38.89	3.78	41.52	11.24		39.42	5.51	159.06	15.91%	103.30
7	693.96	18.64	0.00	38.17	48.88	4.888%	38.89	2.71	42.35	11.47		40.40	5.62	155.89	15.59%	94.22
8	653.36	17.55	0.00	35.93	45.22	4.522%	38.89	1.71	42.95	11.63		41.41	5.73	152.86	15.29%	85.97
9	612.92	16.47	0.00	33.71	44.62	4.462%	38.89	1.55	40.50	10.97		42.45	5.83	149.86	14.99%	78.44
10	572.48	15.38	0.00	31.49	44.61	4.461%	38.89	1.55	37.46	10.14		43.51	5.94	146.90	14.69%	71.55
11	532.04	14.29	0.00	29.26	44.62	4.462%	38.89	1.55	34.40	9.32		44.59	6.06	143.96	14.40%	65.25
12	491.60	13.21	0.00	27.04	44.61	4.461%	38.89	1.55	31.36	8.49		45.71	6.17	141.06	14.11%	59.50
13	451.16	12.12	0.00	24.81	44.62	4.462%	38.89	1.55	28.30	7.66		46.85	6.29	138.18	13.82%	54.24
14	410.72	11.03	0.00	22.59	44.61	4.461%	38.89	1.55	25.26	6.84		48.02	6.41	135.34	13.53%	49.43
15	370.28	9.95	0.00	20.37	44.62	4.462%	38.89	1.55	22.20	6.01		49.22	6.53	132.52	13.25%	45.04
16	329.84	8.86	0.00	18.14	44.61	4.461%	38.89	1.55	19.16	5.19		50.45	6.66	129.74	12.97%	41.04
17	289.40	7.77	0.00	15.92	44.62	4.462%	38.89	1.55	16.10	4.36		51.72	6.78	126.99	12.70%	37.38
18	248.97	6.69	0.00	13.69	44.61	4.461%	38.89	1.55	13.06	3.54		53.01	6.91	124.28	12.43%	34.04
19	208.52	5.60	0.00	11.47	44.62	4.462%	38.89	1.55	10.00	2.71		54.33	7.04	121.60	12.16%	31.00
20	168.09	4.52	0.00	9.24	44.61	4.461%	38.89	1.55	6.96	1.88		55.69	7.18	118.95	11.90%	28.22
21	133.69	3.59	0.00	7.35	22.31	2.231%	38.89	(4.49)	26.66	7.22		57.09	7.31	116.96	11.70%	25.82
22	105.33	2.83	0.00	5.79	0.00		38.89	(10.53)	46.83	12.68		58.51	7.45	115.63	11.56%	23.75
23	76.97	2.07	0.00	4.23	0.00		38.89	(10.53)	44.69	12.10		59.97	7.59	114.33	11.43%	21.86
24	48.61	1.31	0.00	2.67	0.00		38.89	(10.53)	42.56	11.52		61.47	7.74	113.07	11.31%	20.12
25	20.26	0.54	0.00	1.11	0.00		38.89	(10.53)	40.42	10.94		63.01	7.88	111.86	11.19%	18.52
26	(8.10)	(0.22)	0.00	(0.45)	0.00		38.89	(10.53)	38.28	10.37		0.00	0.00	38.06	3.81%	5.86
27	(36.46)	(0.98)	0.00	(2.01)	0.00		38.89	(10.53)	36.14	9.79		0.00	0.00	35.16	3.52%	5.04
28	(64.82)	(1.74)	0.00	(3.56)	0.00		38.89	(10.53)	34.00	9.21		0.00	0.00	32.26	3.23%	4.30
29	(93.18)	(2.50)	0.00	(5.12)	0.00		38.89	(10.53)	31.86	8.63		0.00	0.00	29.36	2.94%	3.64
30	(121.53)	(3.26)	0.00	(6.68)	0.00		38.89	(10.53)	29.72	8.05		0.00	0.00	26.46	2.65%	3.06
31	(149.89)	(4.03)	0.00	(8.24)	0.00		38.89	(10.53)	27.58	7.47		0.00	0.00	23.56	2.36%	2.53
32	(178.25)	(4.79)	0.00	(9.80)	0.00		38.89	(10.53)	25.44	6.89		0.00	0.00	20.66	2.07%	2.07
33	(206.61)	(5.55)	0.00	(11.36)	0.00		38.89	(10.53)	23.31	6.31		0.00	0.00	17.76	1.78%	1.65
34	(234.96)	(6.31)	0.00	(12.92)	0.00		38.89	(10.53)	21.17	5.73		0.00	0.00	14.85	1.49%	1.29
35	(263.32)	(7.07)	0.00	(14.48)	0.00		38.89	(10.53)	19.03	5.15		0.00	0.00	11.95	1.20%	0.96
36	(291.68)	(7.84)	0.00	(16.04)	0.00		38.89	(10.53)	16.89	4.57		0.00	0.00	9.05	0.91%	0.68
37	(320.04)	(8.60)	0.00	(17.60)	0.00		38.89	(10.53)	14.75	3.99		0.00	0.00	6.15	0.62%	0.43
38	(348.40)	(9.36)	0.00	(19.16)	0.00		38.89	(10.53)	12.61	3.42		0.00	0.00	3.25	0.33%	0.21
39	(376.75)	(10.12)	0.00	(20.72)	0.00		38.89	(10.53)	10.47	2.84		0.00	0.00	0.35	0.04%	0.02
40	(405.11)	(10.88)	0.00	(22.28)	0.00		38.89	(10.53)	8.33	2.26		0.00	0.00	(2.55)	-0.25%	(0.14)
41	(433.47)	(11.65)	0.00	(23.84)	0.00		38.89	(10.53)	6.19	1.68		0.00	0.00	(5.45)	-0.55%	(0.29)
42	(461.83)	(12.41)	0.00	(25.40)	0.00		38.89	(10.53)	4.06	1.10		0.00	0.00	(8.35)	-0.84%	(0.41)
43	(490.18)	(13.17)	0.00	(26.96)	0.00		38.89	(10.53)	1.92	0.52		0.00	0.00	(11.25)	-1.13%	(0.51)
44	(518.54)	(13.93)	0.00	(28.52)	0.00		38.89	(10.53)	(0.22)	(0.06)		0.00	0.00	(14.15)	-1.42%	(0.60)
45	(750.00)	(20.15)	0.00	(41.25)	750.00		38.89	192.57	(767.68)	(207.89)		0.00	0.00	(37.83)	-3.78%	(1.49)
Total	\$ 154.29	\$ -	\$ -	\$ 315.87	\$ 1,750.00		\$ 1,750.00	\$ 0.00	\$ 433.18	\$ 117.30	\$ -	\$ 1,189.97	\$ 158.70	\$ 3,686.14	368.61%	\$ 1,705.91
Present Worth Levelized	\$ 171.18	\$ -	\$ -	\$ 350.45	\$ 555.61		\$ 500.89	\$ 14.82	\$ 425.89	\$ 115.33	\$ -	\$ 486.89	\$ 66.35	\$ 1,705.91	170.59%	\$ 996.25
Payment Current Levelized	\$ 13.29	\$ -	\$ -	\$ 27.21	\$ 43.14		\$ 38.89	\$ 1.15	\$ 33.07	\$ 8.95	\$ -	\$ 37.80	\$ 5.15	\$ 132.45	13.24%	
Payment Constant	\$ 10.48	\$ -	\$ -	\$ 21.45	\$ 34.00		\$ 30.65	\$ 0.91	\$ 26.06	\$ 7.06	\$ -	\$ 29.80	\$ 4.06	\$ 104.39	10.44%	

**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	953.39	25.61	0.00	52.44	37.50	3.750%	50.00	(3.39)	84.41	22.86		34.84	5.02	187.38	18.74%	174.37
2	897.38	24.11	0.00	49.36	72.19	7.219%	50.00	6.01	45.49	12.32		35.71	5.11	182.61	18.26%	158.14
3	842.83	22.64	0.00	46.36	66.77	6.677%	50.00	4.54	46.80	12.67		36.60	5.21	178.03	17.80%	143.47
4	789.65	21.21	0.00	43.43	61.77	6.177%	50.00	3.19	47.79	12.94		37.52	5.31	173.60	17.36%	130.19
5	737.72	19.82	0.00	40.57	57.13	5.713%	50.00	1.93	48.51	13.14		38.45	5.41	169.33	16.93%	118.17
6	686.94	18.45	0.00	37.78	52.85	5.285%	50.00	0.77	48.96	13.26		39.42	5.51	165.20	16.52%	107.29
7	637.25	17.12	0.00	35.05	48.88	4.888%	50.00	(0.30)	49.18	13.32		40.40	5.62	161.20	16.12%	97.43
8	588.54	15.81	0.00	32.37	45.22	4.522%	50.00	(1.29)	49.17	13.32		41.41	5.73	157.34	15.73%	88.49
9	540.00	14.51	0.00	29.70	44.62	4.462%	50.00	(1.46)	46.11	12.49		42.45	5.83	153.52	15.35%	80.35
10	491.46	13.20	0.00	27.03	44.61	4.461%	50.00	(1.46)	42.46	11.50		43.51	5.94	149.72	14.97%	72.92
11	442.92	11.90	0.00	24.36	44.62	4.462%	50.00	(1.46)	38.79	10.50		44.59	6.06	145.96	14.60%	66.15
12	394.38	10.59	0.00	21.69	44.61	4.461%	50.00	(1.46)	35.14	9.51		45.71	6.17	142.22	14.22%	59.99
13	345.83	9.29	0.00	19.02	44.62	4.462%	50.00	(1.46)	31.46	8.52		46.85	6.29	138.52	13.85%	54.37
14	297.29	7.99	0.00	16.35	44.61	4.461%	50.00	(1.46)	27.81	7.53		48.02	6.41	134.84	13.48%	49.25
15	248.75	6.68	0.00	13.68	44.62	4.462%	50.00	(1.46)	24.14	6.54		49.22	6.53	131.20	13.12%	44.60
16	200.21	5.38	0.00	11.01	44.61	4.461%	50.00	(1.46)	20.49	5.55		50.45	6.66	127.59	12.76%	40.36
17	151.67	4.07	0.00	8.34	44.62	4.462%	50.00	(1.46)	16.82	4.55		51.72	6.78	124.01	12.40%	36.50
18	103.13	2.77	0.00	5.67	44.61	4.461%	50.00	(1.46)	13.17	3.57		53.01	6.91	120.47	12.05%	33.00
19	54.58	1.47	0.00	3.00	44.62	4.462%	50.00	(1.46)	9.50	2.57		54.33	7.04	116.96	11.70%	29.81
20	6.04	0.16	0.00	0.33	44.61	4.461%	50.00	(1.46)	5.85	1.58		55.69	7.18	113.49	11.35%	26.92
21	(36.46)	(0.98)	0.00	(2.01)	22.31	2.231%	50.00	(7.50)	24.94	6.75		0.00	0.00	46.27	4.63%	10.21
22	(100.00)	(2.69)	0.00	(5.50)	100.00		50.00	13.54	(57.54)	(15.58)		0.00	0.00	39.77	3.98%	8.17
Total		\$ 249.13	\$ -	\$ 510.04	\$ 1,100.00		\$ 1,100.00	\$ 0.00	\$ 699.45	\$ 189.41	\$ -	\$ 889.91	\$120.73	\$ 3,059.22	305.92%	\$ 1,630.15
Present Worth		\$ 159.95	\$ -	\$ 327.46	\$ 546.70		\$ 532.63	\$ 3.81	\$ 435.00	\$ 117.80	\$ -	\$ 429.44	\$ 59.07	\$ 1,630.15	163.02%	\$ 1,011.08
Levelized Payment Current \$		\$ 15.02	\$ -	\$ 30.74	\$ 51.32		\$ 50.00	\$ 0.36	\$ 40.84	\$ 11.06	\$ -	\$ 40.31	\$ 5.55	\$ 153.03	15.30%	
Levelized Payment Constant \$		\$ 12.90	\$ -	\$ 26.41	\$ 44.10		\$ 42.96	\$ 0.31	\$ 35.09	\$ 9.50	\$ -	\$ 34.64	\$ 4.76	\$ 131.49	13.15%	

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

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 Tax (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)	
	1000.00						0.00	0.00									
1	963.11	25.87	0.00	52.97	37.50	3.750%	36.67	0.23	71.81	19.45		34.84	5.02	175.04	17.50%	162.89	
2	916.82	24.63	0.00	50.43	72.19	7.219%	36.67	9.62	33.63	9.11		35.71	5.11	171.27	17.13%	148.32	
3	872.00	23.43	0.00	47.96	66.77	6.677%	36.67	8.15	35.67	9.66		36.60	5.21	167.68	16.77%	135.13	
4	828.54	22.26	0.00	45.57	61.77	6.177%	36.67	6.80	37.39	10.13		37.52	5.31	164.24	16.42%	123.17	
5	786.33	21.12	0.00	43.25	57.13	5.713%	36.67	5.54	38.85	10.52		38.45	5.41	160.97	16.10%	112.34	
6	745.28	20.02	0.00	40.99	52.85	5.285%	36.67	4.38	40.03	10.84		39.42	5.51	157.83	15.78%	102.50	
7	705.31	18.95	0.00	38.79	48.88	4.888%	36.67	3.31	40.98	11.10		40.40	5.62	154.83	15.48%	93.58	
8	666.32	17.90	0.00	36.65	45.22	4.522%	36.67	2.32	41.70	11.29		41.41	5.73	151.96	15.20%	85.47	
9	627.50	16.86	0.00	34.51	44.62	4.462%	36.67	2.15	39.38	10.66		42.45	5.83	149.13	14.91%	78.05	
10	588.69	15.82	0.00	32.38	44.61	4.461%	36.67	2.15	36.46	9.87		43.51	5.94	146.34	14.63%	71.27	
11	549.87	14.77	0.00	30.24	44.62	4.462%	36.67	2.15	33.52	9.08		44.59	6.06	143.56	14.36%	65.07	
12	511.05	13.73	0.00	28.11	44.61	4.461%	36.67	2.15	30.60	8.29		45.71	6.17	140.82	14.08%	59.40	
13	472.23	12.69	0.00	25.97	44.62	4.462%	36.67	2.15	27.66	7.49		46.85	6.29	138.11	13.81%	54.21	
14	433.41	11.64	0.00	23.84	44.61	4.461%	36.67	2.15	24.75	6.70		48.02	6.41	135.43	13.54%	49.47	
15	394.59	10.60	0.00	21.70	44.62	4.462%	36.67	2.15	21.81	5.91		49.22	6.53	132.78	13.28%	45.13	
16	355.77	9.56	0.00	19.57	44.61	4.461%	36.67	2.15	18.89	5.12		50.45	6.66	130.17	13.02%	41.17	
17	316.95	8.51	0.00	17.43	44.62	4.462%	36.67	2.15	15.95	4.32		51.72	6.78	127.59	12.76%	37.56	
18	278.13	7.47	0.00	15.30	44.61	4.461%	36.67	2.15	13.03	3.53		53.01	6.91	125.04	12.50%	34.25	
19	239.31	6.43	0.00	13.16	44.62	4.462%	36.67	2.15	10.10	2.73		54.33	7.04	122.52	12.25%	31.23	
20	200.49	5.39	0.00	11.03	44.61	4.461%	36.67	2.15	7.18	1.94		55.69	7.18	120.04	12.00%	28.48	
21	167.72	4.51	0.00	9.22	22.31	2.231%	36.67	(3.89)	27.01	7.31		57.09	7.31	118.22	11.82%	26.10	
22	140.98	3.79	0.00	7.75	0.00		36.67	(9.93)	47.30	12.81		58.51	7.45	117.05	11.71%	24.05	
23	114.24	3.07	0.00	6.28	0.00		36.67	(9.93)	45.28	12.26		59.97	7.59	115.92	11.59%	22.16	
24	87.50	2.35	0.00	4.81	0.00		36.67	(9.93)	43.27	11.72		61.47	7.74	114.83	11.48%	20.43	
25	60.77	1.63	0.00	3.34	0.00		36.67	(9.93)	41.25	11.17		63.01	7.88	113.78	11.38%	18.84	
26	34.03	0.91	0.00	1.87	0.00		36.67	(9.93)	39.23	10.62		64.59	8.03	112.77	11.28%	17.37	
27	7.29	0.20	0.00	0.40	0.00		36.67	(9.93)	37.22	10.08		66.20	8.19	111.80	11.18%	16.03	
28	(19.45)	(0.52)	0.00	(1.07)	0.00		36.67	(9.93)	35.20	9.53		0.00	0.00	34.68	3.47%	4.63	
29	(46.18)	(1.24)	0.00	(2.54)	0.00		36.67	(9.93)	33.18	8.99		0.00	0.00	31.94	3.19%	3.97	
30	(100.00)	(2.69)	0.00	(5.50)	100.00		36.67	17.15	(70.88)	(19.19)		0.00	0.00	26.44	2.64%	3.05	
Total		\$ 319.66	\$ -	\$ 654.42	\$ 1,100.00		\$ 1,100.00	\$ (0.00)	\$ 897.45	\$ 243.03	\$ -	\$ 1,320.75	\$ 174.92	\$ 3,812.79	381.28%	\$ 1,715.29	
Present Worth		\$ 185.27	\$ -	\$ 379.29	\$ 537.71		\$ 434.78	\$ 27.87	\$ 417.22	\$ 112.98	\$ -	\$ 506.33	\$ 68.76	\$ 1,715.29	171.53%	\$ 991.98	
Levelized Payment Current \$		\$ 15.62	\$ -	\$ 31.99	\$ 45.35		\$ 36.67	\$ 2.35	\$ 35.19	\$ 9.53	\$ -	\$ 42.70	\$ 5.80	\$ 144.66	14.47%		
Levelized Payment Constant \$		\$ 12.93	\$ -	\$ 26.46	\$ 37.51		\$ 30.33	\$ 1.94	\$ 29.11	\$ 7.88	\$ -	\$ 35.33	\$ 4.80	\$ 119.67	11.97%		

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

Line No.	Description	2018 Plant Balance	Average Service Life	Net Salvage Value
	(A)	(B) Company Data	(C) Company Data	(D) Company Data
1	Distribution Investment - Primary and Secondary Capacity Related			
2	360 Land and Land Rights	\$ 1,672,947	0	0%
3	361 Structures and Improvements	\$ 1,965,160	44	-5%
4	362 Station Equipment	\$ 30,756,049	40	-20%
5	363 Storage Battery Equipment	\$0	0	0%
6	364 Poles, Towers and Fixtures	\$ 41,667,046	44	-60%
7	365 Overhead Conductors and Devices	\$ 65,174,236	43	-40%
8	366 Underground Conduit	\$ 6,948,378	56	-10%
9	367 Underground Conductors and Devices	\$ 17,274,059	46	-40%
10	Total Distribution Primary and Secondary Capacity-Related	\$165,457,875	43	-39%
11	368 Line Transformers		37	-30%
12	369 Services		45	-75%
13	370 Meters		22	-10%
14	373 Street Lighting and signal systems		30	-10%

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

Summary of Marginal Capacity Costs

Line No.		Primary - Peak Demand	Source	Secondary - Peak Demand	Source	Transformers - Peak Demand	Source
1	Plant Investment						
2	Marginal Distribution Capacity Costs	\$115,690	Att MFB-1 p1, Line 22	\$82,116	Att MFB-1 p2, Line 22	\$84,022	Att MFB-1 p3, Line 23
3	Marginal General Plant Loading Factor	10.16%	Att MFB-6 p3, Line 22	10.16%	Att MFB-6 p3, Line 22	10.16%	Att MFB-6 p3, Line 22
4							
5	Total Marginal Plant Investment	\$127,439	Line 2 x (1 + Line 3)	\$90,456	Line 2 x (1 + Line 3)	\$92,555	Line 2 x (1 + Line 3)
6							
7	Fixed Carrying Charge Rate	10.84%	Att MFB-7 p1, Col (C), Line 3	10.84%	Att MFB-7 p1, Col (C), Line 3	11.21%	Att MFB-7 p1, Col (C), Line 4
8							
9	Levelized, Annualized Cost of Marginal Plant Investment	\$13,819	Line 5 x Line 7	\$9,809	Line 5 x Line 7	\$10,377	Line 5 x Line 7
10							
11	Operations and Maintenance Expenses						
12	Marginal Operating Expense	\$35,927	Att MFB-4 p1, Line 24	\$3,410	Att MFB-4 p2, Line 25	\$1,458	Att MFB-4 p3, Line 26
13	Marginal Maintenance Expense	\$16,349	Att MFB-4 p4, Line 24	\$9,625	Att MFB-4 p5, Line 23	\$2,846	Att MFB-4 p6, Line 22
14							
15	Total Marginal O&M Expense	\$52,276	Line 12 + Line 13	\$13,035	Line 12 + Line 13	\$4,305	Line 12 + Line 13
16							
17	Administrative and General Expenses						
18	Marginal Plant related A&G per \$ of Marginal Plant Investment	3.53%	Att MFB-6 p1, Line 30	3.53%	Att MFB-6 p1, Line 30	3.53%	Att MFB-6 p1, Line 30
19	Plant related A&G Expense	\$4,505	Line 5 x Line 18	\$3,198	Line 5 x Line 18	\$3,272	Line 5 x Line 18
20							
21	Marginal Non-Plant related A&G per \$ of Marginal O&M Expense	3.73%	Att MFB-6 p1, Line 28	3.73%	Att MFB-6 p1, Line 28	3.73%	Att MFB-6 p1, Line 28
22	Non-Plant related A&G Expense	\$1,947	Line 15 x Line 21	\$486	Line 15 x Line 21	\$160	Line 15 x Line 21
23							
24	Total A&G Expense	\$6,452	Line 19 + Line 22	\$3,683	Line 19 + Line 22	\$3,432	Line 19 + Line 22
25							
26	Marginal Working Capital Calculations						
27	Marginal M&S and Prepayments per \$ of Marginal Plant Investment	2.07%	Att MFB-6 p2, Line 22	2.07%	Att MFB-6 p2, Line 22	2.07%	Att MFB-6 p2, Line 22
28	M&S Cost	\$2,642	Line 5 x Line 27	\$1,875	Line 5 x Line 27	\$1,919	Line 5 x Line 27
29							
30	Cash Working Capital Allowance Rate	6.99%	25.5 Days / 365	6.99%	25.5 Days / 365	6.99%	25.5 Days / 365
31	Working Cash O&M Allowance	\$3,654	Line 15 x Line 30 (Line 28 + Line 31) x Tax Effected Cost of Capital, Att MFB-7 p1, Col (C), Line 16	\$911	Line 15 x Line 30 (Line 28 + Line 31) x Tax Effected Cost of Capital, Att MFB-7 p1, Col (C), Line 16	\$301	Line 15 x Line 30 (Line 28 + Line 31) x Tax Effected Cost of Capital, Att MFB-7 p1, Col (C), Line 16
32	Revenue Requirement for Working Capital	\$644		\$285		\$227	
33							
34	Total Marginal Cost per MW	\$73,192	Σ Lines 9, 15, 24, 32	\$26,812	Σ Lines 9, 15, 24, 32	\$18,341	Σ Lines 9, 15, 24, 32
35	Escalator to Adjust to 2020 Rate Year	3.84%	((1 + Att MFB-7 p1, Col (C), Line 19) ²) - 1	3.84%	((1 + Att MFB-7 p1, Col (C), Line 19) ²) - 1	3.84%	((1 + Att MFB-7 p1, Col (C), Line 19) ²) - 1
36	Total Adjusted Marginal Cost per MW	\$75,999	Line 34 x (1 + Line 35)	\$27,841	Line 34 x (1 + Line 35)	\$19,045	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	\$76.00	Att MFB-8 p1, Line 36 / 1000
7	Distribution - Secondary	\$27.84	Att MFB-8 p1, Line 36 / 1000
8	Distribution - Line Transformers	\$19.04	Att MFB-8 p1, Line 36 / 1000
9			
10	Marginal Costs to Serve per kW: Distribution Primary Customer		
11	Distribution - Primary Component	\$78.89	(1 + Line 2) x Line 6
12	Total	\$78.89	
13			
14	Marginal Costs to Serve per kW: Distribution Secondary Customer		
15	Distribution - Primary Component	\$81.24	(1 + Line 3) x Line 6
16	Distribution - Secondary Component	\$29.76	(1 + Line 3) x Line 7
17	Distribution - Line Transformer Component	\$20.36	(1 + Line 3) x Line 8
18	Total	\$131.36	Σ 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	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)
1	Marginal Capacity Costs									
2	Marginal Costs to Serve per kW: Distribution Primary Customer									
3	Distribution - Primary Component	\$ 78.89	\$ 78.89	\$ 78.89	\$ 78.89	\$ 78.89		\$ 78.89	\$ 78.89	Att MFB-8 p2, Line 11
4	Distribution - Secondary Component	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	
5	Distribution - Line Transformer Component	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	
6	Total	\$ 78.89	\$ 78.89	\$ 78.89	\$ 78.89	\$ 78.89	N/A	\$ 78.89	\$ 78.89	Σ Lines 3 - 5
7	Marginal Costs to Serve per kW: Distribution Secondary Customer									
8	Distribution - Primary Component	\$ 81.24	\$ 81.24	\$ 81.24	\$ 81.24	\$ 81.24		\$ 81.24	\$ 81.24	Att MFB-8 p2, Line 15
9	Distribution - Secondary Component	\$ 29.76	\$ 29.76	\$ 29.76	\$ 29.76	\$ 29.76		\$ 29.76	\$ 29.76	Att MFB-8 p2, Line 16
10	Distribution - Line Transformer Component	\$ 20.36	\$ 20.36	\$ 20.36	\$ 20.36	\$ 20.36		\$ 20.36	\$ 20.36	Att MFB-8 p2, Line 17
11	Total	\$ 131.36	\$ 131.36	\$ 131.36	\$ 131.36	\$ 131.36	N/A	\$ 131.36	\$ 131.36	Σ Lines 8 - 10
12	Voltage Weighting Analysis									
13	Non coincident peak (kW) served at:									
14	Primary Voltage	-	-	28,652	138	-	-	-	-	- Company Data
15	Secondary Voltage	63,104	859	45,066	35,343	22,434	7	2,140	76	Company Data
16	Total	63,104	859	73,718	35,482	22,434	7	2,140	76	Σ Lines 14 - 15
17	Percent of Non coincident peak (kW)									
18	Primary Voltage	0.00%	0.00%	38.87%	0.39%	0.00%	0.00%	0.00%	0.00%	Line 14 / Line 16
19	Secondary Voltage	100.00%	100.00%	61.13%	99.61%	100.00%	100.00%	100.00%	100.00%	Line 15 / Line 16
20	Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	Σ Lines 18 - 19
21	Voltage Weighted Marginal Capacity Costs									
22	Marginal Costs to Serve per kW: Distribution Customer									
23	Distribution - Primary Component	\$ 81.24	\$ 81.24	\$ 80.33	\$ 81.23	\$ 81.24		\$ 81.24	\$ 81.24	Line 3 x Line 18 + Line 8 x Line 19
24	Distribution - Secondary Component	\$ 29.76	\$ 29.76	\$ 18.19	\$ 29.65	\$ 29.76		\$ 29.76	\$ 29.76	Line 4 x Line 18 + Line 9 x Line 19
25	Distribution - Line Transformer Component	\$ 20.36	\$ 20.36	\$ 12.45	\$ 20.28	\$ 20.36		\$ 20.36	\$ 20.36	Line 5 x Line 18 + Line 10 x Line 19
26	Total	\$ 131.36	\$ 131.36	\$ 110.97	\$ 131.16	\$ 131.36	N/A	\$ 131.36	\$ 131.36	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	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)
	Plant Investment									
1	Meters	\$ 105.00	\$ 360.20	\$ 1,605	\$ 900.80	\$ 630.20		\$ 195.20	\$ 290.20	Att MFB-2 p1, Line 8
2	General Plant Loading Factor	10.16%	10.16%	10.16%	10.16%	10.16%		10.16%	10.16%	Att MFB-6 p3, Line 22
3	Unit Costs and Loading Factor	\$ 115.66	\$ 396.78	\$ 1,768	\$ 992.28	\$ 694.20		\$ 215.02	\$ 319.67	Line 1 + (Line 1 x Line 2)
4	Fixed Charge Rate	13.15%	13.15%	13.15%	13.15%	13.15%		13.15%	13.15%	Att MFB-7 p1, Col (C), Line 6
5	Meter Carrying Costs	\$ 15.21	\$ 52.17	\$ 232.47	\$ 130.47	\$ 91.28		\$ 28.27	\$ 42.03	Line 3 x Line 4
6	Services	\$ 693.29	\$ 693.29	\$ 759.17	\$ 759.17	\$ 693.29		\$ 693.29	\$ 693.29	Att MFB-2 p1, Line 4
7	General Plant Loading Factor	10.16%	10.16%	10.16%	10.16%	10.16%		10.16%	10.16%	Att MFB-6 p3, Line 22
8	Unit Costs and Loading Factor	\$ 763.70	\$ 763.70	\$ 836.27	\$ 836.27	\$ 763.70		\$ 763.70	\$ 763.70	Line 6 + (Line 6 x Line 7)
9	Fixed Charge Rate	10.44%	10.44%	10.44%	10.44%	10.44%		10.44%	10.44%	Att MFB-7 p1, Col (C), Line 5
10	Services Carrying Costs	\$ 79.73	\$ 79.73	\$ 87.30	\$ 87.30	\$ 79.73		\$ 79.73	\$ 79.73	Line 8 x Line 9
11	Total Plant Carrying Costs	\$ 94.93	\$ 131.90	\$ 319.77	\$ 217.77	\$ 171.00		\$ 108.00	\$ 121.76	Line 5 + Line 10 + Line
12	A&G Exp Plant-Related Loading Factor	3.53%	3.53%	3.53%	3.53%	3.53%		3.53%	3.53%	Att MFB-6 p1, Line 30
13	Annualized Cost	\$ 126.02	\$ 172.92	\$ 411.83	\$ 282.41	\$ 222.54	N/A	\$ 142.60	\$ 160.06	(Line 12) x (Line 3 + Line 8 + Line) + Line 11
	Operating Expenses									
14	Plant Related O&M \$/Customer	\$ 118.17	\$ 155.95	\$ 349.96	\$ 245.72	\$ 195.91		\$ 131.52	\$ 145.58	Att MFB-5 p2, Col (G)
15	Customer Acctg & Mkg Expenses	\$ 109.64	\$ 109.64	\$ 219.28	\$ 164.46	\$ 109.64		\$ 109.64	\$ 109.64	Att MFB-5 p4, Col (F)
16	A&G Exp Non-Plant Loading Factor	3.73%	3.73%	3.73%	3.73%	3.73%		3.73%	3.73%	Att MFB-6 p1, Line 28
17	Total O&M Expense	\$ 236.30	\$ 275.48	\$ 590.45	\$ 425.46	\$ 316.94	N/A	\$ 250.15	\$ 264.73	Line 15 + Line 16 + ((Line 15 + Line 16) x Line 17)
	Working Capital- \$/Customer									
18	Materials & Supplies + Prepayments Rate	2.07%	2.07%	2.07%	2.07%	2.07%		2.07%	2.07%	Att MFB-6 p2, Line 22
19	M&S Cost	\$ 18.23	\$ 24.06	\$ 53.99	\$ 37.91	\$ 30.22		\$ 20.29	\$ 22.46	Line 20 x (Line 3 + Line 8 + Line)
20	Working Cash O&M Allowance	\$ 16.52	\$ 19.26	\$ 41.27	\$ 29.74	\$ 22.15		\$ 17.49	\$ 18.50	(Line 18) x (Att MFB-8 p1, Line 30)
21	Total Working Capital	\$ 34.75	\$ 43.31	\$ 95.26	\$ 67.65	\$ 52.38		\$ 37.78	\$ 40.96	Line 21 + Line 22
22	Working Capital Rev. Requirement	\$ 3.55	\$ 4.43	\$ 9.74	\$ 6.92	\$ 5.36	N/A	\$ 3.86	\$ 4.19	Line 23 x (Att MFB-7 p1, Col (C), Line 16)
23	Annual Customer Related Cost \$/Customer	\$ 365.87	\$ 452.83	\$ 1,012.02	\$ 714.80	\$ 544.83	N/A	\$ 396.61	\$ 428.98	Line 13 + Line 18 + Line 24
24	Escalator to Adjust to 2020 Rate Year	3.84%	3.84%	3.84%	3.84%	3.84%		3.84%	3.84%	((1 + Att MFB-7 p1, Col (C), Line 19)^2) - 1
25	Annual Customer Related Cost	\$379.90	\$470.20	\$1,050.85	\$742.22	\$565.74	N/A	\$411.82	\$445.43	Line 25 x (1 + Line 26)

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

Summary of Marginal Cost Estimates

Line No.	Description (A)	Domestic D (B)	Domestic-Opt. Peak D-10 (C)	General TOU G-1 (D)	General Long Hour G-2 (E)	General Service G-3 (F)	Outdoor Lighting M (G)	Limited All Electric T (H)	Ltd Comm Space V (I)	Total Company (J)	Explanation (K)
1	Uncollectible Factor	1.15%	1.03%	0.00%	0.21%	0.24%		0.14%	0.39%		Att MFB-5 p5, Col (F)
2	Customer Charge \$'s per month										
3	Monthly Customer Charge w/o Uncollectibles	\$ 31.66	\$ 39.18	\$ 87.57	\$ 61.85	\$ 47.14		\$ 34.32	\$ 37.12		(Att MFB-9 p1, Line 27)/12
4	Adjustment for Uncollectibles	0.36	0.40	0.00	0.13	0.11		0.05	0.15		Line 1 x Line 3
5	Monthly Customer Charge Incl. Uncollectibles	\$ 32.02	\$ 39.59	\$87.57	\$61.98	\$47.26		\$34.37	\$ 37.27		Line 3 + Line 4
6	Demand Charge \$'s per kW										
7	Distribution Demand Charge - Primary Component	81.24	81.24	80.33	81.23	81.24		81.24	81.24		Att MFB-8 p3, Line 23
8	Distribution Demand Charge - Secondary Component	29.76	29.76	18.19	29.65	29.76		29.76	29.76		Att MFB-8 p3, Line 24
9	Distribution Demand Charge - Line Transformer Component	20.36	20.36	12.45	20.28	20.36		20.36	20.36		Att MFB-8 p3, Line 25
10	Adjustment for Uncollectibles	\$1.51	\$1.35	\$0.00	\$0.27	\$0.31		\$0.18	\$0.52		(Line 7 + Line 8 + Line 9) x Line 1
11	Demand Charge Incl. Uncollectibles	\$132.88	\$132.72	\$110.97	\$131.43	\$131.68		\$131.54	\$131.88		Σ line 7 to Line 10
12	Billing Determinants (2018)										
13	Customers	35,382	440	138	907	5,670	0	964	18	43,518	Company Data
14	Non coincident peak (kW)	63,104	859	73,718	35,482	22,434	7	2,140	76	197,820	Company Data
15	Annual Energy Usage (kWh)	278,824,882	5,629,249	379,184,992	147,993,116	88,095,304	4,156,597	15,352,073	328,389	919,564,602	Company Data
16	Total Marginal Costs										
17	Total Customer-related	\$13,596,389	\$208,913	\$145,227	\$674,432	\$3,215,323		\$397,451	\$7,867	\$18,245,601	Line 5 x Line 13 x 12
18	Total Capacity-related: Demand										
19	Demand Distribution Primary	5,185,761	70,511	5,921,600	2,888,282	1,826,941		174,090	6,170	16,073,355	(1 + Line 1) x Line 7 x Line 14
20	Demand Distribution Secondary	1,899,702	25,830	1,341,253	1,054,059	669,264		63,774	2,260	5,056,142	(1 + Line 1) x Line 8 x Line 14
21	Demand Distribution Line Transformer	1,299,512	17,670	917,499	721,041	457,818		43,626	1,546	3,458,711	(1 + Line 1) x Line 9 x Line 14
22	Total Capacity-related: Demand	\$ 8,384,975	\$ 114,011	\$ 8,180,353	\$ 4,663,381	\$ 2,954,023		\$ 281,490	\$ 9,976	\$ 24,588,209	Σ line 19 to Line 21
23	Customer Subtotal	\$13,596,389	\$208,913	\$145,227	\$674,432	\$3,215,323		\$397,451	\$7,867	\$18,245,601	Line 17
24	Distribution Subtotal	8,384,975	114,011	8,180,353	4,663,381	2,954,023		281,490	9,976	24,588,209	Line 19 + Line 20 + Line 21 + Line 24 + Line 25 + Line 26
25	Marginal Cost for Fixtures						609,009			609,009	Att MFB-3 p1, 2,3, Line 20 + Att MFB-3 p4,5, Line 20
26	Total Annual Marginal Cost Excl. Fixtures	\$ 21,981,365	\$ 322,924	\$ 8,325,580	\$ 5,337,813	\$ 6,169,345	\$ -	\$ 678,940	\$ 17,843	\$ 42,833,810	Σ line 23 to Line 24
27	Share of Total Annual Marginal Cost Excl. Fixtures	51.3%	0.8%	19.4%	12.5%	14.4%	0.0%	1.6%	0.0%	100.00%	Col (n) / Col (J)
28	Total Annual Marginal Cost Incl. Fixtures	\$ 21,981,365	\$ 322,924	\$ 8,325,580	\$ 5,337,813	\$ 6,169,345	\$ 609,009	\$ 678,940	\$ 17,843	\$ 43,442,819	Σ line 23 to Line 25
28	Share of Total Annual Marginal Cost Incl. Fixtures	50.60%	0.74%	19.16%	12.29%	14.20%	1.40%	1.56%	0.04%	100.0%	Col (n) / Col (J)

Melissa F. Bartos
Assistant Vice President

Ms. Bartos is a financial and economic consultant with more than twenty years of experience in the energy industry. In the last several years, she has focused on natural gas markets issues, including conducting comprehensive market assessments for various clients considering infrastructure investments and developing detailed demand forecasts for a number of 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. Her modeling experience includes building Monte-Carlo simulation models, designing an allocated cost-of-service model, statistical modeling using SPSS, and programming using Visual Basic for Applications (VBA). Ms. Bartos has also provided expert testimony regarding natural gas demand forecasting and supply planning issues, natural gas markets, and marginal cost studies.

REPRESENTATIVE PROJECT EXPERIENCE

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 and the evaluation of natural gas resource plans for multiple northeast 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)

Assistant Vice President

Project Manager

Senior Consultant

Navigant Consulting, Inc. (1996 – 2002)

Senior Consultant

PROFESSIONAL ASSOCIATIONS

Member of the American Statistical Association

Member of the Northeast Energy and Commerce Association

Member of the Northeast Gas Association

EDUCATION

M.S., Mathematics (Statistics), University of Massachusetts at Lowell, 2003

B.A., Mathematics and Psychology, Computer Science minor, College of the Holy Cross, magna cum laude, 1998

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Connecticut Public Utilities Regulatory Authority				
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
Federal Energy Regulatory Commission				
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
Maine Public Utilities Commission				
Northern Utilities, Inc.	2011	Northern Utilities	Docket No. 2011-526	Integrated Resource Plan; Demand Forecast
Massachusetts Department of Public Utilities				
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
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

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
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
New Hampshire Public Utilities Commission				
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
New Jersey Board of Public Utilities				
South Jersey Gas Company	2015	South Jersey Gas Company	GR15010090	Energy Efficiency Cost Benefit Analysis
Ontario Energy Board				
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
Régie de l'énergie du Québec				
TransCanada Pipelines Ltd.	2014	TransCanada Pipelines Ltd.	R-3900-2014	Natural Gas Market Assessment
Washington Utilities and Transportation Commission				
Puget Sound Energy, Inc.	2015	Puget Sound Energy, Inc.	UG-151663	Distributed LNG Market Assessment