Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Incremental Production Cost Summary - LNG Peaker Unit

Line No.	Description	Company Total	Explanation
	Cost of Production-related Distribution System Reinforcement		
1	Cost of Incremental Production Capacity (2016$)		
2	Cost of Incremental LNG Capactity	$ 6,417,840	WP-MFB-1 p1 , Line12
3	Incremental Capacity	10,000	WP-MFB-1 p1 Line 13
4	Unit Cost of Incremental Production Capacity	$642	Line 2 / Line 3
5	Year of System Pressure Support Analysis	2016	
6	Base year of MCS study	2016	
7	Years Before production-related Pressure Support	0	Line 6 - Line 5
8	Discount (Inflation) rate	1.10%	MFB-7 p1 Line 17
9	Present Worth of Capacity Cost	$ 642	Line 4 x ((1 + Line 8)^ Line 7))
10	Percentage Related to Pressure Support	8.7%	MFB-1 p2 Line 10
11	Production Plant for Distribution Function (Pressure Support)	$56.05	Line 9 x Line 10

Liberty Utilities (EnergyNorth Natural Gas) Corp. MCS Study
Distribution-related Production Plant Investment

Local Production Facilities

Line No.	Plant Name	Location	Type	Rating, mscfg	Heat Rate	Hours per Day	Design Day Dth	Explanation
1	38 Bridge St	Nashua	LP-Air	600	1,250	24	18,000	Company Data
2	130 Elm St	Manchester	LP-Air	600	1,250	24	18,000	Company Data
3	130 Elm St	Manchester	LNG	220	1,050	24	5,544	Company Data
4	Broken Bridge	Concord	LNG	220	1,050	24	5,544	Company Data
5	Tilton Plant	Tilton	LP-Air	60	1,250	24	1,800	Company Data
6	Tilton Plant	Tilton	LNG	350	1,050	24	8,820	Company Data
7	Total			2,050			57,708	Σ line 1 to Line 6

Production Requirements in lieu of Distribution investments
Output Required for Pressure Support

Line No.	Plant Name	Location	Type	Rating, mscfg	Heat Rate	Hours per Day	Design Day Dth	
8	Tilton Plant	Tilton	LNG	200	1,050	24	5,040	Company Data
9	Total			200			5,040	

10	Production Allocated to Pressure Support Function	8.7%	Line 9 / Line 7

Liberty Utilities (Energy North Natural Gas) Corp.
Marginal Cost Study

Marginal Capacity Related Distribution Plant Costs for Reinforcements

Selected Model: Distribution Plant Additions for Reinforcements 2016$ = F(Design Day Demand, Design Day Demand x $\text{Dummy}_{\text{2018 to 2026}}$)

Dependent Variable				
Cumulative Annual Distribution Plant Additions for Reinforcements 2016$ $_{(2016 - 2026)}$				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-7,420,454	-6.99	0.000
Design Day Demand	Design demand	55.15	8.34	0.000
Interactive: Design Day Demand x Years 2018 to 2026	I_18_26xDD	8.18	6.39	0.000
Model Statistics				
R_Squared	0.984			
Mean Absolute % Error (MAPE)	5.999			
Passes ACF/PACF	Yes			

Marginal Cost Calculation

Distribution Plant Additions for Reinforcements = - $7,420,454 + $55.15 x Design demand + $8.18 x I_18_26xDD

For the period prior to 2018:

∂ Distribution Plant Additions for Reinforcements / ∂ Design Day Demand = $55.15 per Dth

For the period 2018 and beyond:

$\boxed{\text{∂ Distribution Plant Additions for Reinforcements / ∂ Design Day Demand = \$63.33 per Dth}}$

Liberty Utilities (Energy North Natural Gas) Corp.
Marginal Cost Study

Marginal Capacity Related Distribution Plant Costs for Main Extensions

Selected Model: Distribution Plant Additions for Main Extensions 2016$ = F(Design Day Demand, Design Day Demand x Dummy$_{2012\text{ to }2016}$, Dummy$_{2000}$, Dummy$_{2012\text{ to }2016}$, Dummy$_{2002\text{ to }2004}$)

Dependent Variable				
Cumulative Annual Distribution Plant Additions for Main Extensions 2016$ $_{(1989 - 2016)}$				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	-154,293,378	-17.74	0.000
Design Day Demand	Design Day Demand	1,672.54	23.34	0.000
Interactive: Design Day Demand x Years 2012 to 2016	I_12_16	-1,167.36	-2.95	0.007
Dummy: 2000	D_00	-19,451,333	-3.05	0.006
Dummy: 2012 to 2016	D_12_16	181,754,420	3.04	0.006
Dummy: 2002 to 2004	D_02_04	21,550,107	5.60	0.000
Model Statistics				
R_Squared	0.977			
Mean Absolute % Error (MAPE)	15.480			
Passes ACF/PACF	Yes			

Marginal Cost Calculation

Distribution Plant Additions for Main Extensions = - $154,293,378 + $1,672.54 x Design Day Demand + - $1,167.36 x I_12_16 + - $19,451,333 x D_00 + $181,754,420 x D_12_16 + $21,550,107 x D_02_(

For the period prior to 2012:

∂ Distribution Plant Additions for Main Extensions / ∂ Design Day Demand = $1,672.54 per Dth

For the period 2012 and beyond:

∂ Distribution Plant Additions for Main Extensions / ∂ Design Day Demand = $505.18 per Dth

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Services and Meters Plant Investment

Line No.	Description	R-1	R-3 R-4	G-41	G-42	G-43	G-51	G-52	G-53	G-54	Explanation
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1	**Service Costs**										
2	Representative Cost	$4,918	$4,918	$4,918	$7,300	$10,913	$4,918	$7,300	$23,006	$54,416	Company Data
3	Customers per Service	1.32	1.32	1.32	1.00	1.00	1.32	1.00	1.00	1.00	Company Data
4	Average Service Cost per Customer	$3,738	$3,738	$3,738	$7,300	$10,913	$3,738	$7,300	$23,006	$54,416	Line 2 / Line 3
5	**Meter Costs**										
6	Current Unit Cost for Metering	$310	$310	$979	$2,433	$6,025	$979	$1,617	$7,312	$9,675	Company Data
7	Meters per Customer	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	Company Data
8	Average Meter Cost per Customer	$310	$310	$979	$2,433	$6,025	$979	$1,617	$7,312	$9,675	Line 6 * Line 7
9	Total	$4,048	$4,048	$4,717	$9,733	$16,937	$4,717	$8,917	$30,318	$64,091	Line 4 + Line 8

Liberty Utilities (Energy North Natural Gas) Corp.
Marginal Cost Study

Marginal Capacity Related Production (Pressure Support) Expense

1 **Selected Model:** Capacity Related Production Expense 2016$ = F(Design Day Demand, Design Day Demand x Dummy$_{2006\text{ to }2016}$, Dummy$_{2006\text{ to }2016}$, Lag 1)

2

		Database variable name	Coefficient value	t test	Significance
3	Dependent Variable				
4	Total Capacity Related Production Expense 2016$ $_{(1989\text{ - }2016)}$				
5	Explanatory Variables	Database variable name	Coefficient value	t test	Significance
6	Constant	Constant	2,515,397	4.55	0.000
7	Design Day Demand	Design Day Demand	-13.92	-2.87	0.009
8	Interactive: Design Day Demand x Years 2006 to 2016	I_06_16	34.49	2.62	0.015
9	Dummy: 2006 to 2016	D_06_16	-4,861,773	-2.64	0.015
10	Autoregressive Term Lag 1	Lag 1	0.56	2.91	0.008
11	Model Statistics				
12	R_Squared	0.769			
13	Mean Absolute % Error (MAPE)	16.892			
14	Passes ACF/PACF	Yes			

15

16 Marginal Cost Calculation

17 Capacity Related Production Expense = $2,515,397 + - $13.92 x Design Day Demand + $34.49 x I_06_16 + - $4,861,773 x D_06_16 + $0.56 x Lag 1

18

19 For the period prior to 2006:

20 ∂ Capacity Related Production Expense / ∂ Design Day Demand = - $13.92 per Dth

21

22 For the period 2006 and beyond:

23	∂ Capacity Related Production Expense / ∂ Design Day Demand = $20.57 per Dth			
24	Percentage Related to Distribution Function		8.7%	MFB-1 p1, Line 10
25	Distribution Related O&M Expense	$	1.80	Line 23 x Line 24

Liberty Utilities (Energy North Natural Gas) Corp.
Marginal Cost Study

Marginal Capacity Related Distribution Operations & Maintenance Expense

Selected Model: Capacity Related Distribution Operations & Maintenance Expense 2016$ = F(Design Day Demand, Dummy_{2010}, $\text{Dummy}_{2014\text{ to }2016}$)

Dependent Variable				
Total Capacity Related Distribution Operations & Maintenance Expense 2016$ $_{(1989 - 2016)}$				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	422,350	0.57	0.575
Design Day Demand	Design Day Demand	29.43	4.86	0.000
Dummy: 2010	D_10	1,200,663	2.10	0.047
Dummy: 2014 to 2016	D_14_16	2,312,231	5.84	0.000
Model Statistics				
R_Squared	0.845			
Mean Absolute % Error (MAPE)	8.626			
Passes ACF/PACF	Yes			

Marginal Cost Calculation

Capacity Related Distribution Operations & Maintenance Expense = $422,350 + $29.43 x Design Day Demand + $1,200,663 x D_10 + $2,312,231 x D_14_16

$\boxed{\partial \text{ Capacity Related Distribution Operations \& Maintenance Expense} / \partial \text{ Design Day Demand} = \$29.43 \text{ per Dth}}$

Liberty Utilities (Energy North Natural Gas) Corp.
Marginal Cost Study

Marginal Customer Related Distribution Operations & Maintenance Expense

Selected Model: Customer Related Distribution Operations & Maintenance Expense 2016\$ = F(Annual Customers, $\text{Dummy}_{\text{2003 to 2013}}$, Dummy_{2012}, Dummy_{2010}, Dummy_{2014}, $\text{Dummy}_{\text{2009 and beyond}}$, $\text{Dummy}_{\text{2000 and beyond}}$, Annual Customers x $\text{Dummy}_{\text{1989 to 1998}}$, $\text{Dummy}_{\text{1989 to 1998}}$, Dummy_{2002}, Dummy_{2008})

Dependent Variable				
Total Customer Related Distribution Operations & Maintenance Expense 2016\$ $_{\text{(1989 - 2016)}}$				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	1,580,466	1.32	0.205
Annual Customers	Annual Customers	45.81	2.76	0.014
Dummy: 2003-2013	D_03_13	-1,338,653	-11.56	0.000
Dummy: 2012	D_12	-802,921	-3.85	0.001
Dummy: 2010	D_10	757,108	3.53	0.003
Dummy: 2014	D_14	794,581	3.75	0.002
Dummy: 2009 and After	D_09_After	808,377	4.55	0.000
Dummy: 2000 and After	D_00_After	-781,318	-3.27	0.005
Interactive: Annual Customers x Years 1989 to 1998	I_89_98	-116.91	-4.89	0.000
Dummy: 1989 to 1998	D_89_98	8,302,254	5.11	0.000
Dummy: 2002	D_02	-1,025,833	-4.70	0.000
Dummy: 2008	D_08	562,638	2.68	0.016
Model Statistics				
R_Squared	0.981			
Mean Absolute % Error (MAPE)	2.184			
Passes ACF/PACF	Yes			

Marginal Cost Calculation

Customer Related Distribution Operations & Maintenance Expense = \$1,580,466 + \$45.81 x Annual Customers + - \$1,338,653 x D_03_13 + - \$802,921 x D_12 + \$757,108 x D_10 + \$794,581 x D_14 + \$808,377 x D_09_After + - \$781,318 x D_00_After + - \$116.91 x I_89_98 + \$8,302,254 x D_89_98 + - \$1,025,833 x D_02 + \$562,638 x D_08

For the period prior to 1999:

∂ Customer Related Distribution Operations & Maintenance Expense / ∂ Annual Customers = - \$71.09 per Customer

For the period 1999 and beyond:

∂ Customer Related Distribution Operations & Maintenance Expense / ∂ Annual Customers = \$45.81 per Customer

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study

Class Weighted Customer 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)
		WP-MFB-BillingDets, Col (E) Lines 2 to 12	MFB-2 p1, Line 9	Col (B) x Col (C)	Col (C) Line n / Line 11	Col (G) Line 10	Col (E) x (F)
1	R-1	3,036	$4,048	12,289,041	0.946	$45.81	$43.35
2	R-3, R-4	76,093	$4,048	308,014,867	0.946	$45.81	$43.35
3	G-41	8,517	$4,717	40,171,435	1.103	$45.81	$50.51
4	G-42	1,714	$9,733	16,679,624	2.275	$45.81	$104.23
5	G-43	51	$16,937	856,504	3.959	$45.81	$181.38
6	G-51	1,251	$4,717	5,901,435	1.103	$45.81	$50.51
7	G-52	309	$8,917	2,750,838	2.084	$45.81	$95.49
8	G-53	34	$30,318	1,017,677	7.087	$45.81	$324.68
9	G-54	27	$64,091	1,760,359	14.981	$45.81	$686.35
10	Total	91,031		389,441,781			$45.81
11	Avg Cost per Customer		$4,278				

Liberty Utilities (Energy North Natural Gas) Corp.
Marginal Cost Study

Marignal Customer Accounting & Marketing Expense

Selected Model: Customer Related Expense 2016$ = F(Annual Customers, Dummy_{2012}, Annual Customers x $\text{Dummy}_{2005\text{ to }2016}$, $\text{Dummy}_{2005\text{ to }2016}$, Dummy_{2011}, $\text{Dummy}_{2001\text{ to }2002}$, Dummy_{1989})

Dependent Variable				
Total Customer Related Expense 2016$ $_{(1989 - 2016)}$				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	14,283,323	10.12	0.000
Annual Customers	Annual Customers	(136.00)	-6.57	0.000
Dummy: 2012	D_12	5,491,884	11.29	0.000
Interactive: Annual Customers x Years 2005 to 2016	I_05_16	214.30	4.05	0.001
Dummy: 2005 to 2016	D_05_16	(16,278,569)	-3.70	0.001
Dummy: 2011	D_11	3,469,154	7.13	0.000
Dummy: 2001 to 2002	D_01_02	(2,497,309)	-6.56	0.000
Dummy: 1989	D_89	(1,327,716)	-2.57	0.018
Model Statistics				
R_Squared	0.943			
Mean Absolute % Error (MAPE)	6.863			
Passes ACF/PACF	Yes			

Marginal Cost Calculation

Customer Related Expense = $14,283,323 + - $136.00 x Annual Customers + $5,491,884 x D_12 + $214.30 x I_05_16 + - $16,278,569 x D_05_16 + $3,469,154 x D_11 + - $2,497,309 x D_01_02 + - $1,327,716 x D_89

For the period prior to 2005:

∂ Customer Related Expense / ∂ Annual Customers = - $136.00 per Customer

For the period 2005 and beyond:

∂ Customer Related Expense / ∂ Annual Customers = $78.30 per Customer

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Class Weighted Bad Debt Accounts Expense

Line No.	Rate Class	Gross Bad Debt Expense 2016	Percent of Total	Adjusted Bad Debt Accounts Expense	Total Normalized Distribution Revenues	Bad Debt Expense Percentage
	(A)	(B) Company Data	(C) Col (B) line (n) / Col (B) Line 10	(D) Col (C) line(n) x Col (D) Line 10	(E) WP-MFB-BillingDets, Col (F)	(F) Col (D) / Col (E)
1	R-1	$ 73,686	2.73%	$40,772	$694,481	5.87%
2	R-3, R-4	$ 2,349,579	87.17%	$1,300,068	$37,445,217	3.47%
3	G-41	$ 156,699	5.81%	$86,705	$11,202,908	0.77%
4	G-42	$ 47,970	1.78%	$26,542	$12,451,487	0.21%
5	G-43	$ -	0.00%	$0	$2,244,971	0.00%
6	G-51	$ 36,289	1.35%	$20,080	$1,390,812	1.44%
7	G-52	$ 31,077	1.15%	$17,196	$1,585,741	1.08%
8	G-53	$ -	0.00%	$0	$1,376,073	0.00%
9	G-54	$ -	0.00%	$0	$931,478	0.00%
10	Total	2,695,300	100.00%	1,491,362	69,323,169	2.15%

Liberty Utilities (Energy North Natural Gas) Corp.
Marginal Cost Study

Plant Related A&G Marginal Loading Factor

Selected Model: Plant Related A&G = F(Total Utility Plant, Total Utility Plant x $\text{Dummy}_{2012\text{ to }2016}$, Total Utility Plant x $\text{Dummy}_{2003\text{ to }2011}$, Dummy_{2000}, Dummy_{2011}, $\text{Dummy}_{1989\text{ to }2000}$)

Dependent Variable				
Total Plant Related A&G $_{(1989 - 2016)}$				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	147,260	0.50	0.623
Total Utility Plant	Total Utility Plant	0.0044	2.91	0.008
Interactive: Total Utility Plant x Years 2012 to 2016	I_12_16	-0.0023	-2.58	0.018
Interactive: Total Utility Plant x Years 2003 to 2011	I_03_11	-0.0024	-3.29	0.004
Dummy: 2000	D_00	595,156	3.11	0.005
Dummy: 2011	D_11	-461,470	-2.37	0.027
Dummy: 1989 to 2000	D_89_00	695,819	4.67	0.000
Model Statistics				
R_Squared	0.875			
Mean Absolute % Error (MAPE)	12.647			
Passes ACF/PACF	Yes			

Marginal Cost Calculation

Plant Related A&G = $147,260 + $0.00443 x Total Utility Plant + - $0.002 x I_12_16 + - $0.0024 x I_03_11 + $595,156 x D_00 + - $461,470 x D_11 + $695,819 x D_89_00

For the period prior to 2003:

∂ Plant Related A&G / ∂ Total Utility Plant = $0.0044 per dollar of Utility Plant

For the period 2003-2011:

∂ Plant Related A&G / ∂ Total Utility Plant = $0.0021 per dollar of Utility Plant

For the period 2012 and beyond:

∂ Plant Related A&G / ∂ Total Utility Plant = $0.0021 per dollar of Utility Plant

Liberty Utilities (Energy North Natural Gas) Corp.
Marginal Cost Study

Non-Plant Related A&G Marginal Loading Factor

Selected Model: Non-Plant Related A&G = F(Adjusted O&M, Adjusted O&M x $\text{Dummy}_{2003\text{ to }2016}$, $\text{Dummy}_{2003\text{ to }2016}$, $\text{Dummy}_{2012\text{ to }2013}$, $\text{Dummy}_{1989\text{ to }2001}$)

Dependent Variable				
Total Non-Plant Related A&G $_{(1989 - 2016)}$				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	12,211,225	4.79	0.000
Adjusted O&M	Adjusted O&M	-1.150	-3.21	0.004
Interactive: Adjusted O&M x Years 2003 to 2016	I_03_16	1.698	4.61	0.000
Dummy: 2003 to 2016	D_03_16	-12,337,744	-4.35	0.000
Dummy: 2012 to 2013	D_12_13	6,232,487	7.03	0.000
Dummy: 1989 to 2001	D_89_01	5,502,395	3.18	0.004
Model Statistics				
R_Squared	0.860			
Mean Absolute % Error (MAPE)	11.001			
Passes ACF/PACF	Yes			

Marginal Cost Calculation

Non-Plant Related A&G = $12,211,225 + - $1.15 x Adjusted O&M + $1.70 x I_03_16 + - $12,337,744 x D_03_16 + $6,232,487 x D_12_13 + $5,502,395 x D_89_01

For the period prior to 2003:

∂ Non-Plant Related A&G / ∂ Adjusted O&M = - $1.150 per dollar of O&M

For the period 2003 and beyond:

$\boxed{\partial \text{ Non-Plant Related A\&G } / \partial \text{ Adjusted O\&M} = \$0.548 \text{ per dollar of O\&M}}$

Liberty Utilities (Energy North Natural Gas) Corp.
Marginal Cost Study

Materials & Supplies and Prepayments Marginal Loading Factor

Selected Model: Materials & Supplies and Prepayments = F(Total Utility Plant, Total Utility Plant x $\text{Dummy}_{2012\text{ to }2016}$, Total Utility Plant x $\text{Dummy}_{2003\text{ to }2011}$, $\text{Dummy}_{2003\text{ to }2011}$, Dummy_{2013})

Dependent Variable				
Materials & Supplies and Prepayments $_{(1989\text{ - }2016)}$				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	4,518,784	5.60	0.000
Total Utility Plant	Total Utility Plant	-0.015	-2.67	0.014
Interactive: Total Utility Plant x Years 2012 to 2016	I_12_16	0.017	4.52	0.000
Interactive: Total Utility Plant x Years 2003 to 2011	I_03_11	0.025	3.04	0.006
Dummy: 2003 to 2011	D_03_11	-6,846,387	-3.56	0.002
Dummy: 2013	D_13	-2,473,288	-3.12	0.005
Model Statistics				
R_Squared	0.863			
Mean Absolute % Error (MAPE)	106.631			
Passes ACF/PACF	Yes			

Marginal Cost Calculation

Materials & Supplies and Prepayments = $4,518,784 + - $0.02 x Total Utility Plant + $0.02 x I_12_16 + $0.03 x I_03_11 + - $6,846,387 x D_03_11 + - $2,473,288 x D_13

For the period prior to 2003:

∂ Materials & Supplies and Prepayments / ∂ Total Utility Plant = - $0.015 per dollar of Utility Plant

For the period 2003-2011:

∂ Materials & Supplies and Prepayments / ∂ Total Utility Plant = $0.010 per dollar of Utility Plant

For the period 2012 and beyond:

∂ Materials & Supplies and Prepayments / ∂ Total Utility Plant = $0.002 per dollar of Utility Plant

Liberty Utilities (Energy North Natural Gas) Corp.
Marginal Cost Study

General Plant Marginal Loading Factor

Selected Model: General Plant = F(Total Utility Plant, $\text{Dummy}_{2012 \text{ to } 2014}$)

Dependent Variable				
General Plant $_{(1989 - 2016)}$				
Explanatory Variables	Database variable name	Coefficient value	t test	Significance
Constant	Constant	2,565,407	4.40	0.000
Total Utility Plant	Total Utility Plant	0.040	16.22	0.000
Dummy: 2012 to 2014	D_12_14	-7,295,432	-8.75	0.000
Model Statistics				
R_Squared	0.914			
Mean Absolute % Error (MAPE)	8.418			
Passes ACF/PACF	Yes			

Marginal Cost Calculation

General Plant = $2,565,407 + $0.040 x Total Utility Plant + - $7,295,432 x D_12_14

∂ General Plant / ∂ Total Utility Plant = $0.040 per dollar of Utility Plant

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Summary of Levelized Fixed Carrying 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			
			Over	
2	Levelized Cost for:		Book Life	
3	Production Plant	12.95%	11.42%	MFB-7 p3, Line 13
4	Mains (Cap-related Dist)	12.45%	10.58%	MFB-7 p4, Line 13
5	Services Investment	12.01%	10.39%	MFB-7 p5, Line 13
6	Meters Investment	13.32%	11.92%	MFB-7 p6, Line 13
7	Cost of Capital			
8	Debt	4.43%	50.00%	WP-MFB-7 p1, Line 1
9	Preferred	0.00%	0.00%	WP-MFB-7 p1, Line 2
10	Common	10.30%	50.00%	WP-MFB-7 p1, Line 3
11	Other	0.00%	0.00%	WP-MFB-7 p1, Line 4
12	Weighted Cost of Capital		7.363%	
13	After Tax Cost of New Capital		6.49%	WP-MFB-7 p1, Line 8
14	Incremental Tax Rate		39.41%	WP-MFB-7 p1, Line 6
15	Tax Effected Cost of Capital		10.71%	WP-MFB-7 p1, Line 5
16	Property Tax Rate		2.91%	WP-MFB-7 p1, Line 7
17	Inflation Rate		1.10%	WP-MFB-7 p1, Line 9
18	Property Tax Escalation Rate		2.50%	WP-MFB-7 p1, Line 10

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Levelized Fixed Carrying Charge Analysis, Input Data

Line No.	Variable	Peaking Plant	Capacity - Related Distribution	Services	Meters	Explanation
	(A)	(B)	(C)	(D)	(E)	(F)
1	Plant Data					
2	Capitalized Cost	$1,000	$1,000	$1,000	$1,000	
3	Book Life	35	59	45	29	MFB-7 p8, Col (D)
4	Salvage Value	0%	-15%	-60%	0%	MFB-7 p8, Col (E)
5	MACRS Life	20	20	20	20	
6	Capital Structure					
7	Debt Ratio	50.00%	50.00%	50.00%	50.00%	MFB-7 p1, Col (C), Line 8
8	Preferred Ratio	0.00%	0.00%	0.00%	0.00%	MFB-7 p1, Col (C), Line 9
9	Common Ratio	50.00%	50.00%	50.00%	50.00%	MFB-7 p1, Col (C), Line 10
10	Other	0.00%	0.00%	0.00%	0.00%	MFB-7 p1, Col (C), Line 11
11	Cost of Capital					
12	Debt Cost	4.43%	4.43%	4.43%	4.43%	MFB-7 p1, Col (B), Line 8
13	Preferred Cost	0.00%	0.00%	0.00%	0.00%	MFB-7 p1, Col (B), Line 9
14	Common Cost	10.30%	10.30%	10.30%	10.30%	MFB-7 p1, Col (B), Line 10
15	Other	0.00%	0.00%	0.00%	0.00%	MFB-7 p1, Col (B), Line 11
16	Wtd Cost Of Capital	7.36%	7.36%	7.36%	7.36%	(Line 7 xLine 12) + (Line 8 xLine 13) + (Line 9xLine 14) + (Line 10xLine 15)
17	After Tax Cost of Capital	6.49%	6.49%	6.49%	6.49%	MFB-7 p1, Col (C), Line 13
18	Tax Data					
19	Tax Rate	39.41%	39.41%	39.41%	39.41%	MFB-7 p1, Col (C), Line 14
20	Property Tax Rate	2.91%	2.91%	2.91%	2.91%	MFB-7 p1, Col (C), Line 16
21	Property Insurance	0.01%	0.01%	0.01%	0.01%	WP-MFB-7 p2, Line 3
22	Property Tax Basis	Dep Bal	Dep Bal	Dep Bal	Dep Bal	
23	Misc. Data					
24	Inflation Rate	1.10%	1.10%	1.10%	1.10%	MFB-7 p1, Col (C), Line 17
25	Prop Tax Escalation Rate	2.50%	2.50%	2.50%	2.50%	MFB-7 p1, Col (C), Line 18
26	Return on Rate Base calculation	EOY	EOY	EOY	EOY	

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Levelized Fixed Carrying Charge Analysis
Peaker Plant

		-- Current Dollars -- (Engineer's FCR)		-- Constant Dollars -- (Economist's FCR)	
Line No.	Item	Current Levelized Dollars	Percent Of Capital Investment	Constant Levelized Dollars	Percent Of Capital Investment
	(A)	(B) MFB-7 p7A	(C) Col (B) x 0.001	(D) MFB-7 p7A	(E) Col (D) x 0.001
1	Interest On Debt	$12.69	1.27%	$11.19	1.12%
2	Return On Preferred	$0.00	0.00%	$0.00	0.00%
3	Return On Common	$29.55	2.95%	$26.05	2.61%
4	Return	$42.24	4.22%	$37.24	3.72%
5	Depreciation	$28.57	2.86%	$25.19	2.52%
6	Income Tax	$14.22	1.42%	$12.54	1.25%
7	Deferred Taxes	$5.00	0.50%	$4.40	0.44%
8	Income Tax	$19.22	1.92%	$16.94	1.69%
9	Revenue Tax	$0.00	0.00%	$0.00	0.00%
10	Property Tax	$39.27	3.93%	$34.63	3.46%
11	Property Insurance	$0.17	0.02%	$0.15	0.01%
12	Other	$39.44	3.94%	$34.78	3.48%
13	Total Revenue Required	$129.48	12.95%	$114.15	11.42%

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Levelized Fixed Carrying Charge Analysis
Capacity Related Distribution

		Current Dollars (Engineer's FCR)		Constant Dollars (Economist's FCR)	
Line No.	Item	Current Levelized Dollars	Percent Of Capital Investment	Constant Levelized Dollars	Percent Of Capital Investment
	(A)	(B) MFB-7 p7B	(C) Col (B) x 0.001	(D) MFB-7 p7B	(E) Col (D) x 0.001
1	Interest On Debt	$13.08	1.31%	$11.11	1.11%
2	Return On Preferred	$0.00	0.00%	$0.00	0.00%
3	Return On Common	$30.44	3.04%	$25.86	2.59%
4	Return	$43.51	4.35%	$36.98	3.70%
5	Depreciation	$19.42	1.94%	$16.51	1.65%
6	Income Tax	$12.54	1.25%	$10.66	1.07%
7	Deferred Taxes	$7.26	0.73%	$6.17	0.62%
8	Income Tax	$19.80	1.98%	$16.82	1.68%
9	Revenue Tax	$0.00	0.00%	$0.00	0.00%
10	Property Tax	$41.64	4.16%	$35.38	3.54%
11	Property Insurance	$0.17	0.02%	$0.15	0.01%
12	Other	$41.81	4.18%	$35.53	3.55%
13	Total Revenue Required	$124.54	12.45%	$105.83	10.58%

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Levelized Fixed Carrying Charge Analysis
Services Investment

		Current Dollars (Engineer's FCR)		Constant Dollars (Economist's FCR)	
Line No.	Item	Current Levelized Dollars	Percent Of Capital Investment	Constant Levelized Dollars	Percent Of Capital Investment
	(A)	(B) MFB-7 p7C	(C) Col (B) x 0.001	(D) MFB-7 p7C	(E) Col (D) x 0.001
1	Interest On Debt	$10.60	1.06%	$9.17	0.92%
2	Return On Preferred	$0.00	0.00%	$0.00	0.00%
3	Return On Common	$24.67	2.47%	$21.34	2.13%
4	Return	$35.27	3.53%	$30.51	3.05%
5	Depreciation	$35.56	3.56%	$30.75	3.08%
6	Income Tax	$13.73	1.37%	$11.88	1.19%
7	Deferred Taxes	$2.31	0.23%	$2.00	0.20%
8	Income Tax	$16.05	1.60%	$13.88	1.39%
9	Revenue Tax	$0.00	0.00%	$0.00	0.00%
10	Property Tax	$33.06	3.31%	$28.60	2.86%
11	Property Insurance	$0.15	0.01%	$0.13	0.01%
12	Other	$33.21	3.32%	$28.73	2.87%
13	Total Revenue Required	$120.08	12.01%	$103.87	10.39%

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Levelized Fixed Carrying Charge Analysis
Metering Equipment

		Current Dollars (Engineer's FCR)		Constant Dollars (Economist's FCR)	
Line No.	Item	Current Levelized Dollars	Percent Of Capital Investment	Constant Levelized Dollars	Percent Of Capital Investment
	(A)	(B)	(C)	(D)	(E)
		MFB-7 p7D	Col (B) x 0.001	MFB-7 p7D	Col (D) x 0.001
1	Interest On Debt	$12.54	1.25%	$11.22	1.12%
2	Return On Preferred	$0.00	0.00%	$0.00	0.00%
3	Return On Common	$29.19	2.92%	$26.12	2.61%
4	Return	$41.74	4.17%	$37.34	3.73%
5	Depreciation	$34.48	3.45%	$30.85	3.09%
6	Income Tax	$15.34	1.53%	$13.73	1.37%
7	Deferred Taxes	$3.65	0.36%	$3.26	0.33%
8	Income Tax	$18.99	1.90%	$16.99	1.70%
9	Revenue Tax	$0.00	0.00%	$0.00	0.00%
10	Property Tax	$37.83	3.78%	$33.85	3.38%
11	Property Insurance	$0.17	0.02%	$0.15	0.01%
12	Other	$38.00	3.80%	$34.00	3.40%
13	Total Revenue Required	$133.20	13.32%	$119.19	11.92%

Liberty Utilities (EnergyNorth Natural Gas) Corp. - Development of Revenue Requirements Stream
Peaker Plant

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 Revenue Requirements	% of Original Investment Revenue	Present 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	967.91	21.42	0.00	49.85	37.50	3.7500%	28.57	3.52	73.34	28.90		29.12	0.15	161.53	16.15%	151.69
2	922.15	20.40	0.00	47.49	72.19	7.219%	28.57	17.19	34.76	13.70		29.85	0.15	157.36	15.74%	138.76
3	878.52	19.44	0.00	45.24	66.77	6.677%	28.57	15.05	36.47	14.37		30.60	0.15	153.43	15.34%	127.05
4	836.87	18.52	0.00	43.10	61.77	6.177%	28.57	13.08	37.93	14.95		31.36	0.15	149.74	14.97%	116.44
5	797.04	17.63	0.00	41.05	57.13	5.713%	28.57	11.25	39.19	15.44		32.15	0.16	146.26	14.63%	106.80
6	758.90	16.79	0.00	39.08	52.85	5.285%	28.57	9.57	40.23	15.85		32.95	0.16	142.98	14.30%	98.04
7	722.33	15.98	0.00	37.20	48.88	4.888%	28.57	8.00	41.09	16.19		33.78	0.16	139.88	13.99%	90.07
8	687.19	15.20	0.00	35.39	45.22	4.522%	28.57	6.56	41.76	16.46		34.62	0.16	136.97	13.70%	82.82
9	652.30	14.43	0.00	33.59	44.62	4.462%	28.57	6.32	39.40	15.53		35.49	0.16	134.10	13.41%	76.14
10	617.41	13.66	0.00	31.80	44.61	4.461%	28.57	6.32	36.44	14.36		36.37	0.17	131.25	13.12%	69.98
11	582.51	12.89	0.00	30.00	44.62	4.462%	28.57	6.32	33.46	13.19		37.28	0.17	128.42	12.84%	64.30
12	547.62	12.12	0.00	28.20	44.61	4.461%	28.57	6.32	30.51	12.02		38.21	0.17	125.62	12.56%	59.06
13	512.72	11.34	0.00	26.41	44.62	4.462%	28.57	6.32	27.53	10.85		39.17	0.17	122.84	12.28%	54.23
14	477.83	10.57	0.00	24.61	44.61	4.461%	28.57	6.32	24.58	9.69		40.15	0.17	120.08	12.01%	49.79
15	442.93	9.80	0.00	22.81	44.62	4.462%	28.57	6.32	21.60	8.51		41.15	0.17	117.35	11.73%	45.69
16	408.04	9.03	0.00	21.01	44.61	4.461%	28.57	6.32	18.64	7.35		42.18	0.18	114.64	11.46%	41.91
17	373.14	8.26	0.00	19.22	44.62	4.462%	28.57	6.32	15.67	6.17		43.24	0.18	111.96	11.20%	38.44
18	338.25	7.48	0.00	17.42	44.61	4.461%	28.57	6.32	12.71	5.01		44.32	0.18	109.30	10.93%	35.24
19	303.36	6.71	0.00	15.62	44.62	4.462%	28.57	6.32	9.74	3.84		45.42	0.18	106.67	10.67%	32.30
20	268.46	5.94	0.00	13.83	44.61	4.461%	28.57	6.32	6.78	2.67		46.56	0.18	104.07	10.41%	29.59
21	242.36	5.36	0.00	12.48	22.31	2.231%	28.57	(2.47)	26.86	10.59		47.72	0.19	102.44	10.24%	27.35
22	225.05	4.98	0.00	11.59	0.00		28.57	(11.26)	47.70	18.80		48.92	0.19	101.78	10.18%	25.52
23	207.74	4.60	0.00	10.70	0.00		28.57	(11.26)	46.23	18.22		50.14	0.19	101.16	10.12%	23.81
24	190.43	4.21	0.00	9.81	0.00		28.57	(11.26)	44.76	17.64		51.39	0.19	100.56	10.06%	22.23
25	173.11	3.83	0.00	8.92	0.00		28.57	(11.26)	43.29	17.06		52.68	0.19	99.99	10.00%	20.76
26	155.80	3.45	0.00	8.02	0.00		28.57	(11.26)	41.81	16.48		54.00	0.20	99.45	9.95%	19.39
27	138.49	3.06	0.00	7.13	0.00		28.57	(11.26)	40.34	15.90		55.35	0.20	98.95	9.90%	18.11
28	121.18	2.68	0.00	6.24	0.00		28.57	(11.26)	38.87	15.32		56.73	0.20	98.48	9.85%	16.93
29	103.87	2.30	0.00	5.35	0.00		28.57	(11.26)	37.40	14.74		58.15	0.20	98.05	9.80%	15.83
30	86.56	1.92	0.00	4.46	0.00		28.57	(11.26)	35.93	14.16		59.60	0.21	97.65	9.76%	14.80
31	69.25	1.53	0.00	3.57	0.00		28.57	(11.26)	34.46	13.58		61.09	0.21	97.29	9.73%	13.85
32	51.93	1.15	0.00	2.67	0.00		28.57	(11.26)	32.99	13.00		62.62	0.21	96.96	9.70%	12.96
33	34.62	0.77	0.00	1.78	0.00		28.57	(11.26)	31.51	12.42		64.18	0.21	96.68	9.67%	12.14
34	17.31	0.38	0.00	0.89	0.00		28.57	(11.26)	30.04	11.84		65.79	0.21	96.43	9.64%	11.37
35	0.00	0.00	0.00	0.00	0.00		28.57	(11.26)	28.57	11.26		67.43	0.22	96.22	9.62%	10.65
Total		$ 307.83	$ -	$ 716.53	$ 1,000.00	$ 1.00	$ 1,000.00	$ (0.00)	$ 1,182.59	$ 466.06	$ -	$ 1,599.76	$ 6.35	$ 4,096.52	409.65%	$ 1,774.02
Present Worth		$173.93	$ -	$ 404.85	$ 565.13	$ 0.57	$ 391.47	$ 68.44	$ 494.52	$ 194.89	$ -	$ 538.11	$ 2.32	$ 1,774.02	$1.77	$ 1,025.88
Levelized Payment		$12.69	$ -	$ 29.55	$ 41.25	$ 0.04	$ 28.57	$ 5.00	$ 36.09	$ 14.22	$ -	$ 39.27	$ 0.17	$ 129.48	12.95%	
Current Levelized Payment		$ 11.19	$ -	$ 26.05	$ 36.36	$ 0.04	$ 25.19	$ 4.40	$ 31.82	$ 12.54	$ -	$ 34.63	$ 0.15	$ 114.15	11.42%	

Liberty Utilities (EnergyNorth Natural Gas) Corp. - Development of Revenue Requirements Stream
Capacity Related Distribution

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 Revenue Requirements	% of Original Investment Revenue	Present 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	973.45	21.54	0.00	50.13	37.50	3.750%	19.42	7.12	64.66	25.48		29.12	0.15	152.98	15.30%	143.65
2	933.23	20.65	0.00	48.06	72.19	7.219%	19.42	20.80	26.56	10.47		29.85	0.15	149.40	14.94%	131.74
3	895.15	19.81	0.00	46.10	66.77	6.677%	19.42	18.66	28.74	11.33		30.60	0.15	146.07	14.61%	120.95
4	859.04	19.01	0.00	44.24	61.77	6.177%	19.42	16.69	30.67	12.09		31.36	0.15	142.96	14.30%	111.17
5	824.75	18.25	0.00	42.47	57.13	5.713%	19.42	14.86	32.40	12.77		32.15	0.16	140.08	14.01%	102.29
6	792.16	17.53	0.00	40.80	52.85	5.285%	19.42	13.17	33.91	13.36		32.95	0.16	137.39	13.74%	94.21
7	761.13	16.84	0.00	39.20	48.88	4.888%	19.42	11.61	35.24	13.89		33.78	0.16	134.89	13.49%	86.86
8	731.54	16.19	0.00	37.67	45.22	4.522%	19.42	10.17	36.38	14.34		34.62	0.16	132.57	13.26%	80.16
9	702.18	15.54	0.00	36.16	44.62	4.462%	19.42	9.93	34.49	13.59		35.49	0.16	130.29	13.03%	73.98
10	672.83	14.89	0.00	34.65	44.61	4.461%	19.42	9.93	32.00	12.61		36.37	0.17	128.04	12.80%	68.27
11	643.48	14.24	0.00	33.14	44.62	4.462%	19.42	9.93	29.50	11.63		37.28	0.17	125.80	12.58%	62.99
12	614.13	13.59	0.00	31.63	44.61	4.461%	19.42	9.93	27.01	10.65		38.21	0.17	123.59	12.36%	58.11
13	584.78	12.94	0.00	30.12	44.62	4.462%	19.42	9.93	24.51	9.66		39.17	0.17	121.41	12.14%	53.60
14	555.43	12.29	0.00	28.60	44.61	4.461%	19.42	9.93	22.02	8.68		40.15	0.17	119.24	11.92%	49.44
15	526.07	11.64	0.00	27.09	44.62	4.462%	19.42	9.93	19.52	7.69		41.15	0.17	117.10	11.71%	45.59
16	496.72	10.99	0.00	25.58	44.61	4.461%	19.42	9.93	17.03	6.71		42.18	0.18	114.99	11.50%	42.04
17	467.37	10.34	0.00	24.07	44.62	4.462%	19.42	9.93	14.53	5.73		43.24	0.18	112.90	11.29%	38.76
18	438.02	9.69	0.00	22.56	44.61	4.461%	19.42	9.93	12.04	4.75		44.32	0.18	110.84	11.08%	35.74
19	408.67	9.04	0.00	21.05	44.62	4.462%	19.42	9.93	9.54	3.76		45.42	0.18	108.81	10.88%	32.94
20	379.32	8.39	0.00	19.53	44.61	4.461%	19.42	9.93	7.05	2.78		46.56	0.18	106.80	10.68%	30.36
21	358.76	7.94	0.00	18.48	22.31	2.231%	19.42	1.14	27.61	10.88		47.72	0.19	105.76	10.58%	28.24
22	346.99	7.68	0.00	17.87	0.00		19.42	(7.65)	48.92	19.28		48.92	0.19	105.70	10.57%	26.50
23	335.22	7.42	0.00	17.26	0.00		19.42	(7.65)	47.92	18.88		50.14	0.19	105.66	10.57%	24.88
24	323.45	7.16	0.00	16.66	0.00		19.42	(7.65)	46.92	18.49		51.39	0.19	105.66	10.57%	23.36
25	311.68	6.90	0.00	16.05	0.00		19.42	(7.65)	45.92	18.10		52.68	0.19	105.68	10.57%	21.94
26	299.91	6.64	0.00	15.45	0.00		19.42	(7.65)	44.92	17.70		54.00	0.20	105.74	10.57%	20.61
27	288.14	6.38	0.00	14.84	0.00		19.42	(7.65)	43.92	17.31		55.35	0.20	105.83	10.58%	19.37
28	276.37	6.11	0.00	14.23	0.00		19.42	(7.65)	42.91	16.91		56.73	0.20	105.96	10.60%	18.21
29	264.61	5.85	0.00	13.63	0.00		19.42	(7.65)	41.91	16.52		58.15	0.20	106.12	10.61%	17.13
30	252.84	5.59	0.00	13.02	0.00		19.42	(7.65)	40.91	16.12		59.60	0.21	106.31	10.63%	16.12
31	241.07	5.33	0.00	12.42	0.00		19.42	(7.65)	39.91	15.73		61.09	0.21	106.55	10.65%	15.17
32	229.30	5.07	0.00	11.81	0.00		19.42	(7.65)	38.91	15.34		62.62	0.21	106.81	10.68%	14.28
33	217.53	4.81	0.00	11.20	0.00		19.42	(7.65)	37.91	14.94		64.18	0.21	107.12	10.71%	13.45
34	205.76	4.55	0.00	10.60	0.00		19.42	(7.65)	36.91	14.55		65.79	0.21	107.47	10.75%	12.67
35	193.99	4.29	0.00	9.99	0.00		19.42	(7.65)	35.91	14.15		67.43	0.22	107.85	10.79%	11.94
36	182.22	4.03	0.00	9.38	0.00		19.42	(7.65)	34.91	13.76		69.12	0.22	108.28	10.83%	11.26
37	170.46	3.77	0.00	8.78	0.00		19.42	(7.65)	33.91	13.36		70.85	0.22	108.75	10.88%	10.62

Liberty Utilities (EnergyNorth Natural Gas) Corp. - Development of Revenue Requirements Stream
Capacity Related Distribution

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 Revenue Requirements	% of Original Investment Revenue	Present Worth Of Revenue
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)
38	158.69	3.51	0.00	8.17	0.00		19.42	(7.65)	32.91	12.97		72.62	0.22	109.26	10.93%	10.02
39	146.92	3.25	0.00	7.57	0.00		19.42	(7.65)	31.91	12.58		74.43	0.23	109.82	10.98%	9.45
40	135.15	2.99	0.00	6.96	0.00		19.42	(7.65)	30.91	12.18		76.29	0.23	110.42	11.04%	8.93
41	123.38	2.73	0.00	6.35	0.00		19.42	(7.65)	29.91	11.79		78.20	0.23	111.07	11.11%	8.43
42	111.61	2.47	0.00	5.75	0.00		19.42	(7.65)	28.91	11.39		80.16	0.23	111.77	11.18%	7.97
43	99.84	2.21	0.00	5.14	0.00		19.42	(7.65)	27.91	11.00		82.16	0.24	112.52	11.25%	7.53
44	88.07	1.95	0.00	4.54	0.00		19.42	(7.65)	26.91	10.61		84.21	0.24	113.31	11.33%	7.12
45	76.31	1.69	0.00	3.93	0.00		19.42	(7.65)	25.91	10.21		86.32	0.24	114.16	11.42%	6.74
46	64.54	1.43	0.00	3.32	0.00		19.42	(7.65)	24.91	9.82		88.48	0.24	115.06	11.51%	6.38
47	52.77	1.17	0.00	2.72	0.00		19.42	(7.65)	23.91	9.42		90.69	0.25	116.01	11.60%	6.04
48	41.00	0.91	0.00	2.11	0.00		19.42	(7.65)	22.91	9.03		92.96	0.25	117.02	11.70%	5.72
49	29.23	0.65	0.00	1.51	0.00		19.42	(7.65)	21.91	8.63		95.28	0.25	118.09	11.81%	5.42
50	17.46	0.39	0.00	0.90	0.00		19.42	(7.65)	20.91	8.24		97.66	0.26	119.21	11.92%	5.14
51	5.69	0.13	0.00	0.29	0.00		19.42	(7.65)	19.91	7.85		100.10	0.26	120.40	12.04%	4.87
52	(6.08)	(0.13)	0.00	(0.31)	0.00		19.42	(7.65)	18.91	7.45		0.00	0.00	18.77	1.88%	0.71
53	(17.84)	(0.39)	0.00	(0.92)	0.00		19.42	(7.65)	17.91	7.06		0.00	0.00	17.51	1.75%	0.62
54	(29.61)	(0.66)	0.00	(1.53)	0.00		19.42	(7.65)	16.91	6.66		0.00	0.00	16.25	1.63%	0.54
55	(41.38)	(0.92)	0.00	(2.13)	0.00		19.42	(7.65)	15.91	6.27		0.00	0.00	14.99	1.50%	0.47
56	(53.15)	(1.18)	0.00	(2.74)	0.00		19.42	(7.65)	14.91	5.87		0.00	0.00	13.73	1.37%	0.41
57	(64.92)	(1.44)	0.00	(3.34)	0.00		19.42	(7.65)	13.91	5.48		0.00	0.00	12.47	1.25%	0.35
58	(76.69)	(1.70)	0.00	(3.95)	0.00		19.42	(7.65)	12.91	5.09		0.00	0.00	11.21	1.12%	0.29
59	(145.99)	(3.23)	0.00	(7.52)	145.99		19.42	49.88	(138.98)	(54.77)		0.00	0.00	3.78	0.38%	0.09
Total		$ 408.71	$ -	$ 951.35	$ 1,145.99	$ 1.00	$ 1,145.99	$ 0.00	$ 1,570.14	$ 618.79	$ -	$ 2,939.29	$ 10.16	$ 6,074.29	607.43%	$ 1,871.83
Present Worth		$196.53	$ -	$ 457.46	$ 568.71	$ 0.57	$ 291.94	$ 109.08	$ 478.23	$ 188.47	$ -	$ 625.78	$ 2.58	$ 1,871.83	187.18%	$ 1,002.53
Levelized Payment Current		$13.08	$ -	$ 30.44	$ 37.84	$ 0.04	$ 19.42	$ 7.26	$ 31.82	$ 12.54	$ -	$ 41.64	$ 0.17	$ 124.54	12.45%	
Levelized Payment		$ 11.11	$ -	$ 25.86	$ 32.15	$ 0.03	$ 16.51	$ 6.17	$ 27.04	$ 10.66	$ -	$ 35.38	$ 0.15	$ 105.83	10.58%	

Liberty Utilities (EnergyNorth Natural Gas) Corp. - Development of Revenue Requirements Stream
Services 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 Revenue Requirements	% of Original Investment Revenue	Present 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	963.68	21.32	0.00	49.63	37.50	3.750%	35.56	0.77	79.97	31.51		29.12	0.15	168.06	16.81%	157.82
2	913.68	20.22	0.00	47.05	72.19	7.219%	35.56	14.44	41.03	16.17		29.85	0.15	163.44	16.34%	144.12
3	865.83	19.16	0.00	44.59	66.77	6.677%	35.56	12.30	42.38	16.70		30.60	0.15	159.06	15.91%	131.71
4	819.94	18.14	0.00	42.23	61.77	6.177%	35.56	10.33	43.48	17.13		31.36	0.15	154.91	15.49%	120.46
5	775.88	17.17	0.00	39.96	57.13	5.713%	35.56	8.50	44.37	17.49		32.15	0.16	150.97	15.10%	110.24
6	733.51	16.23	0.00	37.78	52.85	5.285%	35.56	6.82	45.05	17.76		32.95	0.16	147.24	14.72%	100.96
7	692.71	15.33	0.00	35.67	48.88	4.888%	35.56	5.25	45.55	17.95		33.78	0.16	143.70	14.37%	92.53
8	653.34	14.46	0.00	33.65	45.22	4.522%	35.56	3.81	45.87	18.08		34.62	0.16	140.32	14.03%	84.85
9	614.21	13.59	0.00	31.63	44.62	4.462%	35.56	3.57	43.14	17.00		35.49	0.16	137.00	13.70%	77.79
10	575.09	12.72	0.00	29.62	44.61	4.461%	35.56	3.57	39.83	15.70		36.37	0.17	133.70	13.37%	71.29
11	535.96	11.86	0.00	27.60	44.62	4.462%	35.56	3.57	36.49	14.38		37.28	0.17	130.42	13.04%	65.30
12	496.84	10.99	0.00	25.59	44.61	4.461%	35.56	3.57	33.18	13.07		38.21	0.17	127.16	12.72%	59.79
13	457.71	10.13	0.00	23.57	44.62	4.462%	35.56	3.57	29.84	11.76		39.17	0.17	123.93	12.39%	54.72
14	418.59	9.26	0.00	21.56	44.61	4.461%	35.56	3.57	26.52	10.45		40.15	0.17	120.72	12.07%	50.05
15	379.46	8.40	0.00	19.54	44.62	4.462%	35.56	3.57	23.19	9.14		41.15	0.17	117.53	11.75%	45.76
16	340.33	7.53	0.00	17.53	44.61	4.461%	35.56	3.57	19.87	7.83		42.18	0.18	114.37	11.44%	41.82
17	301.21	6.66	0.00	15.51	44.62	4.462%	35.56	3.57	16.54	6.52		43.24	0.18	111.24	11.12%	38.19
18	262.08	5.80	0.00	13.50	44.61	4.461%	35.56	3.57	13.22	5.21		44.32	0.18	108.13	10.81%	34.86
19	222.95	4.93	0.00	11.48	44.62	4.462%	35.56	3.57	9.89	3.90		45.42	0.18	105.05	10.50%	31.80
20	183.83	4.07	0.00	9.47	44.61	4.461%	35.56	3.57	6.57	2.59		46.56	0.18	101.99	10.20%	29.00
21	153.49	3.40	0.00	7.90	22.31	2.231%	35.56	(5.22)	26.29	10.36		47.72	0.19	99.91	9.99%	26.67
22	131.95	2.92	0.00	6.80	0.00		35.56	(14.01)	46.77	18.43		48.92	0.19	98.80	9.88%	24.77
23	110.41	2.44	0.00	5.69	0.00		35.56	(14.01)	44.94	17.71		50.14	0.19	97.71	9.77%	23.00
24	88.87	1.97	0.00	4.58	0.00		35.56	(14.01)	43.11	16.99		51.39	0.19	96.66	9.67%	21.37
25	67.32	1.49	0.00	3.47	0.00		35.56	(14.01)	41.28	16.27		52.68	0.19	95.64	9.56%	19.85
26	45.78	1.01	0.00	2.36	0.00		35.56	(14.01)	39.45	15.55		54.00	0.20	94.65	9.47%	18.45
27	24.24	0.54	0.00	1.25	0.00		35.56	(14.01)	37.62	14.82		55.35	0.20	93.70	9.37%	17.15
28	2.69	0.06	0.00	0.14	0.00		35.56	(14.01)	35.78	14.10		56.73	0.20	92.77	9.28%	15.95
29	(18.85)	(0.42)	0.00	(0.97)	0.00		35.56	(14.01)	33.95	13.38		0.00	0.00	33.54	3.35%	5.41
30	(40.39)	(0.89)	0.00	(2.08)	0.00		35.56	(14.01)	32.12	12.66		0.00	0.00	31.23	3.12%	4.73
31	(61.94)	(1.37)	0.00	(3.19)	0.00		35.56	(14.01)	30.29	11.94		0.00	0.00	28.92	2.89%	4.12
32	(83.48)	(1.85)	0.00	(4.30)	0.00		35.56	(14.01)	28.46	11.22		0.00	0.00	26.61	2.66%	3.56
33	(105.02)	(2.32)	0.00	(5.41)	0.00		35.56	(14.01)	26.63	10.49		0.00	0.00	24.31	2.43%	3.05
34	(126.57)	(2.80)	0.00	(6.52)	0.00		35.56	(14.01)	24.80	9.77		0.00	0.00	22.00	2.20%	2.59
35	(148.11)	(3.28)	0.00	(7.63)	0.00		35.56	(14.01)	22.97	9.05		0.00	0.00	19.69	1.97%	2.18
36	(169.65)	(3.75)	0.00	(8.74)	0.00		35.56	(14.01)	21.14	8.33		0.00	0.00	17.38	1.74%	1.81

Liberty Utilities (EnergyNorth Natural Gas) Corp. - Development of Revenue Requirements Stream
Services 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 Revenue Requirements	% of Original Investment Revenue	Present Worth Of Revenue
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)
37	(191.20)	(4.23)	0.00	(9.85)	0.00		35.56	(14.01)	19.30	7.61		0.00	0.00	15.07	1.51%	1.47
38	(212.74)	(4.71)	0.00	(10.96)	0.00		35.56	(14.01)	17.47	6.89		0.00	0.00	12.77	1.28%	1.17
39	(234.28)	(5.18)	0.00	(12.07)	0.00		35.56	(14.01)	15.64	6.16		0.00	0.00	10.46	1.05%	0.90
40	(255.82)	(5.66)	0.00	(13.17)	0.00		35.56	(14.01)	13.81	5.44		0.00	0.00	8.15	0.82%	0.66
41	(277.37)	(6.14)	0.00	(14.28)	0.00		35.56	(14.01)	11.98	4.72		0.00	0.00	5.84	0.58%	0.44
42	(298.91)	(6.61)	0.00	(15.39)	0.00		35.56	(14.01)	10.15	4.00		0.00	0.00	3.54	0.35%	0.25
43	(320.45)	(7.09)	0.00	(16.50)	0.00		35.56	(14.01)	8.32	3.28		0.00	0.00	1.23	0.12%	0.08
44	(342.00)	(7.57)	0.00	(17.61)	0.00		35.56	(14.01)	6.49	2.56		0.00	0.00	(1.08)	-0.11%	(0.07)
45	(600.00)	(13.28)	0.00	(30.90)	600.00		35.56	222.45	(615.44)	(242.55)		0.00	0.00	(28.72)	-2.87%	(1.69)
Total		$ 184.63	$ -	$ 429.76	$ 1,600.00	$ 1.00	$ 1,600.00	$ 0.00	$ 709.29	$ 279.53	$ -	$ 1,160.90	$ 4.87	$ 3,659.69	365.97%	$ 1,740.93
Present Worth		$153.66	$ -	$ 357.68	$ 600.55	$ 0.57	$ 515.47	$ 33.53	$ 505.25	$ 199.12	$ -	$ 479.35	$ 2.13	$ 1,740.93	174.09%	$ 1,043.03
Levelized Payment Current		$10.60	$ -	$ 24.67	$ 41.42	$ 0.04	$ 35.56	$ 2.31	$ 34.85	$ 13.73	$ -	$ 33.06	$ 0.15	$ 120.08	12.01%	
Levelized Payment Constant		$ 9.17	$ -	$ 21.34	$ 35.83	$ 0.03	$ 30.75	$ 2.00	$ 30.14	$ 11.88	$ -	$ 28.60	$ 0.13	$ 103.87	10.39%	

Liberty Utilities (EnergyNorth Natural Gas) 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 Revenue Requirements	% of Original Investment Revenue	Present 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	964.33	21.34	0.00	49.66	37.50	3.750%	34.48	1.19	78.95	31.11		29.12	0.15	167.06	16.71%	156.88
2	914.98	20.24	0.00	47.12	72.19	7.219%	34.48	14.86	40.06	15.79		29.85	0.15	162.50	16.25%	143.30
3	867.78	19.20	0.00	44.69	66.77	6.677%	34.48	12.72	41.47	16.34		30.60	0.15	158.19	15.82%	130.99
4	822.54	18.20	0.00	42.36	61.77	6.177%	34.48	10.75	42.63	16.80		31.36	0.15	154.11	15.41%	119.84
5	779.13	17.24	0.00	40.13	57.13	5.713%	34.48	8.93	43.58	17.17		32.15	0.16	150.25	15.02%	109.71
6	737.41	16.32	0.00	37.98	52.85	5.285%	34.48	7.24	44.31	17.46		32.95	0.16	146.59	14.66%	100.51
7	697.26	15.43	0.00	35.91	48.88	4.888%	34.48	5.67	44.87	17.68		33.78	0.16	143.11	14.31%	92.15
8	658.54	14.57	0.00	33.91	45.22	4.522%	34.48	4.23	45.24	17.83		34.62	0.16	139.81	13.98%	84.54
9	620.06	13.72	0.00	31.93	44.62	4.462%	34.48	4.00	42.57	16.78		35.49	0.16	136.55	13.66%	77.54
10	581.59	12.87	0.00	29.95	44.61	4.461%	34.48	3.99	39.31	15.49		36.37	0.17	133.32	13.33%	71.09
11	543.11	12.02	0.00	27.97	44.62	4.462%	34.48	4.00	36.03	14.20		37.28	0.17	130.11	13.01%	65.15
12	504.64	11.17	0.00	25.99	44.61	4.461%	34.48	3.99	32.77	12.91		38.21	0.17	126.92	12.69%	59.68
13	466.16	10.31	0.00	24.01	44.62	4.462%	34.48	4.00	29.49	11.62		39.17	0.17	123.76	12.38%	54.64
14	427.69	9.46	0.00	22.03	44.61	4.461%	34.48	3.99	26.22	10.34		40.15	0.17	120.62	12.06%	50.01
15	389.21	8.61	0.00	20.04	44.62	4.462%	34.48	4.00	22.94	9.04		41.15	0.17	117.50	11.75%	45.75
16	350.73	7.76	0.00	18.06	44.61	4.461%	34.48	3.99	19.68	7.76		42.18	0.18	114.41	11.44%	41.83
17	312.26	6.91	0.00	16.08	44.62	4.462%	34.48	4.00	16.40	6.46		43.24	0.18	111.35	11.13%	38.23
18	273.78	6.06	0.00	14.10	44.61	4.461%	34.48	3.99	13.14	5.18		44.32	0.18	108.31	10.83%	34.92
19	235.30	5.21	0.00	12.12	44.62	4.462%	34.48	4.00	9.86	3.89		45.42	0.18	105.30	10.53%	31.88
20	196.83	4.35	0.00	10.14	44.61	4.461%	34.48	3.99	6.60	2.60		46.56	0.18	102.31	10.23%	29.09
21	167.14	3.70	0.00	8.61	22.31	2.231%	34.48	(4.80)	26.38	10.40		47.72	0.19	100.30	10.03%	26.78
22	146.25	3.24	0.00	7.53	0.00		34.48	(13.59)	46.91	18.49		48.92	0.19	99.25	9.93%	24.88
23	125.36	2.77	0.00	6.46	0.00		34.48	(13.59)	45.14	17.79		50.14	0.19	98.24	9.82%	23.13
24	104.47	2.31	0.00	5.38	0.00		34.48	(13.59)	43.36	17.09		51.39	0.19	97.26	9.73%	21.50
25	83.57	1.85	0.00	4.30	0.00		34.48	(13.59)	41.59	16.39		52.68	0.19	96.31	9.63%	19.99
26	62.68	1.39	0.00	3.23	0.00		34.48	(13.59)	39.81	15.69		54.00	0.20	95.39	9.54%	18.60
27	41.79	0.92	0.00	2.15	0.00		34.48	(13.59)	38.03	14.99		55.35	0.20	94.50	9.45%	17.30
28	20.89	0.46	0.00	1.08	0.00		34.48	(13.59)	36.26	14.29		56.73	0.20	93.65	9.37%	16.10
29	0.00	0.00	0.00	0.00	0.00		34.48	(13.59)	34.48	13.59		58.15	0.20	92.83	9.28%	14.99
Total		$ 267.61	$ -	$ 622.92	$ 1,000.00	$ 1.00	$ 1,000.00	$ (0.00)	$1,028.09	$ 405.17	$ -	$ 1,219.04	$ 5.08	$ 3,519.82	351.98%	$ 1,720.98
Present Worth		$162.04	$ -	$ 377.19	$ 565.13	$ 0.57	$ 445.51	$ 47.14	$ 502.90	$ 198.19	$ -	$ 488.74	$ 2.16	$ 1,720.98	172.10%	$ 1,037.41
Levelized Payment Current $		$12.54	$ -	$ 29.19	$ 43.74	$ 0.04	$ 34.48	$ 3.65	$ 38.92	$ 15.34	$ -	$ 37.83	$ 0.17	$ 133.20	13.32%	
Levelized Payment Constant $		$ 11.22	$ -	$ 26.12	$ 39.14	$ 0.04	$ 30.85	$ 3.26	$ 34.83	$ 13.73	$ -	$ 33.85	$ 0.15	$ 119.19	11.92%	

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Development of Weighted Plant Book Lives and Salvage

Line No.	Acct No.	Description	2016 Plant Balance	Average Service Life	Net Salvage Value
		(A)	(B) Company Data	(D) Company Data	(E) Company Data
1		**Hypothetical Production Plant**			
2	361	Structures and Improvements	$57,345	35	0%
3	363.5	Other Equipment	$7,646	35	0%
4		**Total Production Plant**	**$64,991**	**35**	**0%**
5		**Distribution Investment**			
6					
7	366.2	Structures and Improvements	$269,809	35	0%
8	366.3	Structures and Improvements - Other	$353,851	35	0%
9	367.0	Mains	$234,672,697	60	-15%
10	369.0	Measuring and Regulatin Station Equipment	$4,909,208	35	0%
11	387	Other Equipment	$908,013	19	0%
12		**Total Distribution Capacity-Related**	**$241,113,578**	**59**	**-15%**
13					
14	380	**Services**	**$146,720,226**	**45**	**-60%**
15					
16	381.0	Meters	$14,628,345	32	0%
17	381.1	Meters - Instrument	$188,398	32	0%
18	381.2	Meters - ERTs	$5,647,769	15	0%
19	382	Meter Installations	$14,360,005	32	0%
20		**Total Meters**	**$34,824,517**	**29**	**0%**

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Summary of Marginal Capacity Costs

Line No.	Description	Production in lieu of Reinforcement	Mains Reinforcement	Mains Extension	Total Distribution	Explanation
	(A)	(B)	(C)	(D)	(E)	(F)
	Plant Investment					
1	Long-Run Unit Costs - $/Design Day Dth	$56.05	$63.33	$505.18	$624.56	MCS-1 Page 1 Line 11, MCS-1 Page 3 Line 21, MCS-1 Page 4 Line 24
2	General Plant Loading Factor	3.99%	3.99%	3.99%		MFB-6 p4, Line 17
3	Unit Costs + Loading Factor	58.29	65.85	525.32	$649.46	Line 1 + (Line 1 x Line 2)
4	Fixed Charge Rate	11.42%	10.58%	10.58%		MFB-7 Page 7A and 7B, Levelized Payment Constant $
5	A & G Exp Plant-Related Loading Factor	0.21%	0.21%	0.21%		MFB-6 p1, Line 28
6	Total Rate	11.63%	10.79%	10.79%		Line 4 + Line 5
7	Annualized Cost	$6.78	$7.11	$56.70	$70.58	Line 3 x Line 6
8	**Operating Expenses**					
9	Production capacity costs	$1.80			$1.80	MFB-3 p1, Line 25
10	Distribution capacity costs			$29.43	$29.43	MFB-4 p1, Line 18
11	A&G Exp Non-Plant Loading Factor	54.79%	54.79%	54.79%		MFB-6 p2, Line 24
12	Total O&M Expense	$2.78	$0.00	$45.55	$48.33	(Line 9 + Line 10) x (1 + Line 11)
13	**Working Capital**					
14	Materials & Supplies + Prepayments Rate	0.23%	0.23%	0.23%		MFB-6 p3, Line 27
15	M&S Cost	0.13	0.15	1.20	$ 1.48	Line 3 x Line 14
16	Working Cash O&M Allowance	$0.69	$0.52	$7.43	$ 8.64	Based on 26.53 days net lag
17	7.27%					
18	Total Working Capital	$0.83	$0.67	$8.63	$10.13	Line 15 + Line 16
19						
20	Working Capital Rev Req	$0.09	$0.07	$0.92	$1.08	Line 18 x Line 21
21	10.71%					MFB-7 p1, Line 15
22	System Seasonal Capacity Related Cost					
23	$/Design Day Dth	$9.65	$7.18	$103.18	$120.00	Line 7 + Line 12 + Line 20
24	Gross up for Sales/Sendout Factor	0.976	0.976	0.976	0.976	WP-MFB-6 p3&4A, Line 11
25	Inflation Adjustment	1.10%	1.10%	1.10%	1.10%	(1 + MFB-7 p1, Line 17)-1
26	**Seasonal Capacity Cost**	$9.98	$7.43	$106.78	$124.20	(Line 23 x (1- Line 24) + Line 23) x (1 + Line 25)

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Summary of Marginal Customer Costs

Line No.	Description	R-1	R-3, R-4	G-41	G-42	G-43	G-51	G-52	G-53	G-54	Explanation
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
	Plant Investment										
1	Meters and Regulators	$ 310.20	$ 310.20	$ 979.00	$ 2,433.20	$ 6,024.70	$ 979.00	$ 1,617.00	$ 7,311.70	$ 9,674.50	MFB-2 p1, Line 8
2	General Plant Loading Factor	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	MFB-6 p4, Line 17
3	Unit Costs + Loading Factor	$ 322.57	$ 322.57	$ 1,018.04	$ 2,530.22	$ 6,264.92	$ 1,018.04	$ 1,681.47	$ 7,603.24	$ 10,060.25	Line 1 + (Line 1 x Line 2)
4	Fixed Charge Rate	11.92%	11.92%	11.92%	11.92%	11.92%	11.92%	11.92%	11.92%	11.92%	MFB-7 p1, Line 6
5	Meter Carrying Costs	$ 38.45	$ 38.45	$ 121.34	$ 301.57	$ 746.70	$ 121.34	$ 200.41	$ 906.22	$ 1,199.06	Line 3 x Line 4
6	Services	3,737.68	3,737.68	3,737.68	7,299.74	10,912.52	3,737.68	7,299.74	23,006.43	54,416.35	MFB-2 p1, Line 4
7	General Plant Loading Factor	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	3.99%	MFB-6 p4, Line 17
8	Unit Costs and Loading Factor	3,886.71	3,886.71	3,886.71	7,590.80	11,347.64	3,886.71	7,590.80	23,923.77	56,586.10	Line 6 + (Line 6 x Line 7)
9	Fixed Charge Rate	10.39%	10.39%	10.39%	10.39%	10.39%	10.39%	10.39%	10.39%	10.39%	MFB-7 p1, Line 5
10	Services Carrying Costs	403.70	403.70	403.70	788.44	1,178.65	403.70	788.44	2,484.91	5,877.47	Line 8 x Line 9
11	Total Plant Carrying Costs	$ 442.15	$ 442.15	$ 525.04	$ 1,090.01	$ 1,925.36	$ 525.04	$ 988.85	$ 3,391.12	$ 7,076.53	Line 5 + Line 10
12											
13	A&G Exp Plant-Related Loading Factor	0.21%	0.21%	0.21%	0.21%	0.21%	0.21%	0.21%	0.21%	0.21%	MFB-6 p1, Line 28
14	Annualized Cost	$ 443.08	$ 443.08	$ 526.14	$ 1,092.30	$ 1,929.40	$ 526.14	$ 990.93	$ 3,398.24	$ 7,091.39	(1 + Line 13) x Line 11
15	**Operating Expenses**										
16	Plant Related O&M $/Customer	43.35	43.35	50.51	104.23	181.38	50.51	95.49	324.68	686.35	MFB-5 p2, Col (G)
17	Customer Acctg & Mkg Expenses	78.30	78.30	78.30	78.30	78.30	78.30	78.30	78.30	78.30	MFB-5 p3, Line 26
18	A&G Exp Non-Plant Loading Factor	54.79%	54.79%	54.79%	54.79%	54.79%	54.79%	54.79%	54.79%	54.79%	MFB-6 p2, Line 24
19	Total O&M Expense	188.30	188.30	199.39	282.54	401.96	199.39	269.01	623.78	1183.62	Line 16 + Line 17 + ((Line 16 + Line 17) x Line 18)
20	**Working Capital- $/Customer**										
21	Materials & Supplies + Prepayments Rate	0.23%	0.23%	0.23%	0.23%	0.23%	0.23%	0.23%	0.23%	0.23%	MFB-6 p3, Line 27
22	M&S Cost	9.62	9.62	11.21	23.12	40.24	11.21	21.18	72.03	152.27	Line 21 x (Line 3 x Line 8)
23	Working Cash O&M Allowance	45.89	45.89	52.74	99.93	169.45	52.74	91.58	292.34	601.47	(Line 14 + Line 19) x (MFB-8 p1, Line 17)
24	Total Working Capital	55.51	55.51	63.94	123.05	209.69	63.94	112.76	364.37	753.73	Line 22 + Line 23
25	Working Capital Rev. Requirement	5.95	5.95	6.85	13.18	22.46	6.85	12.08	39.03	80.74	Line 24 x (MFB-7 p1, Line 15)
26	Annual Customer Related Cost $/Customer	$ 637.32	$ 637.32	$ 732.38	$ 1,388.02	$ 2,353.83	$ 732.38	$ 1,272.02	$ 4,061.05	$ 8,355.75	Line 14 + Line 19 + Line 25
27											
28	Inflation Adjustment	1.10%	1.10%	1.10%	1.10%	1.10%	1.10%	1.10%	1.10%	1.10%	(1 + MFB-7 p1, Line 17)-1
29	**Annual Customer Related Cost**	$644.34	$644.34	$740.44	$1,403.30	$2,379.73	$740.44	$1,286.02	$4,105.75	$8,447.72	Line 26 x (1 + Line 28)

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study
Summary of Marginal Cost Estimates

Line No.	Description	R-1	R-3, R-4	G-41	G-42	G-43	G-51	G-52	G-53	G-54	Total Company	Explanation
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)
1	Uncollectible Factor	5.87%	3.47%	0.77%	0.21%	0.00%	1.44%	1.08%	0.00%	0.00%		
2												
3	Customer Charge $'s per month											
4	Monthly Customer Charge w/o Uncollectibles	$ 53.69	$ 53.69	$ 61.70	$ 116.94	$ 198.31	$ 61.70	$ 107.17	$ 342.15	$ 703.98		(MFB-9 p1, Line 29)/12
5	Adjustment for Uncollectibles	3.15	1.86	0.48	0.25	0.00	0.89	1.16	0.00	0.00		Line 1 x Line 4
6	Monthly Customer Charge Incl. Uncollectibles	$56.85	$ 55.56	$62.18	$117.19	$198.31	$62.59	$108.33	$342.15	$703.98		Line 4 + Line 5
7	Capacity-related: Winter Charges											
8	Distribution Demand Charge - Pressure Support	9.98	9.98	9.98	9.98	9.98	9.98	9.98	9.98	9.98		MFB-8 p1, Col (B)
9	Distribution Demand Charge - Reinforcemen	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43		MFB-8 p1, Col (C)
10	Distribution Demand Charge - Main Extensions	106.78	106.78	106.78	106.78	106.78	106.78	106.78	106.78	106.78		MFB-8 p1, Col (D)
11	Adjustment for Uncollectibles	$7.29	$4.31	$0.96	$0.26	$0.00	$1.79	$1.35	$0.00	$0.00		(Line 8 + Line 9 + Line 10) x Line 1)
12	Winter Charges Incl. Uncollectibles	$131.49	$128.51	$125.16	$124.46	$124.20	$125.99	$125.54	$124.20	$124.20		Σ line 8 to Line 11
13	Summer Charges											
14	Capacity-related: Distribution Demand Charge	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
15	Adjustment for Uncollectibles	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00		Line 1 x Line 14
16	Summer Charges Incl. Uncollectibles	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00		Line 14 + Line 15
17	Calendar Month Billing Determinants (2016)											
18	Customers	3,036	76,093	8,517	1,714	51	1,251	309	34	27	91,030.71	MFB-11 p1, Line 16
19	Design Day Dth -Sales and Transportation	587	70,684	28,529	39,806	10,491	2,868	4,420	5,305	3,995	166,685.93	MFB-11 p1, Line 17
20	Winter Dth -Sales and Transportation	47,405	4,667,572	1,815,526	2,710,035	744,316	249,820	445,206	587,060	830,701	12,097,641.21	MFB-11 p1, Line 18
21	Summer Dth -Sales and Transportation	21,069	1,028,925	313,071	650,208	214,952	126,172	269,819	401,365	895,275	3,920,856.16	MFB-11 p1, Line 19
22												
23	**Total Marginal Costs**											
24	Total Customer-related	$2,071,002	$50,731,826	$6,355,050	$2,409,999	$120,342	$939,802	$401,042	$137,816	$232,030	$63,398,907	Line 6 x Line 18 x 12
25	Capacity-related: Winter											
26	Winter Distribution Pressure Support	6,209	730,128	287,005	398,228	104,730	29,049	44,598	52,956	39,885	1,692,787.96	(1 + Line 1) x Line 8 x Line 19
27	Winter Distribution Reinforcements	4,621	543,418	213,611	296,392	77,948	21,621	33,193	39,414	29,686	1,259,903.95	(1 + Line 1) x Line 9 x Line 19
28	Winter Distribution Main Ext.	66,411	7,809,999	3,070,020	4,259,743	1,120,273	310,732	477,054	566,460	426,642	18,107,333.29	(1 + Line 1) x Line 10 x Line 19
29	Total Capacity-related: Winter	$ 77,241	$ 9,083,544	$ 3,570,636	$ 4,954,363	$ 1,302,952	$ 361,402	$ 554,845	$ 658,830	$ 496,212	$ 21,060,025	Σ line 26 to Line 28
30	Capacity-related: Summer											
31	Distribution Demand Charge	-	-	-	-	-	-	-	-	-	-	(1 + Line 1) x Line 14 x Line 21
32	Total Capacity-related:Summer	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Line 31
33	Customer Subtotal	$2,071,002	$50,731,826	$6,355,050	$2,409,999	$120,342	$939,802	$401,042	$137,816	$232,030	$63,398,907	Line 24
34	Distribution Subtotal	$77,241	$9,083,544	$3,570,636	$4,954,363	$1,302,952	$361,402	$554,845	$658,830	$496,212	$21,060,025	Line 26 + Line 27 + Line 28 + Line 31
35	**Total Annual Marginal Cost**	$ 2,148,243	$ 59,815,370	$ 9,925,686	$ 7,364,361	$ 1,423,293	$ 1,301,203	$ 955,887	$ 796,646	$ 728,243	$ 84,458,933	Σ line 33 to Line 34
36	**Share of Total Annual Marginal Cost**	2.5%	70.8%	11.8%	8.7%	1.7%	1.5%	1.1%	0.9%	0.9%	100.0%	Col (n) / Col (K)

Liberty Utilities (EnergyNorth Natural Gas) Corp. Marginal Cost Study

Marginal Unit Costs per Dth

Line No.		R-1	R-3, R-4	G-41	G-42	G-43	G-51	G-52	G-53	G-54	Explanation
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(L)
1	Customer Charge										
2	Customer Charge (w/ Uncoll) $'s per Month	$56.85	$55.56	$62.18	$117.19	$198.31	$62.59	$108.33	$342.15	$703.98	MFB-10 p1, Line 6
3	Capacity-related Winter Unit Costs										
4	Winter Distribution Pressure Support	$0.1310	$0.1564	$0.1581	$0.1469	$0.1407	$0.1163	$0.1002	$0.0902	$0.0480	MFB-10 p1, Line 26 / Line 18
5	Winter Distribution Reinforcements	$0.0975	$0.1164	$0.1177	$0.1094	$0.1047	$0.0865	$0.0746	$0.0671	$0.0357	MFB-10 p1, Line 27 / Line 18
6	Winter Distribution Main Ext.	$1.4009	$1.6732	$1.6910	$1.5718	$1.5051	$1.2438	$1.0715	$0.9649	$0.5136	MFB-10 p1, Line 28 / Line 18
7	Capacity-related Summer Unit Cost										
8	Distribution Demand	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	MFB-10 p1, Line 30 / Line 19
9	**Total Unit Cost Summary**										
10	Distribution										
11	Customer	$56.85	$55.559	$62.181	$117.191	$198.311	$62.594	$108.330	$342.146	$703.976	Line 2
12	Winter, $/Dth	$1.6294	$1.9461	$1.9667	$1.8282	$1.7505	$1.4466	$1.2463	$1.1223	$0.5973	Line 4 + Line 5 + Line 6
13	Summer, $/Dth	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	Line 8
14	Annual Avg, $/Dth	$1.1280	$1.5946	$1.6775	$1.4744	$1.3583	$0.9612	$0.7760	$0.6665	$0.2875	MFB-10 p1, Line 36 / Line 20
15	Test Year Calendar Month Billing Determinants - Sales And Transportation Loads (All Firm Loads)										
16	Customers Annual	3,036	76,093	8,517	1,714	51	1,251	309	34	27	WP-MFB-BillingDets, Col (E) Lines 2 to 12
17	Design Day Dths	587	70,684	28,529	39,806	10,491	2,868	4,420	5,305	3,995	WP-Design Day, Line 29
18	Winter Dths	47,405	4,667,572	1,815,526	2,710,035	744,316	249,820	445,206	587,060	830,701	(WP-MFB-BillingDets, Col (B), Lines 2 to 12) /10
19	Summer Dths	21,069	1,028,925	313,071	650,208	214,952	126,172	269,819	401,365	895,275	(WP-MFB-BillingDets, Col (C), Lines 2 to 12) /10
20	Total Annual Dths	68,473	5,696,497	2,128,598	3,360,243	959,268	375,992	715,025	988,425	1,725,976	Σ line 18 to Line 19

Melissa F. Bartos
Assistant Vice President

Ms. Bartos is a financial and economic consultant with 20 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, marginal cost studies, and incentive ratemaking.

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 and testified regarding marginal cost studies, 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
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

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
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
New Hampshire Public Utilities Commission				
Northern Utilities, Inc.	2011	Northern Utilities	DG 2011-290	Integrated Resource Plan; Demand Forecast
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

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