OUTLINE OF APPENDIX IV

Supplemental Materials for the Planning Standard and Design Forecasts Section

Appendix IV-1. Normal Distribution Tests for EDD Data **2**

A. Normal Distribution Tests for EDD Data – Maine Division 2

B. Normal Distribution Tests for EDD Data – New Hampshire Division 6

Appendix IV-2. Daily Planning Load Models – Maine Division **10**

A. Normal Year – Maine Division 10

B. Design Year – Maine Division 13

C. Design Day Model – Maine Division 16

Appendix IV-3. Daily Planning Load Models – New Hampshire Division **18**

A. Normal Year – New Hampshire Division 18

B. Design Year – New Hampshire Division 22

C. Design Day Model – New Hampshire Division 25

Appendix IV-1. Normal Distribution Tests for EDD Data

A. NORMAL DISTRIBUTION TESTS FOR EDD DATA – MAINE DIVISION

There is no evidence that the Maine Division annual, winter, and peak day EDD data are not normally distributed, based on the following analyses: (1) histogram, (2) skewness, (3) kurtosis, and (4) Kolmogorov-Smirnov test.

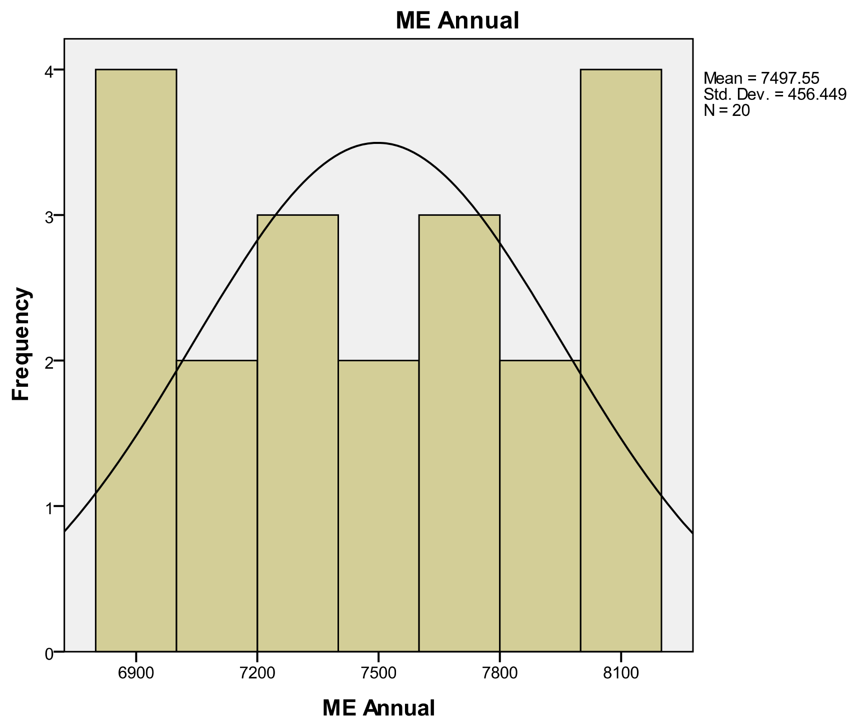
- The histogram (or frequency distribution) is a test by visual inspection to see if the data generally follow the shape of a normal distribution. The histograms below show a normal distribution superimposed on the underlying data.

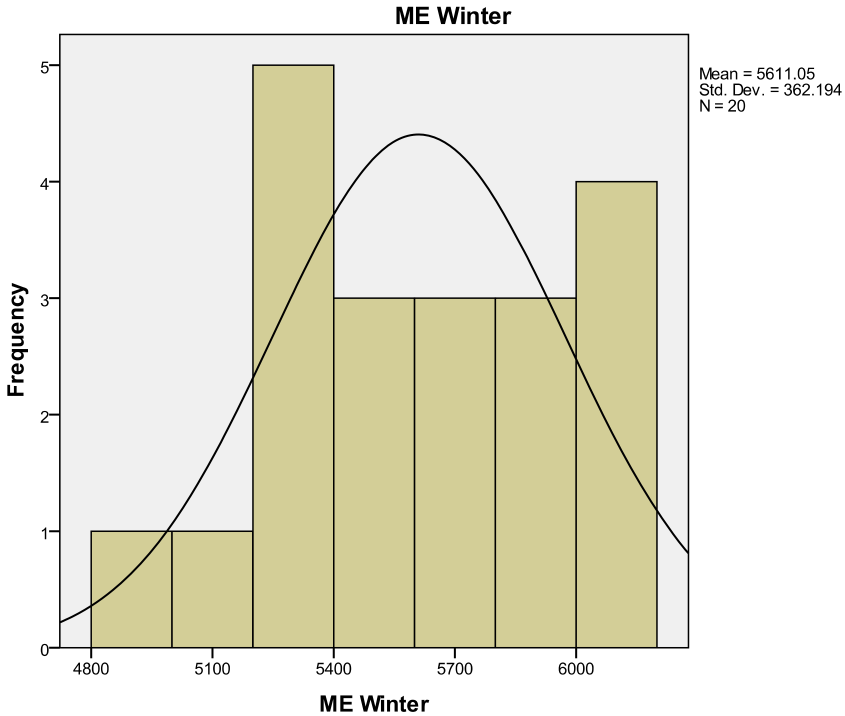
- Skewness is a test of normality based on a measure of symmetry. A skew of zero indicates that the distribution is symmetrical. A positive skew indicates that the data set has large outliers to the right and a negative skew indicates that the data set has large outliers to the left. A normal distribution has a skewness statistic of zero. Data sets with skewness statistics that were within 2 standard errors of skewness are typically assumed to be close enough to zero to be considered not different from a normal distribution. The skewness statistics below, along with their standard errors indicate that both data sets have skewness statistics that are well within 2 standard errors.

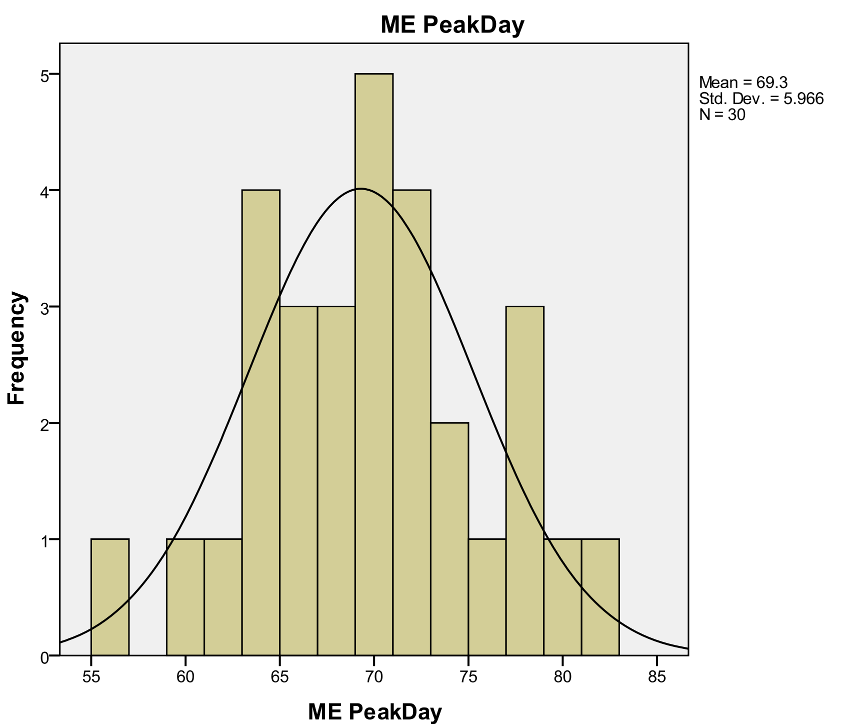
- Kurtosis is a measure of pointedness versus flatness. A positive kurtosis indicates that the data set is especially pointed (i.e. the data is clustered around one point), while a negative kurtosis indicates that the data is relatively flat (i.e. the data are more dispersed across the entire distribution). A normal distribution has a kurtosis of zero. A data set with a kurtosis statistic that is within 2 standard errors of kurtosis is typically assumed to be close enough to zero to be considered not different from a normal distribution. The kurtosis statistics below, along with their standard errors indicate that both data sets have kurtosis statistics that are well within 2 standard errors.

- The Kolmogorov-Smirnov test is a goodness-of-fit test which tests whether a given data set has a distribution that is significantly different from a hypothesized distribution. Possible distributions that can be tested by the Kolmogorov-Smirnov test include the normal, Poisson, exponential and uniform distributions. The statistic is based on the most extreme absolute difference between the cumulative distributions of the data set and the hypothesized distribution and the number of data points in the underlying data set. A large value of the statistic (and a corresponding small value for the significance level) indicates that there is a large difference between the underlying data set and the hypothesized distribution. The Kolmogorov-Smirnov statistics (comparing against a normal distribution) below, along with their significance levels indicate that both data sets have insignificant Kolmogorov-Smirnov statistics and therefore there is no evidence to suggest the data are not normally distributed.

The results of the specific analyses are provided below.




ME Winter
Mean = 5611.05
Std. Dev. = 362.194
N = 20
Frequency
0
1
2
3
4
5
4800
5100
5400
5700
6000
ME Winter


ME PeakDay
Mean = 69.3
Std. Dev. = 5.966
N = 30
Frequency
0
1
2
3
4
5
55
60
65
70
75
80
85
ME PeakDay

Statistics

		ME Annual	ME Winter	ME PeakDay
N	Valid	20	20	30
	Missing	10	10	0
Mean		7497.55	5611.05	69.30
Skewness		-.034	-.049	.037
Std. Error of Skewness		.512	.512	.427
Kurtosis		-1.321	-.967	-.155
Std. Error of Kurtosis		.992	.992	.833

One-Sample Kolmogorov-Smirnov Test

		ME Annual	ME Winter	ME PeakDay
N		20	20	30
Normal Parameters[a,b]	Mean	7497.55	5611.05	69.30
	Std. Deviation	456.449	362.194	5.966
Most Extreme Differences	Absolute	.121	.146	.088
	Positive	.104	.146	.088
	Negative	-.121	-.135	-.080
Kolmogorov-Smirnov Z		.539	.654	.481
Asymp. Sig. (2-tailed)		.933	.786	.975

a. Test distribution is Normal.

b. Calculated from data.

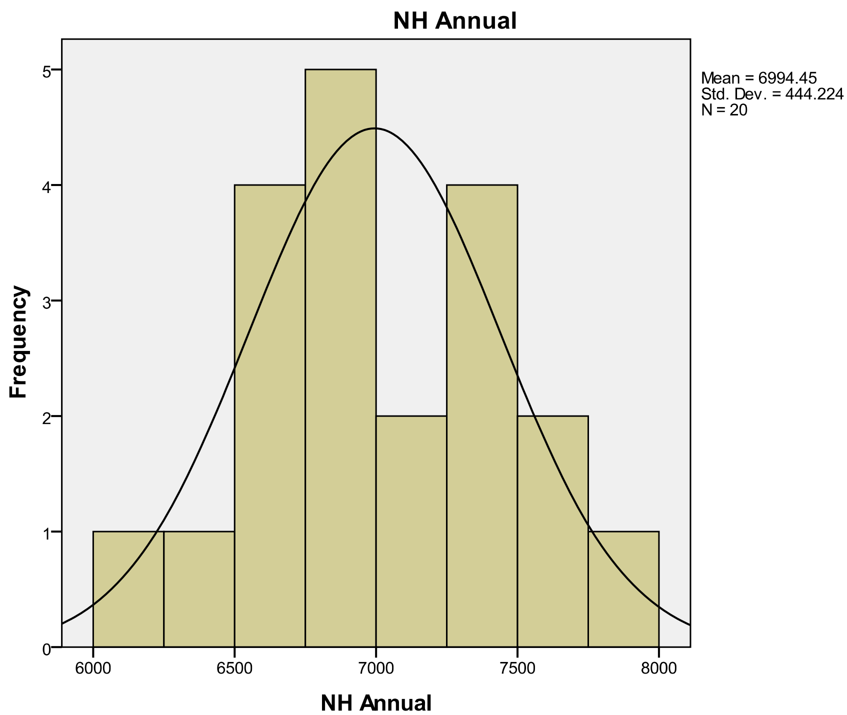
B. NORMAL DISTRIBUTION TESTS FOR EDD DATA – NEW HAMPSHIRE DIVISION

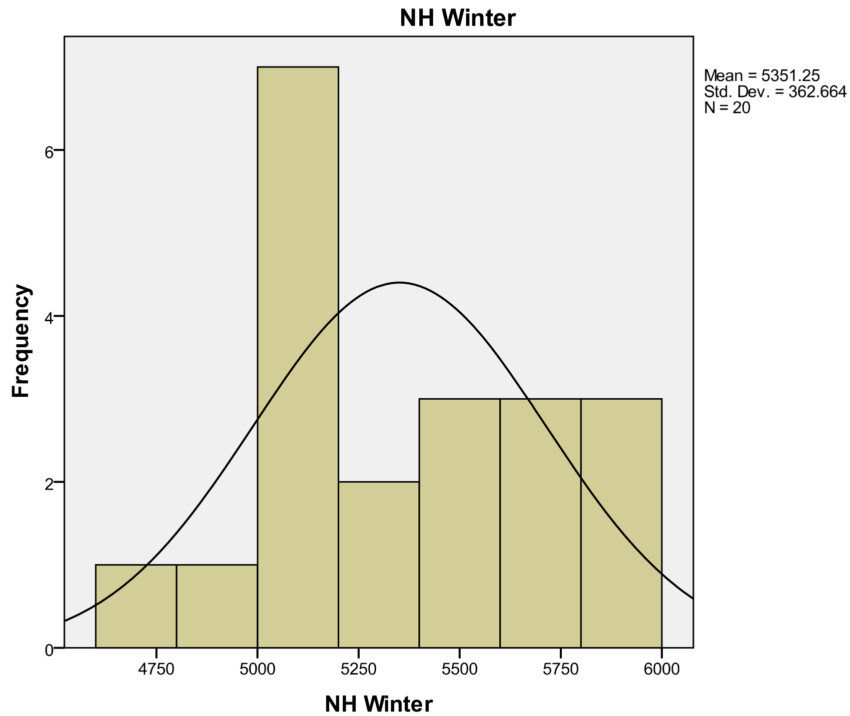
There is no evidence that the New Hampshire Division annual, winter, and peak day EDD data are not normally distributed, based on the following analyses: (1) histogram, (2) skewness, (3) kurtosis, and (4) Kolmogorov-Smirnov test.

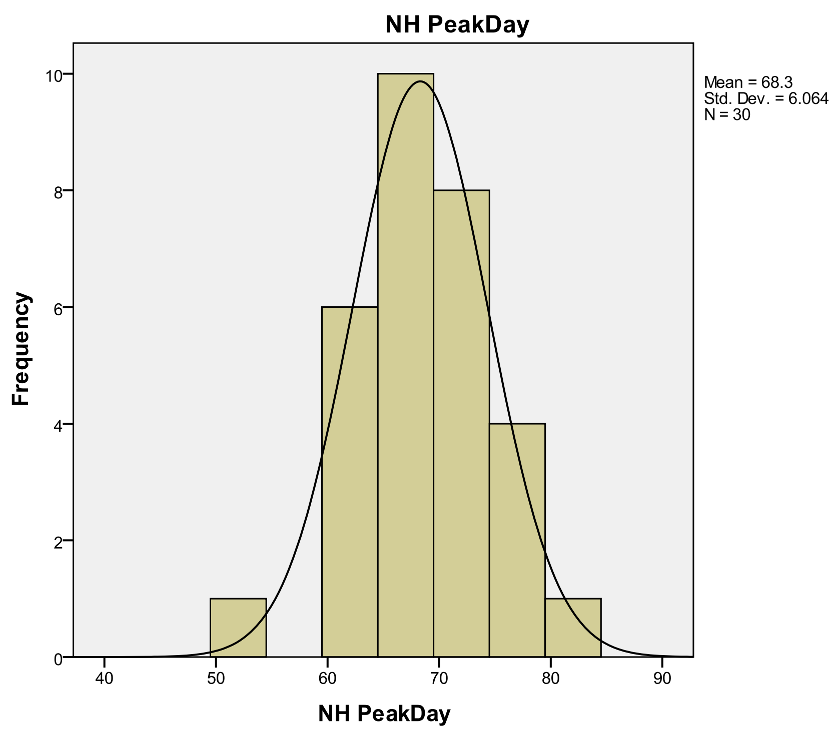
- The histogram (or frequency distribution) is a test by visual inspection to see if the data generally follow the shape of a normal distribution. The histograms below show a normal distribution superimposed on the underlying data.
- Skewness is a test of normality based on a measure of symmetry. A skew of zero indicates that the distribution is symmetrical. A positive skew indicates that the data set has large outliers to the right and a negative skew indicates that the data set has large outliers to the left. A normal distribution has a skewness statistic of zero. Data sets with skewness statistics that were within 2 standard errors of skewness are typically assumed to be close enough to zero to be considered not different from a normal distribution. The skewness statistics below, along with their standard errors indicate that both data sets have skewness statistics that are well within 2 standard errors.
- Kurtosis is a measure of pointedness versus flatness. A positive kurtosis indicates that the data set is especially pointed (i.e. the data is clustered around one point), while a negative kurtosis indicates that the data is relatively flat (i.e. the data are more dispersed across the entire distribution). A normal distribution has a kurtosis of zero. A data set with a kurtosis statistic that is within 2 standard errors of kurtosis is typically assumed to be close enough to zero to be considered not different from a normal distribution. The kurtosis statistics below, along with their standard errors indicate that both data sets have kurtosis statistics that are well within 2 standard errors.
- The Kolmogorov-Smirnov test is a goodness-of-fit test which tests whether a given data set has a distribution that is significantly different from a hypothesized distribution. Possible distributions that can be tested by the Kolmogorov-Smirnov test include the normal, Poisson, exponential and uniform distributions. The statistic is based on the most extreme absolute difference between the cumulative distributions of the data set and the hypothesized distribution and the number of data points in the underlying data set. A large value of the statistic (and a corresponding small value for the significance level) indicates that there is a large difference between the underlying data set and the

hypothesized distribution. The Kolmogorov-Smirnov statistics (comparing against a normal distribution) below, along with their significance levels indicate that both data sets have insignificant Kolmogorov-Smirnov statistics and therefore there is no evidence to suggest the data are not normally distributed.

The results of the specific analyses are provided below.




NH Winter
Mean = 5351.25
Std. Dev. = 362.664
N = 20
Frequency
0
2
4
6
4750
5000
5250
5500
5750
6000
NH Winter


NH PeakDay
Mean = 68.3
Std. Dev. = 6.064
N = 30
Frequency
0
2
4
6
8
10
40
50
60
70
80
90
NH PeakDay

Statistics

		NH Annual	NH Winter	NH PeakDay
N	Valid	20	20	30
	Missing	10	10	0
Mean		6994.45	5351.25	68.30
Skewness		.048	.094	-.018
Std. Error of Skewness		.512	.512	.427
Kurtosis		-.607	-.712	1.238
Std. Error of Kurtosis		.992	.992	.833

One-Sample Kolmogorov-Smirnov Test

		NH Annual	NH Winter	NH PeakDay
N		20	20	30
Normal Parameters[a,b]	Mean	6994.45	5351.25	68.30
	Std. Deviation	444.224	362.664	6.064
Most Extreme Differences	Absolute	.088	.170	.123
	Positive	.088	.170	.123
	Negative	-.086	-.091	-.091
Kolmogorov-Smirnov Z		.392	.760	.673
Asymp. Sig. (2-tailed)		.998	.611	.755

a. Test distribution is Normal.

b. Calculated from data.

Appendix IV-2. Daily Planning Load Models – Maine Division

A. NORMAL YEAR – MAINE DIVISION

a) Detailed Statistical Results: Daily Planning Load Model, Normal Year – Maine Division

Model Statistics

Model	Number of Predictors	Model Fit statistics	
		R-squared	RMSE
M_PlanLoad-Model_1	12	.990	1273.618

ARIMA Model Parameters

		Estimate	SE	t	Sig.
M_PlanLoad-Model_1	M_PlanLoad Constant	10586.093	535.858	19.755	.000
	AR Lag 1	.468	.032	14.767	.000
	AR Lag 6	.178	.036	4.970	.000
	AR Lag 7	.149	.040	3.766	.000
	AR Lag 14	.116	.034	3.448	.001
	D100209_101209	-2488.728	621.522	-4.004	.000
	D31110	8969.157	1127.613	7.954	.000
	D22810	-7591.803	1161.123	-6.538	.000
	M_EDD	165.812	26.295	6.306	.000
	M_JANEDD	468.368	28.641	16.353	.000
	M_FEBEDD	463.231	29.389	15.762	.000
	M_MAREDD	462.499	30.457	15.185	.000
	M_APREDD	270.224	38.483	7.022	.000
	M_MAYEDD	129.896	34.742	3.739	.000
	M_OCTEDD	235.252	30.808	7.636	.000
	M_NOVEDD	365.077	30.061	12.144	.000
	M_DECEDD	468.155	28.554	16.395	.000

Variable Descriptions:

AR Lag 1	Autoregressive Term Lag 1
AR Lag 6	Autoregressive Term Lag 6
AR Lag 7	Autoregressive Term Lag 7
AR Lag 14	Autoregressive Term Lag 14
D100209_101209	Dummy Variable: October 2, 2009 to October 12, 2009
D22810	Dummy Variable: February 28, 2010
D31110	Dummy Variable: March 11, 2010
M_EDD	Maine Division - Daily Billing Cycle EDD
M_JANEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x January
M_FEBEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x February
M_MAREDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x March
M_APREDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x April
M_MAYEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x May
M_OCTEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x October
M_NOVEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x November
M_DECEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x December

b) Calculation of Baseload and Weather-Sensitive Components – Maine Division

Monthly Baseload and Weather-Sensitive Components

Pre-Calibration – Maine Division

Month	**Baseload Factor**		**Weather-Sensitive Component**		
	Constant	**Total Base**	EDD	MonthxEDD	**Total Weather-Sensitive**
Nov	10,586	10,586	166	365	531
Dec	10,586	10,586	166	468	634
Jan	10,586	10,586	166	468	634
Feb	10,586	10,586	166	463	629
Mar	10,586	10,586	166	462	628
Apr	10,586	10,586	166	270	436
May	10,586	10,586	166	130	296
Jun	10,586	10,586	166		166
Jul	10,586	10,586	166		166
Aug	10,586	10,586	166		166
Sep	10,586	10,586	166		166
Oct	10,586	10,586	166	235	401

The monthly pre-calibration baseload and weather-sensitive components from the table above were multiplied by the adjustment factors in the table below to develop the calibrated baseload and weather-sensitive components for Normal Year Base Case Planning Load. The Base Case adjustment factors were determined by season such that the sum of (a) the calibrated baseload component multiplied by the number of days in the month and (b) the calibrated weather-sensitive component multiplied by the Normal Year EDD, equals the Base Case Normal Year Planning Load derived from the Customer Segment modeling, as summarized in Table III-47. Similar calculations were performed to develop baseload and weather-sensitive components for the High Case and Low Case Normal Year Planning Load.

Monthly Baseload and Weather-Sensitive Components – Normal Year Base Case

Post-Calibration – Maine Division

	Calibrated Monthly Baseload and Weather-Sensitive Components			**Calendar Month Planning Load Calculation**		
		Normal				
Month	Adj Factor	Base Dth/d	Heating Dth/EDD	Days In Month	EDD Normal	Planning Load (Dth) Normal
Apr-11	34.5%	3,657	151	30	675	211,385
May-11	34.5%	3,657	102	31	377	151,827
Jun-11	34.5%	3,657	57	30	106	115,750
Jul-11	34.5%	3,657	57	31	16	114,284
Aug-11	34.5%	3,657	57	31	23	114,673
Sep-11	34.5%	3,657	57	30	167	119,278
Oct-11	34.5%	3,657	139	31	523	185,849
Nov-11	75.4%	7,983	400	30	809	563,181
Dec-11	75.4%	7,983	478	31	1,178	810,683
Jan-12	75.4%	7,983	478	31	1,394	913,908
Feb-12	75.4%	7,983	474	28	1,183	784,709
Mar-12	75.4%	7,983	474	31	1,048	743,922
Apr-12	34.7%	3,672	151	30	675	212,261
May-12	34.7%	3,672	103	31	377	152,456
Jun-12	34.7%	3,672	58	30	106	116,230
Jul-12	34.7%	3,672	58	31	16	114,758
Aug-12	34.7%	3,672	58	31	23	115,149
Sep-12	34.7%	3,672	58	30	167	119,773
Oct-12	34.7%	3,672	139	31	523	186,620
Nov-12	76.2%	8,069	405	30	809	569,266
Dec-12	76.2%	8,069	483	31	1,178	819,443
Jan-13	76.2%	8,069	483	31	1,394	923,782
Feb-13	76.2%	8,069	479	28	1,183	793,187
Mar-13	76.2%	8,069	479	31	1,048	751,960
Apr-13	34.8%	3,680	152	30	675	212,702
May-13	34.8%	3,680	103	31	377	152,773
Jun-13	34.8%	3,680	58	30	106	116,471
Jul-13	34.8%	3,680	58	31	16	114,996
Aug-13	34.8%	3,680	58	31	23	115,388
Sep-13	34.8%	3,680	58	30	167	120,022
Oct-13	34.8%	3,680	139	31	523	187,007
Nov-13	77.4%	8,196	411	30	809	578,201
Dec-13	77.4%	8,196	491	31	1,178	832,304
Jan-14	77.4%	8,196	491	31	1,394	938,281
Feb-14	77.4%	8,196	487	28	1,183	805,636
Mar-14	77.4%	8,196	486	31	1,048	763,762
Apr-14	35.2%	3,722	153	30	675	215,131
May-14	35.2%	3,722	104	31	377	154,517
Jun-14	35.2%	3,722	58	30	106	117,801
Jul-14	35.2%	3,722	58	31	16	116,309
Aug-14	35.2%	3,722	58	31	23	116,705
Sep-14	35.2%	3,722	58	30	167	121,392
Oct-14	35.2%	3,722	141	31	523	189,142

	Calibrated Monthly Baseload and Weather-Sensitive Components			Calendar Month Planning Load Calculation		
	Normal			Days		Planning
		Base	Heating	In	EDD	Load (Dth)
Month	Adj Factor	Dth/d	Dth/EDD	Month	Normal	Normal
Nov-14	79.0%	8,363	419	30	809	589,988
Dec-14	79.0%	8,363	501	31	1,178	849,270
Jan-15	79.0%	8,363	501	31	1,394	957,408
Feb-15	79.0%	8,363	497	28	1,183	822,059
Mar-15	79.0%	8,363	496	31	1,048	779,331
Apr-15	35.8%	3,788	156	30	675	218,954
May-15	35.8%	3,788	106	31	377	157,263
Jun-15	35.8%	3,788	59	30	106	119,895
Jul-15	35.8%	3,788	59	31	16	118,376
Aug-15	35.8%	3,788	59	31	23	118,779
Sep-15	35.8%	3,788	59	30	167	123,550
Oct-15	35.8%	3,788	143	31	523	192,504
Nov-15	80.5%	8,521	427	30	809	601,136
Dec-15	80.5%	8,521	510	31	1,178	865,318
Jan-16	80.5%	8,521	510	31	1,394	975,499
Feb-16	80.5%	8,521	506	28	1,183	837,593
Mar-16	80.5%	8,521	506	31	1,048	794,057
Apr-16	36.3%	3,838	158	30	675	221,847
May-16	36.3%	3,838	107	31	377	159,341
Jun-16	36.3%	3,838	60	30	106	121,479
Jul-16	36.3%	3,838	60	31	16	119,940
Aug-16	36.3%	3,838	60	31	23	120,349
Sep-16	36.3%	3,838	60	30	167	125,182
Oct-16	36.3%	3,838	145	31	523	195,047

B. DESIGN YEAR – MAINE DIVISION

a) Calculation of Baseload and Weather-Sensitive Components – Maine Division

The calibrated baseload and weather-sensitive components for Design Year Base Case Planning Load were developed using the same monthly pre-calibration baseload and weather-sensitive components shown on page A-64. The monthly calibrated Design Year baseload components are the same as the calibrated Normal Year baseload components, and the Design Year weather-sensitive components were calculated by identifying the necessary adjustments to produce Design Year Base Case Planning Load. The result is that the Design Year weather-sensitive components reflect the Normal Year weather-sensitive components, plus the incremental load associated with Design Year. The adjustment factors in the table below were multiplied by the pre-calibrated weather-sensitive components to produce the calibrated weather-sensitive components for Design Year Base Case Planning Load. The Base Case adjustment factors were determined by season such that the sum of (a) the calibrated baseload component multiplied by the number of days in the month and (b) the weather-sensitive components multiplied by Design Year EDD, equals the Base Case Design Year Planning Load derived from the Customer Segment modeling, as summarized in Table IV-5. The same calculations were performed to develop baseload and weather-sensitive components for the High Case and Low Case Design Year Planning Load.

Monthly Baseload and Weather-Sensitive Components – Design Year Base Case Post-Calibration – Maine Division

	Calibrated Monthly Baseload and Weather-Sensitive Components			**Calendar Month Planning Load Calculation**		
		Normal	Design			
Month	Adj Factor	Base Dth/d	Heating Dth/EDD	Days In Month	EDD Design	Planning Load (Dth) Design
Apr-11	36.5%	3,657	159	30	675	217,024
May-11	36.5%	3,657	108	31	377	153,960
Jun-11	36.5%	3,657	60	30	106	116,086
Jul-11	36.5%	3,657	60	31	16	114,335
Aug-11	36.5%	3,657	60	31	23	114,746
Sep-11	36.5%	3,657	60	30	167	119,810
Oct-11	36.5%	3,657	146	31	523	189,869
Nov-11	78.4%	7,983	416	30	907	617,061
Dec-11	78.4%	7,983	497	31	1,307	897,251
Jan-12	78.4%	7,983	497	31	1,586	1,036,264
Feb-12	78.4%	7,983	493	28	1,333	880,904
Mar-12	78.4%	7,983	493	31	1,158	817,901
Apr-12	36.7%	3,672	160	30	675	218,085
May-12	36.7%	3,672	108	31	377	154,660
Jun-12	36.7%	3,672	61	30	106	116,577
Jul-12	36.7%	3,672	61	31	16	114,811
Aug-12	36.7%	3,672	61	31	23	115,224
Sep-12	36.7%	3,672	61	30	167	120,322
Oct-12	36.7%	3,672	147	31	523	190,772
Nov-12	79.4%	8,069	421	30	907	624,235
Dec-12	79.4%	8,069	503	31	1,307	907,817
Jan-13	79.4%	8,069	503	31	1,586	1,048,519
Feb-13	79.4%	8,069	499	28	1,333	891,304
Mar-13	79.4%	8,069	499	31	1,158	827,503
Apr-13	36.8%	3,680	160	30	675	218,728
May-13	36.8%	3,680	109	31	377	155,053
Jun-13	36.8%	3,680	61	30	106	116,830
Jul-13	36.8%	3,680	61	31	16	115,050
Aug-13	36.8%	3,680	61	31	23	115,465
Sep-13	36.8%	3,680	61	30	167	120,589
Oct-13	36.8%	3,680	148	31	523	191,303
Nov-13	80.7%	8,196	428	30	907	634,454
Dec-13	80.7%	8,196	512	31	1,307	922,792
Jan-14	80.7%	8,196	512	31	1,586	1,065,857
Feb-14	80.7%	8,196	508	28	1,333	906,028

	Calibrated Monthly Baseload and Weather-Sensitive Components			Calendar Month Planning Load Calculation		
		Normal	Design			
Month	Adj Factor	Base Dth/d	Heating Dth/EDD	Days In Month	EDD Design	Planning Load (Dth) Design
Mar-14	80.7%	8,196	507	31	1,158	841,129
Apr-14	37.3%	3,722	163	30	675	221,392
May-14	37.3%	3,722	110	31	377	156,886
Jun-14	37.3%	3,722	62	30	106	118,174
Jul-14	37.3%	3,722	62	31	16	116,366
Aug-14	37.3%	3,722	62	31	23	116,786
Sep-14	37.3%	3,722	62	30	167	121,982
Oct-14	37.3%	3,722	150	31	523	193,606
Nov-14	82.4%	8,363	437	30	907	647,513
Dec-14	82.4%	8,363	522	31	1,307	941,818
Jan-15	82.4%	8,363	522	31	1,586	1,087,846
Feb-15	82.4%	8,363	518	28	1,333	924,715
Mar-15	82.4%	8,363	518	31	1,158	858,464
Apr-15	38.0%	3,788	166	30	675	225,464
May-15	38.0%	3,788	112	31	377	159,726
Jun-15	38.0%	3,788	63	30	106	120,282
Jul-15	38.0%	3,788	63	31	16	118,435
Aug-15	38.0%	3,788	63	31	23	118,863
Sep-15	38.0%	3,788	63	30	167	124,163
Oct-15	38.0%	3,788	152	31	523	197,145
Nov-15	84.0%	8,521	446	30	907	659,882
Dec-15	84.0%	8,521	532	31	1,307	959,846
Jan-16	84.0%	8,521	532	31	1,586	1,108,682
Feb-16	84.0%	8,521	528	28	1,333	942,422
Mar-16	84.0%	8,521	528	31	1,158	874,888
Apr-16	38.5%	3,838	168	30	675	228,599
May-16	38.5%	3,838	114	31	377	161,896
Jun-16	38.5%	3,838	64	30	106	121,881
Jul-16	38.5%	3,838	64	31	16	120,001
Aug-16	38.5%	3,838	64	31	23	120,436
Sep-16	38.5%	3,838	64	30	167	125,818
Oct-16	38.5%	3,838	155	31	523	199,861

C. DESIGN DAY MODEL – MAINE DIVISION

a) Detailed Statistical Results: Design Day Model – Maine Division

Model Statistics

Model	Number of Predictors	Model Fit statistics	
		R-squared	RMSE
M_PlanLoad-Model_1	22	.993	1060.022

ARIMA Model Parameters

			Estimate	SE	t	Sig.
M_PlanLoad-Model_1	M_PlanLoad	Constant	8479.837	147.286	57.574	.000
	AR Lag 1		.329	.038	8.725	.000
	AR Lag 6		.099	.037	2.671	.008
	AR Lag 13		-.079	.038	-2.072	.039
	M_EDD		123.056	23.378	5.264	.000
	M_JANEDD		246.221	33.511	7.347	.000
	M_FEBEDD		245.577	33.394	7.354	.000
	M_MAREDD		226.253	33.113	6.833	.000
	M_APREDD		116.930	32.519	3.596	.000
	M_MAYEDD		82.590	26.992	3.060	.002
	M_OCTEDD		110.823	27.291	4.061	.000
	M_NOVEDD		171.729	32.641	5.261	.000
	M_DECEDD		233.649	33.170	7.044	.000
	Workday		1635.156	126.641	12.912	.000
	Monday		-249.731	117.738	-2.121	.034
	Friday		-1104.228	117.994	-9.358	.000
	Sunday		833.516	128.233	6.500	.000
	M_EDDB55		113.525	44.399	2.557	.011
	M_EDDB45		121.034	43.028	2.813	.005
	M_EDDB35		51.469	29.194	1.763	.078
	M_PRIOR1EDD		108.265	7.879	13.740	.000
	D31110		8349.859	1010.389	8.264	.000
	D22810		-7944.610	1033.075	-7.690	.000
	D102809_42110		1542.826	346.584	4.452	.000
	D102710_121910		2166.281	398.053	5.442	.000
	D122010A		3601.728	412.738	8.726	.000

Variable Definitions:

AR Lag 1	Autoregressive Term Lag 1
AR Lag 6	Autoregressive Term Lag 6
AR Lag 13	Autoregressive Term Lag 13
M_EDD	Maine Division - Daily Billing Cycle EDD
M_JANEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x January
M_FEBEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x February
M_MAREDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x March
M_APREDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x April
M_MAYEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x May
M_OCTEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x October
M_NOVEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x November
M_DECEDD	Interaction Term: Maine Division - Daily Billing Cycle EDD x December
Workday	Dummy Variable: Workday
Monday	Dummy Variable: Monday
Friday	Dummy Variable: Friday
Sunday	Dummy Variable: Sunday

M_EDDB55	Maine Division - Daily Billing Cycle EDD, Base 55
M_EDDB45	Maine Division - Daily Billing Cycle EDD, Base 45
M_EDDB35	Maine Division - Daily Billing Cycle EDD, Base 35
M_PRIOR1EDD	Maine Division – Prior Day Daily Billing Cycle EDD
D31110	Dummy Variable: March 11, 2010
D22810	Dummy Variable: February 28, 2010
D102809_42110	Dummy Variable: October 28, 2009 to April 21, 2010
D102710_121910	Dummy Variable: October 27, 2010 to December 19, 2010
D122010A	Dummy Variable: December 20, 2010 and Beyond

b) Calculation of Design Day Planning Load – Maine Division

Design Day Planning Load

Pre-Calibration – Maine Division

(Assumes Design Day Occurs on a Workday in January)

	Coefficient	EDD	Dth
Baseload (Dth)	13,717	NA	13,717
HeatLoad (Dth/EDD)	369	78.897	29,135
HeatLoad (Dth/Prior Day EDD)	108	65.397	7,080
HeatLoad Base 55 (Dth/(EDD-10))	114	68.897	7,822
HeatLoad Base 45 (Dth/(EDD-20))	121	58.897	7,129
HeatLoad Base 35 (Dth/(EDD-30))	51	48.9	2,517
Baseload (Dth)	13,717	NA	13,717
		Total (Dth)	**67,399**

The pre-calibration Design Day Planning Load was calibrated using the adjustment factors associated with Design Year January for each forecast year for the Base Case, as shown below. The same calculations were performed to determine Design Day Planning Load for the High Growth and Low Growth scenarios.

Design Day Planning Load - Base Case

Post-Calibration – Maine Division

	Design January Pre-Calibration Result	Design January Post-Calibration Result	Adjustment Factor	Calibrated Design Day Planning Load
2011/2012	1,334,076	1,036,264	77.7%	52,353
2012/2013	1,334,076	1,048,519	78.6%	52,972
2013/2014	1,334,076	1,065,857	79.9%	53,848
2014/2015	1,334,076	1,087,846	81.5%	54,959
2015/2016	1,334,076	1,108,682	83.1%	56,011

Appendix IV-3. Daily Planning Load Models – New Hampshire Division

A. NORMAL YEAR – NEW HAMPSHIRE DIVISION

a) Detailed Statistical Results: Daily Planning Load Model, Normal Year – New Hampshire Division

Model Statistics

Model	Number of Predictors	Model Fit statistics	
		R-squared	RMSE
N_PlanLoad-Model_1	14	.989	1002.011

ARIMA Model Parameters

			Estimate	SE	t	Sig.
N_PlanLoad-Model_1	N_PlanLoad	Constant	5310.589	87.801	60.484	.000
	AR Lag 1		.359	.036	9.973	.000
	AR Lag 8		.099	.039	2.560	.011
	AR Lag 9		-.147	.038	-3.848	.000
	N_EDD		127.268	20.389	6.242	.000
	N_JANEDD		409.689	20.179	20.303	.000
	N_FEBEDD		403.385	20.258	19.912	.000
	N_MAREDD		355.922	20.430	17.422	.000
	N_APREDD		214.302	24.390	8.787	.000
	N_MAYEDD		86.134	24.972	3.449	.001
	N_OCTEDD		186.098	21.384	8.703	.000
	N_NOVEDD		288.029	20.920	13.768	.000
	N_DECEDD		405.834	20.264	20.028	.000
	D120309_120609		-3265.711	657.391	-4.968	.000
	D031110		-8409.885	937.151	-8.974	.000
	D012411		5826.858	941.057	6.192	.000
	D120110_120410		-2121.513	667.773	-3.177	.002
	D112810_113010		2601.308	747.015	3.482	.001

Variable Definitions:

AR Lag 1	Autoregressive Term Lag 1
AR Lag 8	Autoregressive Term Lag 8
AR Lag 9	Autoregressive Term Lag 9
N_EDD	New Hampshire Division - Daily Billing Cycle EDD
N_JANEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x January
N_FEBEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x February
N_MAREDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x March
N_APREDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x April
N_MAYEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x May
N_OCTEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x October
N_NOVEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x November
N_DECEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x December
D120309_120609	Dummy Variable: December 3, 2009 to December 6, 2009
D031110	Dummy Variable: March 11, 2010

D012411	Dummy Variable: January 24, 2011
D120110_120410	Dummy Variable: December 1, 2010 to December 4, 2010
D112810_113010	Dummy Variable: November 28, 2010 to November 30, 2010

b) Calculation of Baseload and Weather-Sensitive Components – New Hampshire Division

Monthly Baseload and Weather-Sensitive Components

Pre-Calibration – New Hampshire Division

Month	**Base Load Factor**		**Weather-Sensitive Component**		
	Constant	**Total Base**	EDD	Month x EDD	**Total Weather Sensitive**
Nov	5,311	5,311	127	288	415
Dec	5,311	5,311	127	406	533
Jan	5,311	5,311	127	410	537
Feb	5,311	5,311	127	403	531
Mar	5,311	5,311	127	356	483
Apr	5,311	5,311	127	214	342
May	5,311	5,311	127	86	213
Jun	5,311	5,311	127		127
Jul	5,311	5,311	127		127
Aug	5,311	5,311	127		127
Sep	5,311	5,311	127		127
Oct	5,311	5,311	127	186	313

The monthly pre-calibration baseload and weather-sensitive components from the table above were multiplied by the adjustment factors in the table below to develop the calibrated baseload and weather-sensitive components for Normal Year Base Case Planning Load. The Base Case adjustment factors were determined by season such that the sum of (a) the calibrated baseload component multiplied by the number of days in the month and (b) the weather-sensitive components multiplied by Normal Year EDD, equals the Base Case Normal Year Planning Load derived from the Customer Segment modeling, as summarized in Table III-48. Similar calculations were performed to develop baseload and weather-sensitive components for the High Case and Low Case Normal Year Planning Load.

Monthly Baseload and Weather-Sensitive Components – Normal Year Base Case

Post-Calibration – New Hampshire Division

	Calibrated Monthly Baseload and Weather-Sensitive Components			**Calendar Month Planning Load Calculation**		
	Normal			Days		Planning
Month	Adj Factor	Base Dth/d	Heating Dth/EDD	In Month	EDD Normal	Load (Dth) Normal
Apr-11	112.6%	5,977	384	30	611	414,257
May-11	112.6%	5,977	240	31	319	261,858
Jun-11	112.6%	5,977	143	30	78	190,499
Jul-11	112.6%	5,977	143	31	10	186,757
Aug-11	112.6%	5,977	143	31	17	187,674
Sep-11	112.6%	5,977	143	30	139	199,230
Oct-11	112.6%	5,977	353	31	471	351,492
Nov-11	99.0%	5,257	411	30	760	469,995
Dec-11	99.0%	5,257	528	31	1,130	759,546
Jan-12	99.0%	5,257	532	31	1,337	873,624
Feb-12	99.0%	5,257	525	28	1,130	740,850
Mar-12	99.0%	5,257	478	31	994	638,495
Apr-12	113.9%	6,049	389	30	611	419,241
May-12	113.9%	6,049	243	31	319	265,008
Jun-12	113.9%	6,049	145	30	78	192,791
Jul-12	113.9%	6,049	145	31	10	189,004
Aug-12	113.9%	6,049	145	31	17	189,932
Sep-12	113.9%	6,049	145	30	139	201,627
Oct-12	113.9%	6,049	357	31	471	355,720
Nov-12	100.3%	5,329	417	30	760	476,392
Dec-12	100.3%	5,329	535	31	1,130	769,883
Jan-13	100.3%	5,329	539	31	1,337	885,514
Feb-13	100.3%	5,329	532	28	1,130	750,933
Mar-13	100.3%	5,329	485	31	994	647,185
Apr-13	114.9%	6,100	392	30	611	422,764
May-13	114.9%	6,100	245	31	319	267,235
Jun-13	114.9%	6,100	146	30	78	194,411
Jul-13	114.9%	6,100	146	31	10	190,592
Aug-13	114.9%	6,100	146	31	17	191,528
Sep-13	114.9%	6,100	146	30	139	203,321
Oct-13	114.9%	6,100	360	31	471	358,709
Nov-13	102.2%	5,428	425	30	760	485,318
Dec-13	102.2%	5,428	545	31	1,130	784,308
Jan-14	102.2%	5,428	549	31	1,337	902,105
Feb-14	102.2%	5,428	542	28	1,130	765,002
Mar-14	102.2%	5,428	494	31	994	659,311
Apr-14	117.2%	6,223	400	30	611	431,300
May-14	117.2%	6,223	250	31	319	272,631
Jun-14	117.2%	6,223	149	30	78	198,336
Jul-14	117.2%	6,223	149	31	10	194,441
Aug-14	117.2%	6,223	149	31	17	195,395

	Calibrated Monthly Baseload and Weather-Sensitive Components			Calendar Month Planning Load Calculation		
	Normal			Days		Planning
Month	Adj Factor	Base Dth/d	Heating Dth/EDD	In Month	EDD Normal	Load (Dth) Normal
Sep-14	117.2%	6,223	149	30	139	207,426
Oct-14	117.2%	6,223	367	31	471	365,952
Nov-14	104.9%	5,573	436	30	760	498,196
Dec-14	104.9%	5,573	559	31	1,130	805,120
Jan-15	104.9%	5,573	563	31	1,337	926,043
Feb-15	104.9%	5,573	557	28	1,130	785,302
Mar-15	104.9%	5,573	507	31	994	676,806
Apr-15	120.8%	6,417	413	30	611	444,752
May-15	120.8%	6,417	258	31	319	281,133
Jun-15	120.8%	6,417	154	30	78	204,522
Jul-15	120.8%	6,417	154	31	10	200,505
Aug-15	120.8%	6,417	154	31	17	201,489
Sep-15	120.8%	6,417	154	30	139	213,896
Oct-15	120.8%	6,417	379	31	471	377,366
Nov-15	107.6%	5,713	447	30	760	510,785
Dec-15	107.6%	5,713	574	31	1,130	825,465
Jan-16	107.6%	5,713	578	31	1,337	949,444
Feb-16	107.6%	5,713	571	28	1,130	805,146
Mar-16	107.6%	5,713	520	31	994	693,909
Apr-16	123.8%	6,576	423	30	611	455,752
May-16	123.8%	6,576	264	31	319	288,087
Jun-16	123.8%	6,576	158	30	78	209,581
Jul-16	123.8%	6,576	158	31	10	205,464
Aug-16	123.8%	6,576	158	31	17	206,473
Sep-16	123.8%	6,576	158	30	139	219,186
Oct-16	123.8%	6,576	388	31	471	386,700

B. DESIGN YEAR – NEW HAMPSHIRE DIVISION

a) Calculation of Baseload and Weather-Sensitive Components – New Hampshire Division

The calibrated baseload and weather-sensitive components for Design Year Base Case Planning Load were developed using the same monthly pre-calibration baseload and weather-sensitive components shown on page A-118. The monthly calibrated Design Year baseload components are the same as the calibrated Normal Year baseload components, and the Design Year weather-sensitive components were calculated by identifying the necessary adjustments to produce Design Year Base Case Planning Load. The result is that the Design Year weather-sensitive components reflect the Normal Year weather-sensitive components, plus the incremental load associated with Design Year. The adjustment factors in the table below were multiplied by the pre-calibrated weather-sensitive components to produce the calibrated weather-sensitive components for Design Year Base Case Planning Load. The Base Case adjustment factors were determined by season such that the sum of (a) the calibrated baseload component multiplied by the number of days in the month and (b) the weather-sensitive components multiplied by Design Year EDD, equals the Base Case Design Year Planning Load derived from the Customer Segment modeling, as summarized in Table IV-6. The same calculations were performed to develop baseload and weather-sensitive components for the High Case and Low Case Design Year Planning Load.

Monthly Baseload and Weather-Sensitive Components – Design Year Base Case

Post-Calibration – New Hampshire Division

	Calibrated Monthly Baseload and Weather-Sensitive Components			**Calendar Month Planning Load Calculation**		
Month	Adj Factor	Normal Base Dth/d	Design Heating Dth/EDD	Days In Month	EDD Design	Planning Load (Dth) Design
Apr-11	115.6%	5,977	395	30	611	420,653
May-11	115.6%	5,977	247	31	319	263,942
Jun-11	115.6%	5,977	147	30	78	190,803
Jul-11	115.6%	5,977	147	31	10	186,797
Aug-11	115.6%	5,977	147	31	17	187,739
Sep-11	115.6%	5,977	147	30	139	199,772
Oct-11	115.6%	5,977	362	31	471	356,016
Nov-11	102.6%	5,257	426	30	855	521,985
Dec-11	102.6%	5,257	547	31	1,262	853,253
Jan-12	102.6%	5,257	551	31	1,538	1,010,142
Feb-12	102.6%	5,257	544	28	1,275	841,233
Mar-12	102.6%	5,257	496	31	1,102	709,487
Apr-12	117.0%	6,049	400	30	611	425,752
May-12	117.0%	6,049	250	31	319	267,130
Jun-12	117.0%	6,049	149	30	78	193,101
Jul-12	117.0%	6,049	149	31	10	189,044
Aug-12	117.0%	6,049	149	31	17	189,998
Sep-12	117.0%	6,049	149	30	139	202,179
Oct-12	117.0%	6,049	367	31	471	360,326
Nov-12	104.1%	5,329	432	30	855	529,431
Dec-12	104.1%	5,329	555	31	1,262	865,513
Jan-13	104.1%	5,329	559	31	1,538	1,024,683
Feb-13	104.1%	5,329	552	28	1,275	853,333
Mar-13	104.1%	5,329	503	31	1,102	719,655
Apr-13	118.0%	6,100	403	30	611	429,410
May-13	118.0%	6,100	252	31	319	269,400
Jun-13	118.0%	6,100	150	30	78	194,727
Jul-13	118.0%	6,100	150	31	10	190,634
Aug-13	118.0%	6,100	150	31	17	191,595
Sep-13	118.0%	6,100	150	30	139	203,884
Oct-13	118.0%	6,100	370	31	471	363,411
Nov-13	106.1%	5,428	441	30	855	539,668
Dec-13	106.1%	5,428	566	31	1,262	882,332
Jan-14	106.1%	5,428	570	31	1,538	1,044,622
Feb-14	106.1%	5,428	563	28	1,275	869,927
Mar-14	106.1%	5,428	513	31	1,102	733,616
Apr-14	120.4%	6,223	411	30	611	438,102
May-14	120.4%	6,223	257	31	319	274,847
Jun-14	120.4%	6,223	153	30	78	198,660
Jul-14	120.4%	6,223	153	31	10	194,483
Aug-14	120.4%	6,223	153	31	17	195,464
Sep-14	120.4%	6,223	153	30	139	208,003

	Calibrated Monthly Baseload and Weather-Sensitive Components			Calendar Month Planning Load Calculation		
		Normal	Design			
Month	Adj Factor	Base Dth/d	Heating Dth/EDD	Days In Month	EDD Design	Planning Load (Dth) Design
Oct-14	120.4%	6,223	377	31	471	370,764
Nov-14	108.9%	5,573	452	30	855	553,933
Dec-14	108.9%	5,573	581	31	1,262	905,639
Jan-15	108.9%	5,573	585	31	1,538	1,072,211
Feb-15	108.9%	5,573	578	28	1,275	892,904
Mar-15	108.9%	5,573	526	31	1,102	752,998
Apr-15	124.2%	6,417	424	30	611	451,716
May-15	124.2%	6,417	265	31	319	283,403
Jun-15	124.2%	6,417	158	30	78	204,854
Jul-15	124.2%	6,417	158	31	10	200,548
Aug-15	124.2%	6,417	158	31	17	201,559
Sep-15	124.2%	6,417	158	30	139	214,486
Oct-15	124.2%	6,417	389	31	471	382,292
Nov-15	111.7%	5,713	464	30	855	567,915
Dec-15	111.7%	5,713	595	31	1,262	928,495
Jan-16	111.7%	5,713	600	31	1,538	1,099,270
Feb-16	111.7%	5,713	593	28	1,275	915,438
Mar-16	111.7%	5,713	540	31	1,102	772,003
Apr-16	127.2%	6,576	435	30	611	462,880
May-16	127.2%	6,576	272	31	319	290,410
Jun-16	127.2%	6,576	162	30	78	209,920
Jul-16	127.2%	6,576	162	31	10	205,508
Aug-16	127.2%	6,576	162	31	17	206,545
Sep-16	127.2%	6,576	162	30	139	219,790
Oct-16	127.2%	6,576	399	31	471	391,742

C. DESIGN DAY MODEL – NEW HAMPSHIRE DIVISION

a) Detailed Statistical Results: Design Day Model – New Hampshire Division

Model Statistics

Model	Number of Predictors	Model Fit statistics	
		R-squared	RMSE
N_PlanLoad-Model_1	20	.992	833.730

ARIMA Model Parameters

			Estimate	SE	t	Sig.
N_PlanLoad-Model_1	N_PlanLoad	Constant	4632.360	100.543	46.074	.000
	AR Lag 1		.206	.039	5.335	.000
	AR Lag 9		-.077	.039	-1.988	.047
	D120309_120609		-1731.351	501.432	-3.453	.001
	D031110		-8828.514	824.567	-10.707	.000
	D112810_113010		1608.065	574.687	2.798	.005
	N_EDD		77.454	17.543	4.415	.000
	N_JANEDD		206.825	22.463	9.208	.000
	N_FEBEDD		204.994	22.334	9.179	.000
	N_MAREDD		184.430	21.679	8.507	.000
	N_APREDD		101.167	21.954	4.608	.000
	N_MAYEDD		54.820	20.065	2.732	.006
	N_OCTEDD		114.197	19.743	5.784	.000
	N_NOVEDD		146.254	21.217	6.893	.000
	N_DECEDD		202.934	22.322	9.091	.000
	N_EDDB55		123.642	31.673	3.904	.000
	N_EDDB45		100.363	25.563	3.926	.000
	N_EDDB25		42.404	18.239	2.325	.020
	Workday		1021.194	96.269	10.608	.000
	Friday		-424.630	93.278	-4.552	.000
	Sunday		460.181	104.799	4.391	.000
	N_PRIOR1EDD		54.962	10.621	5.175	.000
	N_WTR6P1EDD		44.588	12.524	3.560	.000

Variable Definitions:

AR Lag 1	Autoregressive Term Lag 1
AR Lag 9	Autoregressive Term Lag 9
D120309_120609	Dummy Variable: December 3, 2009 to December 6, 2009
D031110	Dummy Variable: March 11, 2010
D112810_113010	Dummy Variable: November 28. 2010 to November 30, 2010
N_EDD	New Hampshire Division - Daily Billing Cycle EDD
N_JANEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x January
N_FEBEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x February
N_MAREDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x March
N_APREDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x April
N_MAYEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x May
N_OCTEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x October
N_NOVEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x November
N_DECEDD	Interaction Term: New Hampshire Division - Daily Billing Cycle EDD x December
N_EDDB55	New Hampshire Division - Daily Billing Cycle EDD, Base 55

N_EDDB45	New Hampshire Division - Daily Billing Cycle EDD, Base 45
N_EDDB25	New Hampshire Division - Daily Billing Cycle EDD, Base 25
Workday	Dummy Variable: Workday
Friday	Dummy Variable: Friday
Sunday	Dummy Variable: Sunday
N_PRIOR1EDD	New Hampshire Division - Prior Day Daily Billing Cycle EDD
N_WTR6P1EDD	Interaction Term: New Hampshire Division - Prior Day Daily Billing Cycle EDD x Dummy Variable: 6 Month Winter Period (October – March)

b) Calculation of Design Day Planning Load – New Hampshire Division

Design Day Planning Load

Pre-Calibration – New Hampshire Division

(Assumes Design Day Occurs on a Workday in January)

	Coefficient	EDD	Dth
Baseload (Dth)	5,654	NA	5,654
HeatLoad (Dth/EDD)	284	80.54	22,895
HeatLoad (Dth/Prior Day EDD)	100	67.09	6,679
HeatLoad Base 55 (Dth/(EDD-10))	124	70.54	8,721
HeatLoad Base 45 (Dth/(EDD-20))	100	60.54	6,076
HeatLoad Base 25 (Dth/(EDD-40))	42	40.54	1,719
		Total (Dth)	**51,743**

The pre-calibration Design Day Planning Load was then calibrated using the adjustment factors associated with Design Year January for each forecast year for the Base Case, as shown below. The same calculations were performed to determine Design Day Planning Load for the High Growth and Low Growth scenarios.

Design Day Planning Load - Base Case

Post-Calibration – New Hampshire Division

	Design January Pre-Calibration Result	Design January Post-Calibration Result	Adjustment Factor	Calibrated Design Day Planning Load
2011/2012	990,320	1,010,142	102.0%	52,778
2012/2013	990,320	1,024,683	103.5%	53,538
2013/2014	990,320	1,044,622	105.5%	54,580
2014/2015	990,320	1,072,211	108.3%	56,021
2015/2016	990,320	1,099,270	111.0%	57,435