PREFILED EVIDENCE OF

PAUL GARDINER, MANAGER, DEMAND FORECASTING AND ANALYSIS

The general service demand forecast for the residential, commercial and industrial service classes is described in this evidence. The total demand forecast is based on natural gas consumption estimates prepared for each customer service and rate class. The general service market demand forecast is used to prepare corporate and operating plans for Union. Union's general service market is comprised of customers in the Rate M2, 01 and 10 customer classes. This evidence has the following sections:

1. An overview of the general service demand forecast for 2007
2. A discussion of the market and customer consumption characteristics
3. A description of the demand forecast methodology
4. A discussion of Union's response to the Board's NAC directive
5. The NAC forecast results

The customer demand forecast was prepared during the first half of 2005 as part of Union's annual budget process and includes actual consumption information up to and including March 2005. The forecasting methodology used to prepare this evidence is similar to the 2004 rate case evidence and the methodology has been reviewed by an external expert for soundness, logic and reasonableness.

In an effort to make the regulatory approval process more efficient, responses to "typical" interrogatory questions that have been asked in past rate cases have been incorporated into the data and background information that has been included in Appendix A and Appendix B.

The information available in Appendix A includes:

- General service market overview
- Summary of the growth in the number of billed customers
- Calculation of customer number shrinkage
- Annual NAC history and forecast from 1991 to 2007

The information available in Appendix B includes:

- Residential and Commercial Use and Volume Equations, and Industrial Volume Equations for general service customers
- Regression analysis
- Forecast accuracy overview
- Year 2004 NAC forecast accuracy
- Actual, weather normalized and forecast throughput volumes from 1985 to 2004
- Explanation of Union's weather normalization process

1. DEMAND FORECAST OVERVIEW

The general service market demand forecast is measured by total throughput volumes. Exhibit C3, Tab 2, Schedule 1 summarizes the total demand forecast for the test year 2007 for each customer and rate class. The total general service throughput volumes for 2007 are estimated to be 5,164,507 10^3m^3. This represents a decrease of 15.9 10^6m^3, or 0.3%, from the actual weather normalized total volumes for 2004. To provide a consistent comparison, the actual volumes for the year 2004 have been weather normalized according to the same weather normal estimate proposed for 2007. The 2007 weather normal is set by the blended 55:45 (30 year average/20 year trend) weather normal methodology in accordance with the Board's RP-2003-0063 Decision.

Table 1

CHANGE IN TOTAL THROUGHPUT VOLUMES: 10^3 m^3
2004 to 2007

Line No.	Rate & Service Customer Class	Total W.N.[1] Throughput 2,004	Change in volumes due to: Customer Growth	DSM Plan	Exchange Rate Effect	NAC Decline	Total Forecast Throughput 2,007	Total Change
		(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	Residential Rate M2	2,190,163	118,374	(16,012)		(61,883)	2,230,642	40,479
2	Residential Rate 01	685,256	28,848	(6,724)		(17,803)	689,577	4,321
3	Commercial Rate M2	1,341,467	89,137	(61,444)		(51,130)	1,318,031	(23,436)
4	Comm. Tobacco M2	25,325	(504)	0		(236)	24,584	(741)
5	Commercial Rate 01	224,460	15,956	(3,207)		(21,475)	215,734	(8,726)
6	Commercial Rate 10	251,124	4,347	(6,323)		4,516	253,664	2,540
7	Industrial rate M2	419,091	35,337	(6,185)	(35,337)	(23,396)	389,510	(29,581)
8	Industrial Rate 10	43,551	1,154	(725)	(1,154)	(60)	42,766	(785)
9	Total Volumes	5,180,437	292,650	(100,620)	(36,492)	(171,469)	5,164,507	(15,930)
10	% change from 2004		5.6%	-1.9%	-0.7%	-3.3%	99.7%	-0.3%
	~ service class summary ~							
11	Residential	2,875,419	147,222	(22,736)	0	(79,686)	2,920,219	44,800
12	Commercial	1,842,376	108,937	(70,974)	0	(68,326)	1,812,012	(30,364)
13	Industrial	462,642	36,492	(6,910)	(36,492)	(23,456)	432,276	(30,366)

1 The 2004 actual throughput volumes are weather normalized according to the 2007 weather normal which is based upon the 55: 45 weather normal methodology.

The decline in total general service throughput between 2004 and 2007 is principally caused by three drivers:

- The forecast decline in NAC: the decline in NAC exclusive of the DSM plan impacts lowers total throughput volumes in 2007 by 171.5 $10^6 m^3$ or 3.3% of the 2004 normalized demand (approximately 1.1% decline annually).
- The decline in light industrial consumption: The forecast decline in industrial volumes arising principally from the effect of the Canada – US exchange rate forecast assumption lowers total throughput volumes in 2007 by 36.5 $10^6 m^3$ or 0.7% of the 2004 normalized demand.

- The cumulative three year impact of the 2004 through 2007 DSM plans: The cumulative three year impact of the DSM plan for the 2005 to 2007 period lowers total throughput volumes in 2007 by about 100.6 10^6m^3 or 1.9% of the 2004 normalized demand.[1]

These three drivers more than offset the increase in total demand from total customer growth over the 2004 to 2007 period, resulting in the net decrease of 15.9 10^6m^3 or 0.3% identified above.

Total billed customer attachments equal 74,693 customers or 6.1% over the three year forecast period. If one ignored the forecast declining NAC levels and assumed that all the customer growth in the future was at the 2004 NAC levels, then the customer growth would increase total throughput between 2004 and 2007 by 292.7 10^6m^3 or by 5.6%.

2. MARKET AND CUSTOMER CONSUMPTION CHARACTERISTICS

The general service market has over 1.2 million customers. This market is divided into three service classes: residential, commercial and industrial. The residential customer class represents approximately 91% of all customers and approximately 57% of total general service throughput volumes. The commercial and industrial customer classes represent approximately 9% of all

[1] The DSM figures used during the forecasting process are lower than Union's revised plans for DSM in 2007 by 2,130 10^3m^3. A discussion of the DSM Plan, which is more accurate and current, can be found in Exhibit D1, Tab 7.

customers and approximately 43% of the total throughput volumes. An overview of the general service market can be found at Appendix A, Table 1. Natural gas consumption in the general service market includes three rate classes:

- Rate M2 – residential, commercial and industrial customers in Union's Southern operations area
- Rate 01 – residential and small volume commercial customers in Union's Northern and Eastern operations areas
- Rate 10 – commercial and industrial customers billed by the Banner billing system in Union's Northern and Eastern operations areas (this customer group excludes a small number of larger volume Rate 10 industrial customers that are billed by the contract customer billing system, approximately 87 customers)

3. DEMAND FORECAST METHODOLOGY

The demand forecast methodology for the residential and commercial markets is a combination of two separate estimation processes. The first process is the forecast of the total number of customers. The second process is the preparation of the NAC forecast. The total demand forecast is calculated by multiplying the estimated number of customers in each month (process 1) by the monthly estimates of the NAC per customer for that same year (process 2). This yields the total monthly and annual throughput volume forecast, which will be discussed in further detail below.

Please see Appendix B for the demand equations.

The commercial tobacco M2 and industrial forecast methodology is based on a single estimation process. The equation can be found in Appendix B.

Forecast of Total Number of Customers

The forecast of total number of customers is obtained by adding the estimated number of new customer attachments and subtracting the estimate of shrinkage in customer numbers to/from the number of customers recorded at the end of the most recently completed historical year. The historical year end customer figures are from December 2004. The formula for forecasting the total number of customers is as follows:

Year End Bills (Actual) + Forecast Customer Attachments – Forecast Customer Number Shrinkage = Total Number of Customers

The customer attachment forecast is described in detail in the evidence of Keith Boulton in Exhibit B1, Tab 3.

Customer number shrinkage represents the loss of billed customers due to building demolition, commercial bankruptcies, factory closings, gas meter consolidations, customers switching off gas to an alternate energy source, and loss of customers due to bill non-payment. Customer number shrinkage has been explicitly identified because Union observed that the increase in the number of total actual billed customers was less than the total number of actual customer attachments. The customer number shrinkage estimate is based on a multi-year comparison of actual customer attachments to the increase in total actual billed customers, during the period December 1999 to February 2005. Total customer number shrinkage is estimated to be 2,800 annually. For more details on the method of calculation of shrinkage, please see Appendix A.

Normalized Average Consumption

NAC forecasts are prepared separately for the residential M2, residential R01, commercial M2, commercial R01, and commercial R10 customer classes.

The NAC forecast methodology combines the econometric estimates for each service and rate class with the future impacts of Union's DSM plan in each market segment. NAC assumes normal weather conditions during the year. Monthly energy demand data contains identifiable patterns. Econometric analysis identifies seasonal, trend and economic behaviour related patterns and quantifies the impact using regression equations. The seasonal pattern in the demand can be explained by the *total heating degree days* ("*HDDs*") variable. The declining usage trends present in the data can be explained by the *residential energy efficiency*, *number of persons per household* and the *commercial segmentation and energy efficiency* variables. The price economic behaviour can be explained by the *total bill* variable. A summary of the econometric demand equations used in this evidence, the results of the statistical regression analysis for each demand equation, and a discussion of forecast accuracy is presented in Appendix B.

In preparing the 2007 demand forecast, a 95% statistical confidence test was applied to the estimated t-statistics for the independent or explanatory variables contained in the econometric demand equations. Although the practice of using a 95% confidence test is not an absolute statistical principle, it is a generally accepted guideline. RJ Rudden, in its review of Union's forecasting methodology, also supports a qualitative application of the confidence test. There are situations when a lower than 95% confidence test can be appropriate (for example, lower confidence levels can be used in econometric analysis if the regression coefficient indicates a proper relationship and possesses the appropriate elasticity).

Key Residential & Commercial Forecast Assumptions:

The key demand forecast variables in the residential and commercial markets are:

a) Weather Normal
b) Residential Furnace Energy Efficiency
c) Number of Persons Per Household
d) Total Bill Amount
e) Commercial Market Segmentation
f) DSM Plan Impacts

These variables are discussed in further detail below. The data used to generate these equations has been provided in Excel spreadsheet format on Union's EB-2005-0520 website: http://www.uniongas.com/EB-2005-0520-2007COS.

a) Weather Normal

The *weather normal* is the key demand forecast variable for these market segments. Variation in weather affects demand. The historical record indicates that the annual variability of actual HDDs since 1991 has been typically in the plus or minus 7% range. This amount of weather variation translates into total throughput volume variances of approximately plus or minus 5%.

The *weather normal* in the demand forecast is determined using the blended weather normal method directed by the Board in its RP-2003-0063 Decision with Reasons. The Board directed a blend of the 30 year average and 20 year trend methodologies in the RP-2003-0063 Decision, "in order to test the suitability of changing the normalization methodology, and in consideration of the principle of minimizing rate shock". The blending proportion for the year 2007 weather normal is 55% of the 30 year average and 45% of the declining trend estimate in accordance with the Board's Decision.

Chart 1 identifies how actual HDDs track with the 70:30 weather normal estimate applicable to 2004 as well as with the 30 year average and 20 year declining trend weather normal estimates. The points on the chart are rolling 12 month totals which represent equivalent twelve month periods. The rolling 12 month charts demonstrate the variability present in the weather data. The chart indicates that a declining trend is present in the actual weather.

The chart and underlying data illustrate that since July 2004 the 20 year declining trend line most closely follows the actual weather data. Looking at the entire period in the chart, the root mean square error measurement shows that the 20 year declining trend weather normal is the more accurate representation of normal weather.[2] The observation of declining trends, as presented in the chart, and the statistical error measurement data support increasing the proportion of the 20 year declining trend contained within the OEB weather normal blending formula.

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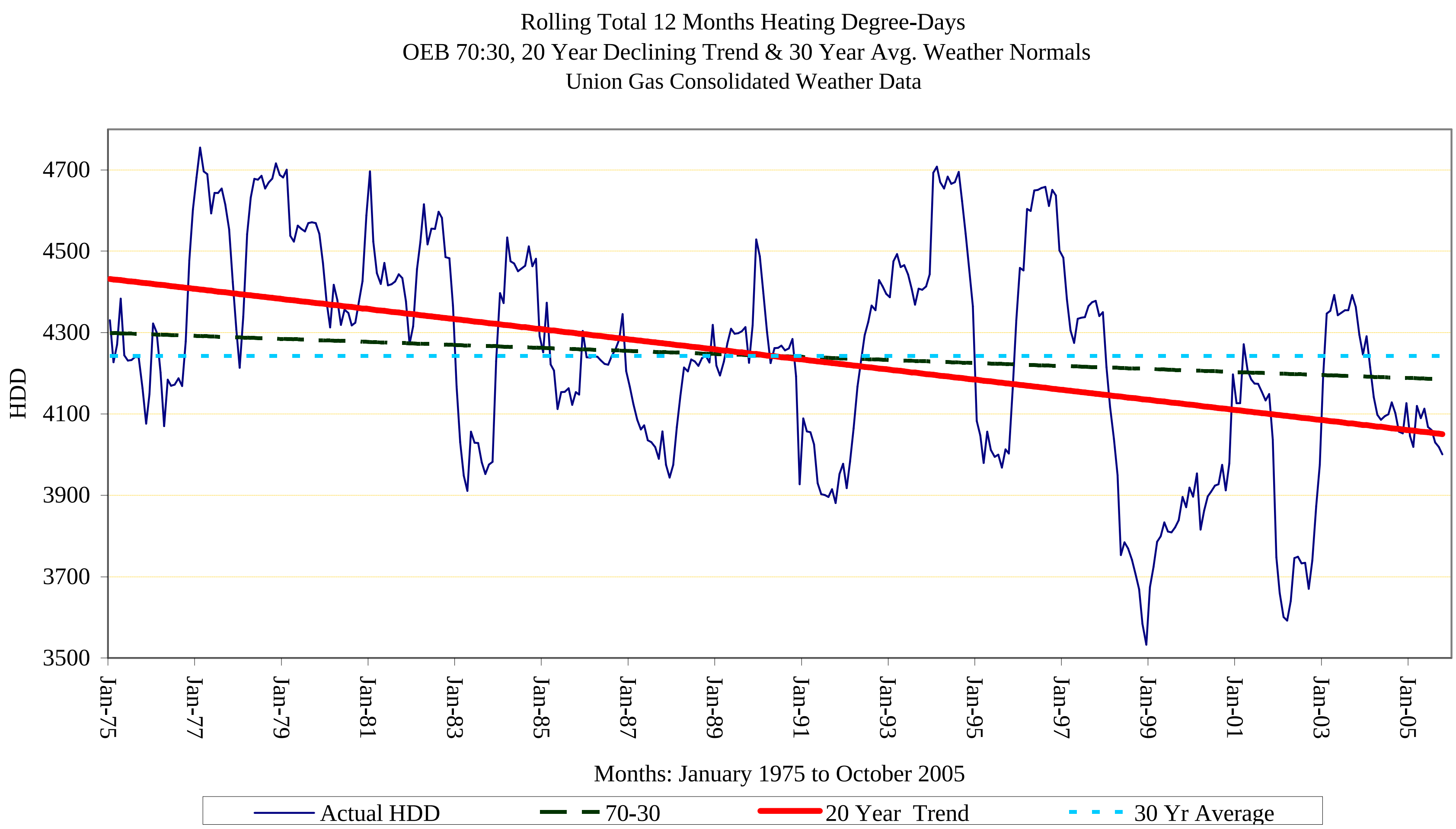
[1] The root mean square errors are 216 HDDs for the 20 year declining trend versus 231 HDDs for the blended 70:30 weather normal and 226 for the 2007 blended 55:45 weather normal. The root mean square error is a statistical accuracy measurement that compares the actual data with both normal estimates.

1 **Chart 1**


Rolling Total 12 Months Heating Degree-Days
OEB 70:30, 20 Year Declining Trend & 30 Year Avg. Weather Normals
Union Gas Consolidated Weather Data
HDD
4700
4500
4300
4100
3900
3700
3500
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Jan-91
Jan-93
Jan-95
Jan-97
Jan-99
Jan-01
Jan-03
Jan-05
Months: January 1975 to October 2005
Actual HDD
70-30
20 Year Trend
30 Yr Average

2

The 55:45 weather normal for 2007 results in 3,822 HDDs for the southern Rate M2 customers and 5,090 HDDs for the northern Rate 01 and 10 customers.

Table 2 shows the 2007 blended 55:45 weather normal and its components.

Table 2
Weather Normal for 2007
Total HDDs Below 18 C

Line		**Weather Normal 55:45**[1] (a)	**30 Year Average**[2] (b)	**20 Year Declining Trend**[3] (c)
1	Union South	3,822	3,918	3,705
2	Union North	5,090	5,219	4,931
3	Total Union[4]	4,139	4,243	4,011

Notes:
1 - Weather normal is a blend of 55% 30 year average and 45% of 20 year declining trend
2 - Based on annual weather data spanning the 1975 to 2004 period
3 - Based on annual weather data spanning the 1985 to 2004 period
4 - Total Union HDD weighted 75% Union South and 25% Union North according to general service volumes.

The total throughput volume forecast for the year 2007 presented in this evidence is based on a weather normal comprised of a blended ratio of 55:45. If the blend used to calculate the weather normal is assumed to be a ratio of 70:30 then the total annual HDDs would be 4,174 compared to 4,139; a difference of 35 HDDs or 0.8%. The total throughput volumes estimated for the year

2007 would consequently become 0.6% higher, or by 31.8 $10^6 m^3$. This represents about $1.9 million of total delivery revenues.

b) Residential Furnace Energy Efficiency

Energy efficiency explains the declining average usage observed in the residential market. Furnace efficiency is a key factor. Market research indicates that the rate of change in the use of more energy efficient furnaces has increased over time. This explains why residential NAC in the last few years has declined faster than over the past 15 years.

Market research information indicates that high efficiency furnaces are being installed in 90% of new homes and in approximately 60% of all replacement furnace installations. Currently about 40% of Union's total customer base still has a conventional furnace. Union's 2007 forecast assumes that about 6% of the customers with conventional furnaces will replace their furnaces each year. Combining furnace market shares and installation rates yields an *aggregate furnace energy efficiency index* variable that quantifies the energy efficiency impact. The *aggregate furnace index* indicates that energy efficiency will continue to increase over time. An aggregate *energy efficiency index* of 80.8% is assumed for the year 2007, up slightly from 78.2% in 2004 and 74.6% in 2001.

The residential furnace energy efficiency variable described above is adjusted to reflect the impact of Union's DSM Program free rider rate[3] to eliminate double counting.

Improvements to housing construction and wiser energy use by customers are qualitative factors that also contribute to the declining usage trend. The regression coefficient estimated for the energy efficiency demand variable will partly reflect these housing construction and wiser energy usage trends.

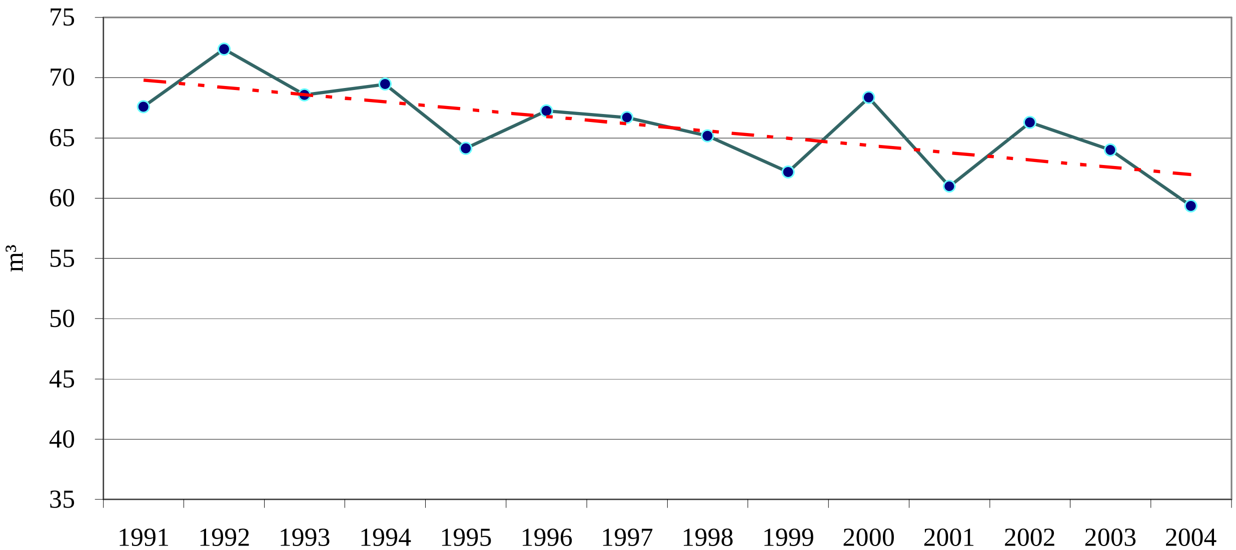
c) Number of Persons Per Household

Union has observed that the average use per customer during the summer months (i.e. June through August) has declined over time. This change in the base load is illustrated in Chart 2.

[3] A free rider is a participant who would have implemented the DSM measure even in the absence of the related DSM program.

Chart 2

Residential Rate M2 Summer Month Use per Customer
Avg. of June, July & August Levels and Trend Line



Water heating is the largest energy requirement during the summer period. According to market research completed in late 2004, 85% of single family homes and 88% of new homes have natural gas water heaters. Customer surveys also indicate that the average number of persons per household has declined over the past 15 years from 3.30 in 1990 to 2.83 in 2004. As the number of persons per household declines, so does the hot water used. The decline observed in the base load illustrated in Chart 2 can be partially accounted for by including the *number of persons per household* in the use per customer demand equation. Including this variable was statistically significant at the 95% confidence level.

d) Total Bill Amount

Economic theory and consumer behaviour indicates that prices affect demand. The price – demand relationship in energy demand forecasting can be represented by either using energy prices or total customer bills.

The NAC forecast for residential and commercial Rate M2 and Rate 01 customers includes a variable that represents the *total bill amount* that the customer pays each month. The *total bill amount* represents the total cost of natural gas at the burner tip and includes delivery, storage, upstream transportation, gas commodity charges and the fixed monthly charge. The *total bill amount* is lagged by one or more months in the demand equations. This lag recognizes the demand response behaviour of customers after receiving their gas bill. Using the *total bill amount* in the demand equations was found to be superior to using the *retail energy price* as was done in Union's 2004 rates proceeding. This is reflected by significant t-statistics in the use per customer demand equations, which can be seen in line 19 of Table 1 in Appendix B.

Comparing the demand equations used in Union's 2004 rates proceeding with the current estimates provides a soundness and reasonableness measure of the price demand relationship. The estimated demand elasticity when using the *total bill amount* as a demand variable is similar in magnitude to the demand price elasticity identified in the 2004 demand forecast. A 15% change in the *total bill amount* changes demand by about one percent in the residential market.

The *total bill amount* paid by customers in 2007 assumed approved January 2005 Union delivery prices and gas commodity charges. A constant annual bill assumption was made because gas commodity price forecasts fluctuate. Gas commodity and transportation related charges which Union does not control represent about three quarters of the total residential customer's annual bill. This proportion is even higher for commercial and industrial customers.

Table 3 presents the assumed *total bill amounts* for residential and commercial customers. A *total bill amount* was not included in the commercial Rate 10 demand equations as it did not meet the 95% confidence test criterion. The industrial demand equation uses an *alternate fuel price* variable that was found to be statistically significant.

Table 3
Estimated Total Customer Bill Amounts for 2007

Customer Class	***Amount***
Residential Rate M2	$1,170
Residential Rate 01	$1,317
Commercial Rate M2	$6,435
Commercial Rate 01	$3,910

e) Commercial Market Segmentation

Commercial market segmentation has two major components:

- Customer distribution and growth
- Existing and new customer energy efficiency

Customer Distribution and Growth:

An examination of customer growth by market segment over the last 5 years indicates that the retail and office market segments significantly affect commercial NAC. These two market segments form almost half of the total customer base as indicated in Column (c) of Table 4. The two segments also dominate the actual customer growth experienced. Retail and office commercial customers also have notably lower annual NAC levels compared to other commercial segments and compared to the total NAC of the commercial class. Accordingly, growth in the retail and office market segments will have the effect of decreasing the average NAC for the commercial market. The commercial market segment classified as "other" represents customers that currently have no market segment classification. These customers possess a monthly and annual load profile that looks similar to the office–retail market load profile in terms of seasonality and annual level. This other market segment group is large in terms of the total number of customers. Given the resemblance of its load profile with the office–retail segment it is believed to include many office–retail customers. These *commercial market segment customer growth trends* were assumed to continue over the 2005 to 2007 period.

Table 4
Commercial Market Segments
Rates M2, 01 & 10

Line	Commercial Market Segment (a)	Distribution of Customer Growth past 5 Years (b)	Number of Customers 2004[1] (c)	2004 NAC (m^3) (d)
1	Colleges/Universities	0.50%	136	92,739
2	Elementary/Secondary Schools & Daycares	2.90%	2,436	61,926
3	Heath Services	1.50%	877	92,785
4	Hotel/Motel	0.80%	617	33,368
5	Multi-Residential	22.80%	10,672	25,995
6	Office	13.00%	35,364	11,062
7	Other	27.90%	19,670	12,513
8	Recreation	2.30%	1,288	52,231
9	Religious	1.00%	2,608	13,470
10	Restaurants	4.30%	4,752	15,543
11	Retail	20.00%	18,551	8,774
12	Warehouse/Wholesale	2.90%	3,334	19,227
13	Total	100%	100,305	15,698

Note:
1 – Excludes agricultural customers

Existing and New Customer Energy Efficiency:

The *commercial segmentation and efficiency index* variable incorporates energy efficiency assumptions for existing and new customers. The energy efficiency assumptions are expressed as energy utilization intensities (“EUI”), an amount of energy per unit of floor space; these EUI are specified for each market segment and according to new and existing buildings.

The commercial market energy efficiency assumptions for each market segment were developed by an external consultant with expertise in commercial energy consumption. The assumptions used research information obtained from federal and provincial government departments as well as studies from the construction and commercial real estate industry. The EUI assumptions for the commercial market segments have not changed from those used in Union's 2004 rates proceeding.

f) DSM Plan Impacts

The econometric NAC estimates are adjusted for future DSM plan activities. See Exhibit D1, Tab 8 for a detailed discussion of the DSM plan. The DSM plan includes programs and targets that Union is planning to achieve in 2007. These adjustments lower the NAC estimates for 2007. Table 5 itemizes the decremental impact that the DSM plan has on NAC for 2007.[4]

Table 5
Estimated DSM Plan NAC Impacts
(Annual m^3 of natural gas)

Customer Class	NAC Forecast
Residential M2	(18)
Residential R01	(25)
Commercial M2	(758)
Commercial R01	(123)
Commercial R10	(2,355)
Industrial M2	(1,162)
Industrial R10	(3,808)

[4] The DSM figures used during the forecasting process are lower than Union's revised plans for DSM in 2007 by 2,130 10^3m^3. Details of the DSM Plan for 2007 can be found in Exhibit D1, Tab 8.

The DSM adjustment to NAC is different from the *energy efficiency* factor used in the use per customer econometric demand equations. The DSM adjustment accounts for future energy efficiency impacts directly influenced by Union's DSM plan. The *energy efficiency* factor excludes the historical DSM impact and represents energy efficiency activities of other market participants.

The *incremental marketing plan adjustment to NAC* which was a component of the 2004 forecast methodology was eliminated from the preparation of the 2007 forecast. The *incremental marketing plan adjustment to NAC* partly offset the DSM plan impact and assumed a future cumulative increase in gas appliance penetration levels that was above observed trends.

4. External Review of the NAC Forecast Methodology:

The NAC forecast methodology Union used to prepare the 2007 demand forecast is similar to the approach used in Union's 2004 rates proceeding with a few enhancements as noted below. In its Decision, dated March 18, 2004, the Board directed Union to, "undertake a thorough and statistically rigorous review of its NAC methodology and present the results of this study at its next rates case so that all parties will have the opportunity to test Union's proposed methodology". RJ Rudden and Associates ("RJ Rudden"), an independent consulting firm with energy forecasting expertise, was selected in the fall of 2004 following a competitive tendering process, to complete this work. The review by RJ Rudden is included in Appendix C.

In summary, RJ Rudden determined:

- The residential and commercial NAC forecast methodology is accurate, logical and statistically credible.
- Union's Industrial Volume Models are competent and credible as to their logical and statistical construct.
- Union's demand forecasters apply professional judgment in a reasonable and appropriate manner.
- Statistical issues pertaining to autocorrelation, multicollinearity and heteroskedasticity were appropriately addressed.

Based on statistical analysis and recommendations by RJ Rudden, Union enhanced the equations to improve the demand forecast relationships. The demand variable and methodology changes made in the 2007 NAC forecast were:

- A *total bill amount* variable replaced the *retail energy price* variable in the residential and commercial equations. *Total bill amounts* were lagged one month in residential equations and four months in the commercial equations.
- A total *number of persons per household* variable was added to the residential equation to account for the observed decline in the base load during the summer months.
- The industrial volume equation was developed from quarterly data and was specified as a function of: HDDs, the US–Canada foreign exchange rate, and the price of heavy fuel oil.

The *energy efficiency* and *total customer* variables used in 2004 were eliminated because they were found not to be statistically significant.

- In order to eliminate autocorrelation issues in certain equations, the estimation time span was shortened; the start of the data series in certain equations became January 1994 instead of January 1991.
- The *incremental marketing plan adjustment to NAC* variable was eliminated.
- The reasonableness test adjustment that was used in Union's 2004 rates proceeding was eliminated from the econometric forecast process. The reasonableness test adjustment was based on a degree of judgment in the forecast. The current forecast does not contain this qualitative factor.

5. NORMALIZED AVERAGE CONSUMPTION FORECAST

The forecast NAC estimates for the year 2007 are presented in Appendix A, Table 3 and 4. The historical NAC levels are also shown in these tables.

The individual rate and service class NAC forecasts are illustrated in Appendix A, in Figures 1.1 to 3.2. All historical and forecast NACs in these figures are based upon the proposed blended weather normal level for the year 2007 (55:45).

Residential NAC

The residential NAC forecasts are presented on Figures 1.1 and 1.2 in Appendix A. The estimated residential M2 and R01 and annual NAC levels in 2007 are 2,479 m^3 and 2,556 m^3 respectively. The residential M2 and R01 customer classes have a declining usage trend. This is due primarily to energy efficiency and demographic factors which were discussed earlier. Recent years have shown a tendency towards greater residential energy efficiency, which explains the faster annual rate of decline.

Table 6
Percent Decline of Residential NAC from 1992-2004

Line	Period (a)	Residential M2 (b)	Residential 01 (c)
1	1992-2001	(0.90)%	(1.40)%
2	2002-2004	(2.10)%	(2.00)%

Table 6 shows that the residential NAC is declining faster over the past few years than previously experienced. Dwelling characteristics (e.g. house size) and regional location (climate) may explain the differences in usage trends between R01 and M2 customers.

Commercial NAC

Commercial customers are very weather sensitive. Please refer to Figures 2.1 to 2.3 in Appendix A for charts that illustrate the commercial NAC forecast. The estimated commercial M2, R01 and R10 annual NAC levels in 2007 are 16,254 m^3, 8,272 m^3 and 94,494 m^3 respectively. The

NAC for the commercial customer classes exhibit a flatter declining usage pattern compared to the residential customer class. The commercial NAC trend primarily reflects the changing composition of the commercial sector, and the energy efficiency improvements that are gradually occurring in this market for both new and existing customers.

The estimated DSM plan impacts on commercial customers is the prime driver for the forecast decline in NAC. For example, the commercial rate M2 NAC decline between 2004 and 2007 is 1,099 m^3. The DSM NAC impact is 758 m^3 or about 69 percent of the total decline.

Commercial M2 Tobacco Volume Forecast

The M2 tobacco customers are a separate subset of the commercial M2 market. In December 2004 it included about 960 customers. The number of customers has declined over the past several years and the forecast assumes a level of 922 customers by year end 2007. Average consumption per customer has also decreased over the past decade. The critical factor behind these two trends is a declining market for cigarettes and other tobacco products in Canada. The size of the total tobacco crop in Ontario continues to shrink as reported by the Ontario Flue Cured Tobacco Growers marketing board.[5]

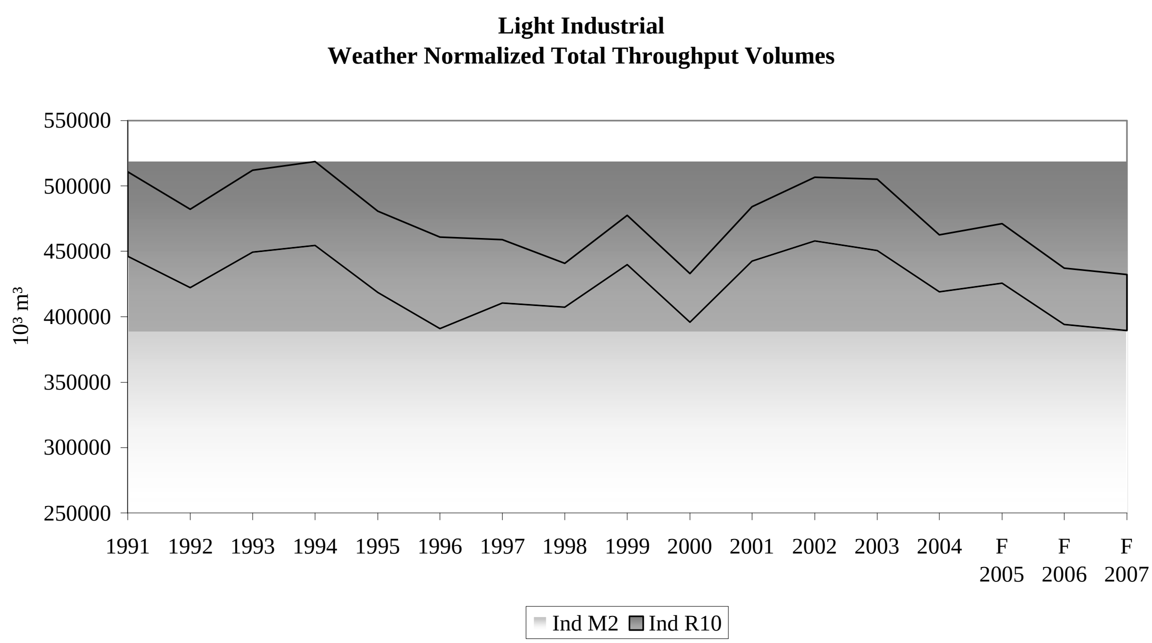
[5] "Tobacco Growers Ready to Quit", *Simcoe Reformer*, January 28, 2005

The 2007 demand forecast estimates that demand from the M2 tobacco market will equal about 24.6 10^6 m^3 or about 0.5% of the total throughput volumes of the general service market.

Industrial Volume Forecast

Chart 3 presents the industrial total throughput volume forecast for M2 and R10 customers served by the Banner billing system. Total throughput volume over the forecast period is expected to decline as a result of the significant appreciation of the Canadian dollar against the U.S. dollar, alternate fuel price competition, and global manufacturing competitiveness related factors. While energy efficiency was not explicitly factored into the forecast estimation, energy efficiency initiatives are also present in this market.

Chart 3



The total industrial volume demand forecast was determined using consolidated industrial throughput volume data for these two rate classes. The use of consolidated data to estimate the industrial demand forecast is not new as it was also done in the 2004 forecast. Consolidation enables econometric estimation to capture economic indicators as explanatory variables in addition to the weather-demand relationship. The U.S./Canada foreign exchange rate and the price of heavy fuel oil were identified as explanatory variables.

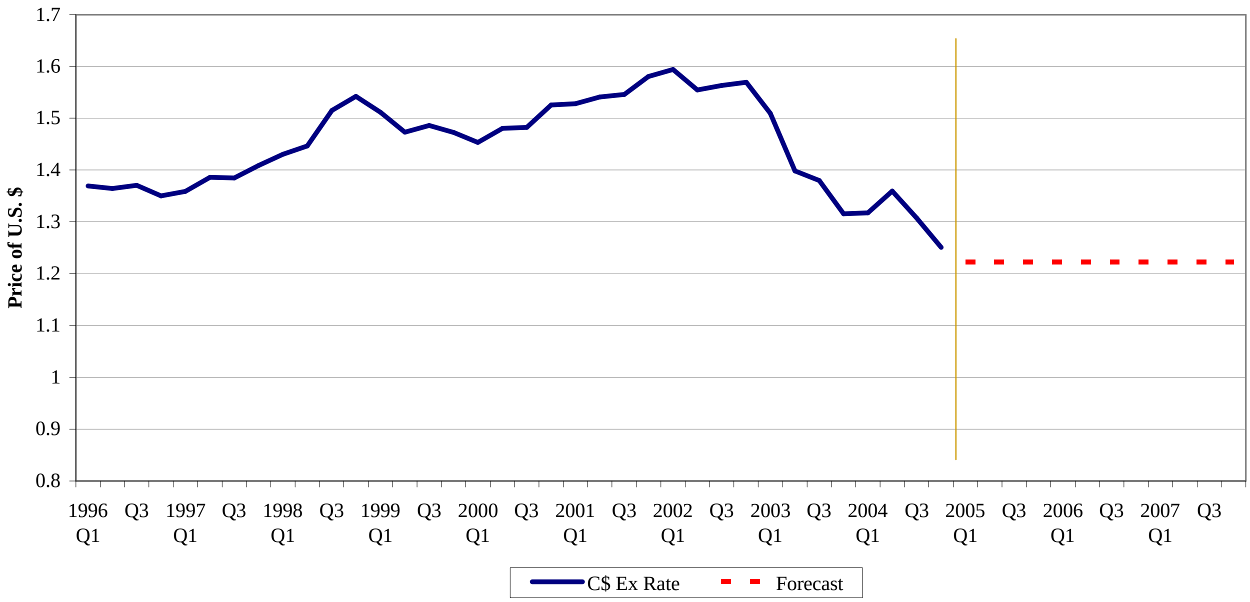
The individual industrial rate class NAC estimates are presented in Figures 3.1 and 3.2 of Appendix A. The estimated annual NAC levels for industrial M2 and R10 customers in 2007 are 73,175 m^3 and 224,565 m^3 respectively.

The exchange rate assumed between Canada and the U.S.A. in 2007 is $1.224 in Canadian funds (or 81.7 cents in US funds) as provided by the Consensus Economics report[6].

[6] See Consensus Forecasts January 2005, page 27.

Chart 4

Exchange Rate Canadian / US Dollar



During the 1990's when the Canadian dollar fell in value in relation to the U.S. dollar, industrial NAC levels rose. Since 2003, the Canadian dollar has appreciated significantly and industrial NAC levels have fallen as shown in Figure 3.1 of Appendix A.

The heavy fuel oil price forecast was provided by Strategic Energy and Economic Research Inc., an external energy price consultant, in January 2005. At the time the forecast was prepared, the price of heavy fuel oil (measured in U.S.$ per mmbtu at New York harbour) was expected to fall from the mid $4 range in 2005 to the low $3 range. This refined oil price forecast was based on a crude oil price forecast that indicated West Texas Intermediate crude oil falling from $40 to $30 per barrel over the forecast period. Since then, both crude oil and natural gas prices have risen significantly with heavy fuel oil maintaining a competitive price advantage.

The industrial M2 customers located in Union’s Southern operations area numbered 5,271 in December 2004, and 188 customers are served by Rate 10 in the Northern and Eastern operations area. Union’s Southern industrial customers represent about 8% of the total general service throughput volumes and include the automotive parts, food & beverage, electronic components, tool & die and printing related industries.

Northern industrial Rate 10 customers served by the Banner billing system account for less than 1% of the total general service throughput volumes and include forestry product and mining related industries. The small number of customers present in the industrial Rate 10 group partly explains the observed variation in the historical NAC levels.

INDEX

December, 2005

1 **1/** **GENERAL SERVICE MARKET OVERVIEW**

Table 1

YEAR 2007

Line No.	Customer Classes	Total Customers: Average Annual No. (a)	Total Customers: % Share (b)	Total Throughput: Volume (10^3 m^3) (c)	Total Throughput: % Share (d)
1	Residential Rate M2	899,710	70%	2,230,642	43%
2	Residential Rate 01	269,528	21%	689,577	13%
3	Sub total	1,169,238	91%	2,920,219	57%
4	Commercial Rate M2	81,100	6%	1,318,030	26%
5	Tobacco Rate M2	929	0%	24,583	0%
6	Commercial Rate 01	26,144	2%	215,733	4%
7	Commercial Rate 10	2,685	0%	253,663	5%
8	Sub total	110,858	9%	1,812,012	35%
9	Industrial Rate M2	5,324	0%	389,510	8%
10	Industrial Rate 10 (Banner)	190	0%	42,765	1%
11	Sub total	5,514	0%	432,275	8%
12	Total	1,285,610	100%	5,164,507	100%

2/ SUMMARY OF GROWTH OF BILLED CUSTOMERS

Table 2

CUSTOMER ATTACHMENTS & BILLED CUSTOMER GROWTH

Year	Residential Customers		Commercial Customers				Industrial Customers		Total
	Rate M2	Rate 01	Rate M2	Tobacco M2	Rate 01	Rate 10	Rate M2	Rate 10	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
				CUSTOMER ATTACHMENTS					
2005	23,061	4,773	1,921	-	496	21	117	7	30,396
2006	21,476	4,517	1,719	-	444	19	105	7	28,287
2007	18,432	4,043	1,450	-	375	15	88	6	24,409
				CUSTOMER SHRINKAGE					
2005	(1,755)	(439)	(395)	(15)	(99)	-	(91)	(6)	(2,800)
2006	(1,955)	(489)	(195)	(15)	(49)	-	(1)	(6)	(2,800)
2007	(2,055)	(514)	(125)	(10)	(31)	-	(60)	(5)	(2,800)
				BILLED CUSTOMER GROWTH AT YEAR END					
2005	21,306	4,334	1,526	(15)	397	21	26	1	27,597
2006	19,521	4,028	1,524	(15)	395	19	14	1	25,488
2007	16,377	3,529	1,325	(10)	344	15	28	1	21,609
				TOTAL BILLED CUSTOMERS AT YEAR END					
2004 A	852,323	260,090	77,001	962	25,111	2,638	5,271	188	1,223,584
2005 F	873,629	264,424	78,527	947	25,508	2,659	5,297	189	1,251,181
2006 F	893,150	268,453	80,051	932	25,904	2,678	5,311	190	1,276,668
2007 F	909,527	271,982	81,376	922	26,247	2,693	5,339	191	1,298,277
				ANN. % CHANGE IN TOTAL BILLED CUSTOMERS AT YEAR END					
2005 F	2.5%	1.7%	2.0%	(1.6)%	1.6%	0.8%	0.5%	0.5%	2.3%
2006 F	2.2%	1.5%	1.9%	(1.6)%	1.5%	0.7%	0.3%	0.5%	2.0%
2007 F	1.8%	1.3%	1.7%	(1.1)%	1.3%	0.6%	0.5%	0.5%	1.7%

3/ NAC BY RATE AND SERVICE CLASS

Table 3

Normalized Average Consumption by Rate & Service Class (m^3/year)
All NACs weather normalized according to the 2007 year 55:45 blended weather normal

Line No.	Year	Residential Rate M2	Residential Rate 01	Commercial Rate M2	Commercial Rate 01	Commercial Rate 10	Industrial Rate M2	Industrial Rate 10
		(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	1991	3,023	3,253	19,337	11,160	111,313	75,417	285,892
2	1992	3,021	3,243	19,769	10,921	105,080	72,432	269,345
3	1993	2,967	3,163	19,206	10,698	104,907	77,595	283,953
4	1994	2,921	3,099	18,414	10,396	108,997	77,143	299,880
5	1995	2,924	3,044	18,535	10,191	111,932	75,905	283,574
6	1996	2,970	2,979	19,267	10,121	109,529	77,835	304,700
7	1997	2,915	2,963	18,982	10,072	106,827	80,633	253,139
8	1998	2,775	2,795	17,983	8,802	100,377	79,800	171,842
9	1999	2,758	2,823	18,008	8,539	93,523	84,239	189,989
10	2000	2,752	2,931	17,551	9,600	105,752	75,840	201,632
11	2001	2,695	2,770	17,681	8,795	97,809	84,249	218,055
12	2002	2,725	2,773	17,829	9,219	102,027	86,683	241,152
13	2003	2,687	2,794	17,786	9,306	97,719	86,094	281,013
14	2004	2,610	2,663	17,353	8,883	96,114	79,811	230,567
				Forecast Estimates				
15	2005F	2,569	2,669	17,092	8,782	98,857	75,842	233,101
16	2006F	2,514	2,597	16,597	8,444	96,340	74,319	228,135
17	2007F	2,479	2,556	16,254	8,272	94,494	73,175	224,565

Table 4

Normalized Average Consumption by Rate & Service Class (m^3/year)
NACs weather normalized with the 2004 Rate Case Decison 70:30 blended weather norma

Line		Residential		Commercial			Industrial	
No.	Year	Rate M2	Rate 01	Rate M2	Rate 01	Rate 10	Rate M2	Rate 10
		(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	1991	3,036	3,274	19,403	11,220	111,869	75,607	286,997
2	1992	3,034	3,264	19,834	10,980	105,636	72,624	270,471
3	1993	2,980	3,184	19,272	10,758	105,463	77,788	285,092
4	1994	2,934	3,120	18,480	10,456	109,553	77,333	301,036
5	1995	2,937	3,064	18,600	10,251	112,488	76,113	284,743
6	1996	2,983	3,000	19,333	10,180	110,085	78,057	305,787
7	1997	2,928	2,984	19,048	10,132	107,382	80,852	254,448
8	1998	2,788	2,816	18,049	8,862	100,932	80,020	173,114
9	1999	2,771	2,844	18,074	8,598	94,079	84,452	191,242
10	2000	2,765	2,952	17,617	9,660	106,308	76,054	203,094
11	2001	2,708	2,791	17,747	8,795	98,365	84,462	219,359
12	2002	2,738	2,794	17,894	9,279	102,583	86,895	242,391
13	2003	2,701	2,815	17,851	9,366	98,275	86,309	282,302
14	2004	2,623	2,684	17,419	8,943	96,670	80,024	231,902

4/ ANNUAL NAC HISTORY & FORECAST 1991 TO 2007 RESIDENTIAL, COMMERCIAL & INDUSTRIAL RATE CLASSES

Figure 1.1
Normalized Average Consumption of Residential M2 Customers

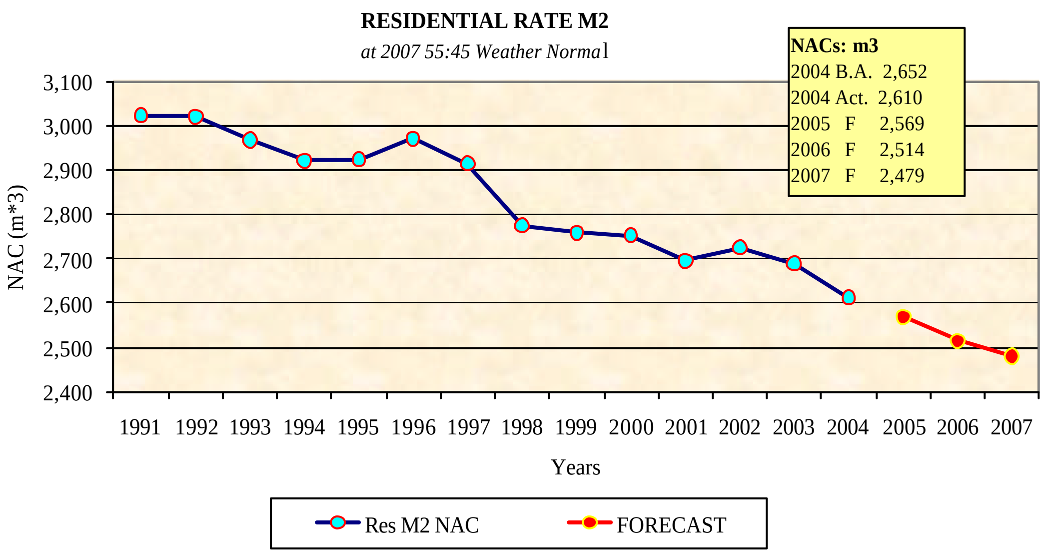


Figure 1.2
Normalized Average Consumption of Residential 01 Customers

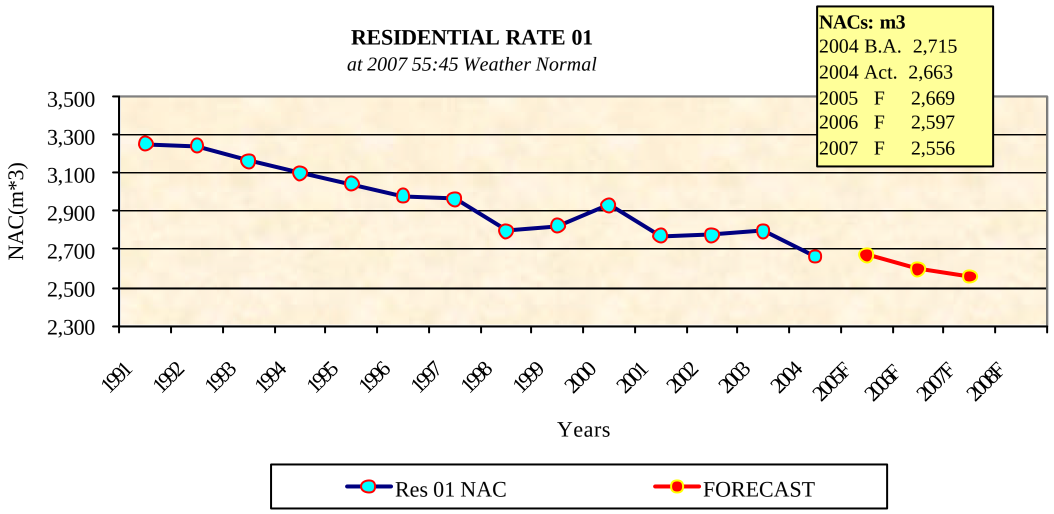


Figure 2.1

Normalized Average Consumption of Commercial M2 Customers

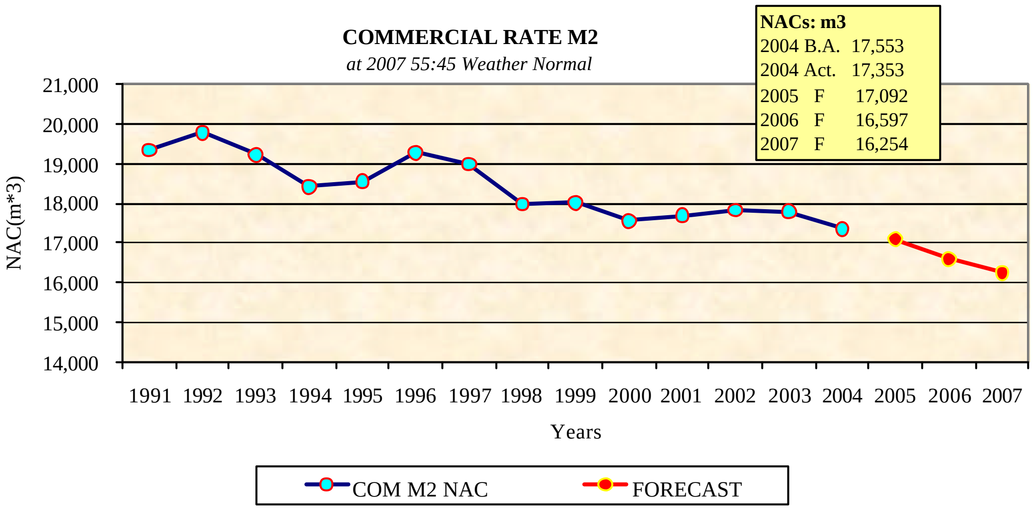


Figure 2.2

Normalized Average Consumption of Commercial 01 Customers

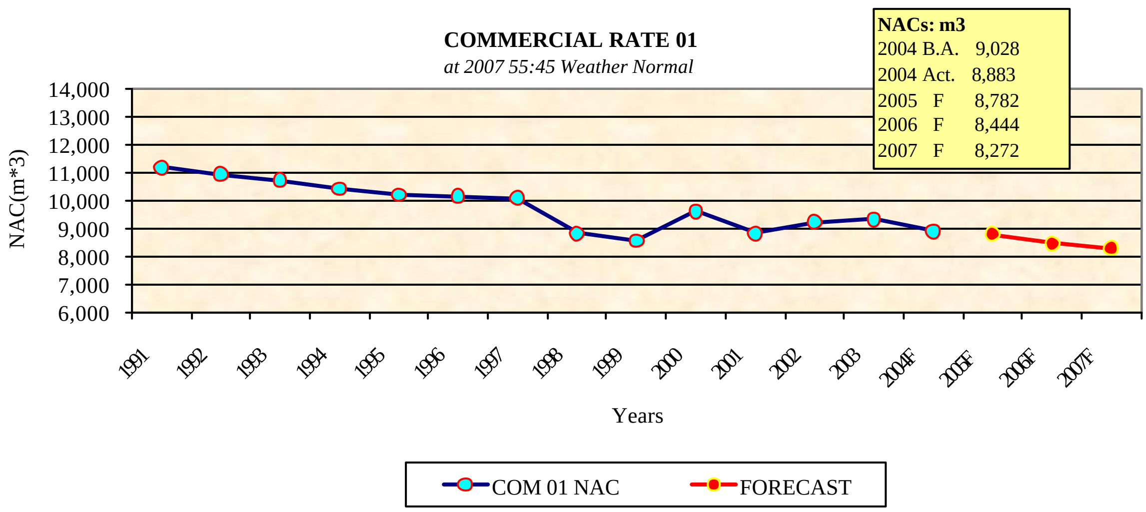


Figure 2.3

Normalized Average Consumption of Commercial 10 Customers

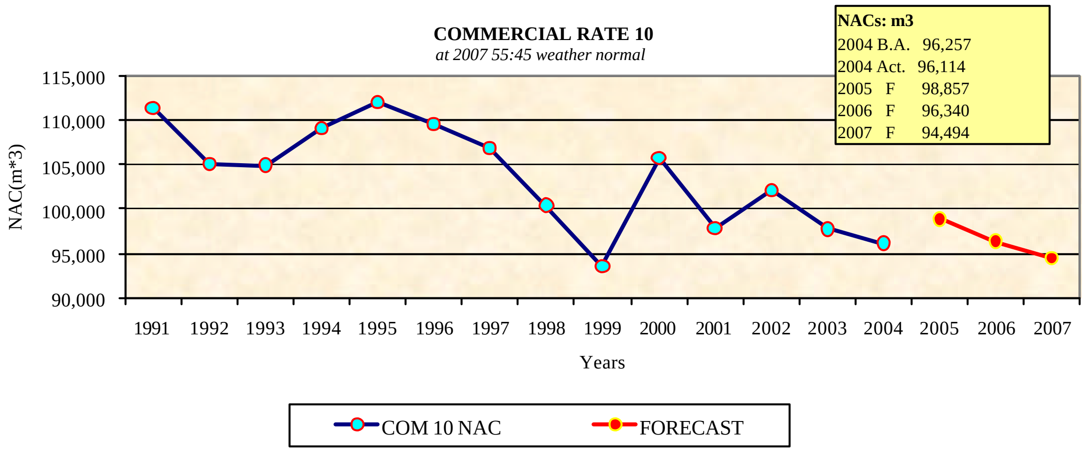


Figure 3.1

Normalized Average Consumption of Industrial M2

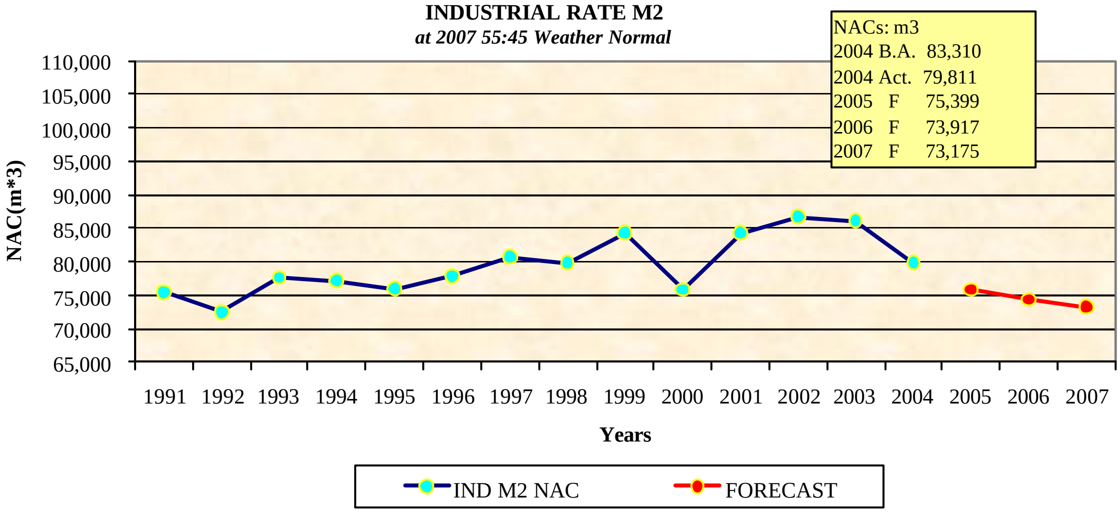
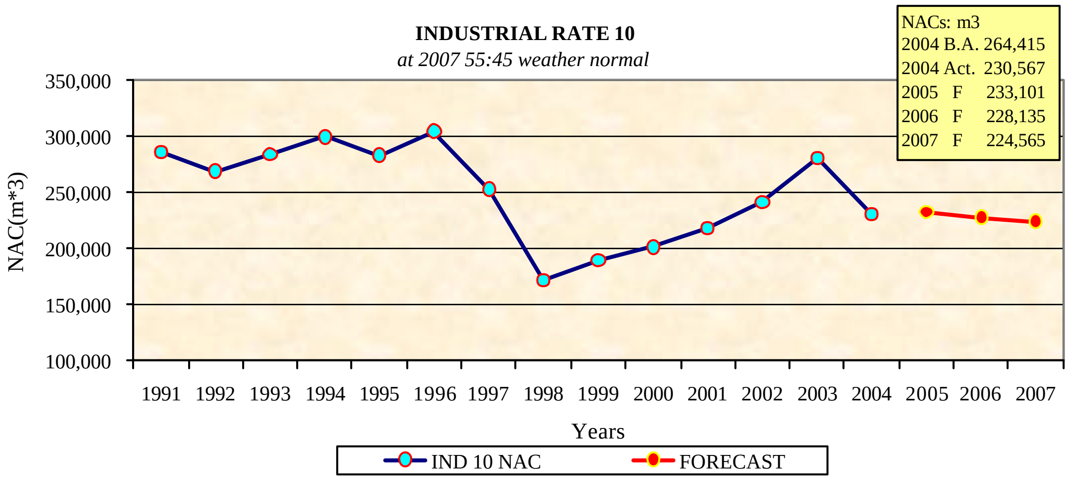


Figure 3.2
Normalized Average Consumption of Industrial R10



5/ CALCULATION OF CUSTOMER NUMBER SHRINKAGE

Table 5 shows how the forecast of customer number shrinkage was established.

Table 5
Estimated Customer Shrinkage

Line	Year	Cumulative Difference at December (a)	Annual Change (b)	Customer Shrinkage (c)
1	2000	2,005	-	2,005
2	2001	(110)	(2,115)	(55)
3	2002	5,148	5,258	1,716
4	2003	11,332	6,184	2,833
5	2004	13,648	2,316	2,730
	Average		2,911	

In any given year, the total number of customers billed will not equal the sum of total customers from the year prior plus new customer attachments. This is due to customer number shrinkage, as discussed in the evidence. Union has been tracking shrinkage since the new Banner billing system was put in place in the year 2000. Union calculates the customer number shrinkage by summing the actual customer attachment numbers and the year end customer count at December 31, 1999 and then comparing this figure with the number of billed customers. The difference between these two figures can be found in column (a) of the table. By the end of 2004, this difference grew to 13,648 customers and by February 2005 the cumulative difference was 14,953. This customer count difference in column (a) implies that each year a number of customers were shed from the customer billing system.

Column (b) shows the annual change in the differences indicated by column (a). The average of the annual changes is 2,911 customers. This provides the first estimate of the customer number shrinkage amount.

Union also reviewed the customer number shrinkage estimate obtained by dividing the difference at December by the number of years that have occurred since 1999 and the information is presented in column (c). For example, the 13,648 difference in the year 2004 divided by 5 years yields the customer shrinkage estimate of 2,730. The customer shrinkage estimate for the year 2003 equaled 2,833.

The customer number shrinkage forecast estimate considered the customer shrinkage measures obtained from column (b) and column (c) (years 2003 and 2004) and settled on an estimate of 2,800 customers.

The year end customer levels, customer attachment, and shrinkage estimate are detailed by service and rate class in Table 2.

INDEX

1/ RESIDENTIAL AND COMMERCIAL USE AND VOLUME EQUATIONS, AND INDUSTRIAL VOLUME EQUATIONS

RESIDENTIAL USE PER CUSTOMER

The econometric residential NAC estimate is obtained by averaging the use per customer estimates obtained from equation 1 and 2.

Eqn. 1: Use = f (HDD[1], Furnace Efficiency, Persons/House, Total Bill)

Eqn. 2: Volume = f (HDD, Total Customers, Total Bill) [2]

Hence, Use = Eqn. 2 Volume / Customers

COMMERCIAL USE PER CUSTOMER

The econometric commercial NAC estimate is obtained by averaging the use estimates obtained from equation 1 and 2.

Eqn. 1: Use = f (HDD, Segmentation & Efficiency, Total Bill)[2]

Eqn. 2: Volume = f (HDD, Total Customers, Total Bill lagged 4 months)

Hence, Use = Eqn. 2 Volume / Customers

[1] HDD – Heating Degree Days
[2] Total bill variable not significant at 95% confidence level

INDUSTRIAL TOTAL THROUGHPUT VOLUMES

The econometric estimate of total industrial demand is obtained directly from a total volume equation.

Eqn.: Volume = f (HDD-Days, U.S. Canada Exchange Rate, Heavy Fuel Oil Price)

2/ REGRESSION ANALYSIS

Table 1
2005 to 2007 Demand Forecast
Residential & Commercial : Use Equations
Regression Equation Coefficients

		Residential		Commercial		
Line	Demand Variable	Rate 01	Rate M2	Rate M2	Rate 01	Rate 10
		(a)	(b)	(c)	(d)	(e)
1	Adjusted R-Squared	99.4%	99.7%	98.6%	98.1%	96.8%
2	Durbin-Watson Statistic	2.07	1.67	2.13	1.11	2.21
3	F	1,263.92	2,532.27	1,217.23	1,035.27	620.54
4	Mean Abs. % Err. (MAPE)	0.97%	1.65%	1.60%	3.06%	3.01%
5	INTERCEPT	(127.16)	(68.99)	(210.63)	(740.86)	(2,570.94)
6	TOTAL BILL	(0.14)	(0.21)	(0.14)		
7	EFFICIENCY	736.10	525.22	773.20	1,034.68	5,887.70
8	PERSONS PER HOUSE	66.37	46.94			
9	HDD January	0.53	0.65	3.64	1.74	15.65
10	HDD February	0.53	0.65	3.79	1.78	15.55
11	HDD March	0.48	0.64	3.82	1.63	15.89
12	HDD April	0.47	0.62	3.51	1.35	13.26
13	HDD May	0.42	0.57	3.13	0.95	9.21
14	HDD September	0.40	0.30			
15	HDD October	0.37	0.42	2.55	1.24	13.28
16	HDD November	0.47	0.51	3.50	1.48	15.70
17	HDD December	0.47	0.59	3.66	1.62	14.62

T-Statistics for Key Demand Variables in Use Equations

	Residential		Commercial		
Demand Variable	Rate 01	Rate M2	Rate M2	Rate 01	Rate 10
	(a)	(b)	(c)	(d)	(e)
INTERCEPT	(3.37)	(2.56)	(1.20)	(8.23)	(2.44)
TOTAL BILL	(2.17)	(4.22)	(2.13)		
EFFICIENCY	4.98	4.92	4.48	10.54	5.13
PERSONS PER HOUSE	5.53	5.45			
HDD January	43.71	68.14	63.56	70.05	53.92
HDD February	32.48	51.72	63.14	59.89	44.85
HDD March	28.01	48.55	59.18	48.30	40.20
HDD April	18.58	31.01	31.28	25.03	21.02
HDD May	10.00	16.82	13.79	9.52	7.91
HDD September	5.44	4.10			
HDD October	12.30	17.63	15.55	19.06	17.41
HDD November	24.37	37.18	35.26	34.59	31.48
HDD December	33.63	59.25	53.39	53.03	40.91

Table 2
2005 to 2007 Demand Forecast
Residential & Commercial : Volume Equations
Regression Equation Coefficients

		Residential		Commercial		
Line	Demand Variable	Rate 01	Rate M2	Rate M2	Rate 01	Rate 10
		(a)	(b)	(c)	(d)	(e)
1	Adjusted R-Squared	98.8%	99.2%	98.1%	98.4%	96.7%
2	Durbin-Watson Statistic	1.57	1.48	1.84	1.33	2.14
3	F	863.60	1,228.46	927.08	1,130.19	535.90
4	Mean Abs. % Err. (MAPE)	0.95%	1.54%	1.95%	2.68%	3.01%
5	INTERCEPT	(14,461.64)	(45,872.15)	(35,909.92)	500.29	(13,107.85)
6	TOTAL BILL / PRICE (Rate 10)			(23.20)	(3.80)	(9,717.01)
7	CUSTOMERS	0.13	0.13	1.16	0.23	9.62
8	HDD January	111.94	422.00	239.36	38.44	35.70
9	HDD February	110.29	433.79	244.26	39.37	35.31
10	HDD March	101.15	418.69	248.66	36.74	36.13
11	HDD April	93.14	386.17	223.08	30.97	29.63
12	HDD May	75.32	327.55	202.97	24.45	20.35
13	HDD September	62.70	121.74			
14	HDD October	69.20	268.74	151.90	24.76	29.88
15	HDD November	98.03	343.83	218.34	31.16	35.29
16	HDD December	100.95	416.70	237.33	35.33	33.09

T-Statistics for Key Demand Variables in Volume Equations

		Residential		Commercial		
	Demand Variable	Rate 01	Rate M2	Rate M2	Rate 01	Rate 10
		(a)	(b)	(c)	(d)	(e)
18	INTERCEPT	(3.48)	(4.56)	(5.06)	0.40	(4.17)
19	TOTAL BILL / PRICE (Rate 10)			(4.12)	(2.69)	(3.14)
20	CUSTOMERS	7.23	9.44	9.85	3.86	5.94
21	HDD January	75.97	75.02	44.37	65.41	51.58
22	HDD February	63.33	74.91	39.27	61.50	43.17
23	HDD March	51.10	63.88	41.25	52.45	38.62
24	HDD April	29.76	35.17	24.94	26.97	19.83
25	HDD May	12.60	15.43	11.76	10.83	7.40
26	HDD September	6.51	2.63			
27	HDD October	16.96	18.20	11.42	15.89	16.59
28	HDD November	38.67	39.48	23.70	30.63	29.82
29	HDD December	55.72	69.47	36.66	48.77	38.93

Table 3
2005 to 2007 Demand Forecast
Industrial Volume Equation
Regression Equation Coefficients

Line	Demand Variable	Industrial
1	Adjusted R-Squared	98.80
2	Durbin-Watson Statistic	2.29
3	F	500.70
4	Mean Abs. % Err. (MAPE)	2.30
5	INTERCEPT	(28,452.36)
6	Lagged Exchange Rate	58,911.43
7	Hvy. Fuel Oil Price	2,685.59
8	HDD Q1	80.37
9	HDD Q2	56.96
10	HDD Q3	72.92
	T-Statistics for Variables in Volume Equations	
11	INTERCEPT	(1.20)
12	Exchange Rate	3.87
13	Hvy. Fuel Oil Price	2.00
14	HDD Q1	45.21
16	HDD Q2	8.80
17	HDD Q3	28.58

3/ FORECAST ACCURACY OVERVIEW

Table 4 provides an indication of the accuracy and capability of the demand forecast equations. Forecast accuracy can be shown by two measures: the ex-post[3] forecast errors for a given actual year, and the in-period[4] mean absolute percent errors (MAPE) of the actual versus predicted annual consumption obtained from the demand forecast equations. The in-period analysis spans the entire historic time frame used to estimate the 2007 demand forecast equations. The ex-post analysis estimates the demand equations with a shorter time span (i.e. 1991 to 2001) to enable the estimation of the year 2004. The ex-post forecast time span in the 2007 rate case evidence is three years long. This time span is longer than the two year regulatory lag present in previous rate cases.

For comparison purposes, the ex-post forecast errors for the year 2004 annual consumption estimates are presented in Table 4 along with the mean absolute percent errors estimates obtained from the 2007 demand forecast equations.

[3] Ex-post refers to the estimation performance obtained with the specified demand equation when the historic time period is shortened so the equation can be used to estimate the demand of a known historic year. If the regression analysis spanned the period January 1994 to December 2004, the demand equation is estimated over the period ending December 2002 or 2003 in order to estimate demand in the year 2004.

[4] In-period refers to the estimation performance obtained with the complete period of time that was used to estimate the analysis. If the regression analysis spanned the period January 1994 to December 2004, then this is the in-period time span.

Table 4

Forecast Accuracy - 2007 Demand Forecast Equations

Line		Use Eqn. (a)	Volume Eqn. (b)	Forecast Error (c)
	Percent Error - Ex Post Error : Forecast 2004			
1	Residential Rate M2	1.10%	1.40%	1.30%
2	Residential Rate 01	0.30%	2.80%	1.60%
3	Commercial Rate M2	1.10%	1.10%	1.10%
4	Commercial Rate 01	4.40%	1.70%	3.00%
5	Commercial Rate 10	3.70%	6.00%	1.20%
6	Industrial Rate M2 & 10		2.90%	2.90%
	M.A.P.E. - In Period Forecast Equations			
7	Residential Rate M2	1.65%	1.54%	2.30%
8	Residential Rate 01	0.97%	0.95%	1.90%
9	Commercial Rate M2	1.60%	1.90%	1.80%
10	Commercial Rate 01	3.10%	2.70%	2.70%
11	Commercial Rate 10	3.00%	2.90%	2.90%
12	Industrial Rate M2 & 10		2.30%	2.30%

Good forecasting results are indicated by instances when the ex-post error is smaller than the in-period error. This occurs in ten of the seventeen comparisons presented above. The majority of the ex-post forecast errors presented in the table, in fourteen instances, fall within two standard deviations or the 95% confidence level of the in-period forecast errors. This indicates a good forecasting tool.

YEAR 2004 FORECAST ACCURACY

Table 5 presents the NAC forecast error results for the year 2004. Please note that the actual NAC levels experienced in 2004, with the exception of the commercial Rate 10 customers, fell below the forecast estimates. All NAC levels presented in the table are weather normalized according to the 20 year declining trend weather normal estimate contained in the 2004 rate case evidence.

Table 5
Year 2004 Results: NAC Forecast

		Normalized Average Consumption: m³				Forecast Variances	
Line	Rate Service Class	Actual	Excl. DSM	Forecast	Econometric	Actual	w/o DSM
		(a)	(b)	(c)	(d)	(e)	(f)
1	Residential M2	2,505	2,516	2,578	2,554	(2.80)%	(1.50)%
2	Residential 01	2,604	2,628	2,642	2,637	(1.40)%	(0.30)%
3	Commercial M2	16,823	17,044	17,120	17,191	(1.70)%	(0.90)%
4	Commercial 01	8,704	8,740	8,816	8,830	-(1.30)%	(1.00)%
5	Commercial 10	94,411	95,355	93,402	93,623	1.10%	1.90%
6	Industrial M2	78,413	78,413	82,598	83,213	(5.10)%	(5.80)%
7	Industrial 10	226,040	226,040	261,385	262,758	13.50%	(14.00)%
8	Total customer weighted forecast error					(2.40)%	(1.20)%

The 2004 NAC forecast was obtained by adding to the econometric estimates the *incremental marketing* and *DSM plan* NAC impacts and the *reasonability test NAC adjustments* that were made to residential Rate M2 and commercial Rate 10 customers.

The forecast variance column titled "actual" shows the observed forecast accuracy of the actual NAC with the forecast NAC estimate. A total weighted forecast error result of (2.4)% was observed. Total number of customers provided the weightings to calculate the total weighted forecast error. The forecast variance column titled "without DSM" shows the forecast accuracy after adjusting for the forecast and realized 2004 DSM plan NAC adjustments. A total weighted forecast error of (1.2)% was obtained. This indicates that the econometric equations performed well. The residential and commercial forecast variances after accounting for the DSM plan are all within the 2 percent range and several below 1 percent. The relatively high industrial NAC forecast errors reflect the fact that the strong appreciation in the Canadian dollar was not assumed in the preparation of the light industrial NAC forecast estimates.

FORECAST ACCURACY FROM 1985 TO 2004

Table 6 presents the forecast accuracy of demand forecasts for the entire in-franchise total throughput volumes prepared over the period 1985 to 2004. In-franchise demand is the sum of general service and contract rate markets. This table was provided in response to interrogatories in several previous rate cases.

Notes for Table:
(1) - As filed in EBRO 493/494, Exhibit C5, Tab 7
(2) - As filed in EBRO 483/484 Exhibit J4.48 & Exhibit J1.52
(3) - As filed in EBRO 474, Exhibit C5, Tab 3, Schedule 6
(4) - As filed in EBRO 493/494, Exhibit C8, Tab 3
(5) - As filed in EBRO 499, Exhibit C5, Tab 2, Schedule 5
(6) - As filed in EBRO 499, Exhibit C6, Tab 2, Schedule 5

(7) - During Union's PBR term there were no Board Approved volumes
n/a - Not Applicable

Table 6

In-franchise Demand Forecast Accuracy 1985-2004

Line	Year	Demand & Revenue Forecast	Notes	Actual Total Throughput Volumes (a)	Weather Normalized Actual Volumes (b)	Board Approved Forecast Volumes (c)	Variance of Weather Normalized to Forecast (b-c=d)
1	1985	EBRO 397 - Fiscal 1985 (Union South)	(1)	7,183,545	7,260,732	6,691,211	569,521
2		EBRO 399 - Fiscal 1985 (Union North)	(2)	3,054,186	3,066,906	2,997,631	69,275
3	1986	EBRO 405-I - Fiscal 1986 (Union South)	(1)	7,627,031	7,731,006	7,294,738	436,268
4		EBRO 408 - Fiscal 1986 (Union North)	(2)	2,979,449	2,951,621	3,113,345	(161,724)
5	1987	EBRO 405-II - Fiscal 1987 (Union South)	(1)	7,257,810	7,439,328	7,330,438	108,890
6		EBRO 430 - Fiscal 1987 (Union North)	(2)	3,137,500	3,291,761	3,058,855	232,906
7	1988	Fiscal 1988 (Union South)	(1)	7,642,165	7,774,543	7,485,416	289,127
8		EBRO 440 - Fiscal 1988 (Union North)	(2)	3,299,749	3,291,237	3,144,317	146,920
9	1990	EBRO 456 - Fiscal 1990 (Union South)	(1)	8,233,997	8,279,012	7,956,142	322,870
10		Calendar 1990 (Union North)	(3)	3,428,228	3,480,766	3,570,243	(89,477)
11	1991	EBRO 462 - Fiscal 1991 (Union South)	(1)	7,685,290	7,952,486	8,054,700	(102,214)
12		EBRO 467 - Calendar 1991 (Union North)	(4)	3,733,028	3,752,592	3,882,029	(129,437)
13	1992	EBRO 470 - Fiscal 1992	(1)	7,800,636	7,897,620	8,167,455	(269,835)
14		EBRO 474 - Calendar 1992 (Union North)	(4)	3,896,559	3,856,571	3,705,285	151,286
15	1993	EBRO 476-01 - Fiscal 1993	(1)	8,230,499	8,198,123	8,097,805	100,318
16		EBRO 483 - Calendar 1993 (Union North)	(4)	3,963,579	3,894,281	3,884,416	9,865
17	1994	EBRO 476-03 - Fiscal 1994	(1)	8,367,784	8,233,663	7,824,519	409,144
18		EBRO 483/484 - Calendar 1994 (Union North)	(4)	4,145,290	4,152,428	4,125,621	26,807
19	1995	EBRO 486 - Fiscal 1995	(1)	8,140,853	8,326,745	8,282,878	43,867
20		EBRO 489 - Calendar 1995 (Union North)	(4)	4,576,284	4,555,201	4,300,976	254,225
21	1996	Calendar 1996 (Union North & South)		13,742,957	13,908,904	n/a	
22	1997	EBRO 493/494 - 1997 (Union South)	(5)	9,393,599	9,412,028	8,793,290	618,738
23		Calendar 1997 (Union North)	(6)	5,083,563	5,040,910	5,016,108	24,802
24	1998	Calendar 1998 (Union North & South)		13,274,000	14,032,563	n/a	
25	1999	EBRO 499 – 1999		14,601,750	14,921,991	14,570,953	351,038
26	2000	Calendar 2000 (Union North & South)	(7)	14,932,767	14,993,484	n/a	
27	2001	Calendar 2001 (Union North & South)	(7)	13,895,526	14,207,096	n/a	
28	2002	Calendar 2002 (Union North & South)	(7)	14,918,061	15,093,526	n/a	
29	2003	Calendar 2003 (Union North & South)	(7)	14,822,350	14,557,446	n/a	
30	2004	Calendar 2004 (Union North & South)		14,453,248	14,308,359	14,617,541	(309,182)

4/ EXPLANATION OF UNION'S WEATHER NORMALIZATION PROCESS

WEATHER AFFECTS DEMAND

The total throughput volumes in the general service market are affected by variation in the weather. Total HDD are used to measure the recorded weather since customers use energy primarily for space heating.

An HDD measures the amount of temperature below and relative to 18 degrees Celsius. For example, if the mean daily temperature is 10 degrees Celsius, then there are 8 HDDs on that day. Union compiles the daily, monthly and annual heating degree days and has weather data going back to the 1960's for its Northern & Eastern and Southern operations areas.

WEATHER DEMAND COEFFICIENTS

Weather demand coefficients are used to estimate the amount of energy associated with a HDD in each customer market. The econometric demand forecast equations provide the weather demand coefficients. The nine weather sensitive months of September through May posses weather demand coefficients in the residential and commercial markets. September is not weather sensitive in the light industrial market. The weather demand coefficients can be expressed on a per customer basis or a total throughput volume basis. For example, the current weather demand coefficient for Residential Rate M2 customers for the month of January is 0.54. This means it takes about 2 HDDs to change the average consumption per customer by one cubic metre.

WEATHER NORMAL

Normal weather describes the most likely weather, or HDDs that can be expected in the long run. Weather normalization estimates what the actual natural gas consumption would be at a normal level of HDD. Union's weather normal is approved by the Board.

WEATHER VARIANCES & DEMAND

The variance in the observed weather is indicated by comparing the actual and normal weather. For example if the actual weather during a month was colder than normal and equaled 500 HDD, and the normal level was 400 HDD, then the weather variance equals 100 HDD.

ESTIMATED WEATHER DEMAND IMPACT

If the weather variance is 100 HDD and the residential weather demand coefficient is 0.54 then the weather demand impact is estimated to be 54 m^3 per customer in that month. Multiplying this estimate by the total number of customers yields the total weather impact volumes for the residential market. For example, 54 m^3 multiplied by one million customers equals 54 $10^6 m^3$ of estimated weather impact. Repeating this calculation in each month and market with the appropriate weather demand coefficients and weather variances and then summing the estimated weather normalized impact volumes for each market provides the total throughput volumes impact estimate.

When it is colder than normal the total throughput volumes impact estimate is subtracted from the total actual volumes to yield the total weather normalized volumes. For example, if the actual volumes were 754 $10^6 m^3$ in the month, following the above examples the weather normalized volume in the residential market would be 700 $10^6 m^3$ (i.e. 754 $10^6 m^3$ - 54 $10^6 m^3$ = 700 $10^6 m^3$).

APPENDIX C

RJ Rudden Review of the Union Gas Demand Forecast Methodology

December, 2005

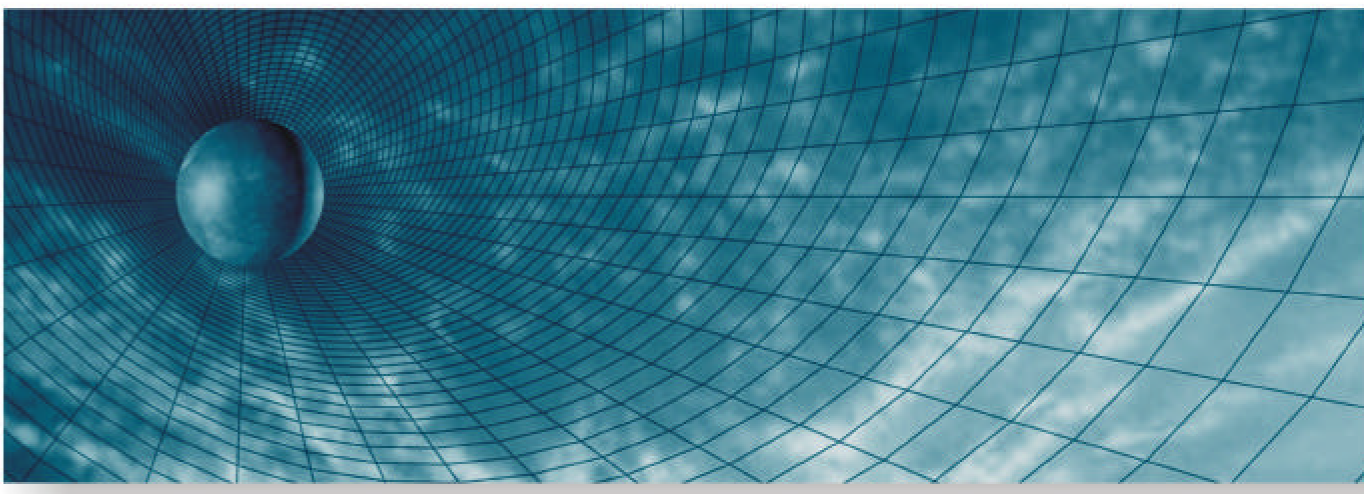
Report to

Union Gas Limited

Regarding

Union Gas Forecast Analysis

December 16, 2004



R·J·Rudden
ASSOCIATES

TABLE OF CONTENTS

SECTION I
INTRODUCTION

In August 2004, R.J. Rudden Associates, Inc. ("Rudden") was retained by Union Gas ("Union") to perform an independent, expert evaluation of its forecasting methodology. Union engaged Rudden pursuant to a Directive by the Ontario Energy Board in Union's last rate case (RP 2003-0063). In order to meet the requirements of this project, Rudden assembled a team of professionals with more than forty person-years of gas and electric forecasting experience and industry-recognized expertise in the evaluation and development of such forecasts for electric and gas utilities.

The Principal Investigator for this assignment was George L. Fitzpatrick, a Senior Associate of Rudden and the Principal/CEO of Harbourfront Consulting Group LLC. He is a recognized statistician and econometrician with more than 30 years of experience in developing electric and gas sales and demand forecasts - both econometric and end use; electric and gas weather normalization studies; electric and gas load research programs and analyses; and interfuel competition analyses. He has provided direct and rebuttal expert testimony before many regulatory bodies for more than 30 utility clients throughout the U.S. on subjects such as forecasting, weather normalization, and a variety of comparative economic, statistical and econometric-related analyses. A complete resume for Mr. Fitzpatrick, as well as the other members of Rudden, can be found in Appendix A of this report.

The objective of this project was to evaluate the Union Gas Forecast Models applicable to general service customers from the following perspectives:

- Forecast accuracy
- Logical construction
- Statistical "goodness-of-fit"

Rudden reviewed a variety of documents from Union Gas including the following:

- The May 2004 forecast document entitled, "Union Gas - Demand Forecast Methodology - General Service Markets - Rates M2, 01 & Banner 10" (See Appendix E of this report),
- Information concerning Union's forecast accuracy,
- A summary of the critiques that were made of Union's forecast methodologies by both the OEB and interveners in the last rate case, and
- A complete list of all of the descriptive statistics for all of the models that were in our scope of evaluation.

It should be noted that Rudden's assignment was limited to the review and evaluation of Union's current forecasting practices. While we have made recommendations for Union to consider in future forecast cycles, we were not commissioned to develop new methodologies and forecasts - nor did we see the need to after our review.

SECTION II
FORECASTING ACCURACY

For models designed to forecast in the short term, the best indicator of forecasting success is the accuracy achieved by the forecasting process. The forecasting process refers to both the methodologies employed and the team that has developed those forecasts. Since judgment is an integral part of any forecast, Rudden had to satisfy itself that the team making those judgments was both knowledgeable about the service territory and the factors that affect that service territory.

Since statistical/econometric models are quantitative expressions of the forecasting team's judgment, the best way to evaluate its collective success is to review the accuracy of the forecasts produced over a reasonably representative period of time - in this case, 2001-2003. Before that time, the methodologies employed by Union were of a less complex structure and the specification of the Heating Degree Day (HDD) weather variables, by month, has evolved based on a different set of controlling forecast assumptions (i.e., 30-year Normals have been replaced by a blend of a 30-year Normal combined with a lesser-year declining HDD trend). For example, earlier forecasts did not:

- Include a two-equation approach for the five primary customer rate classes.
- Recognize the impact of past and audited DSM plans.
- Include the impact of future marketing and DSM plans.
- Span 14-year time periods; the early 1990 forecasts were based on 60 months of data.
- Include the retail energy price in most models.
- The energy efficiency variables were not supported by residential and commercial customer survey results.

After evaluating the forecasts of Union Gas over the 1994-2003 periods, Rudden concluded that the most appropriate focus of a forecast accuracy analysis would be the 2001-2003 time period, since it is over this time frame that significant enhancements were made to the Union Gas methodologies and key assumptions about forecast period weather. The following four tables exhibit both the absolute and arithmetic signed "forecast vs. weather normalized actual" percent variances on a year-by-year basis for each of the four primary rate classes. (Both absolute and signed variances are reviewed since Rudden wanted to capture the average yearly error without having positive errors in one year cancel out the negative errors in another). Accuracy is measured by the absolute percent error measurement.

Forecast accuracy for logically constructed short-term models[1] (that is, models with a forecast horizon of up to 12-24 months) is far and away the most important barometer for judging a modeling system's quality. Statistical elegance is less important with these models—performance, as measured by accuracy, is paramount. The reasons for this are threefold:

1. Accuracy of short-term forecast projections are most important to a utility since these forecasts predict near-term revenue adequacy and resource sufficiency for a time period that is critical to the security of energy

[1] ***Short-term models*** for electric and gas utility forecasting are defined by Rudden as having a duration of 1-2 years (i.e., 12-24 months ahead).

supply for customers and adequacy of returns to stakeholders. Clearly, the accuracy of short-term models becomes apparent to both utility and regulator over a time frame in which these results are fresh in everyone's mind. Accuracy comparisons can be made 12 months after a forecast is produced.

This is not the case with long-term forecasts. Long-term forecasts[2] can be predicted as much as 30 years into the future. Further, they are usually updated every year. Thus, there is never a timely debate over long-term forecast accuracy but, rather, a debate over theories, specifications and assumptions.

2. Statistical issues (e.g., autocorrelation, multicollinearity and heteroskedasticity[3]) that could render long-term models unreliable/unstable are less of an issue in a short-term structure. The reason for this is that short-term forecasts progress only a short time distance (in term of time periods ahead) from the end point of the history of the estimated model (in the case of Union's short-term forecasts, the models only predict two months ahead for each calendar month forecasted). Thus, such structural problems, if they do exist, have less of an absolute influence on the forecast results. Autocorrelation, multicollinearity and heteroskedasticity actually increase their influence in a compounding fashion, the longer the forecast horizon. Thus, the shorter the forecast period, the less the overall effect.

3. Further, in monthly model structures, it would be unusual not to have both explainable and unexplainable autocorrelation and multicollinearity since successive monthly observations are usually related and driver variables have a tendency to move together (e.g., it is unlikely that a warmer than normal January will immediately be followed by a colder than normal February). The comparison of the relative accuracy of alternative model structures, when used to backcast the last year of the historical data series, usually provides guidance in selecting the best model structure.

[2] ***Long-term forecasts*** for electric and gas utilities as defined by Rudden generally have an outlook of between 10-30 years.

[3] ***Autocorrelation*** refers to correlations among adjacent time periods (lag 1 autocorrelation). There may be an autocorrelation for a time lag of one period, another autocorrelation for a time lag of two, and so on. The residuals serve as surrogate values for the error terms. There are several tests for autocorrelated errors. The Box-Pierce test and the Ljung-Box test check whether a sequence of autocorrelations is significantly different from a sequence of zeros; the Durbin-Watson statistic checks for first-order autocorrelations.
Multicollinearity is defined as the presence of correlation among explanatory variables in a regression analysis. This commonly occurs for nonexperimental data. Parameter estimates will lack reliability if there is a high degree of covariation between explanatory variables, and in an extreme case, it will be impossible to obtain estimates for the parameters. Multicollinearity is especially troublesome when there are few observations and small variations in the variables.
Heteroskedasticity refers to nonconstant variances in a series (e.g., differing variability in the error terms over the range of data). Often found when small values of the error terms correspond to small values of the original time series and large error terms correspond to large values. This makes it difficult to obtain good estimates of parameters in econometric models. It also creates problems for tests of statistical significance.

J. Scott Armstrong, "*Principles of Forecasting: A Handbook for Researchers and Practitioners*" *<http://morris.wharton.upenn.edu/forecast/dictionary/defined%20terms.html>(2001)*

Component Forecast Accuracy:

The tables found in Appendix B show the forecast accuracy that has been achieved by the Union forecasts. The summary table appears in the text below, and more detailed tables can be found in Appendix B.

The table below sums the results for the four primary rate classes (i.e., Residential M2, Residential 01, Commercial M2, and Commercial 01), representing about 1.2 million customers and 85% of Union's general service rates throughput volumes. It also shows the forecast error for the years 1994 through 2000 and the error for the years 2001 through 2003. The results demonstrate Union's average error for the first seven years and the last three years.

FORECAST ACCURACY –
TOTAL YEAR VOLUMES - SUM OF THE FOUR PRIMARY RATE CLASSES (10*3 m3)

Year	Normalized Actual	Forecast	Difference	Actual % Diff.	ABS % Diff.
1994	5,065	5,214	149	2.86%	2.86%
1995	5,022	5,089	67	1.32%	1.32%
1996	5,098	4,911	187	-3.80%	3.80%
1997	5,071	4,784	287	-5.99%	5.99%
1998	4,825	4,802	23	-0.48%	0.48%
1999	4,759	4,960	201	4.05%	4.05%
2000	4,719	4,803	84	1.75%	1.75%
2001	4,554	4,597	43	0.94%	0.94%
2002	4,517	4,426	91	-2.06%	2.06%
2003	4,441	4,406	34	-0.78%	0.78%
			Average from 94-00	-0.04%	2.89%
			Average from 01-03	-0.63%	1.26%

As can be observed from the table above, as well as those found in Appendix B, it is Rudden's conclusion that the forecast accuracy achieved by Union over this 2001 through 2003 time period was quite acceptable and in line with other short-term electric and gas forecasts reviewed by Rudden. ***To contrast, the overall absolute variance from the years 1994 through 2000 was 2.89%. For the years 2001 through 2003, this forecast accuracy improved significantly to 1.26%.***

Finally, a look at the overall total volumes of the Union forecast shows the following for the most recent five-year period (a five-year period has been used due to limitations in the number of years that forecasts were produced on a comparable basis).

FORECAST ACCURACY - TOTAL YEAR VOLUMES - SUM OF ALL RATE CLASSES

Year	Normalized Actual	Forecast	Difference	Real % Diff.	ABS % Diff.
1999	5,499	5,707	208	3.65%	3.65%
2000	5,436	5,569	132	2.38%	2.38%
2001	5,294	5,318	24	0.45%	0.45%
2002	5,276	5,153	123	-2.38%	2.38%
2003	5,183	5,136	47	-0.92%	0.92%
			Average from 99-00	3.01%	3.01%
			Average from 01-03	-0.95%	1.25%

From an accuracy perspective, Union's forecasts have improved over the analysis period shown above. The last three forecast years, which are the result of forecasts with enhanced multi-equational methodologies, have produced more accurate results than earlier years.

In Rudden's judgment, Union's Residential and Commercial Volume Forecast Models (i.e., the forecasts for the four primary rate classes) have historically produced accuracy that is consistent with and in some cases better than other gas utilities whose forecasts have been reviewed by Rudden in the past.

The Industrial Models do not meet that same standard. This is due to the economic vagaries under which Union's general service rate industrial customers operate. That is, their dependence on exports to the U.S. economy and the attendant microeconomic production impacts at the factory floor level, have varying and largely unforeseeable quarter-to-quarter effects on the space and process related natural gas consumption. In addition, the distribution of general service rate industrial customers according to total annual volumes is skewed towards large volume customers. Consequently, industrial NAC is sensitive to the consumption behaviour of these large volume customers.

Union Gas recognizes that the forecast accuracy level for industrial customers is more difficult to achieve that it is for residential and commercial customers. The stand-alone accuracy level for industrial customer volumes is plus or minus four percent.

It may well be that this is the best that can be achieved with a modeling system that does not include a costly segmented, formal and constant customer interview process as part of the methodology.

The general service industrial demand is more difficult to forecast than the comparatively more homogeneous residential and commercial customer. Industrial demand includes both space heating and process-related energy requirements. Both of these energy requirements are affected by factors described below.

The two general service industrial rate classes, rate M2 & 10, that are forecast by the demand volume forecast equation that is under review serve customers that form a small portion of the total industrial sector. These industrial customers are classified as general service by the nature of the size of their natural gas consumption as set by Union Gas rate schedules and not by the nature of their production. Industrial customers can migrate between rate classes, e.g., rate M2 to rate M4 and rate 10 to rate 20 and vice-versa, as their consumption levels change.

The general service industrial customers produce goods for North American and global markets and are affected by economic conditions such as U.S. and Canadian economic growth, foreign currency exchange rates, and global manufacturing competition to name the major factors.

As many of the industrial customers are part of larger corporations, changes in production lines, closures and factory floor expansions and inventory-related production changes are determinants to changes in demand. The distribution of general service customers by annual volume is more skewed to large volume customers in contrast to residential customers, which have a more normal distribution. Changes in the number of large volume customers consequently can have a greater effect on industrial NAC.

These four factors described above combine to make the industrial NAC forecasting activity more challenging. Union Gas recognizes that the demand forecast accuracy for industrial customers is more difficult to achieve than for residential and commercial customers. The accuracy level for industrial customer volumes per se is plus or minus four percent.

SECTION III
FORECASTING PROCESS

Analysis of Forecasting Models

While many forecasting models exhibit statistically significant "goodness-of-fit," it is far more important that forecasting systems start off with a solid logic, supported by economic, technological and/or behavioral theory. Once that foundation is achieved, it is then a matter of selecting available independent variables and statistical constructs that produce a cost-effective, unbiased, and accurate forecasting process. The model's structures and variables employed by Union are consistent with those employed by other utilities that Rudden has evaluated in the past as "best practice" for gas utilities.

Given the fact that Union's forecasting process has the objective of providing accurate results over a one-two year time frame, we believe that proven historical accuracy and solid causal logic override are certain statistical issues that would become far more important if the forecast time frame was long-term. The reason for this opinion is that, systemic equational problems such as multicollinearity, heteroskedascity, and autocorrelation, if they exist in a forecasting model of monthly projections with a 10-year or so historical database, do not have the ability, unless they are dramatic in nature, to have a meaningful, statistically significant effect on a set of short-term forecasting predictions.

To explain, heteroskedastic and autocorrelation disturbances exhibit themselves through either expanding or declining error term amplitudes or discernable patterns in error terms, respectively, associated with successive observations in the historical regression equation observations used to estimate the model. Often times, these estimation problems can be attributable to either a missing variable, co-mingling of causality, or misspecification of an included variable. This non-randomness of the error term may manifest itself in an increasingly expanding effect that may result in the over-or-under forecasting of the dependent variable or certain months of the forecast. Thus, the length of the projection period has a direct bearing on the nature and extent of the heteroskedastic, multicollinearity and autocorrelation effects. In Union's case, each monthly observation is forecast only two steps ahead, thus minimizing any deleterious impact. This reality, coupled with the observed historical forecast performance serves to discount heteroskedasticity, multicollinearity and autocorrelation as important considerations.

Finally, it is clear that the relative accuracy of short-term forecasts becomes evident within a short period of time, thus validating their credibility on a year-to-year basis.

The Rudden team has examined the models used by Union, segmenting our analysis into the following categories:

1. Modeling Approach
2. Variables
3. Regression Results (Descriptive Stats)

1. Modeling Approach

The job of any forecasting group is to produce the most accurate forecasts possible given the resources made available. This is not a matter of statistics or econometrics, per se, but rather one of the allocation of resources within available budgets. In the case of Union Gas, there are a number of forecast components that must be developed every year, each of which requires expert internal resources. The following table shows the relative magnitude of volumes for each class that is subject to the Union forecast process:

UNION GAS RATE CLASSES

	Residential		Commercial			Industrial		Total
	M2	01	M2	01	10	M2	10	
# of Customers	827,198	254,998	77,957	25,375	2,567	5,224	189	1,193,508
% Customers	69.3%	21.4%	6.5%	2.1%	0.2%	0.4%	0.0%	
NAC	2,614	2,734	17,319	9,103	95,713	85,161	276,159	488,803
Total Volumes	2,162,296	697,165	1,350,137	230,992	245,694	444,881	52,194	5,183,359
% Volumes	41.7%	13.5%	26.0%	4.5%	4.7%	8.6%	1.0%	

Union employs a reasonable and commonly used approach to the forecast of customer class usage over a two-year forecast horizon. This approach employs separate models for the forecasting of Use per Customer and the total number of customers. The econometric models incorporate measures of gas price, economic activity, and month-to-month weather explanatory variables (for heating season months). These variables are commonly employed by many gas and electric utilities in the forecast of customers and use per customer, and represent a logical and accepted approach.

The primary drivers of use per customer are traditionally defined as weather, as measured by heating degree-days, gas price elasticity of demand, the positive growth impact of new (or net new) gas appliances, and the negative impact of more efficient appliances/equipment entering the end-use pool. The primary elasticity drivers of these models are short-term in nature and, thus, the models have logically been specified with variables that lean more toward short-term nominal gas price drivers.

Of note is a statement found on page 12 of the Union Gas Demand Forecast Methodology - May 2004 -"For the majority of the 136 demand variables tested that are contained in the eleven demand equations, this 95 percent (Confidence Level of the "t" value of each partial regression coefficient) level is met as 127 demand variables had test scores above the 95 percent confidence level. In nine instances, a lower confidence level was considered …" This acceptance of a lower statistical Confidence Level is quite acceptable if the economic relationship attempted to be captured has sound theoretical basis. Often times, the appropriate economic relationship is not able to be captured with the level of confidence a forecaster would like due to the availability of a data series that would most accurately capture that relationship.

Additionally, all exogenous variables that were employed in these models had the appropriate arithmetic sign, which means that the estimated partial regression coefficient for each independent variable was consistent in the direction of the impact that would be expected under economic theory.

2. Variables

The first issue that was uncovered by Rudden in its analysis revolved around Union's somewhat unconventional, yet well supported, statement that a forecast of gas total throughput volumes should take into account evidence that winter weather in the Union Gas service territory, as measured by heating degree days, has actually exhibited a warming trend over the last thirty or so years. From a practical perspective, the theory of global warming suggests that such a trend is likely, and to include such a theory in a short-term forecast appears reasonable in this case.

Evaluation of the Forecast Methodologies for Residential M2, 01; Commercial M2, 01 and 10 Classes

Union employs a multi-equational approach to the forecasting of the Residential M2 and 01 classes, and the Commercial M2 and 01 & 10 classes. The construct of the volume equations employs commonly used variables such as:

- Number of Customers
- Natural Gas prices
- Weather (as captured in nine separate weather variables identifying the heating months of the year)

This model structure is commonly used to forecast short-term sales by month. The overall statistics of these models are acceptable and the signs of the partial regression coefficients comport with accepted economic theory.

Union takes two additional steps to ensure they capture the appropriate month-to-month distribution of volumes and the noticeable declining trend in use per customer. The first of those steps is to estimate use per customer as a function of the following variables:

- Retail Price of Natural Gas
- Residential Energy Efficiency / or Commercial Segmentation Index
- Weather (as measured by monthly heating degree days)

The Retail Price of Natural Gas Price variable used in the model is specified as a nominal value,[4] as opposed to a real value. A short-term model structure should capture "intensity of use" (i.e., responses to a customer's monthly

[4] ***Nominal value*** *is the actual price experienced by a customer without adjustment for the effects of inflation. Real prices are adjusted for inflation.*

budget) responses rather than longer-term structural changes; therefore, a nominal price variable would be acceptable, and probably preferable, from both a statistical and logical perspective.

The Residential Energy Efficiency Variable and Commercial Segmentation Index have been developed to capture the overall declining trend in use per customer, ostensibly caused by increasing appliance/end-use efficiency. The construct of these variables is based upon surveys of both existing and new residential and commercial customers. While the constructs are different, the overall objective of both is reasonable. The resultant variables add to the explanatory power of the models.

The Weather Variables are specified as a series of monthly variables for the nine heating months of each year. These variables capture both relative monthly use intensities and certain sociological-driven use patterns that go hand-in-hand with the months of the year (e.g., Christmas, New Years, winter school breaks, etc.). The mathematical construct of these variables is one of two major constructs that have been proven to be valuable in predicting monthly gas-use intensity.

Rudden found out that a number of other variables have been tested and Union selected the variables primarily used according to their accuracy, in their forecasting systems. From a practical process perspective, a forecaster must choose a set of independent variables that are logical, measurable and readily obtainable in a time period that meets forecast preparation deadlines. The variables used by Union meet all of these criteria.

While Rudden recognizes that there may be other variables that would perform adequately in the Union forecasting system, we are satisfied with the accuracy that has been achieved by Union, especially over the last three years. Further, the use of multiple equations in the development of the forecasts for five of the rate classes has merit even though each equation includes some of the same variables contained in the other. The reason for this conclusion is that each individual equation has been shown to be less accurate than the average result of both equations. Further, Union has not been successful in finding alternative equations that combine the key demand drivers of the current equations.

Judgmental Adjustments

After the use per customer key demand drivers are developed, there are certain judgmental adjustments that are applied to the NAC forecasts to account for influences that cannot be statistically estimated in the historical series. Those adjustments include:

- Marketing Plan Impacts
- DSM NAC Impact
- Water Heater Standards Efficiency Changes

In Rudden's opinion, judgmental adjustments to a statistically prepared forecast are both appropriate and necessary if the influences being recognized through forecaster judgment are known to exist and are also known not to have existed in the historical data series upon which the models have been estimated.

3. Regression Results (Descriptive Statistics)

Rudden reviewed a comprehensive set of descriptive statistics output for each of the ten residential and commercial models.

As evidenced by the data contained in Appendix C, the models' R-Squares[5], t values of the partial regression coefficients, and Standard Errors are all statistically competent. Further, the arithmetic signs of the independent variables are correct.

As evidenced by the data contained in Appendix D, all of the models have acceptable heteroskedastic disturbances. In the models that do contain autocorrelation, as evidenced by the Durbin Watson d or h statistic, the potential effect of this autocorrelation in the equation is far outweighed by the accurate performance of such models. In multiple regression[6] time series modeling, the presence of autocorrelation and multicollinearity are usually not a question of "if," but "how much." Taking steps to eliminate these time series side effects may have the unwanted result of damaging a model's explanatory and predictive power. In any event, Rudden's view of these issues is that the presence of these side effects is not a serious problem for models that forecast 12-24 months into the future. However, in the interest of completeness, Rudden has included a suggested set of tests for Union to consider in the future forecast cycles.

Valuation of the Methodologies to Forecast Industrial M2 & 10 Classes

Conceptually, the model structure utilized for these classes is commonly used by utilities today. The volume equations developed for these classes include:

- Weather
- Number of Customers
- Lagged Change in GDP
- Price Ratio-Natural Gas to Fuel Oil

The problem is that the resulting forecasts are less accurate than the residential and commercial forecasting efforts. However, the problem is most likely not with the model but with the forecasts of the independent variables used to drive the model. In the case of these customers, their "derived" demand for natural gas varies directly with the demand for their industrial output, and the demand for their industrial output varies depending on national and international forces that are beyond their control.

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[5] ***R-Squares***, or the Coefficient of Determination, measures the percent of the variance in the dependent variable that is explained by the independent variable(s).
[6] ***Multiple Regression*** is an extension of simple regression analysis that allows for more than one explanatory variable to be included in predicting the value of a forecast variable. For forecasting purposes, multiple regression analysis is often used to develop a causal or explanatory model.

J. Scott Armstrong, "*Principles of Forecasting: A Handbook for Researchers and Practitioners*"
<http://morris.wharton.upenn.edu/forecast/dictionary/defined%20terms.html>(2001)

SECTION IV
OBSERVATIONS ON OEB AND INTERVENOR CONCERNS

In reviewing the concerns of both the OEB and intervenors in Union's last rate case, there were three areas of focus. They were:

1. Statistical Significance vs. Judgment
2. Economic Theory vs. Statistical Estimation
3. Autocorrelation, Multicollinearity and Heteroskedasticity

With these concerns, Rudden offers the following comments for all parties' consideration.

Statistical Significance vs. Judgment

It is Rudden's perspective that every forecast is a mirror of a forecaster's judgment. Regardless of the sophistication of the models employed, it is the forecaster that selects the models, variables and transformations and then makes informed judgments about influences known to exist, but are not modellable for one reason or another. In short-term model structures, there is great value in trying to capture and model "persistence"-- that is, the experience and trends of the recent past. Short-term demand for natural gas for residential and commercial consumers is often best described as changes in intensity of use, usually as a response to weather. Price effects may not be "capturable" with a high degree of statistical accuracy due to the fact that customers have a limited opportunity to respond in meaningful ways (e.g., families need to keep warm and cook meals, and merchants need to open each day for business regardless of how cold it may be). For this reason, time series and pooled structures used to develop long-term forecasts will have more to work with in the development of own price, cross price and income effect elasticities. Critics of the Union forecasts appear to have a focus on statistical "perfection," perhaps at the expense of a good forecast.

Thus, judgment is entirely appropriate under the following circumstances:

- There is a phenomenon that is known to exist by the forecaster that has not been a factor in the historical series (e.g., new technologies, new efficiencies, weather changes, etc.).
- The judgment of the forecaster is experienced, based upon the latest information, and, where applicable, consistent with accepted economic theory.
- The credibility of the forecaster's past efforts is favorable.

Union forecasters meet these tests for appropriateness.

Economic Theory vs. Statistical Estimation

There are instances in which a forecaster knows that there is a certain logical relationship between a dependent and independent variable. As an example, the relationship known as "price elasticity of demand," in Rudden's experience has not been challenged (i.e., a negative arithmetic sign). However, there are times when a forecaster attempts a statistical estimation of this relationship and there are deficiencies in the data or other overshadowing circumstances (e.g., multicollinearity) that will not permit the statistical estimation algorithm to estimate this relationship with a high level of statistical confidence. The fact remains that this relationship is known to exist. If the resultant statistical estimation procedure captures the correct arithmetic sign of the relationship, it is preferable to include the variable in the forecasting model, even though it has a lower confidence "t"value.

Rudden suggests that critics of "t" values of partial regression coefficients below 95% should consider this perspective in weighing the importance of this criticism.

Autocorrelation, Multicollinearity and Heteroskedasticity

In our review of Union's forecasting models, there were instances in which we found evidence of each of these three statistical problems. In our opinion, the impact of these problems on Union's forecasting results were insignificant given the relatively short forecast horizon; and, given Union's accuracy record (see a complete explanation of the reasons for this conclusion on page 5). Any attempt to fix these problems would have to proceed cautiously due to the construct of the models. However, we would like to discuss the practical aspects of these so-called statistical problems in turn:

- Autocorrelation is usually present to some extent in most time series of a monthly construct. Month-to-month observations usually have some serial linkage and this fact can be of value when forecasting one-to-two years into the future.
- Multicollinearity may exist in a relationship estimation structure such as a multiple regression but it does not impede the model's ability to forecast reliably unless the correlated variables make a sudden departure from this collinear relationship in the forecast period—this is not likely in a 1-2 year ahead forecast. We conclude that this concern is without merit in this case.
- Heteroskedasticity can become a problem in a forecast model if the forecast period is sufficiently long enough to allow the non-constancy of a forecast variance to become unstable. In our Recommendations in Section VI, we do offer some ideas for Union to consider in future forecast cycles. However, at this point, given Union's forecast accuracy track record and the length of the forecast period, we do not believe that this represents a significant threat to forecast accuracy.

SECTION V
CONCLUSIONS

Based upon Rudden's review of Union Gas Ltd. Demand Forecast Methodology - General Service Markets - Rates M2, 01 and Commercial M2, 01 & Banner10 - May 10 2003; our analysis of Union's workpapers; our evaluation of forecast accuracy data, as well as discussions with the Union Gas forecasting staff, we conclude the following:

1. In Rudden's opinion, Union's forecasts and underlying methodologies are reasonable and produce accurate results.

2. Union's Volume Forecasts for the Residential M2, 01 and Commercial M2, 01and 10 classes are logical and statistically credible forecasting methodologies that produce accurate results sufficient for reliable12-24-month-ahead projections.

3. Union's Industrial Volume Models are competent and credible as to their logical and statistical construct. However, their accuracy performance is not up to the level of the Residential and Commercial Models. Rudden's scope of work did not envision the development of alternate structures, databases and/or specifications. However, it may well be that these models' accuracy performance is the best that can be obtained for this class due to the nature of industrial customers' gas consumption and the many potential national and international influences that affect their demands for natural gas.

4. For short-term forecasts, such as the ones produced by Union and focused upon in this report, the most important performance parameter that should be considered is the accuracy of the resultant 12-24 months-ahead projections.

5. There are certain judgmental components that have been made by Union forecasters to the subject forecasts. Rudden's position on judgmental forecasts is that it is acceptable and even preferable for qualified forecasting personnel to adjust forecast model outputs under the following circumstances:

   - The phenomenon that is to be captured is known to be influential on current experience and/or future forecasts but there is a lack of historical influence of this phenomenon on the databases that are being used to estimate the econometric forecast model equation(s).
   - The judgmental adjustment should be the product of a structured estimating process that ought to be documented at the outset and reviewed at the time of each forecast update. Additionally, forecasters should continue to test for the statistically significant presence of the phenomenon that is the subject of the judgmental process by including a relevant independent variable that should logically capture that phenomenon when it does become a statistically significant driver in the forecasting model. Once that variable achieves an acceptable "t" value for its partial regression coefficient, with the expected arithmetic sign, then this variable may replace the judgmental adjustment.

SECTION VI
RECOMMENDATIONS FOR FUTURE INVESTIGATION

This section has been developed to offer Union's forecasting team some ideas that may prove to be cost effective if tested in future forecasting efforts. However, Rudden offers these caveats:

- Union has in place a competent forecasting process yielding accurate results. If Union judges that these recommendations are worthy of consideration, then we suggest that Union start with the first recommendation and, after testing, proceed to the second, and so on. However, it is conceivable that the first recommendation may be the only one necessary to test, since it may serve to improve model performance and reduce statistical side effects to a degree that would make further testing unnecessary at this time.

- While Rudden believes that the following recommendations will improve the statistical sophistication of the model, we do not know whether they will provide any marginal benefit in terms of additional accuracy for the additional cost. Union's first consideration should be to preserve the accurate performance of its forecasts.

Given the caveats mentioned above, Rudden recommends the following for Union's consideration:

Respecification of Weather Variables

Currently, Union's weather variables, by virtue of their specification, capture the **average** effect of heating degree-days over the historical data series. If the weather sensitivity of the monthly use per customer were effectively a constant that varied year-to-year around some average, then the Company's current specification would be optimal. However, it is conceivable that the current specification, by virtue of the fact that use per customer seems to be declining over the historical model estimation period, may be overstating the monthly correction in the forecast year. Further, this error could be compounded when Union normalizes NAC to assess forecast accuracy using the partial regression coefficients from each model.

A potential remedy for this potentially suboptimal specification would be to normalize each historical month in the model database, using a monthly regression analysis of the form (U/C=a+/- b*(monthly HDD) +/- c*(monthly trend variable) for each calendar month group of observations. Then the monthly-normalized equation output could be included in the forecast model to more accurately capture declining weather sensitivity.

When forecasting for the test year and beyond, Union's monthly forecasts would already contain the latest weather sensitivity coefficients as a result of the pre-normalization process and the efficiency trend phenomenon may be more identifiable from a statistical perspective.

An additional benefit may be the fact that, since model variance would be decreased; there may be a better chance of higher "t" values of the partial regression coefficients for the nominal price, customer and efficiency variables.

Testing of ARIMA Model Structures

As a check on the currently employed model structures, Union may want to consider employing an ARIMA-type[7] structure on the individual-month normalized U/C data by class. The Rudden team has had success utilizing, for example, Box Jenkins Model[8] and Box Jenkins Transfer Function models[9] for the purpose of forecasting 12-24 "steps ahead."

An alternate suggestion would be to consider the use of a tool such as Dynamic Regression that has the capability of identifying annual, monthly, or seasonal trends, and accounting for those trends. Perhaps, a coupling of this tool with a linear or polynomial trend parameter to capture the conservation effect would give Union a more powerful single equation perspective and reduce the need for averaging of two forecast equation results.

Alternatives for Minimizing Autocorrelation and Heteroskedasticity

In reviewing the descriptive statistical outputs for the ten residential and commercial models, the early years of the historical series tended to fit the data better than the later years. In other words, the scatter of the residual plots widened at the end of the historical series. Rudden recommends that Union consider testing in future forecast efforts:

1. Shorten the historical data series upon which the models are based. This may help remove the potentially less relevant data in favor of focusing on the most recent history.

2. Experiment with weighted regression. This would allow Union to keep the same data series but add emphasis to the latter year observations.

In those models that exhibit significant Durbin Watson[10] test results, Rudden recommends:

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[7] ***ARIMA*** (Auto Regressive Integrated Moving Average model.) A broad class of time-series models that, when stationarity has been achieved by differencing, follows an ARMA model. An ARMA model is a type of time-series forecasting model that can be autoregressive, moving average, or a combination of the two. In an ARMA model, the series to be forecast is expressed as a function of previous values of the series (autoregressive terms), and previous error terms (the moving average terms).

[8] ***Box Jenkins Model*** is a form of autoregressive-integrated-moving average (ARIMA) models for time series forecasting problems. Originally developed in the 1930s, the approach was not widely known until Box and Jenkins (1970) published a detailed description. For more information see: Box, G. E. P. & G. M. Jenkins (1970), Time-Series Analysis. San Francisco: Holden-Day. Later editions were published in 1976 and 1994, the latter with G.C. Reinsell. Mentzer, J. T. & K. B. Kahn (1995), "Forecasting technique familiarity, satisfaction, usage, and application" Journal of Forecasting, 14, 465-476.

[9] ***Box Jenkins Transfer Function Model*** is a model that employs other independent variables other than time as drivers in an ARIMA model framework.

[10] ***Durbin Watson*** is a measure that tests for autocorrelation between error terms at time t and those at t + 1. Values of this statistic range from 0 to 4. If no autocorrelation is present, the expected value is 2. Small values (less than 2, approaching 0) indicate positive autocorrelation; larger values (greater than 2, approaching 4) indicate negative autocorrelation. Is autocorrelation important to forecasting? It can tell you when to be suspicious of tests of statistical significance, and this is important when dealing with small samples. However, it is difficult to find empirical evidence showing that knowledge of the

1. Experiment with a Cochrane Orcutt –type model structure. We have found the models to be effective at capturing periodicity that may not be captured by the monthly HDD variables.

2. Review the practicality of transformations and elimination of lagged dependent variables, so long as they do not interfere with accuracy objectives.

In sum, Rudden makes the recommendations in recognition of the reality that all forecasting processes are in constant need of review and upgrade, when and where they make sense. However, Union forecasters should first and foremost ensure that any suggestion contained in this report, or from any other source, does not conflict with the accuracy that Union is currently achieving. The goal of statistical perfection must come second to accuracy projections in a short-term forecasting environment.

Durbin-Watson statistic leads to accurate forecasts or to well- calibrated prediction intervals. Do not use it for cross-sectional data as they have no natural order.

J. Scott Armstrong, "*Principles of Forecasting: A Handbook for Researchers and Practitioners*" *<http://morris.wharton.upenn.edu/forecast/dictionary/defined%20terms.html>(2001)*

APPENDIX A
PROFESSIONAL RESOURCES

GEORGE L. FITZPATRICK

George L. Fitzpatrick is the Managing Principal/CEO of Harbourfront Consulting Group LLC. His professional experience includes eight years of service at Long Island Lighting Company managing the Load Research, Forecasting, and Cost of Service Divisions. After that, he held the position of Vice President of Demand Planning with Stone and Webster Management Consultants, Inc.

Twenty-two years of his career have been spent with Applied Energy Group, Inc. as its founder, CEO and Managing Principal. Over his tenure as CEO, he built the firm from one consultant to over twenty-five employees. In 2002, he reached an agreement to sell his share of the firm in order to pursue consulting and expert witness assignments that were specific to his experience, expertise and past utility client relationships.

In 2002, Mr. Fitzpatrick formed Harbourfront Consulting Group LLC to focus on the provision of expert witness services and litigation support in areas that have been central to Mr. Fitzpatrick's practice over his career. More information about the firm and its professional resources can be found at www.harbourfrontllc.com.

Mr. Fitzpatrick has provided expert direct and rebuttal testimony before federal and state regulatory bodies and judicial authorities on subjects such as:

- Lifecycle Economic Evaluation of Utility Investments
- Econometric/statistically-based Load and Energy Forecasting
- Weather Normalization Studies of both gas and electric test year sales
- Weather Normalization probabilistic correction of System Peaks and Class components
- Strategic Planning
- Comparative Economics of Electric Generation Investments
- Load Research Program Sample Design, Implementation and Analysis
- Nuclear and Fossil Power Plant Cost and Performance analyses
- Econometric and Statistical Studies on Utility- related Issues
- Rate Design
- Cost of Service Studies
- DSM/ Renewable Program Evaluation
- Performance Standard design and statistical construction
- SAIDI / SAIFI-related statistical investigations
- Rebuttal testimony on a wide range of statistical and econometric-related subjects.

Over Mr. Fitzpatrick's consulting career he has provided services to over 50 electric and gas utility clients both in the U.S. and abroad. However, there are a number of clients that have utilized his services on an ongoing basis over the years as a senior management consultant and/or expert witness. These clients include:

- Arizona Public Service Company (Pinnacle West)
- Bermuda Electric Light Company Limited
- Consolidated Edison Company of New York
- El Paso Electric Company
- Entergy
- Freeport Electric
- Georgia Power Company (Southern Company)
- KeySpan Energy
- New England Electric System
- Niagara Mohawk Power Corp. (National Grid)
- New York Power Authority
- Northeast Utilities
- TXU Electric (TXU)
- Westar Energy (and its three predecessor companies)

Over his 24 year professional consulting career, he has also served his client base as a negotiator, often playing a key role in the negotiation of multi-million dollar, short and long term utility power supply and franchise contracts (e.g., Ft Bliss, White Sands Missile Range, University of Texas, and El Paso Water Utilities and El Paso Electric Vs. the City of Las Cruces).

Mr. Fitzpatrick has a Master of Business Administration degree in Economic Theory and a Bachelor of Arts in Economics, both from St. John's University. He has also completed course work toward a Master of Science degree in Management Engineering from Long Island University (C.W. Post) as well as advanced training in Box Jenkins forecasting techniques and econometric and statistical modeling. He possesses a Certificate of Mastery in Reengineering from the Hammer Institute and is a member of the Association of Energy Engineers (AEE) and the Energy Services Marketing Society.

PROFESSIONAL EMPLOYMENT

2003-Present — Harbourfront Consulting Group, LLC
Managing Principal and CEO

Founded Harbourfront in 2002. HFG's focus is the development of strategies, analyses and expert testimony to assist its primarily investor-owned utility client base in objectively and expertly presenting and defending issues central to the client's corporate mission. Primary areas of the practice are electric and gas forecast development and review; engineering economic studies; comparative economic studies; lifecycle economic studies; statistical and econometric analyses and rebuttal; rate design and cost of service studies; performance standard statistical design and rebuttal; distribution reliability-related analyses and utility accounting-related matters.

1982 - 2003 — Applied Energy Group, Inc.
Founder, President & CEO

Founded AEG in 1982. The focus of this consulting practice centered in the areas of Peak Load and Energy Forecasting, Load Research program sample design, implementation and analysis, Demand Side Management Program Evaluation, Electric and Gas Weather Normalization Studies, Nuclear and Fossil Generation Cost and Performance Studies and Comparative Engineering Economic Studies of Utility Generation and other investments. Mr. Fitzpatrick provided expert testimony on the above-mentioned areas and also provided clients with leadership services in the startup of new diversification ventures.

1979 - 1981 Stone & Webster Management Consultants, Inc.
Vice President—Demand Planning

Responsible for the coordination and direction of consulting activities in the Planning, Load Research, Load Forecasting, and Load Management areas within the corporation. Additional responsibilities included analysis of data processing requirements and potential new markets for consulting activities - a diversification from Stone & Webster's traditional lines of business.

1971 - 1979 Long Island Lighting Company
Manager—Load Research, Costing and Forecast Division

Primary responsibilities centered on Electric Peak and Energy Forecasts; Electric and Gas Weather Normalization; Statistical Sample Design Development; Load Research Study Implementation; Load Data Management and Analysis; Long Island Lighting Company's Annual Population Survey; all Long-Range Demographic Projections; the collection, processing, and overall supervision of the billing of customers under the Long Island Lighting Company's commercial/industrial time-of-use rate, the Electric Class of Customer Annual System Load Research Study; and all statistical and econometric- based studies performed by Long Island Lighting Company's Economic Research Department.

In 1978, responsibilities were expanded to include fully allocated and marginal cost-of-service studies for electric and gas and total factor productivity studies.

PROFESSIONAL EXPERIENCE

Expert Testimony and Regulatory Support (Selected Assignments)

El Paso Electric vs. City of Las Cruces, New Mexico-2000 Federal Court-Ordered Mediation:
Participated as part of El Paso Electric's officer/attorney team in the final court-ordered mediation sessions that resulted in the settlement of the 10-year dispute between the two parties. Prior to this mediation, worked on behalf of the Company to negotiate a settlement with the City's consultants. .

Freeport Electric-1995 Docket No. 95-E-0676, 2001 Docket No. 01-E0965, 2003Docket No. 03-E-0686:
Provided direct testimony supporting Freeport's KWH sales and peak demand forecasts in four NYPSC proceedings. Constructed econometric models based forecast methodology by calls along with weather

normalization of the test year sales. Provided testimony on the selection of Freeport-specific DSM programs to meet Commission requirements.

Indian Point 2 and Indian Point 3 / Consolidated Edison Company of New York, Inc. and New York Power Authority - NRC Docket Nos. 50-247-SP and 50-286-SP:
Prepared rebuttal testimony comparing the economics of early retirement of the Indian Point units vs. potential conservation investment alternatives in New York State.

KeySpan Energy-1998 Docket Nos. ER98-11-000 and EL98-22-000, 2003; Docket Nos. ER04-112-000 and ER04-112-001:
Provided expert testimony before FERC on the appropriate segmentation of fossil generating plant fixed and variable O&M Costs. Developed statistical models, by plant, to support this segmentation. Testimony was updated again in 2003 for the FERC Docket related to the renewal of the contract that was originally brought before FERC in 1998.

Oklahoma Natural Gas Company- 1991 PUD Docket No 001017:
Provided rebuttal testimony on the comparative economics and efficiency of electric and gas DSM programs and made recommendation to the Oklahoma Commission on incentive rate making for DSM-related investments.

Palo Verde 1, 2, & 3 / Arizona Public Service Company-Docket Nos. U-1345-85-156 and U-1345-85-367:
Provided direct testimony presenting comparative economic analysis of Palo Verde vs. hypothetical coal unit alternative. Provided econometrically developed estimates of Operation and Maintenance Costs, as well as Capital Additions Costs. Provided independent statistically derived estimates of lifecycle Capacity Factors for the Palo Verde units. Participated in the training of APS witnesses.

Palo Verde 1 & 2 / El Paso Electric Company / Texas - Docket No. 7460:
Provided direct testimony on lifecycle economics of nuclear vs. coal alternative. Provided direct testimony on decisional prudency of company to enter into nuclear investment. Provided load forecast of company's future energy and peak demand needs. Participated in the training of Company witnesses.

Palo Verde 1, 2, & 3 / El Paso Electric Company Docket Nos. 8892, 9069 and 9165:
Provided Direct Testimony presenting comprehensive industry analysis and statistical analysis of Nuclear Performance Standards. Presented statistically derived optimal Performance Standard for Palo Verde Units 1, 2, and 3. Provided Rebuttal Testimony discussing theoretical and statistical flaws in intervenor's Performance Standard proposal.

Plant Hatch and Plant Vogtle / Georgia Power Company / Georgia - Docket Nos. 3554-U and 3673-U:
For the Vogtle Financing Case, the Vogtle Rate Case and the Hatch Rate Case: Provided rebuttal testimony on comparative economics of Plant Vogtle, provided rebuttal testimony (with presentation to Commission) on Vogtle's economics, and statistically derived projections of Vogtle's performance and Hatch O&M Costs, participated in witness training, and developed internal statistically-based O&M and Capital Additions "Targets" for Plant Hatch and Plant Vogtle.

Plant Hatch and Plant Vogtle / Georgia Power Company - Docket No. 3840-U:
Provided Rebuttal Testimony that pointed out methodological and statistical flaws in Staff consultant's Performance Standard proposal. Presented parameters for a statistically unbiased, optimal Performance Standard.

Shoreham / Long Island Lighting Company / New York-Docket No. 28252:
Provided rebuttal testimony on most likely performance of Shoreham Unit. Provided testimony on most likely Operation and Maintenance Cost levels and Capital Additions Cost level for Shoreham based upon econometric analysis of nuclear industry. Provided testimony on demand-side vs. supply-side alternatives for the Long Island Lighting Company.

Western Resources-2001 KCC Docket No. 1-WSRE-436-RTS:
Provided direct testimony and supporting statistical / engineering economic analyses on the prudence of Western's investment in the Stateline Generating Plant. Also provided direct testimony on the statistical weather normalization of test year sales.

Developed comparative economic analysis on the benefits to Westar and remaining customers of special power supply contracts for Large C&I customers.

Western Resources – 1996 KCC Docket Nos.193, 305 and 193,30; -U96-KG&E-100-RTS:
Developed an accelerated depreciation plan for Wolf Creek Nuclear Unit to reduce cost of production to market-based competitive levels by 2000 - 2005.

Western Resources – 1996 KCC Docket No. 193,307-U96-WSRE-101-DRS:
Provided expert testimony and supporting statistical analysis for test year, class weather normalization, as well as, primary and secondary economic benefits of key customer discounted contracts.

Western Resources - Missouri Testimony in Generic Proceeding (1994:)
Provide expert testimony during the Missouri Public Service Commission's rule making proceeding concerning Integrated Resource Planning. The testimony discussed the consideration of alternative fuel sources as an end-use measure when developing their resource plan. (MPSC Docket)

Wolf Creek / Kansas Gas and Electric Company / Kansas City Power and Light Company/Kansas-1984 Docket Nos. 84-KG&E-197-R-142, O98-U / Missouri Docket #ER-85-128, EO-85-185:
Provided rebuttal testimony on lifecycle economics of nuclear vs. coal alternative. Provided first-year and lifecycle statistically based estimates of Wolf Creek's Operation and Maintenance Costs and Capital Additions Costs. Provided first-year and lifecycle estimates of Wolf Creek's Capacity Factors. Participated in the preparation of KG&E witnesses on the subjects of statistics, econometrics, forecasting, and engineering economics.

Atlanta Gas Light – Georgia (1997):
Worked with senior management to develop testimony for a performance based rate plan in support of the unbundling of gas service.

El Paso Electric Company -Texas (1997-1998):
Developed unbundling strategy and performance based rate plan in support of ongoing Texas PUC workshops on the unbundling of electric service.

Empire District - Missouri (1992):
Provided econometric rebuttal testimony critiquing MPSC Staff's direct testimony on Empire District's forecast. Staff accepted rebuttal testimony and the Company's forecast was accepted for use in the rate case.

Minnegasco - Docket No. G-008/GR-92-400 (1993 - 1994):
Developed a set of econometrically derived, short run forecasts for Minnegasco's major customer classes. Provided direct expert testimony regarding the use of these forecasts as a factor in determining the need for and magnitude of Minnegasco's requested rate increase. Assisted in preparation of cross-examination of intervening parties. On rebuttal, supported the implementation of weather normalization adjustments and discussed the effects of an adjustment on varying classes of customer use. All testimony was accepted by Staff.

Missouri Public Service (MOPUB) - (1992):
Provided econometric-based rebuttal testimony critiquing MPSC Staff's direct case criticizing MOPUB's forecast. Rebuttal testimony resulted in Staff stipulating to the use of the Company's forecast.

Palo Verde / Arizona Nuclear Power Project:
Developed computer software to facilitate budget tracking and comparison. Developed econometric-based target estimation models of Operation and Maintenance Costs. Developed target estimation of Capital Additions Costs based upon econometric modeling. Developed forced and planned outage statistical models to be used in regulatory proceedings for all participants as well as for internal outage planning. Acted as Advisor to Palo Verde Participant's Engineering and Operating Committee on Palo Verde Cost and Performance budget targeting.

Iowa Power Company:
Preparation of a generic proceeding-related evaluation of Iowa Power Company's current and planned DSM activities in light of its specific planning related need for DSM resources.

Long Island Lighting Company :(1974-1979)
Testified as an expert witness, usually in both the direct and rebuttal phases, in the following New York State Public Service Commission proceedings: Docket Numbers:

- 26733
- 26829
- 26985
- 27136
- 27154
- 80003
- 27319
- 27374
- 27375
- 28223
- 28252

on subjects such as econometric and econometric-end use Electric and Gas Peak and Energy Forecasts, Load Research studies for cost-of-service analysis, Load Management, Cogeneration, Conservation and statistical studies for weather normalization of gas send out and electric energy requirements data.

SELECTED CONSULTING ASSIGNMENTS

El Paso Electric Company
Developed a business plan for and then implemented an Energy Services Business Unit (ESBU) that had as its mission key customer retention contracting and the provision of value added products and services in the areas of energy efficiency, power quality, standby generation, and "behind the fence" maintenance and support services.

Bermuda Electric Light Company, Ltd.
Consulted senior management on opportunities for diversification and franchise protection; from 1993 through 1997. Businesses developed include a full service ESCO (BESCO) and Power Protection Leasing Programs for Residential and Commercial customers.

Western Resources
In 1995, was retained by Western Resources to provide expert advisory services and supporting research to assist in the development of a non-traditional Energy Service Company (ESCO). This engagement also involved the analysis of profitability of certain customer classes.

WPI Group International
In 1993 through 1994, provided advisory services for the acquisition of MICROPALM by WPI. After acquisition, provided strategic market and product planning advisory services to the CEO.

Delmarva Power & Light Company (DP&L)
From 1994 to 1998, supported a market research and business plan development project for the development of a dispatchable photovoltaic power supply system business. Based on our initial contribution, DP&L turned over the entirety of the Phase II commercialization to my firm.

Richardson & Associates
Since 1982, has provided expert technical, economic and business plan analysis for over 15 energy-related venture capital business opportunities. This consulting relationship is ongoing.

Applied Energy Technologies Corporation (AET)
Led the formation of a jointly held subsidiary with Delmarva Power & Light Company, A.C. Battery Corporation (a subsidiary of General Motors) to advance both grid-connected and non-grid-connected dispatchable photovoltaics to domestic and international commercialization. Other contributors include the U.S. Department of Energy, Solarex Corporation (a division of Amoco/Enron), and Ascension Technologies

NCR Corporation
In 1981 through 1983, was retained by NCR to develop a diversification business in the automatic meter-reading field. Developed business plans, marketing plans, and product functional specifications. Worked with NCR's CEO and senior management team.

Confidential Diversification Studies and Business Planning Engagements
Senior Management advisory services, development of business plans, and diversification strategies for twelve nationally known organizations. Since these assignments are governed by strict confidentiality agreements, they cannot be publicly identified.

Planning & Forecasting (Selected Projects)

New York State Electric & Gas Corporation (NYSEG) - (1994 -1997)
Served as Responsible Officer for AEG's development of a Multi-Equational Small Area Forecast Modeling System. This system is used to track monthly sales geographically in the NYSEG system, identifying significant weather normalized monthly variances almost in "real time" so that NYSEG can recognize and react to significant changes in a shorter elapsed time.

Western Resources/Westar - (1984 - 2004)
Provide continuing advisory services to Western Resources (now Westar) on potential methodological upgrades to their forecast and weather normalization methodologies.

Long Island Lighting Company (LILCO)
Directed the preparation of LILCO's Annual Long Range Peak and Energy Forecasts during the years 1974 - 1979. Constructed the first Engineering End Use and Econometric End Use models for electric forecasting in New York State; utilized Box-Jenkins stochastic and multiple transfer functions for short run electric forecasts; employed two and three stage regression techniques in SIC-based commercial-industrial forecasting.

In 1994, provided advisory services to review adequacy of the econometric methodologies for the capture of "market transformation" DSM and efficiency effects.

Saudi Arabia – 1995
Selected from an international list of experts to perform a comprehensive review of Saudi Arabia's largest utility's overall planning and forecasting procedures, methodologies, and results. This two-phase project also called for the reengineering of these processes once the analytical and fact-finding phase was complete.

Bermuda Electric Light Company, Ltd. (BELCO) - (1994)
Reviewed BELCO's existing forecasting process and provided a "phase in" solution for enhancing their forecasting systems.

Freeport Light & Power - (1995-2004)
Have and continue to prepare Freeport’s short and long-term electric peak and energy forecasts. Have presented and defended Freeport’s forecasts and weather normalization studies in its last three rate cases.

INNOVATIVE MARKET SEGMENTATION & PROFITABILITY STUDIES

Western Resources
Served as Responsible Officer for a Competitive Assessment of Western Resources key customer's responses to cost competition.

CINergy
In 1995, advisor to senior staff in a multi-phase project that had as its objective the meaningful (from a risk-profit perspective) segmentation of CINergy key customer markets and the analysis of profitability of the segments. This was followed by the development of strategies to optimize the use of CINergy's marketing resources to maximize shareholder returns while ensuring the long-term viability of the company.

Demand-Side Management Program Design, Reengineering, & Evaluation

Bermuda Electric Light Company, Ltd.
Directed a multi-faceted evaluation of the potential for DSM on Bermuda. Conducted in-depth research of various customer classes to determine likelihood of adoption of available DSM technologies. Building on this research, developed a series of pilot programs that were implemented in 1993, as well as evaluation strategies to be employed at the programs' conclusion.

Consolidated Edison Company of New York, Inc.
Project Manager for a Conservation Assessment Study which included designing a methodology and performing analysis to impact Conservation measures in the residential and commercial sectors to meet requirements imposed by New York PSC in Case No. 28223.

Long Island Lighting Company (LILCO)
Directed a research project focusing on the right-sizing of LILCO's DSM program in the face of a maturing market condition, as well as on the measurement of the extent to which LILCO's programs have successfully moved the market to energy efficient technologies. Research includes an assessment of the impacts of pure market forces on DSM and the role of rebates and information in overall market capture for DSM technologies.

Project Manager for LILCO's 1992 Research and Development Initiative entitled, "Institutional Barriers to Conservation in Master-Metered, Tenant-Occupied Commercial Office Space." The project involved determining the market conservation potential, identifying institutional barriers through focus groups and interviews with landlords and tenants, and establishing a pilot program and blueprint lease to implement in order to enhance DSM measures in the relevant market.

Directed the comprehensive evaluation of LILCO's 1987 Conservation and Load Management Programs. This evaluation is contained in a three-volume report, which has been called the "most comprehensive" effort to date in this area.

Directed the evaluation of LILCO's 1988 and 1989 Conservation and Load Management Programs. Directed the preparation of a June 1988 Load Management Study. Specific responsibilities included estimating Load Management reductions included in LILCO's Load Forecasts by major components.

Minnegasco

Served as the Senior Management Advisor to Minnegasco's DSM/Load Research Program from 1993 through mid-1995. Responsibilities included contract negotiations with consultants, supervision of consultant's activities, and resolution of technical issues, and on-site presence as required to effectively oversee all Load Research-related activities.

New York Power Authority (NYPA)

Served as the Senior Management Advisor for NYPA's $120 million High Efficiency Lighting Program (HELP) having primary responsibility for drafting and negotiating DSM cost sharing umbrella contracts with New York State and New York City.

Analysis on behalf of NYPA of Energy Systems Research Group's (ESRG) Conservation Assessment Report submitted in FERC Case No. 2729: Prattsville Pumped Storage Facility.

Supervised the development of an evaluation of potential Load Management strategies for the NYPA's municipal customers, including a cost/benefit analysis and specific Load Management test programs.

Named "Advisor" to NYPA's extensive Conservation Ten-Year Program.

New York Power Pool

Analyzed the conservation forecasts contained within the Member Systems' individual long range forecasts and critiqued intervenors' conservation forecasts and analyses.

New York State Electric & Gas Corporation (NYSEG)

Served as Responsible Officer for NYSEG's 1991 & 1992 Commercial / Industrial Process and Impact Evaluations. Served as Responsible Officer in the development of NYSEG's June 1994 DSM Market Transformation Study.

Orange and Rockland Utilities (O&R)

Assessed the potential for and designed an Energy Cooperative Program for O&R's commercial customers. Directed project to assess new regulated and unregulated business opportunities to diversify O&R from its core business.

Rochester Gas & Electric Corporation

Served as Responsible Officer for RG&E's 1990-94 DSM Evaluations. Represented RG&E in all DSM-related interactions with PSC Staff.

Load Research

Electric Power Research Institute (EPRI)
Advisor to EPRI's Demand Program. Author of RP 1588-3 "Load Data Management and Analysis"; co-author of EPRI Rate Design Study Topic Paper 3: "Issues in Load Research."

Elizabethtown Gas Company
Asked by Senior Management to assess Elizabethtown's Load Research Program and develop a set of recommendations that would result in full cost-effective utilization of the Load Research resource, developed study plan, conducted in-depth technical interviews of potential load research clients, and presented findings and recommendations to all levels of Management.

Iowa Power Company
Directed weather normalization analysis on historical system peak demands. Results from analysis will be utilized in future system peak demand forecasts.

Long Island Lighting Company (LILCO)
Designed and implemented stratified sampling software that employed Dalenius-Hodges and Neyman Allocation techniques with stratum optimization and validation. Also directed LILCO's Load Research Program.

New England Power Service Company (NEPSCo)
Reviewed NEPSCo's Load Research Data Management and Analysis System from analytical and data perspectives and developed a NEPSCo-specific computer hardware and software plan for implementation.

New York Power Authority
Directed the review of the existing Load Research Program and formulated a Management Plan to specify future needs in the areas of sample design, hardware, software, and staffing.

Assisted in the development of specifications for a microcomputer-based Load Research Data Collection, Editing and Analysis System.

New York State Electric & Gas Corporation (NYSEG)
Served as Technical Advisor to the Manager of NYSEG's Load Research Department.

Northeast Utilities Service Company
Performed a comprehensive audit of the technical, software, and organizational aspects of the Northeast Utilities Load Research Program, including the identification of current uses and recommended future cost-effective uses within the company.

Supervised development of a study to analyze load research, weather, and attribute data for the small Commercial and Industrial customer group.

Northern States Power Company (NSP)
Directed the review of all aspects of NSP's load research process and presented findings in a comprehensive presentation to senior management.

Pacific Gas & Electric Company (PG&E)
Performed a comprehensive audit of the PG&E Load Research Data Management and Analysis System. Also, assessed the value of Load Research to all relevant departments in the company including recommendations for more cost-effective uses of Load Research data for both current and future applications.

Tennessee Valley Authority (TVA)
Conducted review of TVA's Sampling Plan strategies and methodologies.

DSM Bidding

Orange and Rockland Utilities
Directed the economic evaluation of the first utility bidding program in New York State.

Cogeneration

Caribbean Gulf Refining Corporation
Performed an economic review for the construction of a nine megawatt Cogeneration facility.

Day and Zimmermann, Inc.
Performed a detailed analysis on the potential for Cogeneration Systems in the United States, which included the development of a comprehensive marketing strategy.

Orange and Rockland Utilities
Developed a Corporate Strategy for Cogeneration in the O&R service territory.

PUBLICATIONS, PRESENTATIONS, AND SEMINARS

Speaker, “The Electrotechnologies Conference,” El Paso Electric Company; El Paso, Texas; March 31, 1998.

Speaker, “The Customer Information Seminar,” El Paso Electric Company; El Paso, Texas; October 7, 1997.

Speaker, “The Energy Revolution Conference,” El Paso Electric Company; UTEP Campus; El Paso, Texas; June 3, 1997.

Speaker, “Customer/Market Segmentation to Optimize Competitive Opportunities,” AMRA 1996 Annual Symposium; New Orleans, Louisiana; September 10, 1996.

Speaker, "Customer Segmentation," Infocast; Deloitte & Touche; Strategic Marketing Seminar; Atlanta, Georgia; May 1996.

Speaker, "Reengineering Customer Service & DSM - Keys to Building Competitive Advantage in the Future" with Steven J. Maslak; CARILEC CEO Conference; Freeport, Bahamas; June 1 & 2, 1995.

Speaker, "A Presentation To The Deloitte & Touche Partners" with Steven J. Maslak; Public Utilities SLIP Meeting; Las Vegas, Nevada; December 12-13, 1994.

Speaker, "Demand Side Management Alternatives for the Caribbean," Caribbean High-Level Workshop on Renewable Energy Technologies; December 5-9, 1994.

Speaker, "Projects For Energy Efficiency, And The Conservation Of Economic And Environmental Resources," The Caribbean Workshop On Renewable Energy Technologies; St. Lucia, West Indies; December 5-8, 1994.

Speaker, "Demand Side Management As An Economic Development Tool," MEUA Conference; Syracuse, New York; October 13, 1994.

Speaker, "The Effect Of The Market Transformation Phenomenon On DSM And Utility Competitiveness," EUMMOT Fall 1994 Meeting; Corpus Christi, Texas; September 9, 1994.

Speaker, "Evaluation Protocols: Preparing For DSM Evaluation," Presentation to the 4th Quarter EUMMOT Meeting; Columbia Lakes, Texas; December 13, 1993.
Author, "Incentive Regulation in the United States: an Update," EEI; 1992.

Speaker, "The Career Challenges Facing the Electric Industries in the 1990's," Hofstra University, M.B.A. Career Forum; Hempstead, New York; April 1992.

Speaker, "DSM Evaluation for Incentives: How Heavy Should the Burden of Proof Be?" Washington Gas Least-Cost Planning Conference; Washington D.C.; April 1992.
Speaker, "Practical Cases in Evaluating Energy Efficiency Initiatives," Hydro-Quebec Symposium; Montreal, Canada; November 1992.
Author, "Integration of Load Research into the DSM Evaluation Framework," Chapter 8; DOE DSM Evaluation Handbook.

Speaker, "Measuring the Impacts of Demand Side Management Programs," Northern States Power DSM Evaluation Overview; Minneapolis, Minnesota; December 1991.

Speaker, "Incentive Regulation an Overview of Operating Incentive Programs in the U.S. Today," The Southeastern Electric & Gas Conference; University of Georgia; Atlanta, Georgia; August 1991.

Speaker, "The Comparative Costs of and Sensitivities Surrounding the ALWR vs. Alternate Generation Options," EEI Working Group; Washington D.C.; July 1991.

Speaker, "The Role of Load Research in DSM Evaluation," NYSEG Conference; Saratoga Springs, New York; May 1991.

Speaker, "The Role of Load Research in Demand Side Management" with Joseph Lopes; Northeast AEIC Load Research Conference; Farmington, Connecticut; September 1989.

Speaker, "The Role of Load Research in Demand Side Management," 1989 APPA Accounting, Finance, Rates and Information Systems Workshop; Chicago, Illinois; September 1989.

Speaker, "Demand Side Management; The Key to Measuring Success and Cost Recovery," Iowa Utility Association; Integrated Resource Planning Conference; Des Moines, Iowa; August 1989.

Speaker, "DSM Program Monitoring & Evaluation Workshop," Rochester, New York; December 1988.
Speaker, "The Massachusetts Joint Utility Monitoring Projects" with Eric P. Cody; Northeast Regional AEIC Load Research Conference; Farmington, Connecticut; September 1986.

Author, "The Load Research Process Above and Beyond PURPA," Public Utilities Fortnightly; March 18, 1982.

"Load Data Management and Analysis," EPRI RP1588-3; December 1981.

Co-Author, "Issues in Load Research," Topic Paper 3; EPRI Rate Design Study; 1981.

Instructor, "Load Research and Load Management Seminar," Stone and Webster Utility Management Development Course; New York (2 courses); 1980.

Speaker, "Allocating Revenues Between Service Classifications: Necessary Load Research," National Regulatory Research Institute; Ohio State University; 1980.

Speaker, "Issues in Load Research," EPRI Rate Design Study Executive Transfer Conferences; San Francisco, Kansas City, and Washington D.C.; 1980.

"How Electric Utilities Forecast," EPRI Peak Load Forecasting Methodologies; EPRI Symposium Proceedings; New Orleans, Louisiana; 1979.

"Report of the Member Electric Systems of the New York Power Pool and the Empire State Electric Energy Research Corporation pursuant to Article 3, Section 5, 112 of the Energy Law of New York State, Exhibit 7," LILCO Load Forecast Methodology; 1979.

Speaker, "Load Forecasting Working Group Chairman Reports (3)," Utility Modeling Forum (EPRI sponsored); San Francisco, California; 1979.

"Report of the Member Electric Systems of the New York Power Pool and the Empire State Electric Energy Research Corporation pursuant to Article 8, Section 149-b of the Public Service Law, Exhibit 7," LILCO Load Forecast Methodology; 1974-1978.

AFFILIATIONS

Association of Energy Engineers

American Statistical Association

American Economic Association

Mathematical Association of America

Omicron Delta Epsilon

Advisor to American Management Association

EDUCATION

St. John's University, M.B.A., Economic Theory, 1972

St. John's University, B.A., Economics, 1969

C.W. Post College, course work toward an MS, Management Engineering

Mr. Fitzpatrick has also completed course work in Engineering Economics, Load Research, Demand Forecasting in Electric Power Systems, Box-Jenkins Forecasting Techniques, logistic curve analyses; two and three stage multiple regression techniques; advanced econometric modeling and the utilization and interpretation of multiple regression models and associated analytical techniques. Mr. Fitzpatrick also holds a "Certificate of Mastery" in Reengineering from the Hammer Institute's Speaker: Center for Reengineering Leadership.

RICHARD J. RUDDEN

Mr. Rudden is a generalist in the areas of energy industry change, strategic and business planning, financing, and organizational restructuring and analysis. He is a specialist in the practice areas of energy and utility strategy, pricing, financing, economic and regulatory policy analysis, economic analysis, and related management consulting. He is highly proficient in the management of large, complex and multi-disciplinary management consulting projects.

PROFESSIONAL EMPLOYMENT

1981 - Present	R.J. Rudden Associates, Inc. *Chairman, President & Chief Executive Officer*
1975 - 1981	Stone & Webster Management Consultants, Inc. *Vice President, Regulation Services Division*
1970 - 1975	Consolidated Edison Company of New York, Inc. *Divisional Manager, Rate Design; Rate Engineering Department*
1967 - 1970	U.S. Navy *Commissioned Officer*

PROFESSIONAL EXPERIENCE

Strategic and Business Planning, Merger and Acquisition Analysis

Mr. Rudden has been involved in many engagements in this area of the firm's practice. As the Responsible Officer for these projects, he has been asked to identify and screen potential merger or acquisition candidates, participate in the restructuring of financially-distressed assets and corporations, and assess the strategic compatibility of acquirer and the acquired, including reviews of their organizations, managements, and regulatory environments. He has also directed due-diligence reviews, the determination of enterprise value, and the analysis of the supply, distribution and market infrastructures of the parties to the transaction. He has also assisted members of the financial community in assessing the risks of increased competition and open access in electric utility industry. He has participated in joint venture and acquisition negotiations on behalf of the principals, and has testified on reorganization and bankruptcy issues. In addition, he has been involved in evaluating proposed utility municipalization/privatization activities, and was retained as the independent consultant to the Board of Directors of one utility that was the object of a proposed state takeover. In that project, he was responsible for overseeing an analysis of the market power exerted by the acquisition target. Mr. Rudden's clients have included the New York, Midwest and PJM Independent System Operators; Long Island Lighting Company (now LIPA); Fitch Investors Service, Inc.; J.P. Morgan Chase; Goldman Sachs; Macquarie Holdings; Edison Source; EON; Centrica; Sempra Energy; Hydro Quebec; NUI Corporation; Orange & Rockland Utilities; Norstar Energy

Limited Partnership; KCS Power Marketing, Inc.; Star Gas Partners; Blavin & Co.; EPRI; Macquarie Capital; ProLiance Energy, LLC; GE Nuclear Energy; the Equity Committee of Public Service Company of New Hampshire; PEPCO; Utah International; Philadelphia Gas Works; GWC Corporation; ENERGYiNTELLECT (New Zealand); State Street Bank & Trust Company; SHV Oil and Gas; Southern Union Company; a number of U.K.- and Asia-based utility acquirers; and a U.K. developer of cogeneration engines.

Utility Pricing and Regulatory Policy Analysis

Mr. Rudden has participated in both electric and gas pricing and cost analyses, and has held operational responsibilities within a major utility for cost analysis, tariff design and administration. He has experience in virtually every facet of utility pricing and has provided expert testimony before the FERC, state and Canadian provincial regulatory commissions, as well as civil and bankruptcy courts, on such issues as general regulatory policy, ISO/RTO rate design; revenue enhancement strategies; integrated resource planning; fully allocated and marginal costs; service unbundling and rate design; proforma adjustments and revenue requirements; sales and revenue forecasts; strategic and market sensitive pricing; incentive rate making, rate and regulatory polices for cogenerators, both with respect to rates for natural gas as a fuel, and electric standby, supplemental, maintenance and sale-back rates; revenue sharing and automatic adjustment mechanisms; by-pass; price elasticity and fuels switching; rate phase-in plans; transmission pricing; and other issues.

In addition, Mr. Rudden has testified on a diversity of other matters, such as utility revenue requirements, financial matters, sales forecasts, and proforma adjustments to test periods. Complementing his work in rate design, Mr. Rudden has also participated in a variety of projects relating to the establishment of new regulatory policies, including industry restructuring, competitive market analysis, market power issues, cogeneration policies, generic rate design issues, PURPA guidelines, regulatory aspects of utility bankruptcy, and price discrimination. A few of the clients for whom Mr. Rudden has performed these services include: the California ISO, PJM, the Midwest and MAPP ISOs; Con Edison; Energy West; China Light & Power; Seattle City Light; the City of Calgary Electric System (ENMAX); Long Island Lighting Company; Atlanta Gas Light Company; Chugach Electric Cooperative; Empire District Electric; Elizabethtown Gas Company; Philadelphia Gas Works; the Equity Committee for Public Service Company of New Hampshire; Southern Connecticut Gas; Vermont Gas Systems; Gulf States Utilities; Nova Scotia Power Corporation; Southern Union Gas Company; the U.S. Department of Energy; Bethlehem Steel; New Jersey Transit Corporation; Co-Steel; and AGL Gas Companies (Sydney, Australia).

Market Analysis, Sales Forecasting and Marketing

Mr. Rudden has directed or participated in a number of projects related to market analysis and forecasting, as well as the functional area of marketing. These projects include market research and segmentation analysis, new market entry strategies, market forecasting for both rate cases and other applications, analysis of declining customer use, the development of new unbundled products and services, load research, and customer attitude surveys. The results of his work have been used in expert testimony, business plans, joint venture and merger and acquisition activities, and client-internal reports. Mr. Rudden has also directed a number of studies that have assessed the changes in the competitive positions of both electric and gas utilities resulting from energy industry restructuring. His work includes the development of a framework for analyzing the market and financial risks of electric utilities, the costs of least-cost alternative power supplies under open access conditions, and the determination of the value of both natural and regional markets for power sold in the open access market. Mr. Rudden's clients in this area have included Edison Source; Atlanta Gas Light Company; Philadelphia Gas Works; Elizabethtown Gas Company; Con Edison; Star Gas Partners; GE Nuclear Energy; Niagara Mohawk Power Corporation; Gas Company of New Mexico; Rochester Gas & Electric Corporation; KCS Power Marketing, Inc.; Utah International; SHV Oil and Gas; Long Island Lighting Company; the Department of Energy, Mines and Resources, Canada; the Columbia Gas Distribution Companies; and IBC Fitch Investors Service, Inc.

Corporate and Project Financing

Mr. Rudden has participated in numerous energy project analyses and financings. Matters with respect to which he has offered advice and expert testimony include: power purchase and sales agreements; fuels availability; utility interconnects; utility standby, back up and power purchase contracts; the market for project power and project revenue streams; wheeling options for project power; and regulatory policies. His expertise has been applied in a variety of ways, including due-diligence reviews, project risk identification and management, contract negotiations, business plans, feasibility analysis, and testimony. Clients for whom he has performed this work include Donaldson, Lufkin & Jenrette; Macquarie; Goldman, Sachs & Company; a group of Detroit pension funds; Inter-Continental Energy; KIAC Project Partners; State Street Bank & Trust Company; Allegheny Power System; The Royal Banks of Canada and Scotland; Bank of Montreal; Amtrak; Long Island Lighting Company; Arkla, Inc.; the University of Pennsylvania; the State University of New York at Stony Brook; Utah International; Reckson Associates; and the Montecristi Corporation.

Generation and Transmission Planning

Mr. Rudden has been involved in a variety of consulting projects and employment positions dealing with the issues of generation and transmission planning, especially as they relate to electric ratemaking, establishment of regulatory policies, and RTO/ISO formation and regulation. Mr. Rudden has dealt with these matters in the context of FERC Orders 2000 and 888, PURPA regulations, the development of wheeling and wholesale rates, cogeneration project feasibility analyses, utility bankruptcies, generation and transmission reliability studies, strategic planning, and the analysis of regional markets for bulk power. He has also directed benchmarking studies related to T&D operations, and an analysis of historical reliability performance and the establishment of reliability objectives in the context of utility budgeting and performance-based ratemaking. In addition, while at Con Edison, Mr. Rudden had responsibilities in the areas of generation operations and transmission load flow analyses. Utilities and other clients with respect to whom Mr. Rudden has provided consulting services in this area include: the New York ISO; Sempra; the U.S. Department of Energy; El Paso Electric Company; Entergy/Gulf States Utilities; the Canadian Department of Energy, Mines and Resources; Chugach Electric Cooperative; ENMAX/City of Calgary Electric System; Amtrak; NU/Public Service Company of New Hampshire; Philadelphia Electric Company; Baltimore Gas & Electric Company; State Street Bank &Trust Company; and Nantahala Power & Light Company.

Gas Supply and Transportation Planning

Mr. Rudden has performed gas supply and transportation studies for both utility companies and non-utility marketers, transporters and end-users of natural gas. He has advised cogenerators on gas acquisition policies; LDCs on transportation policies, pricing strategies, and bypass issues; large end-users on appropriate price levels for purchased gas and related contractual terms and conditions; and third party developers and financial institutions with regard to fuel supplies to independent power projects. In addition, he has directed projects relating to gas supply modeling for the purposes of least-cost planning, marginal costing, and merger and acquisition work. Clients for whom Mr. Rudden has provided these services include: Atlanta Gas Light Company, Energy West/Great Falls Gas Company, NUI Corporation, GWC Corporation, Intercontinental Energy; Southern Union Company, Elizabethtown Gas Company, Niagara Mohawk Power Corporation, Providence Memorial Hospital, Standard Chlorine of Delaware, Sithe Energies/Bank of Montreal, and State Street Bank & Trust Company.

Integrated Resource Planning and Demand-Side Management

Mr. Rudden has been responsible for many of the firm's projects within the integrated resource planning area. Projects which the firm has performed include the development of complete integrated resource plans for Atlanta Gas Light Company, Providence Gas Company, and The Peoples Gas Light and Coke Company; a critical review and evaluation of both Commonwealth Edison's Least-Cost Plan and Entergy's regional IRP; a review of the merged PacifiCorp-Utah Power & Light least cost plan as applied to the Utah division; the evaluation of proposed DSM programs by TransAlta Utilities and Alberta Power Corporation on behalf of ENMAX/ City of Calgary Electric System; identification and quantification of least cost gas supply plans for NUI Corporation and Southern Union Company, both in connection with proposed reorganization and acquisition activities; the development of an integrative utility planning methodology for the U.S. Department of Energy; and the development of PC-based gas supply models for two LDCs in conjunction with least-cost supply planning. Mr. Rudden has also been involved in the review and critique of Public Service Company of New Hampshire's demand-side management (DSM) program within the context of its Chapter 11 Bankruptcy proceeding, and Oklahoma Natural Gas with regard to the DSM programs of Oklahoma Gas & Electric Company. Finally, Mr. Rudden has assisted a variety of industrial clients in developing and implementing least-cost energy purchasing strategies, such as Amtrak, Reckitt & Coleman, New Jersey Transit, Bethlehem Steel, Standard Chlorine of Delaware, and Geneva Steel.

Organizational Consulting

Mr. Rudden's years of experience and his diverse technical background have made him very effective as an organizational consultant, especially in such areas as organizational structuring, cultural change, forecasting and planning processes, rate and regulatory support, information systems, market and load research, marketing, and gas supply. As a part of these assignments, Mr. Rudden has provided leadership not only at the higher levels associated with strategic plan implementation, but also at the more "granular" levels of operations. He has reviewed and made recommendations pertaining to operating policies and procedures, strategic mission and objectives statements, program implementation plan, spans of control, staffing levels and qualifications, culture change, salary structures and bonus plans, and information systems support. His clients have included Energy West; Star Gas Partners, Edison Source; Rochester Gas and Electric Corporation; the New York Independent

System Operator; Western Gas Interstate Pipeline Company; Con Edison; Norstar Energy Partners, LLC; the City of Colorado Springs Municipal Utility System; the City of Garland, Texas; a confidential New York State gas distribution company; Philadelphia Gas Works; EPRI; Atlanta Gas Light Company; and GWC Corporation.

Information Systems Support

Mr. Rudden has been responsible for the specification of user requirements, conceptual system design, and components of detail system design, and for the testing and acceptance of a number of information technology and software development projects. These systems related to costing and rate design, complete FERC rate filing requirements, forecasting, load research, market information systems, least-cost energy acquisition, utility billing and revenue reporting systems, integrated supply and demand side planning, litigation support systems, and financial analysis and reporting. Clients whom Mr. Rudden has served in these areas include: Valero Energy Corporation, El Paso Electric Company, Con Edison, Utah International, Southern Connecticut Gas Company, Amtrak, Western Gas Interstate, Southern Union Company, and NUI Corporation.

Litigation Support

As an integral part of the service that he has provided clients in the above areas, Mr. Rudden has frequently offered expert testimony before state regulatory commissions, city councils, the FERC, civil court, Federal Bankruptcy Court and Canadian regulators. This includes testimony before the U.S. Bankruptcy Court in the Public Service Company of New Hampshire Chapter 11 proceedings; before a civil court on behalf of a plaintiff in a class action suit against a facility owner, alleging overcharges for electric service; before the FERC on both electric and natural gas matters; and before many state regulatory commissions on a variety of costing, rate design, revenue requirement, market, economic and regulatory policy issues. In all, Mr. Rudden has submitted testimony in approximately 37 proceedings, in 19 jurisdictions.

PUBLICATIONS AND PRESENTATIONS

"A Primer on the Regulatory Environment for Energy Utilities," presented at the American Gas Association's Financial Forum; Bonita Springs, Florida; May 2, 2004.

"Utility Regulatory Preparedness," presented at the American Gas Association's Rate & Regulatory Issues Seminar; Phoenix, Arizona; April 6, 2004.

"Regulators and Regulations," presented at the American Gas Association Workshop, Introduction to the Energy Industry;" New York, New York; March 15, 2004.

"Utility Rate Case Preparedness – A Commentary Based on Survey Results," presented at the EEI Strategic Issues Committee; October 17, 2003.

"The Mother of All Rate Cases," published by *Hart's Energy Markets*, October 2003.

"The Energy Marketplace: The Advisors Weigh-In," moderator at the North American Energy Standards Board 2nd Annual Meeting; Austin, Texas; September 16-17, 2003.

"Massive North American Blackout and the Lack of Investment," interview published in *World Interview*, The Nihon Keizai Shimbun Japan Economic Journal; September 8, 2003.

"The Shock Heard 'Round The World Or ... The August 14th Birth Of The United Grid Of America," August 2003.

"Distribution Reliability and Power Quality: The Next Industry Time Bomb?" June 2002 (co-authored).

"Legal Document Management in the Energy Industry: Moving From Information Flow to Knowledge Leadership," June 2002 (co-authored).

"Mergers & Acquisitions, 2002: An Urgent Need for Strategic Clarity," *Public Utilities Fortnightly*; April 15, 2002 (co-authored).

"What Has the Energy Industry Learned From Deregulation?" presented at the American Gas Association's 20th Annual Bankers Conference; New York, New York; November 11-13, 1998.

"Ten Hurdles to Full-Scale Competition in the U.S. Electric Power Industry," presented at the National Association for Business Economics; Washington, D.C.; October 4-7, 1998.

"Utility Strategic Planning," presented at the Exnet Utility Strategic Planning Seminar; Washington, D.C.; July 14-15, 1997.

"Winners in Deregulation—Electric or Gas?" presented at ANR Pipeline Company's 1997 Business Strategy Meeting, Ideas for the Future; Phoenix, Arizona; March 14, 1997.

"Electric Industry Restructuring and its Affects on the U.S. Natural Gas Industry," presented at the International Centre for Gas Technology Information Seminar; Tokyo, Japan; September 18, 1996.

"Product Pricing Considerations in Energy Company Mergers," presented at the Institute of Gas Technology's Financing the Fusion of the Gas and Electric Industries Conference; New York, New York; July 24, 1996 (co-authored).

"The Barbarians at the City Gate," presented at the American Gas Association's *Competing in a Restructuring World: Becoming the Customer's Choice*; Orlando, Florida; April 10, 1996.

"Electric Industry Restructuring 101: Trends in State PUC Regulatory Policies, Attitudes, and Opinions Regarding Electric Industry Changes" and "Electric Industry Restructuring 102: Implications of Competitive Electricity Price Trends and Pricing Strategies for Natural Gas Markets," presented at the American Gas Association's Industrial Marketing Committee Meeting; Salt Lake City, Utah; April 1, 1996.

"Operating in a Competitive Environment: Will the Market Stay the Way It Is?," presented at the ZECO's Conference on *Operating in a Competitive Environment*; Salt Lake City, Utah; March 5, 1996.

Effect of Electric Industry Restructuring on the Competitive Price Position of Natural Gas, February 1996 (co-authored).

1995 Survey of State Regulatory Commissions Regarding Electric Utility Competition, December 1995 (co-sponsored by the American Gas Association).

"Electric Industry Change: Bringing Order Out of Chaos," presented at the American Gas Association's Conference on Electric Industry Restructuring; Baltimore, Maryland; October 26, 1995.

"Electric Industry Restructuring: Its Implications for the Natural Gas Industry," presented at the American Gas Association Rate Committee Meeting; New Orleans, Louisiana; April 4, 1995.

"The Electric Industry Change: The Views of State Regulators," presented at the AIC Conference on *Positioning for the New Integrated Gas & Electric Power Market*; New York, New York; March 27, 1995.

"The Implications of Electric Restructuring for the Use of Natural Gas," presented at the American Gas Association's Symposium on *The Effects of Deregulation in the Electric Industry on Gas Markets*; Albuquerque, New Mexico; March 20, 1995.

"Competitive Forces and Market Risks: Regulators' Views of the Future Electric Utility Industry," *Public Utilities Fortnightly*, November 1994 (co-authored).

"A Survey of State Regulatory Commissions on Competitive Forces and Market Risks in the Electric Utility Industry," presented before the Public Service Company of Colorado; Denver, Colorado; November 1994.

"The Future Power Industry—Defining the Boundaries," *Cogeneration and Competitive Power Journal*, Fall 1994.

"Competition in the Electric Markets," *The Energy Daily—Special Insert*, October 1994.

"A Survey of State Commissions on Electric Industry Competition," presented at the *Energy Daily's* Impact of Retail Competition on the Electric Markets Conference; San Diego, California; September 1994.

R.J. Rudden Associates, Inc. 1994 Survey of State Regulatory Commissions Regarding Electric Utility Competition, September 1994 (co-authored).

"The EPAct of 1992: New Players, New Plays," presented at the Association of Energy Engineers Competitive Power Congress; Philadelphia, Pennsylvania; June 9, 1994.

“Quantifying Competitive Forces in the Electric Industry,” *The Rudden Resource—Special Edition*, June 1994.

“Electric Utility Competition: A Survey of Regulators,” presented at the Transmission Access, Wheeling and Deregulation of America’s Utilities—A National Conference and Summit Meeting; Arlington, Virginia; May 23, 1994.

“Changing Financial Risks in the Restructured Gas Industry,” presented at the Tejas Power Corporation’s Seventh Annual Conference on Industry Issues, April 1994.

“Electric Utilities in the Future,” *Fortnightly*, April 1994 (co-authored).

“Electric Utility Competition: A Survey of State Regulators,” presented at the Edison Electrical Institute’s 28th Financial Conference; Orlando, Florida; November 1993.

“Electric Utilities Competitive Risk: A Commentary,” presented at Fitch Investors Service’s Electric Utility Roundtables; Boston, Massachusetts; Hartford, Connecticut; Chicago, Illinois; and Minneapolis, Minnesota; August 1993.

“Integrated Resource Planning: Ensuring Technological Excellence in the Natural Gas Industry,” presented at the Southern Gas Association’s 85th Annual Meeting, April 1993.

“IRP and its Impacts on Architects and Engineers,” presented at the Southern Gas Association’s Southern Conference for Architects and Engineers, October 1992.

“Integrated Resource Planning: Nationwide Trends,” presented at the American Gas Association Rate Committee Meeting, April 1992.

“IRP: A Forecaster’s Fantasy,” presented before the American Gas Association’s Statistics and Load Forecast Methods Committee Seminar on Long Range Forecasting for Integrated Resource Planning, March 1992.

“Integrated Resource Planning—A Strategic Marketing Perspective,” presented before the Southern Gas Association Marketing Executives Committee, February 1992.

“Supply Side Marginal Costs as an Element of Integrated Demand and Supply Side Planning, Natural Gas Strategies: Integrating Supply Planning, Marketing and Pricing,” presented at before the American Gas Association Rate Committee and Marketing Section, May 1989.

“The Impact of Current Market Changes on Distributors: Diversification Strategies and Regulatory Issues,” presented at the Fifteenth Annual Rate Symposium, University of Missouri, February 1989.

“Natural Gas: Issues and Outlook, Unbundling at the Distribution Level,” presented before The Energy Bureau Inc., October 1988.

"Natural Gas, Cogeneration, and Merchant Generation in New England: Pipeline Capacity Constraints," presented before the American Bar Association, October 1987.

"Utility Rate Unbundling," presented at the American Gas Association Advanced Regulatory Seminar, University of Maryland, 1986-1990.

"Effective Diversification Strategies and Regulatory Issues Surrounding Diversification in a Competitive Market," presented at the IGT Conference, November 1986.

"Cogeneration Financing in a Changing Utility Market," presented at the Proceedings of the 9th World Energy Engineering Conference, October 1986.

"The Strategic Utility Response to Power Wheeling Initiatives," presented before the Energy Management Division Conference of the Electric Council of New England, August 1986.

"How Can Cogenerators Take Advantage of Current Natural Gas Dislocations?" *Strategic Planning and Energy Management*, Spring 1985.

"The Economics of Gas-Fired Cogeneration," presented before the American Gas Association Rate Committee, April 1985.

"Cogeneration: the Strategic Opportunity," presented at the Southern Union Gas Cogeneration Seminar and Workshop, December 1984.

"Choices," presented before the ANR Pipeline Company Annual Marketing Meeting, June 1984.

"Natural Gas Regulation," presented before the New England Gas Users Group, March 1984.

"A Survey of Rate Case Computerization," presented before the Rate Committee of the American Gas Association, September 1983.

"Natural Gas Deregulation: Options at the Distribution Level," presented before the Seventh Annual Public Utilities Conference at the University of Texas, July 1982.

"The Public Utilities Regulatory Policies Act of 1978 - A Wolf in Sheep's Clothing," presented before the Northwest Public Power Association Consumer Services and Communications Conference, August 1979.
"Regulatory Guidelines and Standards Under the Public Utilities Regulatory Policies Act of 1978," presented before the Fifth Annual Symposium on the Problems of Regulated Industries, February 1979.

"The DOE Ratemaking Guidelines Project," presented before the Northwest Public Power Association, January 1979.

"New Ideas in Gas Rate Design," presented before the Texas Gas Association, June 1978.

"A Technical and Organizational Overview of the Nova Scotia Rate and Load Control Experiment," presented before the Canadian Electrical Association, March 1978.

"Another Kind of Audit," *Public Utilities Fortnightly*; October 13, 1977.

AFFILIATIONS AND HONORS

Board Member, North American Energy Standards Board

Financial Associate, American Gas Association

Marketing Associate, American Gas Association

Associate Member, Edison Electric Institute

Member, EEI Strategic Issues Committee

Member, National Association of Business Economists; Corporate Planning Roundtable

Member, American Gas Association Rate Committee

Member, Association of Energy Service Professionals

Member, Society of Gas Lighting

Omicron Delta Epsilon (Honor Society in Economics)

Past Member, Presidential Cogeneration/Energy Advisory Committee, State University of New York at Stony Brook

Past Member, Advisory Board, W. Averell Harriman School for Management and Policy, State University of New York at Stony Brook

EDUCATION AND LICENSES

Queens College, City University of New York, B.A., Economics, 1967, with Honors

New York Graduate School of Business Administration, course work in finance and economics for M.B.A.

NASD licensed Securities Representative (Series 7 and 63) and General Securities Principal (Series 24).

JOSEPH T. TRAINOR

Mr. Trainor is an electrical engineer with specialties in the areas of cost of service and financial modeling. He has broad experience in the fields of unbundled cost of service modeling, statistical analysis, forecasting, load research and analysis, transmission system benchmarking, Form 1 and NERC Form 411 data analysis, and database management.

Mr. Trainor is the architect and implementer the Rudden Electric and Gas Cost of Service Model. He has performed both electric and gas cost of service and marginal cost of service projects for a variety of clients, as well as benchmarking studies for transmission entities. He created models to forecast revenue requirements. He has also created models to perform economic, rate and financial valuations of multi-jurisdictional utilities for the purpose of investment. He analyzed electric load data for State Agencies to support its competitive procurement. He has assisted in the economic evaluations of Power Plants to assess their performance in a deregulated environment. He has developed systems for managing large and complex data sets for energy prices and costs. He has preformed statistical sampling and forecasting for the purpose of load forecasting and investment.

In addition to his utility and energy industry analytical skills, Mr. Trainor's broader IT expertise includes, application programming and database management. He has extensive experience in supporting computer user applications, including the Microsoft Office Suite, Lotus and WordPerfect, and has created applications in VB/VBA, FoxPro, C, Access and Excel.

PROFESSIONAL EMPLOYMENT

1998 - Present	R.J. Rudden Associates, Inc. *Senior Consultant* *Director of Information Systems*
1994 - 1998	MUZE, INC., NY (Software Development Firm) *Supervisor of Software Updates*

- Produced 10 software applications monthly used for the retail of entertainment products.

PROFESSIONAL EXPERIENCE

Computer Modeling and Database Creation

Mr. Trainor has utilized his modeling skills to develop and enhance analytical tools, as well as enhance and upgrade the R.J. Rudden Cost of Service Models. The enhancements to the models include a VBA-user interface that allows the user to navigate the model, analyze the data, and perform maintenance functions through menu routines. In addition to the numerous PC-based programs, he has experience in running, modifying and extracting information from databases that contain hundreds of thousands of records and made them available to clients using a graphical user interface. Mr. Trainor has designed and used computer models to perform economic, rate and financial planning. He has analysis customer databases to perform statistical sampling. He is skilled in multiple spreadsheet and database application software, including Microsoft Excel, Access, and FoxPro. Clients for whom Mr. Trainor has served in these areas include: Nissequogue Cogen Partners, Connecticut Natural Gas, Baltimore Gas and Electric Company, Kansas Gas Service and Philadelphia Gas Works.

Electric and Gas Costing

Mr. Trainor has performed both electric and gas cost of service and marginal cost of service projects. He has developed the special studies, interviewed personnel and performed other data gathering procedures necessary to obtain all of the information needed to perform both Marginal and Cost of Service Studies. Mr. Trainor has completed these studies for both wholesale and retail clients using an enhanced version the R.J. Rudden Cost of Service Study Model. The completion of the Cost of Service Study included Functionalizing, Classifying and the allocation of all the Utility's Rate Base, operating and maintenance costs, production costs, gas costs, taxes and working capital costs, development of all Allocators, and implementation of billing determinants for rate design. Clients for whom Mr. Trainor has served in these areas include: Philadelphia Gas Works, Baltimore Gas and Electric, Keyspan, MidWest Energy, Energy West Resources, and Niagara Mohawk Power Corporation.

Competitive Procurement

Mr. Trainor has participated in a project to procure electric supply for a group of State Agencies. He assisted in the creation of the Request for Proposal, Appendixes and Exhibits. He managed the collection of the historical load data by obtaining, cleaning and presenting the data. He developed an easy to use front-end application, which became part of the RFP and was posted on the Rudden Website for distribution to Bidders.

Energy Project Financing and Analysis

Mr. Trainor has participated in projects in this area. Participation consists of assisting in economic and financial modeling of multi-jurisdictional utilities for the purpose of investment analysis. Mr. Trainor has assisted in performing economic and rate forecast modeling for Bond issuance and financial analysis of regulated utilities for investment purposes. Mr. Trainor has participated in economic and financing analyses evaluating the performance and profitability of electrical power plants. He has assisted in the economic evaluations of Power Plants to project their performance in a deregulated environment. Clients for whom Mr. Trainor has served in these areas include: Enmax Power Corporation, Nissequogue Cogen Partners, and Blavin & Company.

EDUCATION

Long Island University, New York, Master of Business Administration, 2003

Manhattan College, New York; Bachelor of Electrical Engineering, 1993

R. J. RUDDEN ASSOCIATES, INC.

R.J. Rudden Associates, Inc. (Rudden) provides economic, management and financial consulting services to utilities and their customers throughout North America and internationally. Founded in 1981, we have approximately 70 consultants. Our headquarters office is in Hauppauge, New York with regional offices in Washington, D.C. and San Francisco, California. Rudden's major practice areas include utility pricing; regulatory policy analysis; strategic and market planning; market research, demand forecasting and marketing; merger and acquisition assistance; generation and transmission planning; energy project management, financing and analysis; fuels analysis and acquisition; and litigation support and testimony. Our clients include electric and gas utilities subject to FERC and state regulation, energy producers and consumers, other industrial and commercial organizations, financial institutions and the U.S. and Canadian government.

APPENDIX B
COMPONENT ACCURACY TABLES

Residential Rate Class

FORECAST ACCURACY - TOTAL YEAR VOLUMES for RESIDENTIAL RATE M2 (S)

Year	Normalized Actual	Forecast	Difference	Actual % Diff.	ABS % Diff.
1994	2,496	2,539	44	1.73%	1.73%
1995	2,486	2,485	1	-0.03%	0.03%
1996	2,521	2,439	82	-3.36%	3.36%
1997	2,500	2,408	92	-3.81%	3.81%
1998	2,392	2,397	5	0.22%	0.22%
1999	2,334	2,452	117	4.79%	4.79%
2000	2,317	2,364	47	1.99%	1.99%
2001	2,221	2,267	46	2.04%	2.04%
2002	2,211	2,183	28	-1.27%	1.27%
2003	2,162	2,158	5	-0.21%	0.21%
			Average from 94-00	0.22%	2.28%
			Average from 01-03	0.19%	1.18%

FORECAST ACCURACY - TOTAL YEAR VOLUMES for RESIDENTIAL RATE 01 (N)

Year	Normalized Actual	Forecast	Difference	Actual % Diff.	ABS % Diff.
1994	824	837	12	1.49%	1.49%
1995	795	795	1	-0.06%	0.06%
1996	780	794	14	1.74%	1.74%
1997	779	752	27	-3.59%	3.59%
1998	748	752	4	0.51%	0.51%
1999	755	756	1	0.13%	0.13%
2000	757	747	10	-1.30%	1.30%
2001	714	723	9	1.27%	1.27%
2002	695	706	11	1.55%	1.55%
2003	697	683	14	-2.07%	2.07%
			Average from 94-00	-0.15%	1.26%
			Average from 01-03	0.25%	1.63%

Commercial Rate Classes

FORECAST ACCURACY - TOTAL YEAR VOLUMES for COMMERCIAL RATE M2 (S)

Year	Normalized Actual	Forecast	Difference	Actual % Diff.	ABS % Diff.
1994	1,470	1,550	80	5.17%	5.17%
1995	1,478	1,547	69	4.46%	4.46%
1996	1,533	1,409	125	-8.85%	8.85%
1997	1,528	1,368	160	-11.71%	11.71%
1998	1,443	1,398	45	-3.25%	3.25%
1999	1,440	1,504	63	4.22%	4.22%
2000	1,397	1,444	47	3.22%	3.22%
2001	1,374	1,373	1	-0.09%	0.09%
2002	1,381	1,299	82	-6.33%	6.33%
2003	1,350	1,334	16	-1.24%	1.24%
			Average from 94-00	-0.96%	5.84%
			Average from 01-03	-2.55%	2.55%

FORECAST ACCURACY - TOTAL YEAR VOLUMES for COMMERCIAL RATE 01 (N)

Year	Normalized Actual	Forecast	Difference	Actual % Diff.	ABS % Diff.
1994	275	287	13	4.37%	4.37%
1995	263	262	1	-0.25%	0.25%
1996	264	270	6	2.24%	2.24%
1997	263	256	8	-2.93%	2.93%
1998	241	255	14	5.31%	5.31%
1999	229	248	19	7.60%	7.60%
2000	247	248	0	0.08%	0.08%
2001	245	234	11	-4.81%	4.81%
2002	230	238	8	3.28%	3.28%
2003	231	232	1	0.46%	0.46%
			Average from 94-00	2.35%	3.26%
			Average from 01-03	-0.36%	2.85%

APPENDIX C

SUMMARY OUTPUT RES 01 VOL			**HETEROSCEDASTICITY TEST "Constant Variance Confirmed"**		
Regression Statistics			*Regression Statistics*		
Adjusted R Square		0.9837	Adjusted R Square	-	0.0066
Standard Error		4,442.11			
Observations		154.00			*t Stat*
Durbin's h		3.77	Residuals	-	0.00
MAPE		1.0%			
		Coefficients	*Standard Error*		*t Stat*
Intercept	-	16,820.76	2,589.06	-	6.50
VOL lag 1m		0.12	0.04		3.12
CUST		0.15	0.02		8.49
PRICE LAG 1M	-	13,437.33	6,362.45	-	2.11
HDD Jan		94.89	3.25		29.23
HDD Feb		89.03	4.74		18.79
HDD Mar		80.79	4.71		17.16
HDD Apr		69.17	6.00		11.53
HDD May		53.92	7.68		7.02
HDD Sept		66.49	8.49		7.83
HDD Oct		72.47	3.87		18.74
HDD Nov		87.86	2.79		31.47
HDD Dec		88.15	2.88		30.56
DUMMY VOL 3D MAY-00		19,147.19	4,624.36		4.14
DUMMY VOL 3D OCT-00		16,091.72	4,615.00		3.49
DUMMY VOL 3D Jan-03		20,345.54	4,688.80		4.34

SUMMARY OUTPUT RES 01 USE		HETEROSCEDASTICITY TEST "Constant Variance Confirmed"	
Regression Statistics		*Regression Statistics*	
Adjusted R Square	0.9907	Adjusted R Square	- 0.0065
Standard Error	16.00		
Observations	155.00		*t Stat*
D W Test	1.87	Residuals	- 0.00

	Coefficients	Standard Error	t Stat
Intercept	688.21	94.69	7.27
Price (Ex. Summer mnths)	- 41.50	19.83	- 2.09
R.F.E.I	- 823.17	126.18	- 6.52
HDD Jan	0.52	0.01	68.28
HDD Feb	0.51	0.01	58.24
HDD Mar	0.47	0.01	45.73
HDD Apr	0.43	0.02	27.59
HDD May	0.37	0.03	12.69
HDD Sept	0.35	0.04	8.41
HDD Oct	0.38	0.02	19.74
HDD Nov	0.46	0.01	37.97
HDD Dec	0.47	0.01	53.11
Dummy May-00	101.22	16.58	6.10

SUMMARY OUTPUT RES M2 VOL			HETEROSCEDASTICITY TEST "Constant Variance Confirmed"	
Regression Statistics			*Regression Statistics*	
Adjusted R Square	0.9886		Adjusted R Square	- 0.0061
Standard Error	11,608.66			
Observations	167.00			*t Stat*
Durbin's h	5.70		Residuals	- 0.00
MAPE	1.3%			
	Coefficients		*Standard Error*	*t Stat*
Intercept	- 58,701.68		8,061.46	- 7.28
VOL Lag 1m	0.09		0.03	3.01
CUST	0.15		0.02	9.17
PRICE Lag 1m	- 338.27		185.69	- 1.82
HDD Jan	375.87		10.82	34.74
HDD Feb	363.13		14.76	24.60
HDD Mar	358.68		14.71	24.39
HDD Apr	315.95		21.03	15.02
HDD May	254.74		27.48	9.27
HDD Sept	161.15		37.86	4.26
HDD Oct	267.84		13.61	19.67
HDD Nov	321.18		8.85	36.30
HDD Dec	375.73		8.40	44.74
Dummy Vol Feb-00	44,979.67		12,077.28	3.72
Dummy Vol Jan-03	54,731.76		12,289.98	4.45

SUMMARY OUTPUT RES M2 USE		HETEROSCEDASTICITY TEST "Constant Variance Confirmed"	
Regression Statistics		*Regression Statistics*	
Adjusted R Square	0.9969	Adjusted R Square	- 0.0060
Standard Error	9.07		
Observations	168.00		*t Stat*
D W Test	1.56	Residuals	- 0.00

	Coefficients	*Standard Error*	*t Stat*
Intercept	386.54	52.66	7.34
R.F.E.I	- 425.04	70.17	- 6.06
Price(Ex. Summer mnths)	- 0.48	0.11	- 4.26
HDD Jan	0.64	0.01	117.76
HDD Feb	0.63	0.01	102.35
HDD Mar	0.62	0.01	89.01
HDD Apr	0.59	0.01	52.89
HDD May	0.52	0.02	24.16
HDD Sept	0.31	0.04	7.96
HDD Oct	0.44	0.01	30.12
HDD Nov	0.52	0.01	60.94
HDD Dec	0.60	0.01	99.19
Dummy Use Jan-90	33.26	9.44	3.52
Dummy Use Jan-00	65.81	9.49	6.94
Dummy Use feb-00	34.97	9.42	3.71

SUMMARY OUTPUT COM M2 VOL			HETEROSCEDASTICITY TEST "Constant Variance Confirmed"		
Regression Statistics			*Regression Statistics*		
Adjusted R Square		0.9860	Adjusted R Square	-	0.0061
Standard Error		8,283.36			
Observations		167.00			*t Stat*
Durbin's h		2.66	Residuals		0.00
MAPE		1.5%			
		Coefficients	*Standard Error*		*t Stat*
Intercept	-	38,960.44	7,569.28	-	5.15
CUST		0.97	0.15		6.63
PRICE NO LAG	-	71.72	125.75	-	0.57
LAG VOL		0.06	0.04		1.77
HDD Jan		241.42	7.98		30.26
HDD Feb		244.19	10.48		23.31
HDD Mar		242.50	10.63		22.82
HDD Apr		225.27	15.98		14.09
HDD May		185.58	20.11		9.23
HDD Sept		95.68	26.90		3.56
HDD Oct		191.56	9.70		19.76
HDD Nov		242.01	6.57		36.81
HDD Dec		247.11	6.85		36.07
Dummy VOL Mar'00		50,185.44	8,751.49		5.73
Dummy VOL Apr'00		57,583.38	8,689.89		6.63

SUMMARY OUTPUT COM M2 USE		HETEROSCEDASTICITY TEST "Constant Variance Confirmed"	
Regression Statistics		*Regression Statistics*	
Adjusted R Square	0.9902	Adjusted R Square	- 0.0060
Standard Error	103.09		
Observations	168.00		*t Stat*
D W Test	1.76	Residuals	- 0.00

	Coefficients	*Standard Error*	*t Stat*
Intercept	- 5,573.22	1,229.93	- 4.53
C.F.E.I	6,039.80	1,240.89	4.87
HDD Jan	3.82	0.04	86.34
HDD Feb	3.93	0.05	77.49
HDD Mar	3.89	0.06	66.89
HDD Apr	3.78	0.10	39.20
HDD May	3.11	0.18	17.12
HDD Sept	1.08	0.33	3.26
HDD Oct	2.87	0.12	23.83
HDD Nov	3.70	0.07	50.91
HDD Dec	3.81	0.05	74.50
Dummy Use Mar-00	655.20	105.64	6.20
Dummy Use Apr-00	805.27	107.42	7.50

SUMMARY OUTPUT COM 01 VOL		HETEROSCEDASTICITY TEST "Constant Variance Confirmed"	
Regression Statistics		*Regression Statistics*	
Adjusted R Square	0.9896	Adjusted R Square	- 0.0068
Standard Error	1,352.19		
Observations	150.00		*t Stat*
Durbin's h	3.16	Residuals	0.00
MAPE	1.8%		

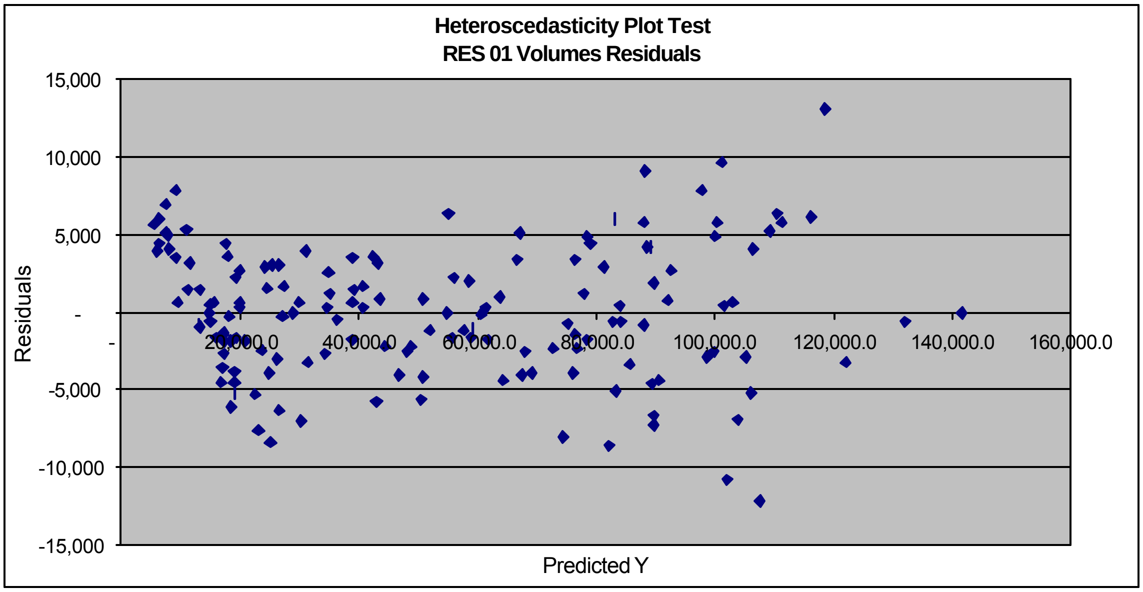
	Coefficients	*Standard Error*	*t Stat*
Intercept	- 2,121.44	1,268.81	- 1.67
CUST	0.30	0.07	4.08
PRICE	- 1,281.48	2,040.20	- 0.63
Lag VOL	- 0.03	0.04	- 0.70
HDD Jan	40.18	1.17	34.34
HDD Feb	41.18	1.65	24.98
HDD Mar	38.78	1.69	22.94
HDD Apr	32.62	2.23	14.63
HDD May	23.11	2.54	9.09
HDD Sept	15.02	2.68	5.61
HDD Oct	28.52	1.17	24.38
HDD Nov	34.04	0.93	36.49
HDD Dec	37.78	0.99	38.02
Dummy vol May-00	6,738.85	1,405.59	4.79
Dummy vol Sep-00	4,367.96	1,441.44	3.03

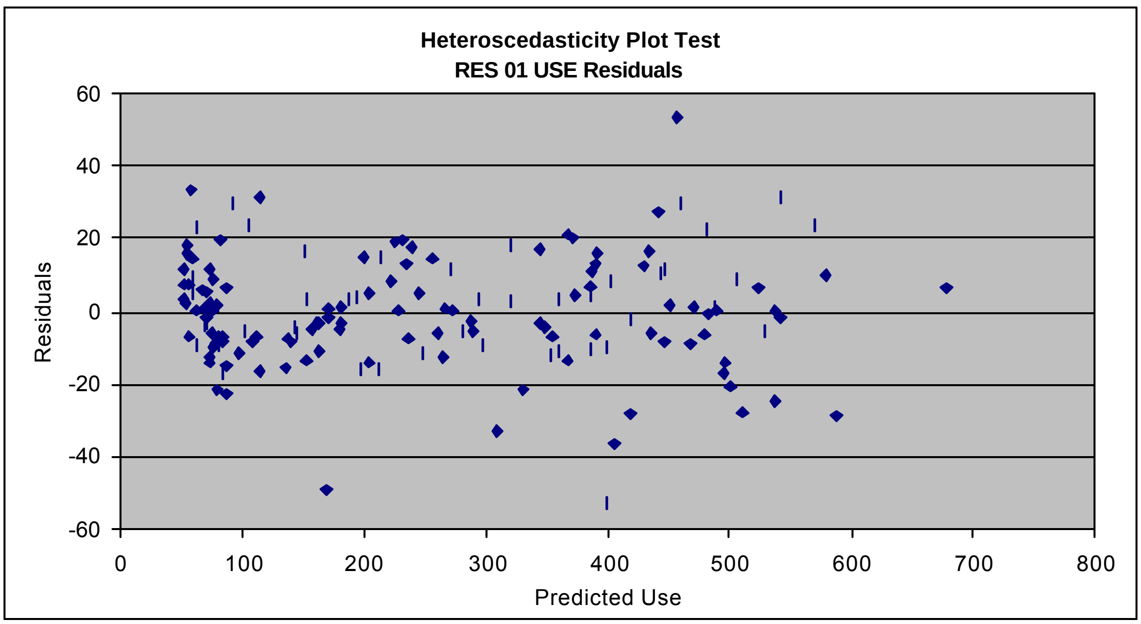
SUMMARY OUTPUT COM 01 USE		HETEROSCEDASTICITY TEST "Constant Variance Confirmed"		
Regression Statistics		*Regression Statistics*		
Adjusted R Square	0.9894	Adjusted R Square	-	0.0067
Standard Error	63.41			
Observations	151.00			*t Stat*
D W Test	1.40	Residuals	-	0.00

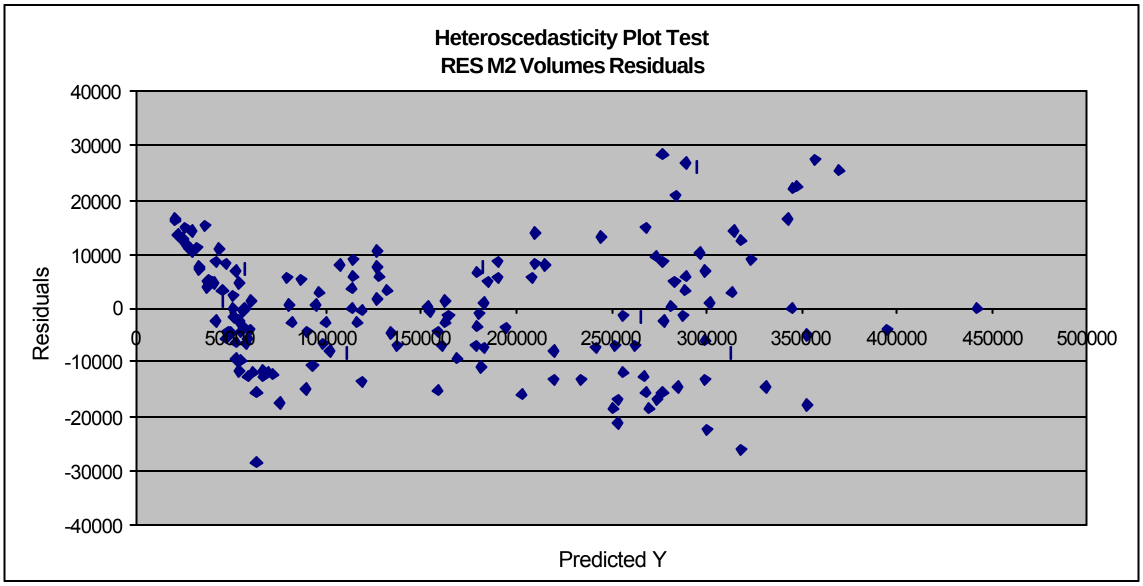
		Coefficients	*Standard Error*		*t Stat*
Intercept	-	7,140.28	787.99	-	9.06
Price(Ex. Summer mnths)	-	261.89	232.02	-	1.13
C.F.E.I		7,387.19	794.25		9.30
HDD Jan		1.87	0.05		38.91
HDD Feb		1.91	0.06		34.69
HDD Mar		1.80	0.06		28.20
HDD Apr		1.54	0.10		15.08
HDD May		1.19	0.19		6.38
HDD Sept		0.90	0.27		3.29
HDD Oct		1.48	0.12		11.97
HDD Nov		1.64	0.08		20.94
HDD Dec		1.77	0.06		31.51
Dummy Use May-00		323.56	65.84		4.91
Dummy Use Aug-00		216.46	64.42		3.36

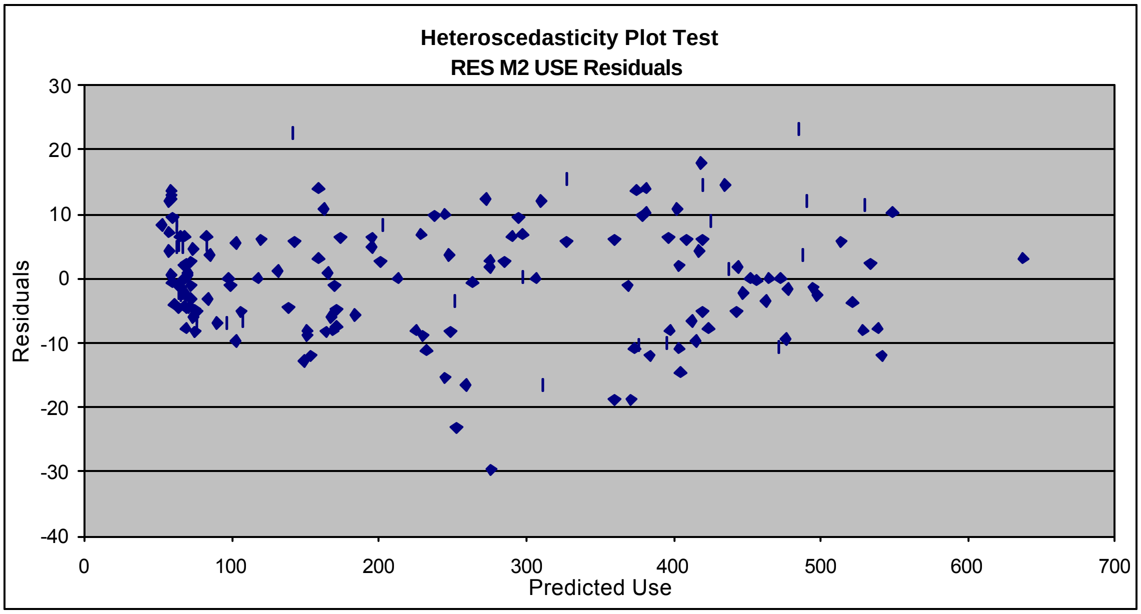
SUMMARY OUTPUT COM 10 USE			HETEROSCEDASTICITY TEST "Constant Variance Confirmed"		
Regression Statistics			*Regression Statistics*		
Adjusted R Square		0.9861	Adjusted R Square	-	0.0070
Standard Error		657.24			
Observations		145.00			*t Stat*
D W Test		1.66	Residuals	-	0.00
		Coefficients	*Standard Error*		*t Stat*
Intercept	-	14,188.05	10,748.54	-	1.32
PRICE(Ex Summer Mnths)	-	1,979.92	881.33	-	2.25
C.F.E.I		16,942.90	10,823.72		1.57
HDD Jan		16.63	0.30		54.96
HDD Feb		16.98	0.35		48.82
HDD Mar		16.89	0.41		41.66
HDD Apr		15.51	0.62		24.84
HDD May		11.52	1.13		10.16
HDD Sept		7.89	1.70		4.64
HDD Oct		15.69	0.76		20.75
HDD Nov		16.89	0.49		34.65
HDD Dec		16.41	0.37		44.38
Dum Use Nov-00		3,675.77	686.55		5.35
Dum Use Dec-00		4,782.40	706.82		6.77

APPENDIX D
HETEROSCEDASTICITY PLOT TEST
CHARTS BY RATE CLASS






Heteroscedasticity Plot Test
RES M2 Volumes Residuals
40000
30000
20000
10000
0
-10000
-20000
-30000
-40000
Residuals
0
50000
100000
150000
200000
250000
300000
350000
400000
450000
500000
Predicted Y


Heteroscedasticity Plot Test
RES M2 USE Residuals
30
20
10
0
-10
-20
-30
-40
Residuals
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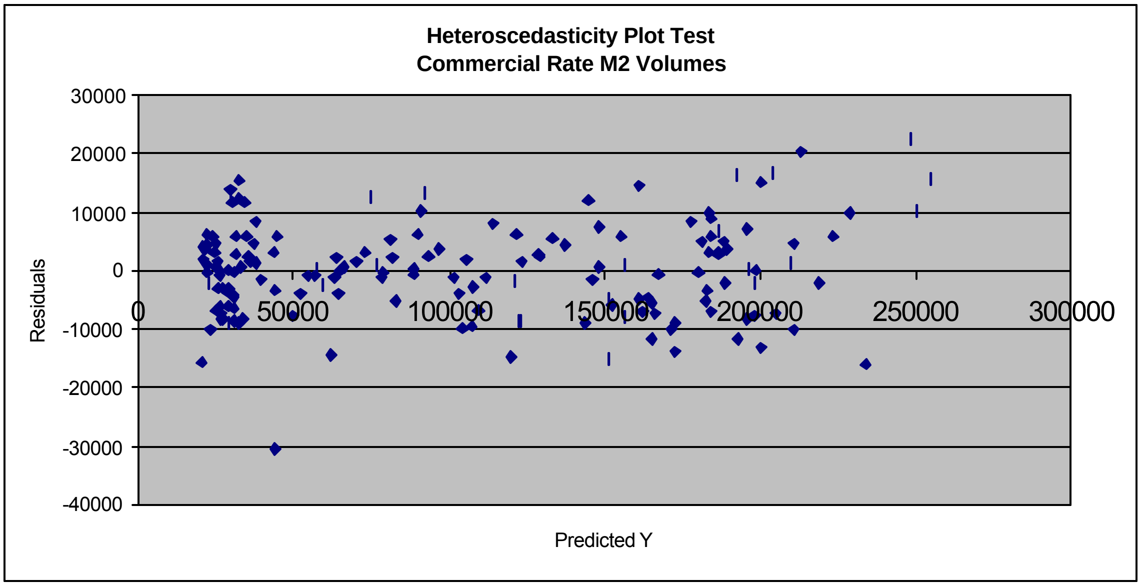
100
200
300
400
500
600
700
Predicted Use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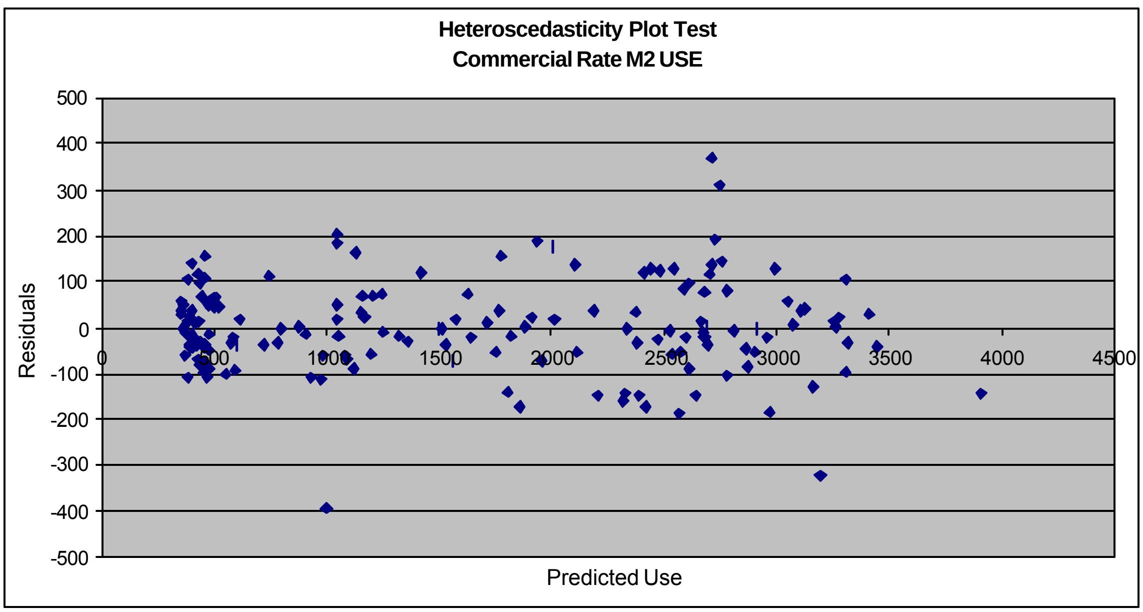
Predicted Y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Commercial Rate M2 USE
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200
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1500
2000
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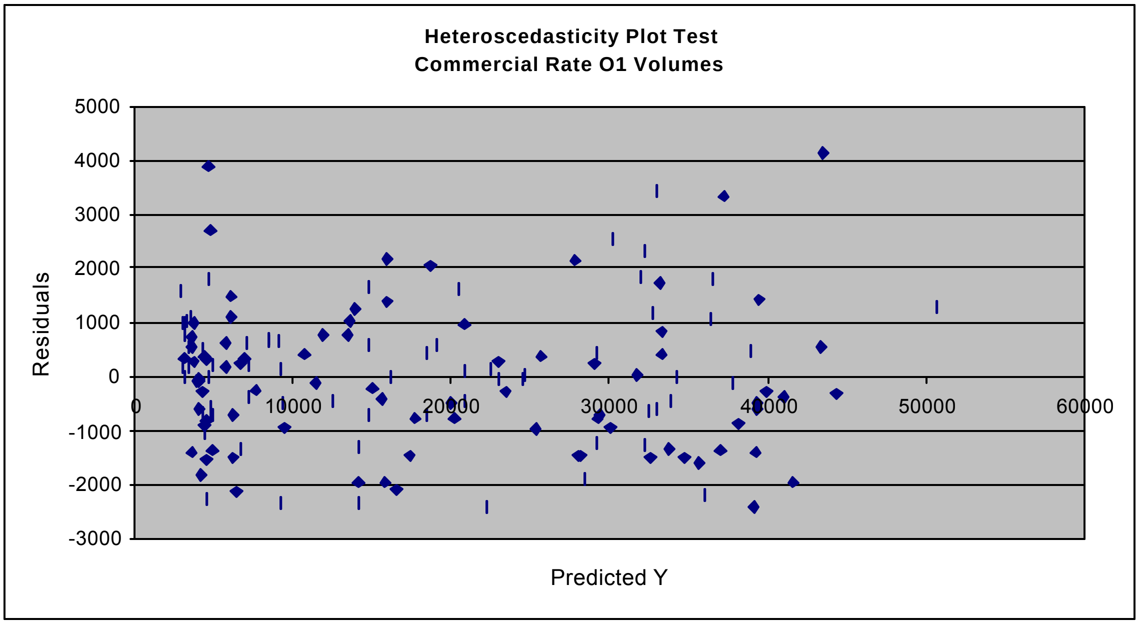
4000
4500
Predicted Use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Commercial Rate O1 Volumes
Residuals
Predicted Y
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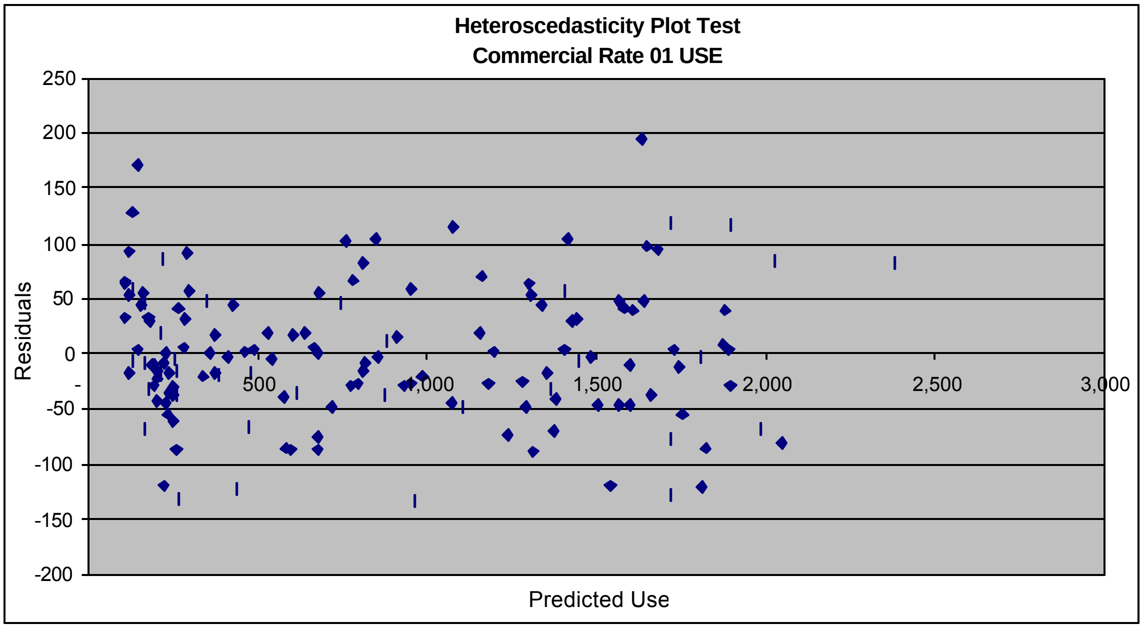
60000


Heteroscedasticity Plot Test
Commercial Rate 01 USE
Residuals
Predicted Use
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200
150
100
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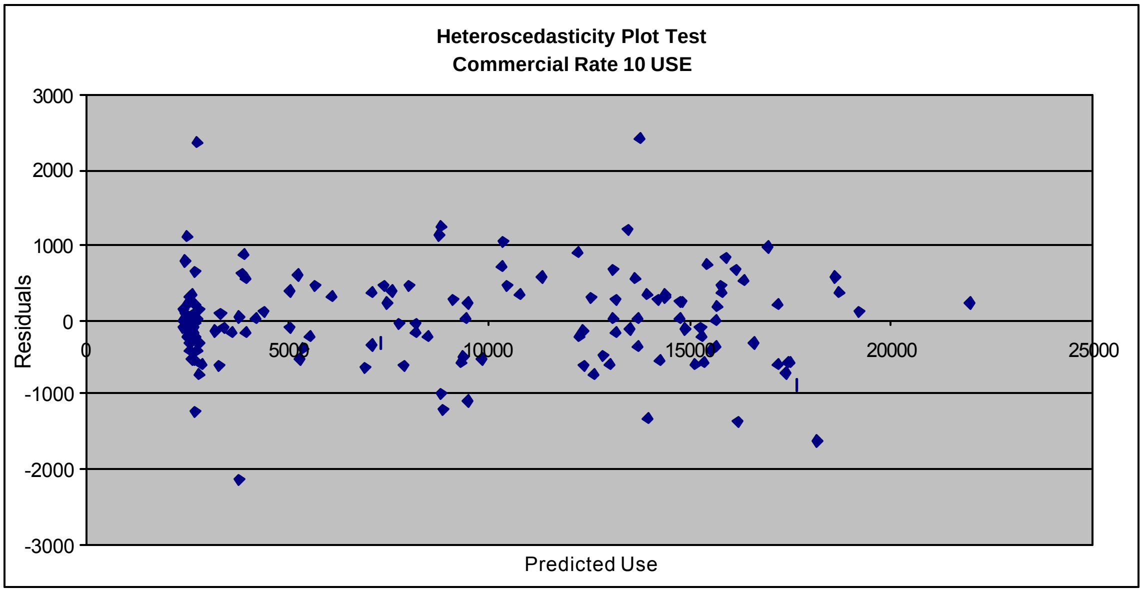
2,000
2,500
3,000


Heteroscedasticity Plot Test
Commercial Rate 10 USE
Residuals
Predicted Use
3000
2000
1000
0
-1000
-2000
-3000
0
5000
10000
15000
20000
25000

Appendix E
Demand Forecast Methodology
(See Next Page)

unionGas
A Duke Energy Company

Demand Forecast Methodology

General Service Markets

Rates M2, 01 & Banner 10

May 2004

Table of Contents

1. Introduction:

This report documents the methodology used to prepare the total throughput volumes demand forecast for the general service market served by the following rate classes: Rate M2, Rate 01 & Banner Rate 10. These three rate classes are also classified according to residential, commercial and industrial market sectors, also referred to as customer service classes.

This document does not review either the forecast assumptions or the forecast estimates[1].

The contract rate demand forecast for large volume commercial and industrial accounts served by Union Gas Rates M4. M5, M6, M7, M9, T-1, T-3 20, 25/30, and 100 are prepared by a different methodology and process.

The general service demand forecast provides the basic planning information used to prepare annual corporate budgets, regulatory evidence and capacity management planning related activities. The demand forecast horizon is four years long and includes a bridge year, a budget year, and a rate case test year which could be the budget year or post budget year depending on circumstances.

The demand forecast provides the customer and consumption data needed to prepare the revenue forecast.

The demand forecast uses both internal and external information sources.

The customer billing system and the financial reporting system provides internal information in the form of monthly customer statistics pertaining to the number of customers, the actual total throughput consumption, and the average use per customer consumption for each service and rate class, e.g. residential rate M2. Calendar month consumption data is used; the billing cycle reported information has been adjusted for unbilled consumption estimates. These customer statistics have been compiled in a demand forecast data base with data starting in January 1990. Union Gas rate schedules are also used in preparing monthly retail energy gas price information. Results from Union Gas residential market gas appliance penetration surveys are also considered.

External information related to housing start forecasts, North American economic growth and conditions as measured by the real gross domestic product, light fuel oil prices and trends in the commercial sector are used in the preparation of the demand forecast. Forecasts from the Canada Mortgage and Housing Corporation, Consensus Economics, external economic service consultants and energy price journals are referenced.

2. Econometric Demand Forecast Variables:

Economic demand and consumer behaviour principles suggest that the demand variables selected and contained in the econometric demand equations need to account for several factors.

Seasonality: Any seasonality that is present in the consumption data needs to be explainable. The total monthly heating degree-day weather data accounts for the seasonality.

Trends: Any increasing or declining trend that is present in the consumption data needs to be explained. The energy efficiency trend variable in the residential market explains the declining usage over time and reflects the energy efficiency choices and behaviours of energy consumers. The commercial market segmentation & efficiency trend variable accounts for the declining usage present in the commercial market. Total customer

[1] A forecast assumption indicates the future direction or level of the demand variable, e.g. the number of new customers being added each year ; forecast estimates indicate the result of the forecast, e.g. residential rate M2 NAC estimate of 2,627 cubic metres per year.

growth in the industrial market accounts for the increasing total throughput volumes observed over the estimation period.

Economic Behaviour: Changes in retail natural gas energy prices affect consumption in the residential and commercial markets, and changes in relative prices between natural gas and light fuel oil affect total throughput volumes in the industrial market. As well changes in North American gross domestic product affect total throughput volumes in the industrial market as the provincial economy is well integrated with the larger economy especially via the automotive manufacturing industry.

The criteria used to select the demand variables are important as the econometric estimates of the average consumption per customer are a key component of the demand forecast. There are several criteria for selecting demand data.

The demand variables must be available according to a monthly format and span a fairly long period; 1990 to present in this instance. The monthly data requirement arises from both the seasonality that is present in the demand data and the ultimate client need for the forecast information which is monthly in nature. Monthly data can be a limiting factor in selecting the demand variable data.

The demand variables must be relevant and founded on economic behaviour and energy demand principles; demand theory suggests that weather and retail energy prices are two key demand drivers to consider. Correlations of energy demand to other data that possess a seasonal characteristic that is not related to natural gas energy demand in Ontario, e.g. beer consumption in Australia, is not sound or reasonable.

The data should be ideally franchise area or provincial level detail specific, with the notable exception for the industrial market where North American data can be used. This geographic criterion can also limit the data selection.

The demand data should be public and obtained from reputable sources, e.g. Statistics Canada, external economic services consultants, and should be reproducible.

The demand variables ideally should be statistically significant at the 95 percent level, although lower levels of significance as explained below may be accepted. A student's t test is used to examine the statistical significance of the demand variable in the regression equation.

3. Actual & Normal Weather:

The weather factor is the key demand forecast variable in the econometric analysis. The demand equations and the associated demand coefficients that are estimated are based on actual weather data. Weather is measured by total monthly heating degree-days (HDD) below 18 degrees Celsius. Historic monthly weather data for the southern and northern franchise areas has been compiled since the mid 1960's.

3.1. Actual Weather

Actual monthly weather time series data is used in the estimation of the econometric demand equations. The actual weather data is specified in the regression analysis as a nine month matrix where each heating season month, September through May, is a separate weather variable. For example January HDD is a time series demand variable where all the January months between the years 1990 and 2003 possess as a value the actual observed total heating degree-days during the month and zero values for all other data in the present time series. The other heating season months are set up in similar fashion. **[See Appendix 3.1]**

This weather matrix approach enables a separate weather coefficient to be estimated for each heating season month and this recognizes that consumer behaviour differs between the shoulder months and high heating seasons. The summer months of June through August were identified by previous statistical analysis as being non weather related and represent only base loads. In the industrial equation the time series are quarterly as a result of the GDP data, and the weather demand variable includes the first, second and fourth quarters where the second quarter excludes the month of June.

3.2. Normal Weather

The demand forecast estimates are based upon an assumption of normal weather occurring over the forecast horizon. Normal weather conditions are defined separately for the southern and northern franchise areas; as well, consolidated total company weather normal is established for the industrial demand equation.

Normal weather is defined as a blend of two estimated normals following a decision made by the Ontario Energy Board in April 2004: the blend incorporates a thirty year average normal estimate and an estimate obtained from the 20 year declining trend methodology that Union Gas developed in 2002 and has used in the preparation of the 2002 through 2004 budgets.

The weather normal blend assumes a ratio of 70:30 between the thirty year average normal estimate and the 20 year declining trend estimate for the years 2004 and 2005. The blend drops to a ratio of 60:40 in 2006 and 2007.

The thirty year average is based on monthly weather data spanning the 1974 to 2003 period. Averages are calculated for each month and then summed to yield the annual estimate.

The 20 year declining trend is based on weather data spanning the 1984 to 2003 period. A linear trend in the annual weather data is established by regression analysis; this trend is projected forward. The monthly forecast estimates are obtained from the annual forecast weather normal estimates by applying historic percent distributions for each month. These percent distributions are the average percent shares for the past twenty years.

Historic weather normals are also used to identify past cold and warm years as well as provide a standard weather condition for energy growth analyses of past and future consumption.

The actual weather and forecast normal estimates are shown in **[appendix 3.2]**.

4. Environment Scan:

The environment scan is a forecast assumption document that states expectations regarding key demand factors such as: total housing starts, retail energy prices, alternate fuel prices, real economic growth in Canada and the United States, mortgage interest rates, provincial unemployment rates and service sector employment growth. Sources include: Statistics Canada, Canada Mortgage and Housing Corporation (CMHC), Consensus Economics, The Centre for Spatial Economics (C4SE), Global Insight.

Housing start estimates and mortgage rate forecasts are directly used in the preparation of the customer attachment forecasts. In addition Canadian and U.S. real GDP growth rate forecasts are used to prepare the economic activity variable used in the light industrial demand equation. Retail natural gas and light fuel oil prices at April 2004 are used to prepare the energy price variables used in the regression analysis. The other economic indicators contained in the environment scan are considered in preparing the marketing and DSM plans and are also used for other planning activities within Union Gas, e.g. inflation rates for budgeting purposes.

The environment scan is prepared by Market Knowledge early in the year and updated in September.

The environment scan used in the preparation of the 2005 budget demand forecast is presented in **[appendix 4]**

5. Customer Attachment & Total Customer Forecast:

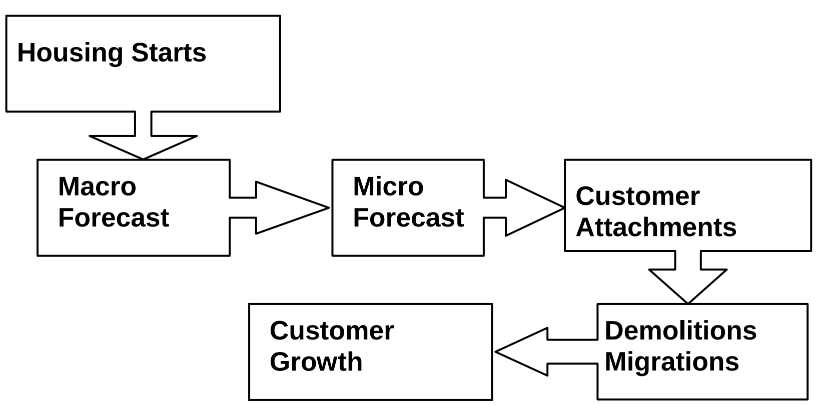
The total customer forecast estimates are obtained primarily from the customer attachment forecast estimates.

The customer attachment estimates are based on a macro analysis and a micro regional based assessment. The customer attachment estimates are gross new customer additions.

The macro analysis translates provincial housing start estimates obtained from several external housing start analysts (CMHC, the Chartered Banks, Consensus Economics, etc.) into a Union Gas franchise housing start estimate. Macro commercial and light industrial customer attachments are also provided. These commercial and industrial customer growth estimates are based on historic residential to commercial and industrial to commercial customer ratios. These annual customer growth estimates do not include any conversion market related customer attachments. This macro analysis is prepared by Market Knowledge for Channel Management.

Channel Management reviews the estimates obtained from the macro analysis and prepares the micro regional based estimates that include the conversion market related customer attachments. The micro regional based estimates become the recommended customer attachment forecast which is reviewed for approval by executive management.

The total customer forecast recognizes that demolitions, customer losses and rate class migration or classification related changes occur; the latter pertain mainly to commercial and industrial customers. These demolitions and other customer loses are subtracted from the gross customer attachment estimates to yield the net customer growth levels.



Monthly customer growth estimates are obtained from the annual estimates by applying historic percent distributions for each service and rate class.

The monthly customer growth estimates for each service and rate class are applied to the most recent historic December total customer level to yield the forecast total customer levels. For example December 2003 was used in preparing the 2005 demand forecast.

The customer attachment and total customer forecast is tabled in **[appendix 5.1 & 5.2]**.

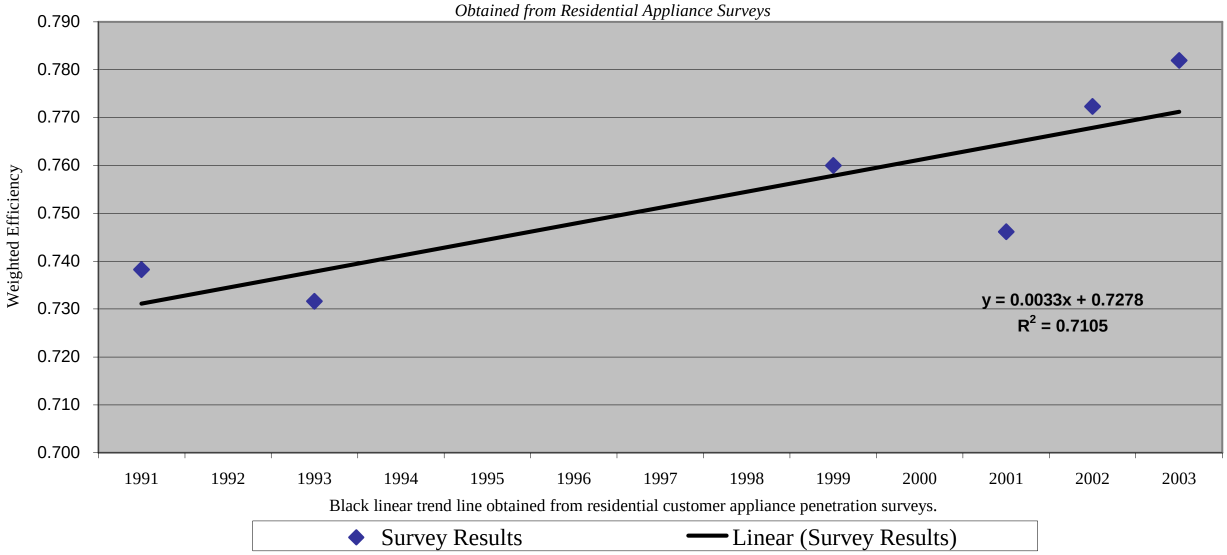
6. Residential Energy Efficiency:

A declining trend is present in the average consumption of a residential customer. A linear trend variable is created and used in the residential use equation regression; this trend variable is established from analysis of furnace type penetration data obtained from Union Gas appliance surveys since 1991. This data is used to establish a weighted furnace efficiency level. Weighted furnace efficiency is determined by multiplying the furnace type market shares by the recognized furnace efficiencies: conventional furnace 60% AFUE, mid efficient furnace 80% AFUE and high efficiency furnace 95% AFUE.

Non linear trends were examined but proved to be statistically inferior to a linear trend according to regression R square results which indicate degrees of fit.

The chart below indicates the weighted efficiency trend which is projected forward to obtain the forecast assumption for this variable. A 71% R-square was obtained.

Chart A
Residential Aggregate Furnace Energy Efficiency
Obtained from Residential Appliance Surveys



Black linear trend line obtained from residential customer appliance penetration surveys.

7. Commercial Market Segmentation:

The use equations in the commercial market demand equations contain a demand variable that represents the changing composition of the commercial market. This trend variable is developed from a commercial market segment analysis that is described below.

The trend variable was derived using the results of the past four years of data created by the model. The following is a discussion of the model and the variables used.

7.1. Commercial Segmentation Model – A Discussion

The model has been designed to be rebased each year using actual consumption data from the billing system. The 2005 Demand Forecast version used actual volumes and customers counts pulled from the customer database for 2003.

Consumption and customer counts are extracted from the billing system using a Discoverer query. The data is then pulled together to classify the data in to the following segments.

7.1.1. Commercial Segments

- Office
- Elementary/Secondary School
- Health Service
- Retail
- Warehouse/Wholesale
- College/University
- Restaurant
- Recreation
- Hotel/Motel
- Religious
- Multi-residential
- Other

Each of the segments is made up of several different dwelling types **[see Appendix 7.1]**, these are compiled together using the monthly consumption data, which is then weather normalized. The annualized data for consumption and dwelling counts are entered in to the model for the base year. Currently we do not split the data into Northern and Southern franchise areas, for analysis, we compile the statistics for the entire franchise area.

7.2. *Fuel Shares*

The model makes certain assumptions on penetration and use; these assumptions come from outside consultants' reports that have not been updated since the model's creation.

7.2.1. Fuel Shares

	FUEL SHARE EXISTING STOCK			FUEL SHARE NEW STOCK		
	Space Heating	**Water Heating**	**Other**	**Space Heating**	**Water Heating**	**Other**
Office	88%	50%	100%	90%	50%	100%
Elementary/Secondary School	94%	75%	100%	95%	75%	100%
Health Service	94%	94%	100%	95%	95%	100%
Retail	88%	50%	100%	90%	50%	100%
Warehouse/Wholesale	80%	50%	100%	80%	50%	100%
College/University	94%	94%	100%	95%	95%	100%
Restaurant	96%	75%	100%	97%	80%	100%
Recreation	90%	75%	100%	92%	80%	100%
Hotel/Motel	91%	91%	100%	92%	92%	100%
Religious	90%	75%	100%	92%	80%	100%
Multi-residential	91%	60%	100%	92%	80%	100%
Other	80%	50%	100%	80%	50%	100%

7.3. *Floor Space*

The model calculates energy usage based on floor space, the model assumes specific square footage based on external reports provided in 2002. The current assumptions for floor space per dwelling are as follows:

COMMERCIAL SEGMENT	SQUARE FOOTAGE per dwelling
Office	6,000
Elementary/Secondary School	30,000
Health Service	22,500
Retail	5,000
Warehouse/Wholesale	25,000
College/University	150,000
Restaurant	4,000
Recreation	25,000
Hotel/Motel	17,500
Religious	5,000
Multi-residential	41,400
Other	5,000
Total (Average)	**8,500**

7.4. Growth and Decay

The model uses assumptions on growth and decay rates, which the model designer derived from external sources, Energy use indices that are derived from Natural Resources Canada and other studies are used to calculate the use based on the total square footage of the segment. The model calculates the annual consumption by sector for the forecast period.

The following table can be also be found in the **[appendix 7.4]**

Assumptions used for growth, decay & vacancy			
	(percentage per year)		
	Floor Space Growth rates	Floor Space Decay Rates	Vacancy Rates
All segments (except Multi Res)	0.25%	0.10%	5.00%
Multi-residential	0.25%	0.10%	2.70%

7.5. Energy Use Model

The general form for the equation used for the commercial sector energy model is as follows:

Energy Use = ƒ (A×B×C×D),

Where, A=Activity variable (floor space)
B=Fuel share
C=Energy Technology Intensity
D=Usage

The Activity variable – A – comes from our Union's segment research and industry information. For the model, C and D are combined to create an energy intensity (EI) or end-use intensity (EUI) – **[See Appendix 7.5]**. Fuel shares – B – comes from information obtained by Union's own research. Once the model is populated, a calibration exercise may be performed if it is deemed necessary. This exercise allows the user to tailor the model for changes in any of the variables, such as changes in floor space of a sector, change in growth patterns or changes in use.

The following has been extracted form the current model and shows relative impacts on overall energy use of various changes in our inputs.

Volumes in 10^3m^3	Model 2004	1% Customer Change	1% Fuel Share
Office	420,984	4,210	8,378
Elementary/Secondary School	219,525	2,195	2,195
Health Service	89,369	894	868
Retail	182,789	1,828	1,806
Warehouse/Wholesale	96,291	963	963
College/University	65,406	654	631
Restaurant	82,973	830	784
Recreation	78,441	784	784
Hotel/Motel	25,180	252	247
Religious	28,803	288	288
Multi-residential	242,762	2,428	2,104
Other	276,396	2,764	2,641
Total	**1,808,918**	**18,089**	**21,689**

Each year when the data is extracted from the billing system there are checks that must be run against the data. One of the key items is customer count; if there is an unexpected result, the reason for its occurrence is investigated. This may mean re-pulling the data and/or contacting the Banner group to determine if there may have been changes to the system that may have accounted for this. If this does not resolve the issue, we try to determine if something has happened in the affected sectors that may be driving change.

The model uses a historical growth rates for fuel share and floor space applied across all the segments. The model may be changed to reflect changes in growth across the various segments. Demolitions and vacancies are also accounted for within the model and may be changed as needed.

Floor space Growth Rate used is 0.25% per year Decay rate used is 0.10%. The Assumed vacancy rate is 5% with the exception of Multi-residential at 2.7%

Fuel Share Growth Rate - % Existing is 0.25% New 0.50%

EUI Improvement - % - Existing is 0.10% New 1.0%

Overall percentage growth built into the model

Year	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Percentage Growth	0.264%	0.035%	0.035%	0.035%	0.035%	0.035%

The largest sectors in terms numbers, floor space and total volumes are really office and retail. The Commercial "Other" group tends to be a group of unclassified businesses that at the time of being entered in to the billing system were just lumped into the generic category. Some work has been completed in the clean up of these records.

BASE YEAR: 2003

COMMERCIAL SEGMENT	**REPORTED GAS USE (10^3m^3)**	**NUMBER OF BUILDINGS**	**TOTAL FLOORSPACE (SQ. FT)**	**AVERAGE ANNUAL USE (m^3/bldg)**
Office	417,948	34,342	206,052,000	12,170
Multi-residential	278,568	2,600	107,640,000	107,141
Other	268,915	19,839	99,195,000	13,555
Retail	179,890	18,023	90,115,000	9,981
Elementary/Secondary School	167,618	2,457	73,710,000	68,221
Health Service	85,528	910	20,475,000	93,986
Restaurant	75,489	4,651	18,604,000	16,231
Warehouse/Wholesale	69,578	3,283	82,075,000	21,193
Recreation	65,886	1,227	30,675,000	53,697
Religious	39,944	2,623	13,115,000	15,229
Hotel/Motel	21,283	602	10,535,000	35,354
College/University	13,251	124	18,600,000	106,860
Total	**1,683,900**	**90,681**	**770,791,000**	**18,569**

To summarize the commercial segmentation model provides us with a tool to predict the various dynamics of our commercial market. The model is easily adaptable to changes within our markets and is an invaluable tool for analyzing the commercial segments.

The commercial segment model predicts total volumes and total use per customer. The total commercial use per customer estimate is then converted into the trend index variable that represents the changing commercial segmentation and energy efficiency characteristics present in the market. The Model's usefulness will improve as additional years' of data are accumulated.

8. Retail Energy Prices:

The retail natural gas prices used in the regression analyses were constructed from the monthly actual use per customer statistics for each customer service & rate class and the appropriate delivery, commodity and transportation rate schedules for the period January 1990 to December 2003.

The consumption of an average system sales customer was assumed in the creation of the burner-tip unit prices; this average consumption was applied to the delivery consumption rate blocks in the rate schedules to derive the average unit price. Retail price information that direct purchase customers pay is spotty and the market share of each retail energy marketer is not available to create a weighted market retail price due to code of conduct ethics.

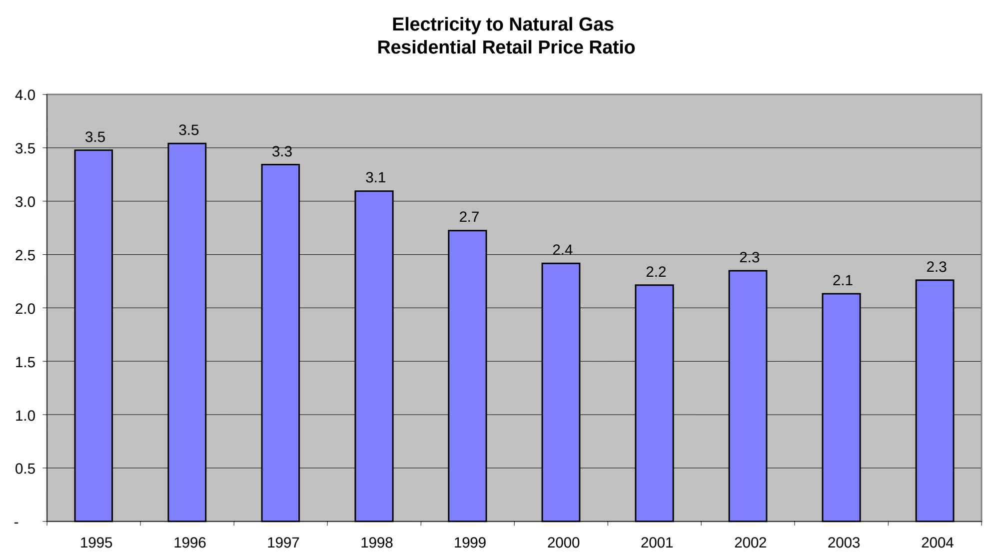
Retail energy prices primarily change when the more volatile commodity price changes.

Light fuel oil prices reported for the London, Ontario wholesale market are used in the estimation of the industrial demand equation.

Electric power retail prices were not analyzed for the following two reasons:

Electric distribution company retail power prices for the 90 odd electric power companies located throughout the Union Gas franchise area are not available on a monthly basis. Residential average use statistics for electric power are not public and easily made available. Electric power usage in the commercial segment would vary widely by commercial segment, and commercial segment consumption data is limited for gas consumption and non existent for electricity consumption.

Over the 1990 to 2003 period electricity prices were frozen in Ontario; price comparisons indicate that electricity is not competitive with natural gas as the price ratio between electricity and natural gas has ranged from the 3.0 to 2.0 levels. Any relative price demand price variable in the regression equation would essentially reflect the gas price variation.



9. Econometric Equations:

The estimation of econometric demand equations for forecasting purposes is based upon econometric practices and principles. Economic theory and statistical methods are the basis of econometrics. Energy forecasting is applied econometrics. Forecasters are challenged by data limitations due to the availability and appropriateness of the information, the cost of obtaining the information, and the complexity in creating the appropriate information in certain instances, e.g. weighted market share retail energy prices.

Forecasters seek to improve their forecast equations by enhancing the equation specifications which may involve lagging variables, pooling data, adding newly obtained information, and incorporating knowledge obtained from forecasting journals and attendance at forecasting conferences to name a few examples.

10. NAC Forecast:

The normalized average consumption (NAC) forecast estimates for the general service rate and service class customers are a major component of the total throughput volumes demand forecast. The NAC forecast is a key determinant to the rate of growth present in the demand forecast.

The NAC forecast estimates are obtained by summing the results of three separate analyses. These three analyses are: the econometric NAC forecast estimates, the marketing plan NAC impact estimates and the DSM plan NAC impacts. These are described below.

10.1. DSM Plan & Energy Efficiency Trend

As described in the Use Equation section below, the historic Union Gas DSM plans need to be recognized in the regression analysis. The energy efficiency trend variable that is used in the use equations should not contain the impact of the past DSM plans.

Double counting the DSM plan impact in a going forward analysis is the issue; the historic energy efficiency trend that is estimated by the regression analysis should only reflect the condition where there is no DSM plan in place, as the new incremental DSM plan impacts is overlaid. This issue affects only the residential and commercial use equations and is not present with any of the volume equations.

This double-counting issue is resolved by restating the reported consumption statistics that are used to estimate the energy efficiency coefficient present in the use equation. Two regressions are undertaken; one with the actual reported statistics and one with the restated statistics. The restatement makes an account for the total consumption impact of past DSM plans. Audited annual DSM plan consumption statistics are used to restate the actual consumption data; monthly allocation is based on the seasonality present in the reported actual statistics. The restatement affects only the energy efficiency coefficient. The remaining coefficients contained in the use equation are based on the actual reported statistics.

11. Econometric NAC Forecast Estimates:

Econometric normalized average consumption (NAC) forecast estimates are determined for each service and rate class: residential Rate M2 and 01, commercial Rate M2, 01 & 10, and industrial Rate M2 and 10. The forecast estimates are referred to as normalized average consumption because they are based on normal weather assumptions as discussed earlier in the weather normal section above.

11.1. Statistical Estimation & Rigour

The econometric estimation process that is applied in preparing the NAC forecast estimates follow generally accepted energy demand forecasting methods. The independent demand variables included in estimated demand equations are variables that are conceptually well recognized as drivers for energy consumption, e.g. weather, retail energy prices, etc.

The estimated demand equation are selected on the basis of the conventional tests: Regression R Square, F and t tests, and Mean Absolute Percent Error (MAPE) for the equation fit, the Durbin Watson (DW) & Durbin H (DH) tests for auto correlation, and the Chow test for the presence of heteroskedasticity. Graphic examination is also undertaken.

A 95 percent confidential level is ideally the first screen or test level that one considers for determining the statistical significance of a demand variable.

For the majority of the 136 demand variables tested that are contained in the 11 demand equations, this 95 percent level is met as 127 demand variables had t test scores above the 95 percent confidence level. In nine instances a lower confidence level was considered and this is noted in the table below. The column titled P-value indicates the inverse of the confidence level. The percent level is obtained if the P-value is subtracted from 1.

The table shows that in three instances a 90 percent level indicates significance (Res M2 Price, Comm M2 Volume lagged and Ind Volume GDP); in 5 cases a level of 80 percent indicates significance (Res M2 Price, Comm M2 Volume lagged, Ind Volume GDP, Com 10 Commercial Index, Ind Volume Price Ratio).

Rate Class	Equation	Variable	*P-value*
Res M2	Volume Equation	Price	0.07
Com 01	Volume Equation	Volume Lagged	0.49
Com 01	Volume Equation	Price	0.53
Com 01	Use Equation	Price	0.26
Com 10	Use Equation	Commercial Index	0.12
Com M2	Volume Equation	Volume Lagged	0.08
Com M2	Volume Equation	Price	0.57
Ind	Volume Equation	GDP	0.06
Ind	Volume Equation	Price Ratio	0.19

A lower confidence level is acceptable if the dependent variable is widely recognized in the energy demand forecast community as a key demand forecast variable, e.g. retail energy prices. Furthermore, if the estimated demand relationship is correct, e.g. an inverse relationship between price and demand, and the estimated demand elasticity is within the expected range as indicated by a research of external literature then the variable can be included. If the inclusion of the variable improves the historic accuracy of the predicted estimate or does not materially affect the forecast estimate then also the inclusion of the variable is not a concern. Materiality defined as being within the standard error or mean absolute percent error range. If the inclusion of the variable eliminates an auto correlation issue that is present in the equation without the variable then the inclusion of the variable is a sound and reasonable forecasting technique.

For example: The price ratio variable in the industrial volume equation is significant at the 81 percent confidence level. Excluding the price ratio variable from the industrial volume equation yields a demand equation whose residuals are positively correlated, whereas the demand forecast equation that incorporates the price ratio variable is not auto correlated. The excluded variable equation possesses both a larger standard error and a larger mean absolute percent error for the predicted annual estimate. The t statistics for the remaining variables in the excluded variable equation all pass the 95 percent confidence test. The total volume estimate for 2005 obtained from the demand equation that excludes the price ratio variable is 0.7 percent higher than the estimate obtained from the demand forecast equation.

The presence of autocorrelation in an initial demand equation is remedied by introducing a lagged dependent variable in the equation and using the Durbin H statistic to test for autocorrelation.

11.2. Two Equation Approach

Specifying the demand equation as either an “average use per customer” equation or a “total volume” equation follows a conventional approach in econometric estimation. Either approach can yield strong and statistically significant demand equations. Both equations have their merits; the use equation identifies the trend present in the consumption data and the volume equation better identifies the demand-price relationship. And both approaches share common demand variables such as weather.

For the residential and commercial service classes, Union Gas has found that averaging the estimates obtained from each approach yields an econometric NAC estimate that is more accurate than the results that would be obtained from the individual equations.

The volume and use per customer demand forecast equation approaches are described below.

11.3. Volume Equations

See **[Appendix 11.3]** for Volume Equation Coefficients.

11.3.1. Residential Rate M2 & 01

The volume equation approach is used to estimate NACs in all three service classes.

The process of forecasting demand relies on using historical consumption data and identifying variables that can, at first accurately replicate historical demand patterns. The statistical results reveal the significance of the variables included and the extent to which they are able to predict historical demand. The object being that the models include all the primary drivers of demand and have the capacity to predict future demand with the same accuracy as it predicts historical demand.

Based on 14 years of monthly reported throughput volumes data for each of the rate classes, various drivers which could influence demand were tested using regression analysis to arrive at the final three, which are Number of Customers, Natural Gas Prices and Weather data for the two principal southern and northern franchise areas.

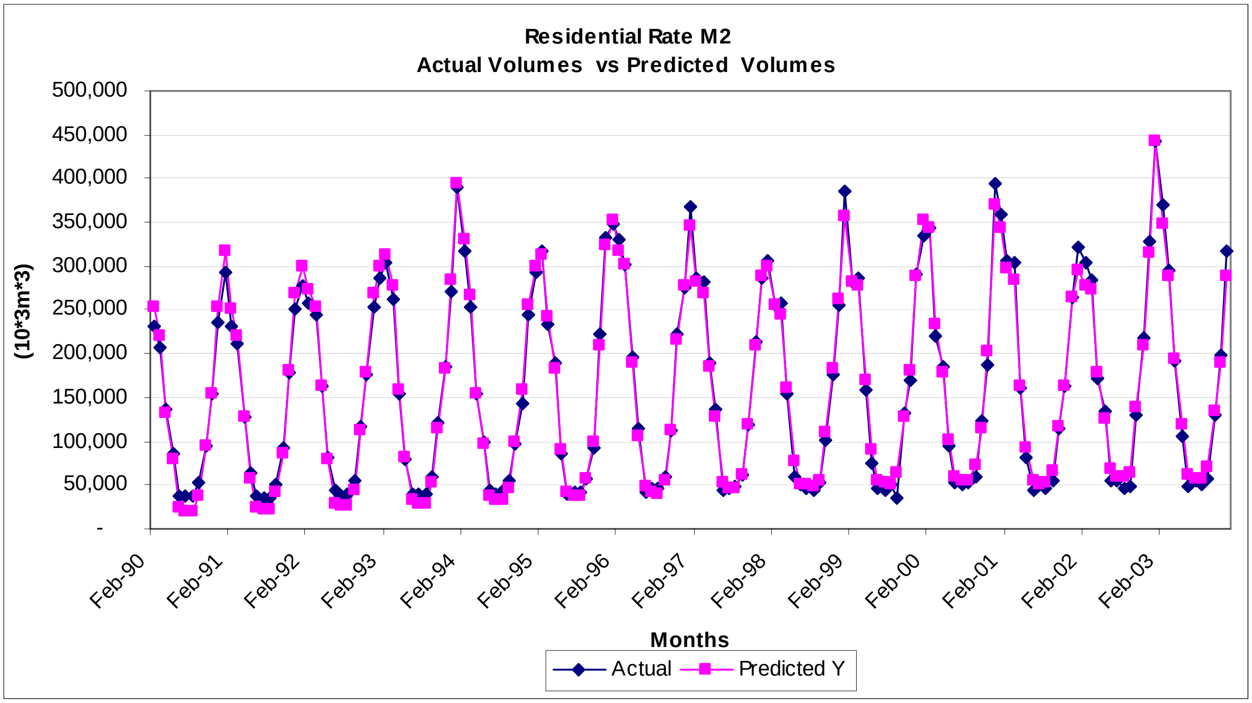
The Volume Equation for the residential market is defined by the relationship, total throughput volumes are a function of number of customers, natural gas prices and weather.

The monthly total number of customers captures the growth over time in throughput volumes. The retail natural gas prices identifies the consumer economic behaviour as the price variable is a retail burner tip price that is determined from the average use per customer statistics for each rate class and the past and current Union Gas delivery, transportation & commodity charge rate schedules. The weather variable, which is the primary driver of demand, is set-up as a matrix that excludes the summer months of June, July and August. Weather accounts for the seasonal patterns contained in the consumption data. Actual monthly weather data for the southern and northern franchise areas is considered.

Total Throughput Volumes= f *{Number of Customers, Natural Gas Prices, Weather}*

Where:

Number of customers is the total number within the residential service and rate class, e.g. Rate M2.
Natural gas price is the residential retail burner tip unit price that excludes the fixed monthly charge.
Weather measures the total number of heating degree-days during the month.



The historic fit between the actual total consumption and the demand equation's estimated predicted values is shown in the chart above. The mean absolute percent error between the actual consumption and predicted estimates for the total annual throughput volumes is **1.3** percent with a standard deviation of **0.8** percent. This implies that the demand equation has forecast capability of roughly plus or minus **1.6** percent.

The regression results are presented in **[Appendix 11.3.1]**

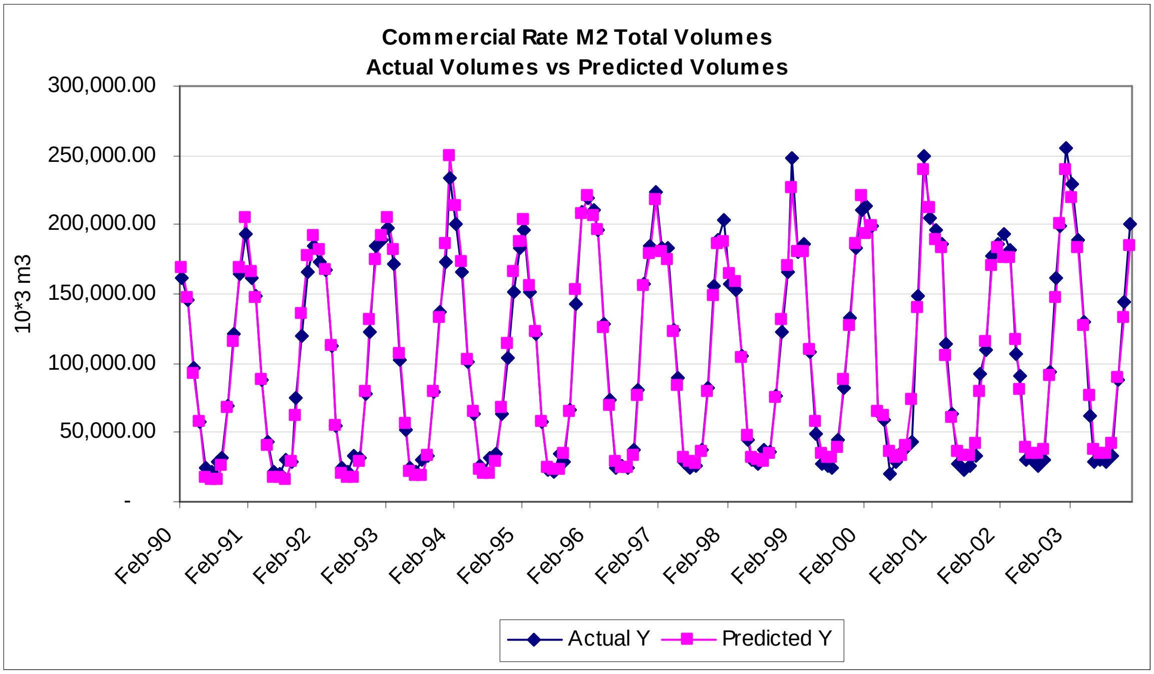
11.3.2. Commercial Rate M2, 01 & 10

The demand variables contained in the volume equation that were found to drive demand in the commercial market are similar to those cited above for the residential market. The only difference being that the total number of customers and the retail unit prices are based on the individual commercial customer rate class statistics. The structure of the volume equation is the same as that used in the residential service class. The volume equation is defined as follows: total throughput volumes are a function of natural gas prices, weather and number of customers.

Total Throughput Volumes= f *{Number of Customers, Natural Gas Prices, Weather}*

Where:

Number of customers is the total number within the commercial service and rate class, e.g. Rate M2. Natural gas price is the commercial retail burner tip unit price that excludes the fixed monthly charge. Weather measures the total number of heating degree-days during the month.



The historic fit between the actual total consumption and the demand equation's estimated predicted values is shown in the chart above. The mean absolute percent error between the actual consumption and predicted estimates for the total annual throughput volumes is **1.5** percent with a standard deviation of **1.1** percent. This implies that the demand equation has forecast capability of roughly plus or minus **2.2** percent.

The regression results are presented in **[Appendix 11.3.2]**

11.3.3. Industrial Rate M2 & 10

The volume equation was the only approach selected for the industrial service class. The volume approach enabled the identification of an economic activity variable in the demand equation. This economic activity variable is based on quarterly changes in North American real gross domestic product (GDP). A relative industrial gas to fuel oil price variable completed the demand equation. Weather identifies the seasonality present in the monthly total consumption data. The total customer variable accounts for the growth over time in the consumption.

A consolidated industrial service class was examined as opposed to three individual rate class equations. The total volumes represent the sum of Rate M2, Banner Rate 10 and CIA Rate 10 customers. Industrial Rate 16 volumes were also included; this interruptible rate class is currently vacant. Inclusion of CIA Rate 10 and industrial Rate 16 customers improved the statistical estimation and this inclusion recognized that there has been migration back and forth over time between Banner and CIA Rate 10 customer classes, as well as with the Rate 16 customer class.

Pooling the industrial rate classes together creates a light industrial sector that correlates with North American GDP, which is not the case if individual and separate service class demand equations were specified. Weaker results were obtained if the volume equation was specified using the individual rate class information, e.g. the industrial rate M2 which represents about 83 percent of the total light industrial volumes, the regression analysis identifies only the weather relationship and the overall regression results are weaker in terms R Square and F statistics. This pooled rate class approach also enables the demand equation to identify a relationship between consumption and comparative energy prices.

The estimated industrial demand equation based on historical quarterly data spanning 1996 to 2003 is the following:

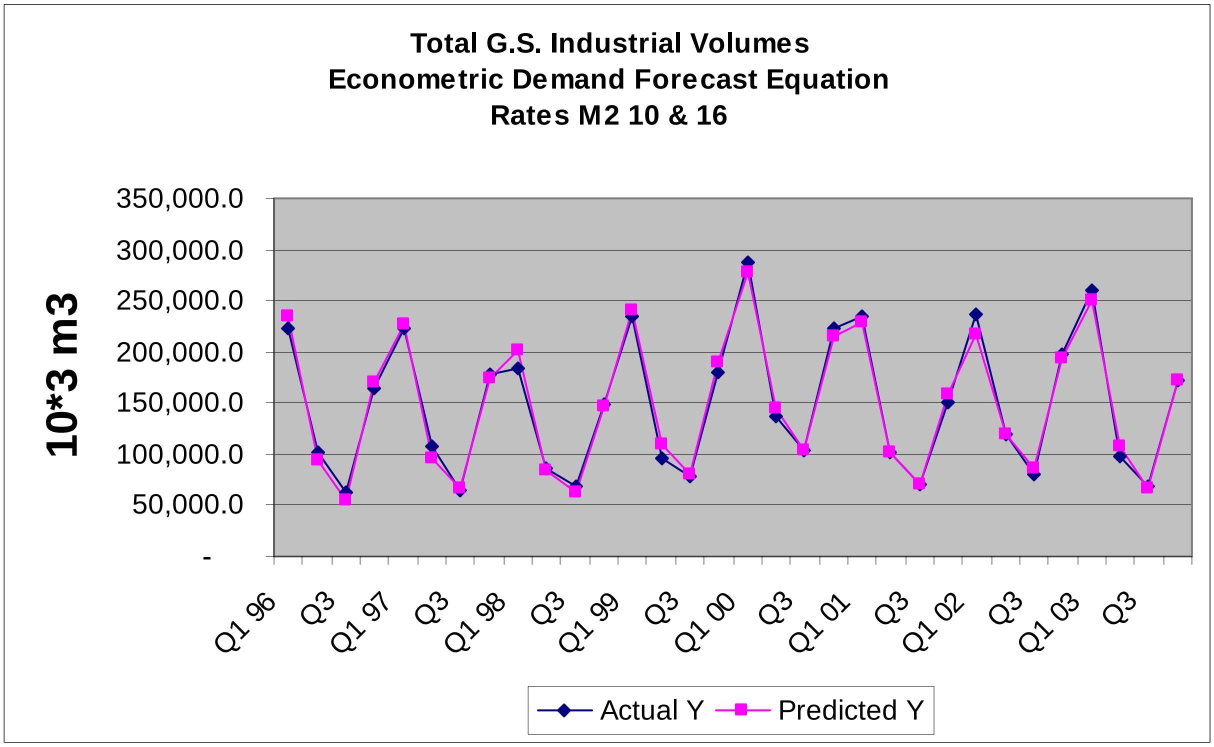
Volumes = f (weather, customers, lagged change in GDP, and the price ratio between natural gas and fuel oil.)

Where:

- Volumes is the consolidated total throughput of industrial Rate M2, 10 and 16 customers
- Weather represents the total heating degree-day weather matrix for nine heating months
- Customers is the consolidated total number of industrial Rate M2, 10 and 16 customers
- Lagged change in GDP is the quarter to quarter real dollar change in gross domestic product
- Price ratio relates the industrial burner tip natural gas unit price and the wholesale light fuel oil No. 2 price at London Ontario.

Consistent price data prior to 1996 was limited and this constrained the analysis.

The historic fit between the actual total consumption and the demand equation’s estimated predicted values is shown in the chart below. The mean absolute percent error between the actual consumption and predicted estimates for the total annual throughput volumes is 1.8 percent with a standard deviation of 1.7 percent. This implies that the demand equation has forecast capability of roughly plus or minus 3.5 percent.



The statistical results for industrial volume equation are presented in **[Appendix 11.3.3-1]**.

The total throughput volumes for the industrial Rate M2 service class customers are obtained from the total consolidated volumes equation by means of a subsidiary regression equation that relates industrial Rate M2 volumes to the consolidated volumes. The results for this subsidiary regression are also shown in **[Appendix 11.3.3-2]**.

The total throughput volumes for the industrial Banner Rate 10 service class customers are obtained as a residual once the historic market share of CIA Rate 10 customers of the total consolidated volumes is attributed. CIA Rate 10 customers over the past two years have represented about 13.8 percent of the total consolidated light industrial throughput. The currently are no industrial rate 16 customers and none are expected in the future.

Once the historic predicted estimates and the forecast estimates, for the Rate M2 and Banner Rate 10 industrial volumes are obtained, the actual predicted average use and the forecast NAC estimates are determined by dividing the total volume estimates by the number of industrial customers in each service class.

Note that the volume approach demand specification yields an equation whereby increases in the total number of customers increases the NAC estimate. This seemingly paradoxical result arises from the presence of the other variables in the equation and the large estimated constant value that is part of the equation. The equation infers that over the past new industrial customers were larger than the average customer.

11.4. Use Equations

The use equation approach is used to estimate NACs in the residential and commercial service & rate classes. See **[Appendix 11.4]** for Use Equation Coefficients.

11.4.1. Residential Rate M2 & 01

The residential use equation emerged out of a need to capture the impact that energy efficiency has on overall consumption. As described earlier, a residential trend variable that represents energy efficiency gains was included in the use equation.

The residential use equation is determined from 14 years of monthly reported consumption data starting in January 1990 and finishing in December 2003.

Since reported use per customer data is used in the regression analysis, this implies that all the past DSM plan related efficiency gains are included in this historic consumption data. The incorporation of an efficiency variable in the model causes DSM gains to be counted twice. In order to prevent this, cumulative audited DSM impacts since 1995 were obtained and then added back into the actual reported use per customer statistics.

The use equation for the residential market is defined by the relationship; total use per customer is a function of natural gas prices, residential energy efficiency trend and weather.

Use per Customer= ƒ {Natural Gas Prices, Residential Energy Efficiency, Weather}

Where:
- *Natural Gas Prices* are an average price that is representative of the economic forces driving energy demand
- *Energy Efficiency Trend*, captures the changing mix in appliance type and penetration
- *Weather* represents the total heating degree-day weather matrix for nine heating months.

11.4.2. Commercial Rate M2, 01 & 10

The use equation for the commercial market is similar to the use equation in the residential market as it defines use per customer is a function of natural gas prices, a trend variable representing the changing mix in commercial market segmentation and weather.

Use per Customer= ƒ {Natural Gas Prices, Commercial Segmentation Index, Weather}

Where:
- *Natural Gas Prices* are an average price that is representative of the economic forces driving energy demand
- *Segmentation Index*, captures the changing mix in commercial market segmentation and energy efficiency.
- *Weather* represents the total heating degree-day weather matrix for nine heating months

11.4.3. Industrial Rate M2 & 10.

No use equation is estimated for the light industrial rate class.

The application of a use equation approach for the industrial market is difficult as the energy demand forecaster is confronted with the presence of an increasing trend in the average consumption that does not appear to relate to economic conditions. This conclusion is based on various exploratory regression equations that were undertaken. Identifying the price variable in the use equation, specified as either a single natural gas price variable or as a relative price, was not found to be significant. The use equation approach yielded weaker statistical results (R Square, F and t tests, MAPE) compared to the volume equation approach and therefore this use equation approach was not pursued any further.

12. DSM & Marketing Plan NAC Impacts:

The econometric demand equations do not take account of the incremental impact on total throughput of new Demand Side Management (DSM) and marketing plan programmes. Being new programmes, the actual customer consumption statistics do not reflect these programmes.

New DSM programmes lower total throughput by encouraging increased energy efficiency. New marketing plans encourage customers to consider clean natural gas energy instead of other energy types; these marketing plans marginally increase total throughput.

The Channel Management department provides the total volume estimates associated with these new DSM and marketing programmes. These annual volumes for the pertinent service class are cumulated over the multi-year forecast horizon and then divided by the forecasted total average number of customers in the service class to yield the incremental NAC impact. These are shown in **[Appendix 12].**

A small water heating energy efficiency related impact is also recognized. New water heater standards support this adjustment.

The volume impact of previous DSM plans were taken into account in the estimation of the demand equations following the use equation approach as described earlier in the econometric NAC Forecast Estimates section.

13. Total NAC Forecast

The two tables below summarize the preparation of the NAC Forecast and show the forecast estimates. The first table indicates the process:

NAC Forecast = Econometric Forecast + DSM & Marketing Plan NAC Impacts + Other Adjustments

NAC ESTIMATES & ADJUSTMENTS

YEAR 2004	Res M2	Res 01	Comm M2	Comm 01	Comm 10	Ind M2	Ind 10
Use Equation NAC Estimate (1)	2,748	2763	18,153	8,751	102,625		
Historic DSM NAC Impact	-70	-72	-701	-364	-3,806		
Use NAC Estimate (A)	2,678	2,691	17,452	8,387	98,819		
Volume Equation NAC Estimate (B)	2,646	2,748	17,715	9,215	99,101	85,797	261,926
Average of A & B	2,662	2,720	17,584	8,801	98,960	85,801	261,931
Marketing Plan NAC Impact	12	12	112	112	112		
DSM NAC Impact	-2	-2	-67	-25	-265	-332	-774
Water Heater Standards Eff	-2	-2					
NAC	2,669	2,728	17,629	8,888	98,807	85,469	261,157
FINAL NAC Forecast Estimate	**2,670**	**2,728**	**17,629**	**8,888**	**98,807**	**85,469**	**261,157**

The following table indicates the final annual NAC forecast estimates developed by the forecast methodology and process. Charted illustrations of the NAC forecast are presented in the table below.

BUDGET 2005: TOTAL NAC FORECAST: m3

	Residential Customers		Commercial Customers				Industrial Customers	
	Rate M2	Rate 01	Rate M2	Tobacco M2	Rate 01	Rate 10	Rate M2	Rate 10
2003	2,700	2,819	17,877		9,412	98,675	88,884	282,671
2004	2,669	2,728	17,629	29,895	8,888	98,807	85,469	261,157
2005	2,627	2,677	17,290	29,895	8,647	97,355	88,054	303,146
2006	2,594	2,635	16,972	29,895	8,435	96,125	88,448	299,766
2007	2,570	2,602	16,796	29,895	8,293	95,554	89,165	297,211

14. Direct Purchase Market Estimates:

The direct purchase (DP) market includes customers served by the following delivery service options (DSO): ABC-T service, bundled T service and the new unbundled service option.

The demand forecast estimates for this market are based on two key determinants:

1) The total number of customers by service and rate class for each direct purchase service option is set by the total number reported at a specified time. For the 2005 Demand Forecast the total count at March 2004 set the total direct purchase customer levels. Total customers by direct purchase service option are held constant over the forecast horizon, except for one situation. The total number of ABCT customers decreases by the number of unbundled service customers when that service offering commences, e.g. May 2004. Total unbundled customers remain constant over the forecast period. The assumed constant level of direct purchase customers recognizes the difficult challenge and uncertainty related to forecasting the market share held by direct purchase service suppliers.

2) The NAC forecast estimates for each DP service & rate class is related to the all DSO or aggregate NAC estimates. These aggregate NACs indicate the average consumption of all customers regardless of delivery service option being used. A historic ratio relates the DP NACs to the aggregate NACs. These ratios are based on the most current historic relationship between the aggregate and the DP NACs based on customer billing information and DP customer information as provided by Customer Fulfillment Support Services. In general, the residential ratios are close to one, whereas the commercial and industrial DP NAC ratios show a notable difference between the aggregate NAC and DP NACs.

The northern region is obtained by a residual calculation from the northern rate 01 &10 franchise area after the five other regions have been estimated based on historic volume market share percentages. This provides a reconciliation feature for the very detailed regional volume forecast calculation.

The product of forecast DP customer and NAC estimates derives the DP total demand forecast. The subtraction of the DP customers and total throughput volumes from the aggregate All DSO customer and total throughput volumes forecast yields the system sales forecast of customers and total throughput volumes.

15. Total Throughput Volumes Forecast:

The total throughput volumes forecast is the product of the service class customer and NAC estimates for each month, rate class, delivery service option and region that has been described above. Annual consumption estimates are summations of the monthly estimates.

The total throughput volumes forecasts provide the base gas supply planning information as the throughput forecast identifies total monthly demand by delivery service option for both northern and southern franchise regions; the northern franchise can further be subdivided into six regions that indicate TCPL toll zones and specific single supply source situations, e.g. Sault Sainte Marie.

16. Differences in methodology from Budget 2004 filed Evidence:

The Budget 2005 Demand Forecast methodology very closely follows that of the Budget 2004 Demand Forecast filed evidence. The only notable differences are outlined below:

- All the models in each of the rate classes have been updated to reflect an additional one year of data.
- Some of the assumptions previously used in the Total Throughput Volumes Industrial Model have been replaced with variables which are more significant and far more reflective of the actual relationship. The previous equation was defined by the relationship: *Volumes= ƒ {Number of Customers, Gas Prices, Heavy Fuel Oil Prices, Weather, Efficiency Trend}.*
- The NAC Reasonability Test is no longer a part of the methodology in determining the Budget 2005 Demand Forecast.

16.1. NAC Reasonability Test As Used in Budget 2004

16.1.1. NAC Reasonability Test

The January to March period represents a significant portion of the total annual consumption, almost half of the annual consumption in certain rate-service classes. The table below shows these proportions for each service and rate class. Examining the trends present in the historic proportions as well as the past 5-year average provides an analytical tool, or a ***"NAC Reasonability Test",*** to estimate in a simple fashion the total annual NAC estimates for the bridge year. High and low range estimates can be obtained by using the standard deviations present in the data for each proportion. Dividing the observed total January to March NAC by the trend proportion yields a simple statistical estimate of the total annual NAC for the bridge year.

16.1.2. How the Reasonability Test is used

The annual NAC estimates obtained from the NAC Gauge can be used to assess the NAC estimates obtained from the sum of the econometric analysis and the marketing plan NAC impact assessments. The econometric analysis is a robust statistical analysis that incorporates weather, energy efficiency and price related factors. The marketing plan NAC impacts build into the NAC forecast the expected consumption gains arising from marketing initiatives aimed at specific market segments or growth gas application opportunities. The marketing plan impacts are the first year impacts that cumulate over time. The NAC Gauge also provides a quick check on the current budget year NAC estimates.

The table below shows the January to March NAC proportions for each of the rate and service classes. This table was used to prepare the 2004 energy demand forecast. The bridge-year for this forecast is the year 2003. Note that the trend and past five-year average proportions are very close in most cases. Also note that the standard deviations of the proportions are generally similar in magnitude to the standard errors that are obtained from the econometric estimation and analysis.

The January to March trend and range proportions were applied to sum of the reported January and March 2003 NAC levels in order to derive the trend and range total NAC estimates shown in the table. All the NAC's were weather normalized using the 2004 declining trend weather normal. This illustrates the NAC Reasonability Test concept.

JANUARY TO MARCH NAC as % of TOTAL ANNUAL NAC TABLE

Year	Res M2	Res 01	Comm M2	Comm 01	Comm 10	Ind M2	Ind 10
1991	46.0%	44.7%	45.8%	46.7%	42.8%	41.0%	37.2%
1992	45.9%	44.6%	44.9%	47.1%	43.3%	42.2%	38.5%
1993	46.3%	45.4%	45.6%	47.8%	44.0%	40.5%	38.4%
1994	46.6%	45.5%	45.2%	48.1%	42.7%	41.9%	37.6%
1995	45.8%	45.3%	45.1%	47.2%	44.3%	40.6%	37.4%
1996	45.7%	44.8%	44.6%	46.9%	43.3%	41.5%	36.9%
1997	46.8%	46.8%	45.3%	46.9%	44.2%	42.4%	42.8%
1998	47.1%	48.4%	45.1%	51.2%	46.8%	40.1%	48.0%
1999	46.7%	45.0%	45.9%	46.9%	46.0%	40.5%	41.2%
2000	45.9%	43.9%	50.0%	44.9%	44.3%	41.9%	40.0%
2001	46.9%	45.7%	43.9%	49.0%	44.1%	41.9%	34.8%
2002	46.7%	46.1%	45.1%	49.1%	45.9%	39.4%	40.5%
past 5 Years	46.7%	45.8%	46.0%	48.2%	45.4%	40.8%	40.9%
Trend	**46.8%**	**46.0%**	**45.8%**	**48.4%**	**46.3%**	**40.8%**	**40.7%**
past 5: Trend	*99.7%*	*99.6%*	*100.4%*	*99.6%*	*98.2%*	*100.0%*	*100.5%*
Low Trend	46.3%	44.8%	44.3%	46.8%	45.0%	39.8%	37.2%
High Trend	47.3%	47.2%	47.3%	50.0%	47.5%	41.7%	44.1%
Std. Dev.	0.5%	1.2%	1.5%	1.6%	1.3%	0.9%	*3.5%*
As % of Trend	*1.1%*	*2.6%*	*3.3%*	*3.3%*	*2.7%*	*2.3%*	*8.5%*
Jan-March NAC	1,207	1,270	7,756	4,461	41,298	35,485	111,326

Estimated Annual NAC: m3 per Customer

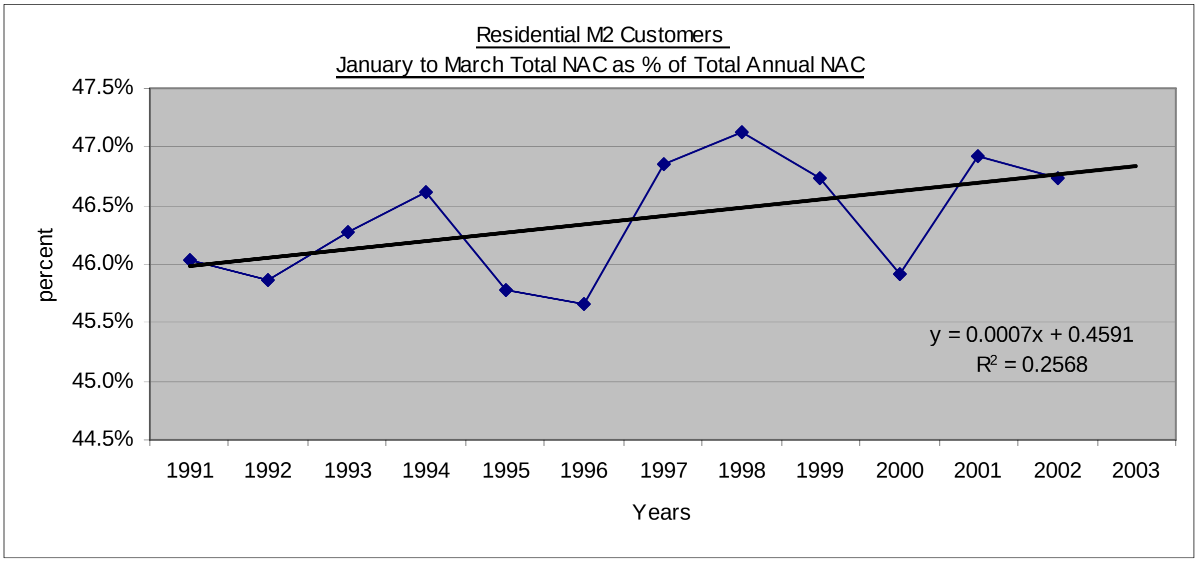
	Res M2	Res 01	Comm M2	Comm 01	Comm 10	Ind M2	Ind 10
Trend Estimate	2,578	2,760	16,934	9,217	89,293	87,079	273,589
Upper Range	2,607	2,834	17,514	9,534	91,825	89,142	299,001
Lower Range	2,551	2,690	16,392	8,920	86,898	85,109	252,158
Budget 2003	2,608	2,679	17,107	9,145	100,476	82,213	223,860

Preliminary NAC Estimates (First Draft Estimates)

	Res M2	Res 01	Comm M2	Comm 01	Comm 10	Ind M2	Ind 10
Econometric Estimate	2,611	2,710	17,394	9,071	95,348	87,129	291,335
DSM Plan	-4	-11	-52	-19	-198	(244)	(486)
Plus Mkt Plan	14	14	22	15	138	7	27
Total NAC Prelim.	2,621	2,713	17,364	9,067	95,288	86,893	290,876
Reasonability Test Adjustment	*(14)*	-	-	-	*(3,463)*	-	0
FINAL NAC Bridge Yr 2003	2,607	2,713	17,364	9,067	91,825	86,893	290,876

The NAC Reasonability Test suggests that the **Preliminary NAC** estimates for the year 2003 in the case of Residential Rate M2 & Commercial Rate 10 may be on the high side, when compared to the upper and lower limits as assigned by the reasonability tool. In this case, the relationship defined by the forecast equation is re-examined, the assumptions are checked and alternatives are examined. If all else fails then the suggested adjustment is made to the preliminary NAC estimates to line it up with the limit that it is closest to. This is done solely to ensure that the size of the reasonability adjustment is kept to a minimum. As in the case of the Residential Rate M2, a preliminary NAC estimate of 2,621 m*3 is deemed to be too high since it is outside of the band, i.e. the Upper & Lower limits of the Reasonability Test. Since the closest limit is the Upper limit, the preliminary estimates are lowered by 14 m*3 to 2,607 m*3. This adjustment is then made to all the years in the forecast horizon. Interestingly, the Actual 2003 Year NAC came in at 2,601 m*3.

The chart below further illustrates the January to March NAC proportions. The proportions for residential rate M2 customers are presented. The trend line shows how the proportions are changing over time. An increasing proportion indicates that base load is being lost over time. Loss of base load can result from various factors: replacement of pilot lights in new and replacement furnaces and water heaters with electronic ignition systems will lower the base load energy requirement, increased energy efficiency in furnaces and dwelling construction, and customer behaviour.



The NAC Reasonability Test is a very useful tool in the forecaster's toolkit. This tool relies on accurate and sound reported customer statistics for it to be valuable.

17. Appendices

ACTUAL HEATING DEGREE-DAYS: SOUTH RATE M2 & NORTH RATES 01& 10

HISTORICAL HEATING DEGREE DAYS - UNION SOUTH

Year	Jan	Feb	Mar	Apr	May	Non Heating Summer Months Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Htg. Deg.Days
1969	733.9	639.1	593.8	215.9	181.3	74.3	10.5	10.1	88.4	272.1	443.9	701.2	3,964.5
1970	812.9	660.9	621.7	312.7	136.2	41.2	5.6	8.0	73.8	200.1	409.6	659.5	3,942.2
1971	794.9	624.3	625.9	381.4	181.7	27.1	11.6	20.0	61.0	145.0	447.2	564.2	3,884.3
1972	724.7	722.5	643.1	416.5	128.2	80.4	23.5	24.7	79.3	335.4	486.8	616.9	4,282.0
1973	669.4	693.8	434.5	326.9	205.0	13.7	5.3	9.6	97.1	196.9	419.2	666.6	3,738.0
1974	701.5	697.8	567.4	313.0	224.4	41.8	6.8	4.9	127.5	308.7	430.2	611.9	4,035.9
1975	649.5	602.7	622.5	439.8	94.0	30.0	8.2	14.7	137.1	235.3	326.7	660.6	3,821.1
1976	827.4	573.3	499.3	307.6	205.3	19.5	8.8	30.4	114.5	344.9	545.2	779.5	4,255.7
1977	924.1	664.2	471.6	294.7	112.3	62.1	7.4	32.5	71.2	284.5	413.1	676.2	4,013.9
1978	814.7	802.0	677.1	384.4	165.8	55.6	16.6	5.6	83.8	290.9	440.2	633.3	4,370.0
1979	806.2	797.2	498.3	375.6	195.9	52.1	12.7	24.3	90.6	285.9	423.7	580.5	4,143.0
1980	714.2	735.0	612.1	346.4	136.6	86.4	4.4	1.3	90.4	339.2	474.7	724.2	4,264.9
1981	829.0	572.3	542.5	305.9	186.8	28.9	7.7	9.7	115.4	333.4	422.7	643.8	3,998.1
1982	846.4	711.7	600.2	397.9	85.5	67.6	5.1	41.6	102.7	238.1	407.5	506.6	4,010.9
1983	663.2	566.7	513.3	364.6	228.6	47.2	7.9	5.6	78.6	257.6	417.8	757.0	3,908.1
1984	836.3	553.0	683.1	322.6	228.8	22.8	12.5	10.5	117.4	207.8	442.2	560.2	3,997.2
1985	793.4	667.1	523.0	279.2	126.4	62.1	7.8	12.4	79.9	239.8	413.1	722.0	3,926.2
1986	723.7	665.4	527.6	299.7	126.1	52.6	9.3	37.2	87.1	259.9	490.5	602.7	3,881.8
1987	706.6	633.7	492.4	282.0	130.9	24.4	5.3	26.2	70.0	338.6	407.3	566.2	3,683.6
1988	720.0	702.5	559.7	339.5	126.8	53.1	2.9	14.8	86.2	343.7	397.1	640.1	3,986.4
1989	613.5	679.2	581.3	382.0	168.0	35.1	3.1	17.0	101.4	251.8	472.3	849.2	4,153.9
1990	583.4	586.1	502.5	303.0	195.3	39.0	6.2	8.0	98.9	269.4	393.6	586.1	3,571.5
1991	735.0	561.8	497.9	276.4	100.8	16.6	4.3	5.4	118.2	230.2	468.9	615.7	3,631.2
1992	676.5	622.6	574.6	376.2	168.1	72.3	26.8	40.7	109.2	314.5	447.0	602.2	4,030.7
1993	665.8	714.9	619.2	343.0	167.1	50.3	2.4	9.4	143.0	304.5	448.1	637.2	4,104.9
1994	905.8	729.9	578.2	318.0	205.5	38.1	4.1	27.1	81.1	238.4	369.4	559.2	4,054.8
1995	646.7	695.7	499.1	403.2	152.1	21.0	11.0	2.4	116.2	217.2	514.1	708.3	3,987.0
1996	757.8	683.1	650.5	393.4	201.0	20.5	11.3	2.8	79.6	258.0	517.8	576.7	4,152.5
1997	743.0	572.5	558.7	371.2	265.8	29.5	13.8	26.7	84.3	263.6	480.8	595.2	4,005.1
1998	608.1	504.9	492.5	289.3	68.0	59.4	1.5	6.2	44.5	225.9	393.8	530.6	3,224.7
1999	761.5	545.7	565.3	300.7	105.3	36.1	2.0	12.9	67.1	281.5	371.7	591.2	3,641.0
2000	734.5	603.2	422.2	343.0	134.0	33.7	12.6	19.4	111.3	217.2	440.4	804.9	3,876.5
2001	680.0	587.7	574.1	276.8	119.4	35.8	12.5	2.0	95.1	236.4	321.2	525.70	3,466.7
2002	577.5	537.8	540.1	319.2	218.3	35.8	0.5	3.4	28.5	294.7	445.2	634.6	3,635.6
2003	799.3	691.8	557.4	358.1	184.8	47.1	4.7	4.9	70.0	279.6	384.8	575.0	3,957.5

HISTORICAL HEATING DEGREE DAYS - UNION NORTH

Year	Jan	Feb	Mar	Apr	May	Non Heating Summer Months Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1969	895.5	747.8	746.7	275.3	282.1	150.2	39.3	25.7	169.5	392.0	553.5	842.9	5,120.5
1970	1,026.9	868.8	750.0	439.6	287.3	92.7	26.2	48.0	159.5	294.1	540.2	881.0	5,414.3
1971	1,023.9	802.8	764.9	469.8	270.4	75.2	54.1	77.5	125.2	241.3	575.8	793.2	5,274.1
1972	950.2	914.6	813.7	514.5	196.6	118.0	48.5	74.8	196.8	430.2	591.7	892.2	5,741.8
1973	855.9	846.6	541.6	422.3	270.7	77.6	26.2	20.5	188.1	276.2	564.7	850.6	4,941.0
1974	947.9	888.9	759.0	453.2	316.1	86.7	25.8	46.7	237.1	413.2	543.4	727.9	5,445.9
1975	871.3	763.5	764.9	524.7	151.2	71.7	26.4	46.1	206.4	324.5	509.0	874.3	5,134.0
1976	1,029.4	765.2	738.2	395.8	272.1	46.6	34.0	61.7	199.8	431.3	650.9	1,018.3	5,643.3
1977	1,054.6	786.4	588.2	407.3	165.3	119.6	38.4	98.8	170.9	367.0	533.7	857.9	5,188.1
1978	1,006.5	876.8	780.3	498.1	191.6	130.4	48.4	56.0	192.6	385.3	601.9	871.6	5,639.5
1979	1,008.5	967.7	667.8	465.0	261.6	107.0	34.4	83.1	177.1	395.4	546.1	744.2	5,457.9
1980	906.7	895.9	744.5	404.2	196.6	153.2	25.8	27.7	207.4	443.0	594.2	959.5	5,558.7
1981	994.7	693.9	641.0	420.9	255.0	102.9	27.0	30.3	203.4	420.2	522.7	780.3	5,092.3
1982	1,118.7	839.5	732.0	515.5	163.2	143.2	33.1	103.0	180.4	322.1	555.6	723.4	5,429.7
1983	876.3	726.1	663.8	465.1	318.6	93.9	22.1	21.1	136.4	356.8	552.6	962.5	5,195.3
1984	1,027.0	670.3	799.2	356.0	295.8	89.6	35.2	35.9	207.6	311.1	553.6	793.4	5,174.7
1985	994.5	815.9	672.4	428.3	225.4	137.4	51.7	64.7	156.0	342.5	614.6	934.4	5,437.8
1986	947.1	815.2	670.7	363.0	191.8	131.7	37.0	76.8	197.5	384.1	630.0	730.3	5,175.2
1987	846.3	741.0	619.2	322.4	218.1	69.5	28.1	61.5	135.3	417.3	550.2	713.5	4,722.4
1988	933.8	903.7	728.0	426.7	191.5	100.0	15.9	51.6	165.5	422.4	514.3	863.3	5,316.7
1989	855.2	874.2	798.9	481.5	208.6	104.6	21.9	64.7	159.0	348.0	658.7	1,078.9	5,654.2
1990	780.2	785.1	662.4	410.4	273.6	95.5	33.8	46.8	185.7	386.4	527.4	806.5	4,993.8
1991	972.1	733.0	667.0	371.0	176.4	52.7	30.7	38.1	200.9	368.6	586.3	821.7	5,018.5
1992	905.5	811.0	766.3	479.6	231.8	135.5	92.8	93.7	181.2	411.1	591.9	788.5	5,488.9
1993	903.8	887.6	704.0	450.8	254.8	110.0	22.6	33.8	235.8	431.7	621.5	803.9	5,460.3
1994	1,180.2	902.6	674.8	463.0	258.1	75.1	32.8	82.3	136.0	305.9	502.9	679.9	5,293.6
1995	831.7	861.6	642.8	516.2	237.5	59.5	32.1	29.1	210.4	329.4	701.9	905.6	5,357.8
1996	1,015.5	874.6	792.6	525.5	293.5	67.4	50.4	39.4	130.3	366.3	633.5	761.0	5,550.0
1997	987.3	798.9	764.3	466.6	336.6	51.1	47.3	77.3	154.1	363.3	594.5	742.8	5,384.1
1998	852.2	610.2	646.3	360.9	141.0	87.4	23.5	29.3	130.9	326.9	517.3	731.5	4,457.4
1999	956.3	686.7	676.6	382.5	165.3	64.1	16.1	58.4	134.1	389.2	482.3	742.4	4,754.0
2000	946.2	744.7	554.6	441.4	217.9	117.3	45.7	51.1	193.3	332.0	542.1	971.9	5,158.2
2001	827.9	790.4	679.3	383.9	172.7	69.9	43.0	27.7	155.4	337.2	449.8	654.5	4,591.8
2002	782.8	706.2	746.0	447.0	299.0	83.5	14.1	28.7	99.3	440.4	611.5	738.0	4,996.5
2003	978.9	869.3	717.9	487.5	199.9	74.5	24.7	27.1	120.4	368.5	519.3	723.2	5,111.2

2005 Budget Demand Forecast Weather Normal
OEB 70:30 BLENDED Weather Normal

Blend	Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
Union South Heating Degree Days below 18 C														
70:30	2004	721.5	653.7	547.1	331.1	158.6	41.2	7.8	14.9	91.2	267.8	426.5	625.8	3,887.4
70:30	2005	720.9	630.5	546.6	330.8	158.5	41.2	7.8	14.9	91.1	267.6	426.1	625.2	3,861.2
60:40	2006	715.3	625.9	543.6	328.3	157.5	40.7	7.7	14.7	90.2	265.4	424.1	621.1	3,834.6
60:40	2007	714.4	625.1	542.9	327.9	157.3	40.7	7.7	14.7	90.1	265.1	423.5	620.3	3,829.8
Union North Heating Degree Days below 18 C														
70:30	2004	928.6	819.8	694.3	428.6	226.5	91.7	34.1	51.8	169.6	369.5	561.4	802.8	5,178.7
70:30	2005	927.6	790.7	693.6	428.2	226.3	91.6	34.0	51.8	169.4	369.1	560.8	801.9	5,145.0
60:40	2006	920.6	785.5	689.8	424.6	225.0	90.6	34.0	51.3	167.9	366.7	557.9	795.8	5,109.6
60:40	2007	919.3	784.4	688.8	424.0	224.6	90.5	34.0	51.2	167.7	366.2	557.1	794.7	5,102.4

ECONOMIC OUTLOOK - 2005 Demand Forecast
Canada & U.S.A.

Economic Indicator	Actual 2002	Outlook 2003	Outlook 2004	Outlook 2005	Outlook 2006
U.S. Real GDP Ann. Growth Rate: % p.a.	2.4	3.1	4.9	4.3	
U.S. Light Vehicle Production: million units	16.7	16.5	16.8	16.7	
Canada Real GDP Ann. Growth Rate: % p.a.	3.3	1.6	2.8	3.1	2.8
Manufacturing GDP Ann. Growth Rate: % p.a.	2.6	-0.6	2.4	3.1	2.4
Machinery & Equipment Prices: % p.a.	-2.5	-9.8	-6.4	-5.4	-3.1
Machinery & Equipment Cap. Ex.: % p.a	-3.2	4.3	7.8	7.3	8.8
Total Housing Starts Canada: 000's	205.7	220.6	216.2	196.6	163.5
Canadian Unemployment Rate: %	7.6	7.6	7.6	7.5	7.7
Canadian Consumer Price Index: % p.a.	2.2	2.8	0.9	0.8	1.2
Canada USA Exchange Rate: U.S. $ in Cdn $	1.570	1.401	1.261	1.218	1.203
Canada 3-Month T Bills: %	2.59	2.9	2.33	2.53	3.39
GOC 10-Year Bonds: %	5.29	4.81	5.01	5.44	5.86
5-Year Mortgage Rates:%	7.02	6.29	5.45	5.51	6.34

source: Centre for Spatial Economics (C4SE) January 2004

Ontario Real GDP Growth by Industry
at 1997 chained dollars

Year	Total GDP	Goods Production	Auto Mfg	Service Sector
1998	4.9%	5.1%		4.7%
1999	7.6%	8.2%	20.8%	7.4%
2000	6.0%	7.4%	0.7%	5.3%
2001	1.3%	-2.8%	-9.4%	3.4%
2002	3.8%	3.5%	7.3%	4.0%
2003	1.4%	0.1%	0.8%	1.9%
2004	3.0%	2.9%	3.5%	3.1%
2005	3.3%	3.7%	4.1%	3.1%

	Residential Customers		Commercial Customers				Industrial Customers		Total
	Rate M2	Rate 01	Rate M2	Tobacco M2	Rate 01	Rate 10	Rate M2	Rate 10	Customers
NEW CUSTOMER ATTACHMENTS									
2004	20,953	4,476	1,681		411	46	123	9	27,699
2005	20,385	4,524	1,630		311	132	119	9	27,110
2006	19,321	4,397	1,543		377	42	112	8	25,800
2007	18,628	4,301	1,476		361	41	108	8	24,923
DEMOLITIONS / LOST CUSTOMERS / RATE MIGRATION & RECLASSIFICATION									
2004	-683	-17	-50	-30	18	-38	-95	-7	-902
2005	-533	-164	-52	-30	101	-122	-93	-7	-900
2006	-632	-69	-50	-30	12	-32	-85	-6	-892
2007	-622	-78	-49	-30	10	-31	-82	-6	-888
NET CUSTOMER YEAR END GROWTH									
2004	20,270	4,459	1,631	-30	429	8	28	2	26,797
2005	19,852	4,360	1,578	-30	412	10	26	2	26,210
2006	18,689	4,328	1,493	-30	389	10	27	2	24,908
2007	18,006	4,223	1,427	-30	371	10	26	2	24,035

2005 DEMAND FORECAST
TOTAL NUMBER OF CUSTOMERS

CUSTOMERS AT DECEMBER 2003

Residential Customers			Commercial Customers			Industrial Customers		TOTAL
Rate M2	Rate 01	Rate M2	Tobacco M2	Rate 01	Rate 10	Rate M2	Rate 10	CUSTOMERS
827,198	254,998	77,957	977	25,375	2,567	5,224	189	1,194,485

TOTAL CUSTOMERS - ALL DSO

		Residential Customers			Commercial Customers			Industrial Customers		TOTAL
	Month	Rate M2	Rate 01	Rate M2	Tobacco M2	Rate 01	Rate 10	Rate M2	Rate 10	CUSTOMERS
Forecast	Jan-04	829,241	255,711	78,894	977	25,405	2,567	5,225	189	1,198,210
Forecast	Feb-04	830,795	256,045	79,126	977	25,398	2,568	5,227	189	1,200,324
Forecast	Mar-04	831,916	256,164	79,413	977	25,452	2,568	5,228	189	1,201,908
Forecast	Apr-04	832,542	256,107	79,488	977	25,728	2,569	5,230	189	1,202,830
Forecast	May-04	832,862	255,788	79,521	977	25,904	2,569	5,232	190	1,203,044
Forecast	Jun-04	832,858	255,512	79,080	977	25,846	2,570	5,235	190	1,202,268
Forecast	Jul-04	832,825	255,332	78,840	977	25,522	2,571	5,238	190	1,201,494
Forecast	Aug-04	830,107	255,124	78,603	977	25,763	2,572	5,241	190	1,198,576
Forecast	Sep-04	835,736	255,280	78,452	947	25,739	2,573	5,244	190	1,204,161
Forecast	Oct-04	840,133	256,626	78,728	947	25,756	2,573	5,246	191	1,210,201
Forecast	Nov-04	844,859	258,315	79,314	947	25,785	2,574	5,249	191	1,217,234
Forecast	Dec-04	847,468	259,457	79,588	947	25,804	2,575	5,252	191	1,221,282
Forecast	Jan-05	849,469	260,154	80,495	947	25,833	2,576	5,253	191	1,224,917
Forecast	Feb-05	850,991	260,480	80,719	947	25,826	2,576	5,255	191	1,226,985
Forecast	Mar-05	852,089	260,597	80,997	947	25,878	2,577	5,256	191	1,228,532
Forecast	Apr-05	852,702	260,541	81,069	947	26,143	2,577	5,257	191	1,229,428
Forecast	May-05	853,016	260,230	81,101	947	26,312	2,578	5,260	192	1,229,635
Forecast	Jun-05	853,011	259,960	80,674	947	26,257	2,579	5,262	192	1,228,882
Forecast	Jul-05	852,979	259,783	80,442	947	25,945	2,580	5,265	192	1,228,133
Forecast	Aug-05	850,317	259,580	80,213	947	26,176	2,581	5,268	192	1,225,273
Forecast	Sep-05	855,830	259,733	80,067	917	26,154	2,582	5,270	192	1,230,745
Forecast	Oct-05	860,136	261,049	80,334	917	26,170	2,583	5,273	193	1,236,655
Forecast	Nov-05	864,765	262,700	80,901	917	26,198	2,584	5,275	193	1,243,533
Forecast	Dec-05	867,320	263,817	81,166	917	26,216	2,585	5,278	193	1,247,492
Forecast	Jan-06	869,204	264,509	82,024	917	26,243	2,586	5,279	193	1,250,954
Forecast	Feb-06	870,636	264,833	82,236	917	26,237	2,586	5,281	193	1,252,919
Forecast	Mar-06	871,670	264,949	82,499	917	26,286	2,587	5,282	193	1,254,383
Forecast	Apr-06	872,247	264,894	82,568	917	26,536	2,587	5,283	193	1,255,225
Forecast	May-06	872,543	264,584	82,597	917	26,696	2,588	5,286	194	1,255,405
Forecast	Jun-06	872,538	264,316	82,194	917	26,643	2,589	5,289	194	1,254,680
Forecast	Jul-06	872,508	264,141	81,974	917	26,349	2,590	5,292	194	1,253,965
Forecast	Aug-06	870,002	263,939	81,757	917	26,567	2,591	5,294	194	1,251,262
Forecast	Sep-06	875,192	264,091	81,619	887	26,546	2,592	5,297	194	1,256,419
Forecast	Oct-06	879,246	265,397	81,871	887	26,562	2,593	5,300	195	1,262,051
Forecast	Nov-06	883,604	267,036	82,408	887	26,588	2,594	5,302	195	1,268,614
Forecast	Dec-06	886,009	268,145	82,659	887	26,605	2,595	5,305	195	1,272,400
Forecast	Jan-07	887,824	268,820	83,479	887	26,631	2,596	5,306	195	1,275,738
Forecast	Feb-07	889,204	269,136	83,681	887	26,625	2,596	5,308	195	1,277,633
Forecast	Mar-07	890,200	269,249	83,933	887	26,672	2,597	5,309	195	1,279,042
Forecast	Apr-07	890,756	269,195	83,999	887	26,910	2,597	5,310	195	1,279,850
Forecast	May-07	891,041	268,893	84,027	887	27,063	2,598	5,313	196	1,280,017
Forecast	Jun-07	891,036	268,632	83,641	887	27,013	2,599	5,315	196	1,279,320
Forecast	Jul-07	891,007	268,461	83,431	887	26,732	2,600	5,318	196	1,278,633
Forecast	Aug-07	888,593	268,264	83,224	887	26,940	2,601	5,321	196	1,276,026
Forecast	Sep-07	893,593	268,412	83,092	857	26,920	2,602	5,323	196	1,280,996
Forecast	Oct-07	897,499	269,687	83,333	857	26,935	2,603	5,326	197	1,286,437
Forecast	Nov-07	901,698	271,286	83,846	857	26,960	2,604	5,328	197	1,292,776
Forecast	Dec-07	904,015	272,368	84,086	857	26,976	2,605	5,331	197	1,296,435
control chek									59,712,921	59,712,921

TOTAL CUSTOMERS - ALL DSO

	Residential Customers			Commercial Customers			Industrial Customers		TOTAL
Year	Rate M2	Rate 01	Rate M2	Tobacco M2	Rate 01	Rate 10	Rate M2	Rate 10	CUSTOMERS
No. of Customers at Year End December									
2003	827,198	254,998	77,957	977	25,375	2,567	5,224	189	1,194,485
2004	847,468	259,457	79,588	947	25,804	2,575	5,252	191	1,221,282
2005	867,320	263,817	81,166	917	26,216	2,585	5,278	193	1,247,492
2006	886,009	268,145	82,659	887	26,605	2,595	5,305	195	1,272,400
2007	904,015	272,368	84,086	857	26,976	2,605	5,331	197	1,296,435
Annual Increase in Number of Customers at December									
2004	20,270	4,459	1,631	- 30	429	8	28	2	26,797
2005	19,852	4,360	1,578	- 30	412	10	26	2	26,210
2006	18,689	4,328	1,493	- 30	389	10	27	2	24,908
2007	18,006	4,223	1,427	- 30	371	10	26	2	24,035
Average Annual No. of Customers									
2003	817,445	253,810	77,587	994	25,104	2,564	5,205	191	1,182,899
2004	835,112	256,288	79,087	967	25,675	2,571	5,237	190	1,205,128
2005	855,219	260,719	80,681	937	26,092	2,580	5,264	192	1,231,684
2006	874,617	265,069	82,201	907	26,488	2,590	5,291	194	1,257,356
2007	893,039	269,367	83,648	877	26,865	2,600	5,317	196	1,281,909

2003 Pull

Segment	Dwtp Code	Dwtp Code Desc
Colleges/Universities	CEDCU	EDUCATION COLLEGE/UNIVERSITY
	PBIEDC	EDUCATION COLLEGE/UNIVERSITY
Elementary/Secondary Schools & Daycares	CEDPS	EDUCATION PRIMARY/SECONDARY
	PBIEDP	EDUCATION PRIMARY/SECONDARY
	CDAYCA	PERMANENT DAY CARE CENTRE
	CDIDAY	PERMANENT DAY CARE CENTRE
Heath Services	CDIHOS	HOSPITAL FACILITY
	CHOSP	HOSPITAL FACILITY
	PCOR	PERMANENT CORRECTIONAL FACILITY
	CDIPSY	PERMANENT PSYCHIATRIC INSTITUTION
	PPSYC	PERMANENT PSYCHIATRIC INSTITUTION
	CDIHEA	SENIOR/NURSING/HEALTH CARE
	CHEAL	SENIOR/NURSING/HEALTH CARE
Hotel/Motel	CHOTMO	HOTEL/MOTEL
	CIHOTM	HOTEL/MOTEL
Multi-Residential	CIAPTB	APARTMENT BUILDING
	MAPTBG	APARTMENT BUILDING
	CICNDO	CONDOMINIUM BUILDING
	MCNDOB	CONDOMINIUM BUILDING
	CIFUNC	MULTI-FAMILTY OTHER
	MFUNCD	MULTI-FAMILY OTHER
	MROW	ROW/TOWNHOUSE COMPLEX
Office	CIOFFI	OFFICE BUILDING
	COFFIC	OFFICE BUILDING
	CIOFFU	OFFICE BUILDING UNIT
	COFFUN	OFFICE BUILDING UNIT
Other	CCOMM	COMMERCIAL OTHER
	CICOMM	COMMERCIAL OTHER
	CISPEC	COMMERCIAL SPECIAL
	CSPEC	COMMERCIAL SPECIAL
	CIINST	INSTITUTIONAL OTHER
	CINSTO	INSTITUTIONAL OTHER
Recreation	CARENA	ARENA
	PBIARE	ARENA
	CAUDI	AUDITORIUM
	PBIAUD	AUDITORIUM
	CPOOL	COMMERCIAL POOL
	CENTER	ENTERTAINMENT FACILITY
	PBICEN	ENTERTAINMENT FACILITY
	OPARK	PARK LAND
	CTHEAT	THEATRE
Religious	CREL	RELIGIOUS FACILITY
	PBIREL	RELIGIOUS FACILITY
Restuarants	CIREST	RESTAURANT / FOOD SERVICE
	CREST	RESTAURANT / FOOD SERVICE
Retail	CILAUN	COMMERCIAL LAUNDROMATS
	CLAUN	COMMERCIAL LAUNDROMATS
	CGSCW	GAS STATION / CAR WASH
	CIRET	RETAIL BUILDING
	CRET	RETAIL BUILDING
	CIRETP	RETAIL PLAZA
	CRETPL	RETAIL PLAZA
	CRETPU	RETAIL PLAZA UNIT
Warehouse/Wholesale	CIWARE	WAREHOUSE FACILITY
	CWARE	WAREHOUSE FACILITY

Assumptions used for growth, decay & vacancy

(percentage per year)

	Floorspace Growth rates	Floorspace Decay Rates	Vacancy Rates
Office	0.25%	0.10%	5.00%
Elementary/Secondary School	0.25%	0.10%	5.00%
Health Service	0.25%	0.10%	5.00%
Retail	0.25%	0.10%	5.00%
Warehouse/Wholesale	0.25%	0.10%	5.00%
College/University	0.25%	0.10%	5.00%
Restaurant	0.25%	0.10%	5.00%
Recreation	0.25%	0.10%	5.00%
Hotel/Motel	0.25%	0.10%	5.00%
Religious	0.25%	0.10%	5.00%
Multi-residential	0.25%	0.10%	2.70%
Other	0.25%	0.10%	5.00%

2005 to 2007 DEMAND FORECAST
VOLUME EQUATION
REGRESSION EQUATION COEFFICIENTS

	Residential		Commercial		
Demand Variable	**Rate M2**	**Rate 01**	**Rate M2**	**Rate 01**	**Rate 10**
Adjusted R Square	98.9%	98.4%	98.6%	99.0%	98.6%
F	1,033.63	617.71	837.50	1,017.28	769.02
MAPE	1.3%	1.0%	1.5%	1.8%	2.0%
INTERCEPT	-58,701.68	-16,820.76	-38,960.44	-2,121.44	-7,163.48
VOLUME LAGGED	0.09	0.12	0.06	-0.03	n/a
TOTAL CUSTOMERS	0.15	0.15	0.97	0.30	6.39
RETAIL GAS PRICE	-338.27	-13,437.33	-71.72	-1,281.48	-5,982.22
HDD January	375.87	94.89	241.42	40.18	35.84
HDD February	363.13	89.03	244.19	41.18	36.55
HDD March	358.68	80.79	242.50	38.78	36.20
HDD April	315.95	69.17	225.27	32.62	32.27
HDD May	254.74	53.92	185.58	23.11	21.83
HDD September	161.15	66.49	95.68	15.02	13.55
HDD October	267.84	72.47	191.56	28.52	32.51
HDD November	321.18	87.86	242.01	34.04	36.20
HDD December	375.73	88.15	247.11	37.78	35.44

	Industrial	
Demand Variable	**Merged**	**Rate M2**
Adjusted R Square	98.3%	99.7%
F	297.58	5,404.70
MAPE	1.8%	1.8%
INTERCEPT	-404,048.72	-10,864.16
HDD Q1	74.77	
HDD Q2	50.05	
HDD Q4	71.34	
GDP(CAN&US)	57.42	
GAS/LFO PRICE RATIO	-313,929.36	
CUSTOMERS	88.83	
Total Ind Vol M21016		0.84

t-statistics for key demand variables in Volume Equations

	Residential		Commercial		
Demand Variable	**Rate M2**	**Rate 01**	**Rate M2**	**Rate 01**	**Rate 10**
INTERCEPT	-7.28	-6.50	-5.15	-1.67	-2.67
VOLUME LAGGED	3.01	3.12	1.77	4.08	n/a
TOTAL CUSTOMERS	9.17	8.49	6.63	-0.63	4.73
RETAIL GAS PRICE	-1.82	-2.11	-0.57	-0.70	-2.71
HDD January	34.74	29.23	30.26	34.34	66.09
HDD February	24.60	18.79	23.31	24.98	58.16
HDD March	24.39	17.16	22.82	22.94	52.26
HDD April	15.02	11.53	14.09	14.63	29.65
HDD May	9.27	7.02	9.23	9.09	11.08
HDD September	4.26	7.83	3.56	5.61	4.66
HDD October	19.67	18.74	19.76	24.38	25.38
HDD November	36.30	31.47	36.81	36.49	41.71
HDD December	44.74	30.56	36.07	38.02	53.86

t-statistics for key demand variables in Volume Equations

	Industrial	
Demand Variable	**Merged**	**Rate M2**
INTERCEPT	-8.57	-8.35
HDD Q1	31.82	
HDD Q2	6.15	
HDD Q4	21.63	
GDP(CAN&US)	2.00	
GAS/LFO PRICE RATIO	-1.36	
Total Ind Vol M21016		103.85

Note: Industrial is a combination of Total Industrial

BASE YEAR

SECTOR	BASE YEAR EUI EXISTING			EUI - NEW STOCK		
	Space Heating	Water Heating	Other	Space Heating	Water Heating	Other
Office	2.23	0.15		2.007	0.135	0
Elementary/Secondary School	3	0.2		2.7	0.18	0
Health Service	3	1.1	0.5	2.7	0.99	0.45
Retail	2.1	0.15	0.1	1.89	0.135	0.09
Warehouse/Wholesale	1.4	0.1		1.26	0.09	0
College/University	2.8	0.4	0.5	2.52	0.36	0.45
Restaurant	2.5	1.4	1	2.25	1.26	0.9
Recreation	2.5	0.4		2.25	0.36	0
Hotel/Motel	1.9	0.5	0.2	1.71	0.45	0.18
Religious	2.1	0.4	0.0	1.89	0.36	0
Multi-residential	2.1	0.48	0.05	1.89	0.432	0.045
Other	2.6	0.4	0.5	2.34	0.36	0.45

SUMMARY OUTPUT: Consolidated Light Industrial Volume Equation Regression

Rates M2, 10 & 16

Regression Statistics	
Multiple R	99.3%
R Square	98.6%
Adjusted R Square	98.3%
Standard Error	8,733.4
Observations	32

ANOVA

	df	*SS*	*MS*	*F*	*Signif. F*	DW	
Regression	6	136,180,409,441.0	22,696,734,906.8	297.6	0.0	2.32	
Residual	25	1,906,799,919.6	76,271,996.8				
Total	31	138,087,209,360.6					

		No positive auto	Inconclusive negative auto
DW	2.32		
DW lwr		1.11	2.89
DW uppr		1.82	2.18

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-404,048.7	47,165.2	-8.6	0.0	-501,187.1	-306,910.3	-501,187.1	-306,910.3
HDD Q1	74.8	2.3	31.8	0.0	69.9	79.6	69.9	79.6
HDD Q2 (May & June)	50.1	8.1	6.2	0.0	33.3	66.8	33.3	66.8
HDD Q4	71.3	3.3	21.6	0.0	64.5	78.1	64.5	78.1
CAN-USA QTR - Qtr GDP	57.4	28.8	2.0	0.1	-1.8	116.7	-1.8	116.7
PM210LFO Ratio	-313,929.4	230,909.4	-1.4	0.2	-789,495.9	161,637.1	-789,495.9	161,637.1
Customers	88.8	8.4	10.6	0.0	71.6	106.1	71.6	106.1

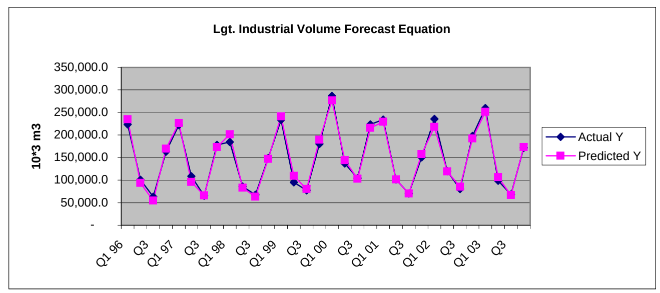
RESIDUAL OUTPUT

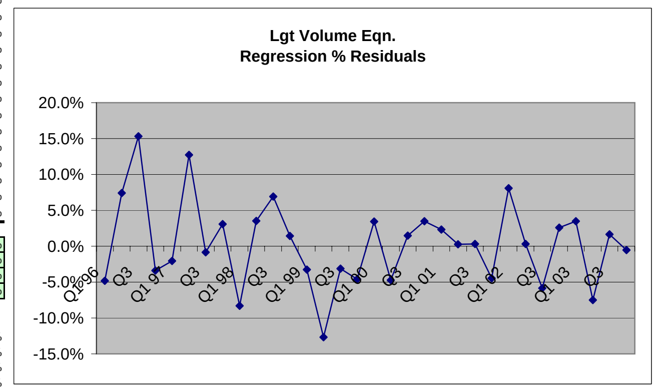
Observation	*Actual Y*	*Predicted Y*	*Residuals*	*%Resid.*	*Abs Resid.*	*% Abs Resid.*
Q1 96	223,754.5	235,105.1	-11,350.7	-4.8%	11,350.7	4.8%
Q2	100,896.4	93,940.9	6,955.4	7.4%	6,955.4	7.4%
Q3	62,862.0	54,513.1	8,348.8	15.3%	8,348.8	15.3%
Q4	163,601.1	169,350.1	-5,749.0	-3.4%	5,749.0	3.4%
Q1 97	221,998.8	226,617.1	-4,618.3	-2.0%	4,618.3	2.0%
Q2	108,299.9	96,085.7	12,214.2	12.7%	12,214.2	12.7%
Q3	65,165.0	65,709.3	-544.3	-0.8%	544.3	0.8%
Q4	178,467.7	173,130.6	5,337.1	3.1%	5,337.1	3.1%
Q1 98	184,749.7	201,487.3	-16,737.6	-8.3%	16,737.6	8.3%
Q2	86,208.3	83,279.0	2,929.3	3.5%	2,929.3	3.5%
Q3	67,604.4	63,223.9	4,380.5	6.9%	4,380.5	6.9%
Q4	149,282.6	147,151.7	2,131.0	1.4%	2,131.0	1.4%
Q1 99	233,795.4	241,634.1	-7,838.7	-3.2%	7,838.7	3.2%
Q2	95,187.5	108,996.4	-13,808.9	-12.7%	13,808.9	12.7%
Q3	77,670.8	80,171.2	-2,500.3	-3.1%	2,500.3	3.1%
Q4	180,677.7	189,376.6	-8,698.8	-4.6%	8,698.8	4.6%
Q1 00	286,682.2	277,110.0	9,572.2	3.5%	9,572.2	3.5%
Q2	137,266.4	144,100.9	-6,834.5	-4.7%	6,834.5	4.7%
Q3	104,407.2	102,906.7	1,500.5	1.5%	1,500.5	1.5%
Q4	223,343.4	215,796.0	7,547.5	3.5%	7,547.5	3.5%
Q1 01	234,424.2	229,066.0	5,358.1	2.3%	5,358.1	2.3%
Q2	101,656.3	101,399.1	257.2	0.3%	257.2	0.3%
Q3	70,387.3	70,177.0	210.3	0.3%	210.3	0.3%
Q4	150,537.0	157,600.1	-7,063.1	-4.5%	7,063.1	4.5%
Q1 02	235,876.8	218,215.3	17,661.5	8.1%	17,661.5	8.1%
Q2	119,849.1	119,489.6	359.5	0.3%	359.5	0.3%
Q3	80,363.4	85,352.2	-4,988.8	-5.8%	4,988.8	5.8%
Q4	197,741.1	192,713.0	5,028.1	2.6%	5,028.1	2.6%
Q1 03	259,728.1	250,970.9	8,757.2	3.5%	8,757.2	3.5%
Q2	98,734.5	106,717.6	-7,983.1	-7.5%	7,983.1	7.5%
Q3	68,189.3	67,080.4	1,108.9	1.7%	1,108.9	1.7%
Q4	172,154.4	173,095.3	-941.0	-0.5%	941.0	0.5%

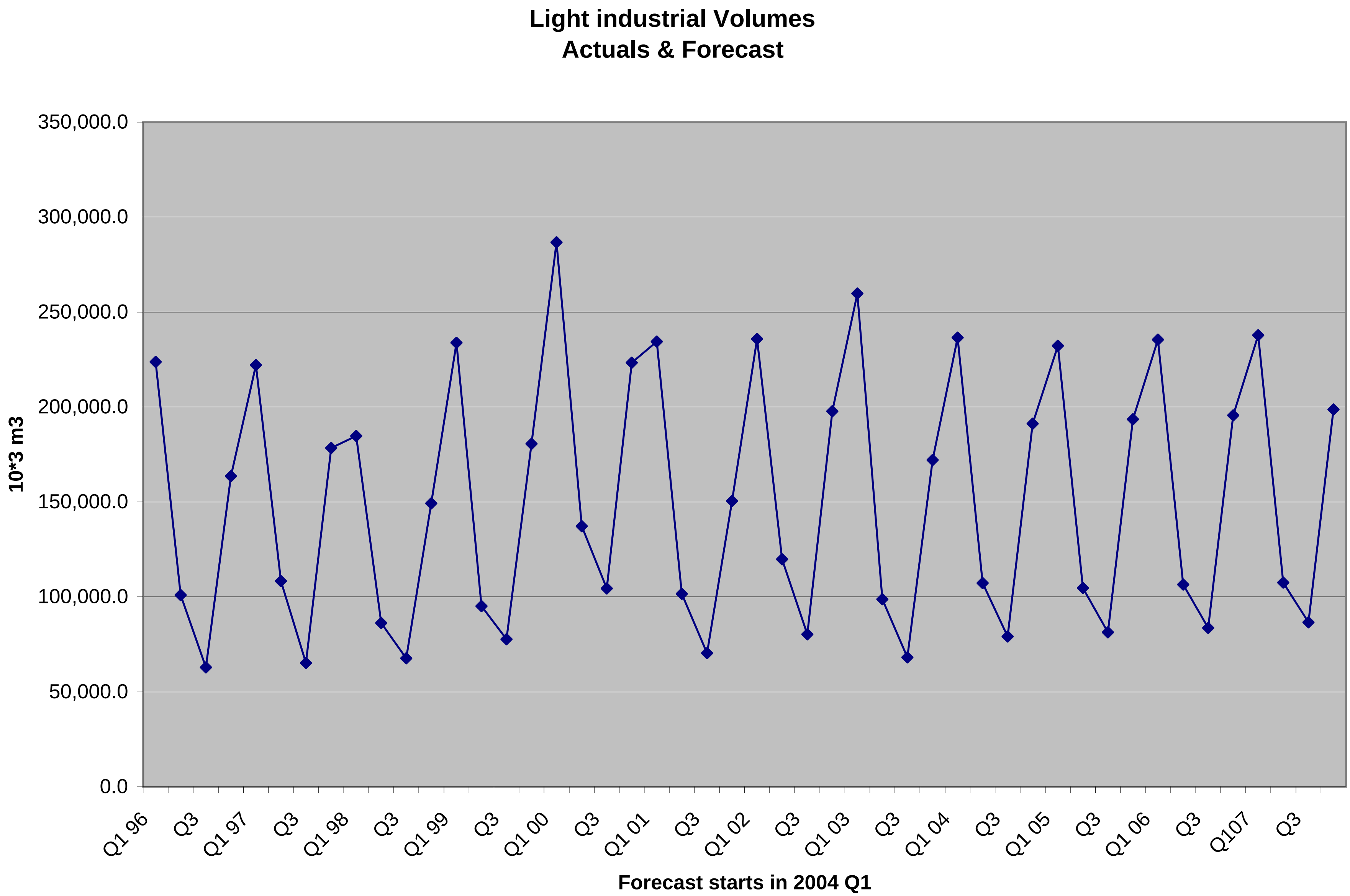
Q1	MAPE Q1	4.5%
Q2	MAPE Q2	6.1%
Q3	MAPE Q3	4.4%
Q4	MAPE Q4	3.0%

1996	551,113.9	552,909.3	-1,795.4	-0.3%	-0.3%	0.3%
1997	573,931.3	561,542.7	12,388.6	2.2%	2.2%	2.2%
1998	487,845.0	495,141.9	-7,296.9	-1.5%	-1.5%	1.5%
1999	587,331.4	620,178.2	-32,846.8	-5.3%	-5.3%	5.3%
2000	751,699.3	739,913.7	11,785.6	1.6%	1.6%	1.6%
2001	557,004.7	558,242.2	-1,237.5	-0.2%	-0.2%	0.2%
2002	633,830.4	615,770.1	18,060.3	2.9%	2.9%	2.9%
2003	598,806.3	597,864.3	942.0	0.2%	0.2%	0.2%
			MPE	-0.1%		
				MAPE	1.78%	

MPE - Mean Percent Error
MAPE - Mean Absolute Percent Error







Light industrial Volumes
Actuals & Forecast
350,000.0
300,000.0
250,000.0
200,000.0
150,000.0
100,000.0
50,000.0
0.0
10*3 m3
Q1 96
Q3
Q1 97
Q3
Q1 98
Q3
Q1 99
Q3
Q1 00
Q3
Q1 01
Q3
Q1 02
Q3
Q1 03
Q3
Q1 04
Q3
Q1 05
Q3
Q1 06
Q3
Q107
Q3
Forecast starts in 2004 Q1

LIGHT INDUSTRIAL VOLUME REGRESSION DATA (Rates M2, Banner and CIA 10 & 16)

		Rates M2 10 16 Total Volumes 10*3 m3	Weather Htg. Degree-Days 18C HDD Q1	HDD Q2	HDD Q4	Lagged 1 Qtr. North Am. GDP Qtr-Qtr Change 97 $ Billions	Natural Gas LFO Price Ratio	Total No. Customers
1996	Q1 96	223,754.5	2,239.2	0.0	0.0	60.3	0.0223	5,350
Act.	Q2	100,896.4	0.0	650.6	0.0	50.5	0.0233	5,289
Act.	Q3	62,862.0	0.0	0.0	0.0	130.8	0.0252	5,167
Act.	Q4	163,601.1	0.0	0.0	1,454.5	41.6	0.0199	5,330
1997	Q1 97	221,998.8	2,043.3	0.0	0.0	103.0	0.0252	5,402
Act.	Q2	108,299.9	0.0	678.6	0.0	87.4	0.0281	5,291
Act.	Q3	65,165.0	0.0	0.0	0.0	110.7	0.0301	5,323
Act.	Q4	178,467.7	0.0	0.0	1,429.8	94.6	0.0263	5,381
1998	Q1 98	184,749.7	1,731.3	0.0	0.0	51.5	0.0300	5,432
Act.	Q2	86,208.3	0.0	393.5	0.0	120.5	0.0369	5,317
Act.	Q3	67,604.4	0.0	0.0	0.0	42.6	0.0418	5,381
Act.	Q4	149,282.6	0.0	0.0	1,256.7	63.5	0.0367	5,285
1999	Q1 99	233,795.4	1,980.9	0.0	0.0	138.1	0.0384	5,648
Act.	Q2	95,187.5	0.0	441.5	0.0	84.8	0.0354	5,597
Act.	Q3	77,670.8	0.0	0.0	0.0	64.3	0.0318	5,522
Act.	Q4	180,677.7	0.0	0.0	1,334.0	116.0	0.0265	5,628
2000	Q1 00	286,682.2	1,881.3	0.0	0.0	168.1	0.0231	6,058
Act.	Q2	137,266.4	0.0	522.6	0.0	72.1	0.0260	5,922
Act.	Q3	104,407.2	0.0	0.0	0.0	102.0	0.0254	5,731
Act.	Q4	223,343.4	0.0	0.0	1,558.4	19.3	0.0232	5,796
2001	Q1 01	234,424.2	1,955.8	0.0	0.0	9.5	0.0307	5,583
Act.	Q2	101,656.3	0.0	436.3	0.0	- 14.2	0.0397	5,594
Act.	Q3	70,387.3	0.0	0.0	0.0	- 40.4	0.0452	5,524
Act.	Q4	150,537.0	0.0	0.0	1,172.9	- 10.4	0.0364	5,516
2002	Q1 02	235,876.8	1,800.3	0.0	0.0	51.2	0.0421	5,605
Act.	Q2	119,849.1	0.0	589.6	0.0	117.6	0.0302	5,592
Act.	Q3	80,363.4	0.0	0.0	0.0	114.1	0.0314	5,547
Act.	Q4	197,741.1	0.0	0.0	1,478.4	95.4	0.0284	5,569
2003	Q1 03	259,728.1	2,178.2	0.0	0.0	31.6	0.0258	5,611
Act.	Q2	98,734.5	0.0	579.0	0.0	64.8	0.0355	5,507
Act.	Q3	68,189.3	0.0	0.0	0.0	112.2	0.0470	5,397
Act.	Q4	172,154.4	0.0	0.0	1,332.6	226.3	0.0425	5,431

2005 to 2007 DEMAND FORECAST
USE EQUATION
REGRESSION EQUATION COEFFICIENTS

	Residential		Commercial			Industrial
Demand Variable	**Rate M2**	**Rate 01**	**Rate M2**	**Rate 01**	**Rate 10**	**Merged**
Adjusted R Square	99.7%	99.1%	99.0%	98.9%	98.6%	N/A
F	3,784.65	1,362.57	1,400.62	1,077.21	789.10	
MAPE	1.0%	1.6%	1.8%	2.7%	2.1%	
INTERCEPT	386.54	688.21	- 5,573.22	- 7,140.28	- 14,188.0	
EFFICIENCY	- 425.04	- 823.17	6,039.80	7,387.19	16,942.9	
GAS PRICE	- 0.48	- 41.50	n/a	- 261.89	- 1,979.9	
HDD January	0.64	0.52	3.82	1.87	16.63	
HDD February	0.63	0.51	3.93	1.91	16.98	
HDD March	0.62	0.47	3.89	1.80	16.89	
HDD April	0.59	0.43	3.78	1.54	15.51	
HDD May	0.52	0.37	3.11	1.19	11.52	
HDD September	0.31	0.35	1.08	0.90	7.89	
HDD October	0.44	0.38	2.87	1.48	15.69	
HDD November	0.52	0.46	3.70	1.64	16.89	
HDD December	0.60	0.47	3.81	1.77	16.41	
t-statistics for key demand variables in Use Equations						
	Residential		**Commercial**			**Industrial**
Demand Variable	**Rate M2**	**Rate 01**	**Rate M2**	**Rate 01**	**Rate 10**	**Merged**
INTERCEPT	7.34	7.27	- 4.53	- 9.06	- 1.32	N/A
EFFICIENCY	- 6.06	- 6.52	4.87	9.30	1.57	
GAS PRICE	- 4.26	- 2.09	n/a	- 1.13	- 2.25	
HDD January	117.76	68.28	86.34	38.91	54.96	
HDD February	102.35	58.24	77.49	34.69	48.82	
HDD March	89.01	45.73	66.89	28.20	41.66	
HDD April	52.89	27.59	39.20	15.08	24.84	
HDD May	24.16	12.69	17.12	6.38	10.16	
HDD September	7.96	8.41	3.26	3.29	4.64	
HDD October	30.12	19.74	23.83	11.97	20.75	
HDD November	60.94	37.97	50.91	20.94	34.65	
HDD December	99.19	53.11	74.50	31.51	44.38	

2005 Marketing Plan
TOTAL THROUGHPUT VOLUME IMPACT: 10*3 M3

	2004	2005	2006	2007
Residential Rate M2	10,099.2	10,344.6	13,836.0	14,170.0
Residential Rate 01	3,123.3	3,171.2	4,206.4	4,271.4
Total Residential	13,222.5	13,515.7	18,042.4	18,441.4
Commercial Rate M2	8,675.3	8,848.8	9,025.8	9,206.3
Commercial Rate 01	2,823.8	2,880.3	2,937.9	2,996.6
Commercial Rate 10	285.7	291.4	297.2	303.1
Total Commercial	11,784.8	12,020.4	12,260.9	12,506.1
Tot. Res. & Comm.	**25,007.2**	**25,536.2**	**30,303.2**	**30,947.4**

ESTIMATED ANNUAL NAC IMPACT: m3 / customer

	2004	2005	2006	2007
Residential M2 & 01	12	12	16	16
Commercial M2	112	112	111	111
Commercial 01	112	114	114	114
Commercial 10	111	114	115	117

2005 Cost of Service
DSM Plan Total Volumes: 10*3 m3

	2004	2005	2006	2007
	Residential Rate M2			
2004	1,658.5	3,317.0	3,317.0	3,317.0
2005		1,691.7	3,383.3	3,383.3
2006			1,725.5	3,451.0
Total	**1,658.5**	**5,008.7**	**8,425.8**	**10,151.3**
	Residential Rate 01			
2004	480.5	961.0	961.0	961.0
2005		490.1	980.2	980.2
2006			499.9	999.8
Total	**480.5**	**1,451.1**	**2,441.1**	**2,941.0**
	Commercial & Industrial Rate M2			
2004	6,992.5	13,985.0	13,985.0	13,985.0
2005		7,132.4	14,264.7	14,264.7
2006			7,275.0	14,550.0
Total	**6,992.5**	**21,117.4**	**35,524.7**	**42,799.7**
Commercial M2	5,249.5	15,853.6	26,669.7	32,131.3
Industrial M2	1,743.0	5,263.8	8,855.0	10,668.4
	Commercial Rate 01& 10 & Industrial Rate 10			
2004	1,458.0	2,917.0	2,917.0	2,917.0
2005		1,487.2	2,974.3	2,974.3
2006			1,516.9	3,033.8
Total	**1,458.0**	**4,404.2**	**7,408.2**	**8,925.1**
Commercial 01	628.9	1,899.6	3,195.3	3,849.6
Commercial 10	680.7	2,056.1	3,458.6	4,166.8
Industrial 10	148.4	448.4	754.3	908.7
Total DSM	**10,589.5**	**31,981.3**	**53,799.9**	**64,817.2**

2005 DSM PLAN EST. NAC IMPACT: m3 per customer

	2004	2005	2006	2007
Residential M2	- 2	- 6	- 18	- 21
Residential 01	- 2	- 6	- 31	- 34
Commercial M2	- 66	- 196	- 492	- 615
Commercial 01	- 24	- 73	- 156	- 203
Commercial 10	- 265	- 797	- 1,720	- 2,263
Industrial M2	- 332	- 991	- 2,464	- 3,110
Industrial 10	- 774	- 2,266	- 4,745	- 6,117