FLORIDA SOLAR ENERGY CENTER®

Creating Energy Independence

Developing Natural Gas Cost Escalation Rates for the Associated Gas Distributors of Florida

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Abstract

The Florida Solar Energy Center (FSEC) created a spreadsheet tool used to calculate the fuel escalation rates for electricity and natural gas for the previous 5-year and 10-year periods. These escalation rates are calculated at the local, State, and national level for both residential and commercial customers. The previous 5-year and 10-year general inflation rates as determined by the U.S. Department of Labor's Bureau of Labor Statistics consumer price index are also included. These calculations are made in accordance with rules established by the Florida Building Commission pursuant to rule 9B-13.0071 – Cost Effectiveness of Amendments to Energy Code.

The Associated Gas Distributors of Florida (AGDF) is currently performing economic analysis for several energy conservation programs for both residential and commercial customers. The inflation rates calculated using this spreadsheet tool will be used as inputs to the economic analysis for these energy conservation programs.

Introduction

The Florida Department of Community Affairs (DCA) through the Florida Building Commission has adopted rules for determining the cost effectiveness of products or programs used in the construction or operation of Florida buildings. One such rule is the method for measuring the cost-effectiveness assessment of a specific product or program. This rule states that any proposed amendments to the Florida Energy Efficiency Code for Building Construction shall demonstrate cost effectiveness by applying tests as outlined in an associated document entitled "The Cost Effectiveness Test for Amendments to the Florida Energy Efficiency Code for Building Construction".

A previous study[1], performed to assess the energy savings for various residential energy conservation measures, outlines the methodology used for economic assessments. This methodology was subsequently described in the aforementioned DCA document and adopted by reference on June 9, 2009 by the Florida Building Commission[2]. The DCA rule and governing Florida statue along with the cost effectiveness test document are presented in Appendix A and B for completeness.

This report describes the accepted methodology used for determining several key economic impact factors used for economic analysis. The methodology described here was used to develop a spreadsheet tool used for calculating the inflation rates of these economic impact factors.

Economic Impact Factors

In general, the life-cycle cost of a particular consumer product is based on the initial cost of the product, the operating and maintenance costs over the life of the product, and any salvage value

[1] "Energy Efficiency Cost-Effectiveness Tests for Residential Code Update Process," P. Fairey, R. Vieira, FSEC-CR-1794-09, February 27, 2009.

[2] 9B-13.0071: Cost Effectiveness of Amendments to Energy Code

recovered at the end of the product's expected life. The life expectancy of the product may be measured in months, years, or even decades. In order to predict the total life-cycle cost of a specific product, economic impact factors must be used to predict the future costs of operating and maintaining said product. Several key economic impact factors used in typical economic analysis include the general inflation rate and consumer price index, fuel escalation rates, and the monetary discount factor. These economic impact factors are described here.

Consumer Price Index

The U.S. Department of Labor's Bureau of Labor Statistics compiles monthly and annual statistics for changes in the prices of various goods and services[3]. These statistics are formally referred to as the Consumer Price Index (CPI). These statistics are compiled for many groups of goods and services as well as for multiple groups and service categories. Categories include foods, energy or fuels, household goods, and homes to name a few. One of these statistical measures is the cost of goods and services for all urban customers, known as CPI-U. The CPI-U is commonly used to represent the general inflation rate.

Discount Rate

The periodic compound interest rate at which a future cash flow is discounted back to the present value (PV) of money. The discount rate is also considered to be the interest rate charged to banks for borrowing short-term funds and would normally be considered to be 1.5% - 2% greater than the general inflation rate.

General Inflation Rate

The periodic rate increase in general consumer prices. The general inflation rate may be calculated using a base period where the reference cost is fixed in time or calculated using chained measurements where the reference cost changes over time. In this report, the general inflation rate will be considered analogous to the consumer price index for all urban consumers.

Fuel Escalation Rate

The periodic rate increase of energy. In this study, electricity and natural gas are the specific energy source. The energy cost is calculated as the revenue based cost of energy and may be calculated at the local, state, or federal level. The fuel escalation rate may also be adjusted for the general inflation rate in calculations which already include this economic impact factor.

Methodology for Determining Inflation Rates

Inflation rates describe the compounded annual increase or decrease in the price of a commodity or service over a period of time. The inflation rate can represent a change in price over the previous month or year, or the cumulative change in price over a number of months or years. The basis for the rate may be a fixed time (e.g., 1984), or represent a running time period (e.g., previous 5 years). With the various methods available for calculating the rate of inflation for specific products, a common

[3] United States Department of Labor – Bureau of Labor Statistics.

methodology must be used to provide uniformity in the analysis technique. The Florida Building Commission's adoption of the cost effectiveness test methodology prescribes a method to be used for determining inflation rates. Specifically, the inflation rate shall be the greater of the most recent 5-year and 10-year annual compound inflation rate.

The annual compound inflation rate is defined here as: $r_{inf} = \left(\frac{c_0}{c_n}\right)^{1/n} - 1$

where:

r_{inf} = rate of inflation
c_0 = cost of goods or service at the end of the previous year (year 0)
c_n = cost of goods or services at the end of previous year n

The future value of goods and services can then be calculated using the annual compound inflation rate. Rearranging the terms in the previous equation, the future value at year n of a product or service with a current cost of c_0 is:

$$FutureValue = c_0\left(1 + r_{inf}\right)^n$$

The rate of inflation is typically presented as a percentage where an inflation rate (r_{inf}) equal to the numerical value 0.035 would be presented as 3.5%.

Calculating Inflation Rates

An economic analysis begins by first determining the goal and assumptions of the analysis. These assumptions and goals would then dictate the source of the data used to determine inflation rates. For example, a national program to predict the average cost of purchasing and operating an automobile would use the average national cost of the vehicle and a fuel inflation rate based on the national average fuel costs. Similarly, if a local dealership were to conduct the same program, this local dealership may choose to use the local dealership's vehicle cost along with the local fuel inflation rates calculated from fuel prices collected in the general area. Both the vehicle cost and fuel inflation rate described in these examples would be calculated on a revenue per unit basis. If multiple sources of data are collected (e.g., all local area dealerships and gas stations), the number of customers is also required to calculate a customer-weighted average unit cost.

For this project, the Association of Gas Distributors of Florida wishes to determine the state-wide fuel inflation rates for use in their economic assessment of various appliance programs. In addition, the costs associated with the largest utility companies throughout Florida were to be analyzed. Information was gathered in a spreadsheet based tool to allow the calculation of inflation rates for 2008 and beyond.

The 3 key economic impact factors described here are:

- General Inflation Rate (CPI-U)
- Fuel Inflation Rate
- Discount Rate

General Inflation Rate calculation

The general inflation rate used for this project will be considered to be analogous to the national consumer price index as calculated by the U. S. Department of Labor's Bureau of Labor Statistics. The Bureau of Labor Statistics publishes historical prices for all urban consumers in 1983 dollars. Using the historical values for the previous 10 years, the 5-year and 10-year inflation rates can be calculated.

$$5-year;\ r_{inf} = \left(\frac{215.3}{184.0}\right)^{1/5} - 1 = 0.03192$$

$$10-year;\ r_{inf} = \left(\frac{215.3}{163.0}\right)^{1/10} - 1 = 0.02822$$

General Inflation Rate – CPI-U				
10-year	5-year	1998	2003	2008
2.82%	3.19%	163.0	184.0	215.3

The larger of the 5-year and 10-year inflation rate is used as the general inflation rate for economic calculations. For economic calculations performed in 2009, a value of 3.19% would be used.

Fuel Inflation Rate calculation

The energy prices used in this analysis reflect the costs of natural gas and electricity throughout the State of Florida. The energy prices for the four largest electric and natural gas utilities are also presented. In addition, the energy prices for the four utility companies will be averaged, based on the number of customers, and will be compared to the state-wide and national average energy cost. The energy costs are also a function of the rate schedule used by the utility and can vary widely for residential and commercial customers. In this project, the costs for both residential and commercial customers are examined.

The Florida Public Service Commission (FPSC) provides a summary of residential energy costs for both electricity and natural gas (Quick Search for Comparative Rate Statistics and scroll down). These statistical summaries were used to gather information for the past 10 years. For each utility company, the cost per unit energy along with the number of customers served by each utility were cataloged to allow averaging of utility data and comparison of this data with state and national averages. Using the previously described methodology, the 5-year and 10-year inflation rates were calculated.

The FPSC's comparative rate statistics provides the information required to determine the average energy cost for the four largest utility companies in the State of Florida. The four electric utilities and associated statistics for the residential sector, as presented by the FPSC, are summarized in Figure 1 below. The number of customers, total revenue, and average revenue per kWh sold are presented. These statistics are available for the previous 10 years.

Similarly, the four natural gas utilities and associated statistics for the residential sector, also presented by the FPSC, are summarized in Figure 2 below. The number of customers, total revenue, and average revenue per therm sold are presented.

Investor-Owned Electric Utilities
Growth and Use Statistics
December 31, 2008

UTILITY	RESIDENTIAL				ANNUAL REVENUES				
	Average Annual Consumption		Number of Customers		Residential			Total Retail Operating	
	kWh	Percent Increase	As of 12/31/2008	Percent Increase	Total Revenue	Percent Increase	Avg. Revenue per kWh Sold (cents)	Revenue	Percent Increase
Florida Power & Light Co.	13,333	-3.70%	3,992,262	0.30%	$6,216,864,898	-1.10%	11.68	$11,295,886,437	0.30%
Progress Energy Florida, Inc.	13,339	-3.34%	1,448,933	-2.00%	$2,273,649,802	-3.79%	11.76	$4,002,713,138	-3.28%
Tampa Electric Co.	14,545	-3.80%	586,611	-0.40%	$981,713,435	-3.60%	11.49	$2,021,557,803	-4.60%
Gulf Power Co.	14,274	-3.26%	373,595	0.15%	$562,922,559	2.67%	10.52	$1,080,601,719	5.10%

Figure 1. Investor-Owned Electric Utility Growth and Use Statistics for Residential Consumers

Investor-Owned Natural Gas Utilities
Growth and Use Statistics
December 31, 2008

UTILITY	RESIDENTIAL				ANNUAL REVENUES				
	Avg. Consumption		Number of Customers		Residential			Retail Operating	
	Total Therms	Percent Increase	As of 12/31/2008	Percent Increase	Total Revenues	Percent Increase	Revenue per Therm	Total Revenue	Percent Increase
Chesapeake Utilities Corporation	247.00	4.70%	13,401	-2.00%	$3,725,321	-1.23%	$1.127	$11,842,928	2.11%
Florida City Gas	174.00	1.00%	96,771	-84.00%	$40,401,683	13.00%	$2.400	$93,534,826	8.08%
Florida Public Utilities Company	252.16	-95.00%	47,078	68.00%	$23,675,370	10.00%	$1.996	$72,588,611	11.93%
Indiantown Gas Company	NR	NR	NR	NR	NR	NR	NR	NR	NR
Peoples Gas System	243.80	6.10%	304,111	-4.0%	$150,457,999	7.40%	$2.03	$680,919,753	14.82%
Sebring Gas System	122.50	-2.70%	414	-97%	$67,857	-4.26%	$1.45	$530,597	-52.28%
St. Joe Natural Gas Company	252.00	0.00%	3,097	8.20%	$1,413,274	40.03%	$2.02	$2,510,865	0.00%

Note: All revenues include gas costs. All data unaudited, preliminary, and subject to change.
NR=Not reported

Figure 2. Investor-Owned Natural Gas Utility Growth and Use Statistics for Residential Consumers

Also available from the FPSC are the annual reports from the utility companies. These annual reports were used to determine the commercial energy costs for the four largest electric and natural gas utility companies. Information gathered from the Federal Energy Regulatory Commission's FERC Financial Report FERC Form No. 1: Annual Report of the Major Electric Utilities, Licensees and Others and Supplemental Form 3-Q: Quarterly Financial Report (select Electric Companies and click Electric radio button and then View – Page 304) was used to determine the commercial electric fuel cost. Information gathered from the FPSC's Annual Report of Natural Gas Utilities (select Gas Companies and click Gas radio button and then View – Page 26) was used to determine commercial natural gas fuel cost.

The Energy Information Administration (EIA) is the official energy statistics agency of the U.S. government and publishes historical fuel cost data for residential and commercial consumers. This information is available for both electricity and natural gas and was used to determine the Florida State and U.S. national average fuel costs for both electric and natural gas.

Information from each of these sources was assembled into a spreadsheet tool and used for calculating economic impact factors. The spreadsheet tool used to calculate the energy cost inflation rate statistics is shown in Figure 3 for both residential and commercial consumers. Information is shown for years 1998 through 2008. Additional columns included in the tool, out through the year 2018, are not shown in these figures, but are available in the tool for calculating energy cost data for future years.

The 5-year and 10-year inflation rates are calculated for:

- The general inflation rate (consumer price index – CPI-U)
- Each of Florida's four largest electric and natural gas utility companies
- The customer-weighted average of the four largest electric and natural gas utility companies
- The state-wide average cost of electricity and natural gas
- The national average cost of electricity and natural gas

The spreadsheet tool automatically calculates the larger of the 5-year and 10-year inflation rates and highlights these values in green as shown in the figure. The 4-Utility Average shown in the figure is a customer-weighted average of the energy costs for the four largest electric and natural gas utility companies. The sum of the energy cost for each utility company multiplied by the number of customers in each service territory is divided by the total number of customers in all service territories. The fuel costs associated with each utility company and the 4-Utilty Average are also compared to the Florida State and U.S. national averages.

Application of Economic Impact Factors

The economic impact factors described in this document may be used for a variety of economic analysis. The assumptions and goals for any given economic analysis will identify the specific impact factors to be used for the analysis. Let's identify the economic impact factors to be used for an energy conservation program in the State of Florida.

Program statement:	Florida natural gas utility companies would like to implement an energy conservation program which will provide an incentive to specific Florida commercial or residential customers to purchase a gas appliance over a comparable electric appliance.
Assumptions:	The program will be offered to customers residing in the territories of the four largest natural gas utility companies.

Goal: Determine the economic impact factors used in this programs economic analysis.

Appliance Costs: Although not related to the economic impact factors, the appliance costs are required to complete the economic analysis and would be an average of the purchase price, installation costs, operating and maintenance costs, replacement cost(s), and salvage value for the specific appliance as determined in the general service territories of the utility companies.

Given these assumptions and goals, the accepted methodology for defining a general inflation rate, an associated discount rate, and a commercial and residential natural gas and electric fuel escalation rate is as follows.

1. The general inflation rate is assumed to be analogous to the consumer price index. In this case, the national average CPI-U rate is used. This method provides the simplest approach for determining the general inflation rate.
2. The discount rate is greater than the general inflation rate by 1.5%.
3. The natural gas and electric fuel escalation rates are derived from revenue based fuel costs. In this case, the commercial natural gas and electric fuel costs for Florida's four largest utility companies are used to compute the customer-weighted average fuel cost.

Using Figure 3, the economic impact factors and fuel escalation rates calculated using a 5-year and 10-year period calculation methodology are shown in Table 1. Also shown are the escalation rates calculated using an alternate methodology ($Base_{1970}$) as described in later sections of this report.

Table 1. Residential and Commercial Fuel Escalation Rates

Escalation Rate (%) (4-Utility Average)	**Calculation Method**		
	5-Year	10-Year	$Base_{1970}$
Commercial Natural Gas	6.76	8.77	7.52
Commercial Electricity	7.12	4.58	4.27
Residential Natural Gas	4.32	4.83	5.77
Residential Electricity	6.07	3.92	4.41
General Inflation Rate (%)	3.19 (CPI-U)		
Discount Rate (%)	4.69 (CPI-U + 1.5)		

It is left to the reader to select which methodology will be used for a given economic analysis. The greater of the 5-year and 10-year escalation rates are highlighted in the table above and represent the result using the 5-year and 10-year "methodology" described previously in this report. However, other information (e.g., long-term pricing data) may be available which could indicate that an alternative escalation rate calculation method may be more appropriate.

Remember also that the fuel escalation rates shown here would be reduced by the general inflation rate for calculations where the general inflation rate is already accounted for. These economic impact factors are then used to perform an economic analysis for the given appliance type. Alternatively, the analysis could also be based on the service territories of each individual natural gas company. In this case, the natural gas and electric fuel escalation rates would be based on the specific natural gas utility company and the associated electric utility company serving the same territory. Alternatively, the Florida state-wide average fuel cost could be used if the conservation programs covered the majority of the State of Florida.

The analysis results would then accurately measure the ratio of the monetary benefits of purchasing and operating a natural gas appliance to the monetary cost for purchasing and operating a comparable electric appliance. This type of economic analysis is referred to as a benefit-to-cost ratio analysis and would typically be calculated for a period greater than or equal to the larger of the life expectancies of the natural gas or electric appliance. The details of this type of analysis are beyond the scope of this document.

Sector	Fuel Type	Region	Inflation Rate (Analysis Year 2008) 10-YR	5-YR	Description	Year 1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
All Items		Comsumer Price Index	2.82%	3.19%	CPI-U	$ 163.0	$ 166.6	$ 172.2	$ 177.1	$ 179.9	$ 184.0	$ 188.9	$ 195.3	$ 201.6	$ 207.4	$ 215.3
Residential	Natural Gas	Florida City Gas	2.20%	4.46%	Cost per Therm ($)	$ 1.930	$ 1.700	$ 1.440	$ 1.920	$ 1.770	$ 1.930	$ 2.210	$ 2.290	$ 2.390	$ 2.130	$ 2.400
					No. of Customers	94,819	95,045	96,335	96,285	96,318	98,860	97,946	97,244	98,350	97,595	96,771
		Florida Public Utilities	6.79%	5.32%	Cost per Therm ($)	$ 1.035	$ 1.045	$ 1.180	$ 1.440	$ 1.240	$ 1.540	$ 1.630	$ 1.843	$ 2.055	$ 1.810	$ 1.996
					No. of Customers	33,007	34,636	36,217	36,900	42,226	43,319	45,078	46,068	46,706	47,139	47,078
		Peoples Gas	6.36%	4.23%	Cost per Therm ($)	$ 1.096	$ 1.134	$ 1.240	$ 1.470	$ 1.270	$ 1.650	$ 1.750	$ 1.960	$ 2.000	$ 2.000	$ 2.030
					No. of Customers	218,408	224,542	235,895	244,683	253,588	271,153	285,204	293,468	303,858	305,439	304,111
		St. Joe Natural Gas	10.78%	4.77%	Cost per Therm ($)	$ 0.725	$ 1.149	$ 0.930	$ 1.860	$ 1.600	$ 1.600	$ 1.850	$ 1.451	$ 1.395	$ 1.410	$ 2.020
					No. of Customers	3,101	3,118	3,140	3,068	3,080	3,015	3,005	2,906	2,862	3,097	3,097
		4-Utility Average	4.83%	4.32%	Cost per Therm ($)	$ 1.313	$ 1.276	$ 1.283	$ 1.584	$ 1.391	$ 1.705	$ 1.843	$ 2.017	$ 2.087	$ 2.004	$ 2.106
		State of Florida	6.55%	5.66%	Cost per Therm ($)	$ 1.092	$ 1.121	$ 1.250	$ 1.521	$ 1.321	$ 1.564	$ 1.716	$ 1.949	$ 2.083	$ 1.993	$ 2.059
		United States	7.21%	7.27%	Cost per Therm ($)	$ 0.659	$ 0.647	$ 0.750	$ 0.931	$ 0.763	$ 0.931	$ 1.040	$ 1.228	$ 1.328	$ 1.263	$ 1.323
	Electricity	Florida Power & Light	4.03%	6.21%	Cost per kWh ($)	$ 0.079	$ 0.076	$ 0.076	$ 0.088	$ 0.080	$ 0.086	$ 0.091	$ 0.096	$ 0.119	$ 0.114	$ 0.117
					No. of Customers	3,266,011	3,332,422	3,413,953	3,490,541	3,566,167	3,652,666	3,744,920	3,828,375	3,906,270	3,981,453	3,992,262
		Gulf Power	5.40%	6.80%	Cost per kWh ($)	$ 0.062	$ 0.062	$ 0.065	$ 0.064	$ 0.070	$ 0.076	$ 0.078	$ 0.086	$ 0.090	$ 0.100	$ 0.105
					No. of Customers	307,077	315,240	321,731	327,128	333,757	341,935	343,151	354,466	364,647	373,036	373,595
		Progress Energy (FPC prior to 2003)	3.40%	6.21%	Cost per kWh ($)	$ 0.084	$ 0.084	$ 0.085	$ 0.092	$ 0.087	$ 0.087	$ 0.093	$ 0.101	$ 0.118	$ 0.119	$ 0.118
					No. of Customers	1,182,787	1,208,739	1,234,285	1,274,672	1,290,805	1,339,285	1,390,228	1,411,764	1,487,586	1,449,195	1,448,933
		Tampa Electric Co.	3.70%	4.34%	Cost per kWh ($)	$ 0.080	$ 0.080	$ 0.083	$ 0.087	$ 0.094	$ 0.093	$ 0.099	$ 0.098	$ 0.110	$ 0.115	$ 0.115
					No. of Customers	466,189	477,533	491,925	505,964	518,554	537,812	549,940	567,071	581,955	588,867	586,611
		4-Utility Average	3.92%	6.07%	Cost per kWh ($)	$ 0.079	$ 0.077	$ 0.078	$ 0.087	$ 0.082	$ 0.087	$ 0.091	$ 0.097	$ 0.116	$ 0.114	$ 0.116
		State of Florida	3.99%	6.42%	Cost per kWh ($)	$ 0.079	$ 0.077	$ 0.078	$ 0.086	$ 0.082	$ 0.086	$ 0.090	$ 0.096	$ 0.113	$ 0.112	$ 0.117
		United States	3.24%	5.43%	Cost per kWh ($)	$ 0.083	$ 0.082	$ 0.082	$ 0.086	$ 0.084	$ 0.087	$ 0.090	$ 0.095	$ 0.104	$ 0.107	$ 0.114
Commercial	Natural Gas	Florida City Gas	8.17%	6.21%	Cost per Therm ($)	$ 0.683	$ 0.630	$ 0.639	$ 1.122	$ 0.923	$ 1.108	$ 1.261	$ 1.331	$ 1.490	$ 1.666	$ 1.498
					No. of Customers	4,707	4,707	4,725	3,948	3,792	3,855	4,011	4,071	4,200	4,364	4,552
		Florida Public Utilities	9.84%	7.28%	Cost per Therm ($)	$ 0.535	$ 0.560	$ 0.713	$ 0.886	$ 0.671	$ 0.963	$ 1.041	$ 1.255	$ 1.377	$ 1.151	$ 1.368
					No. of Customers	3,412	3,493	3,594	3,707	4,107	4,182	4,214	4,193	4,278	4,316	4,366
		Peoples Gas[1]	8.85%	6.76%	Cost per Therm ($)	$ 0.624	$ 0.613	$ 0.747	$ 0.983	$ 0.751	$ 1.051	$ 1.148	$ 1.424	$ 1.412	$ 1.425	$ 1.458
					No. of Customers	17,530	18,163	16,795	15,255	13,392	11,284	11,316	10,774	10,257	10,028	9,805
		St. Joe Natural Gas	6.95%	7.75%	Cost per Therm ($)	$ 0.725	$ 0.599	$ 0.745	$ 1.135	$ 0.947	$ 0.978	$ 1.091	$ 1.118	$ 1.006	$ 0.997	$ 1.420
					No. of Customers	240	250	253	258	255	262	256	249	251	253	248
		4-Utility Average	8.77%	6.76%	Cost per Therm ($)	$ 0.624	$ 0.609	$ 0.722	$ 0.993	$ 0.769	$ 1.042	$ 1.147	$ 1.364	$ 1.416	$ 1.413	$ 1.446
		State of Florida	8.62%	7.08%	Cost per Therm ($)	$ 0.619	$ 0.629	$ 0.746	$ 1.015	$ 0.794	$ 1.005	$ 1.105	$ 1.284	$ 1.345	$ 1.264	$ 1.415
		United States	8.14%	7.38%	Cost per Therm ($)	$ 0.530	$ 0.515	$ 0.637	$ 0.815	$ 0.641	$ 0.812	$ 0.912	$ 1.097	$ 1.160	$ 1.095	$ 1.159
	Electricity	Florida Power & Light[2]	4.73%	7.00%	Cost per kWh ($)	$ 0.065	$ 0.063	$ 0.062	$ 0.074	$ 0.067	$ 0.073	$ 0.078	$ 0.082	$ 0.105	$ 0.100	$ 0.103
					No. of Customers	396,752	404,944	415,295	426,577	435,322	444,654	458,057	469,976	478,869	493,131	500,751
		Gulf Power[2]	5.68%	7.90%	Cost per kWh ($)	$ 0.052	$ 0.051	$ 0.054	$ 0.053	$ 0.058	$ 0.061	$ 0.064	$ 0.071	$ 0.076	$ 0.085	$ 0.090
					No. of Customers	45,510	47,292	47,584	48,481	49,139	50,421	51,981	52,916	53,479	53,791	53,810
		Progress Energy[3]	4.00%	7.89%	Cost per kWh ($)	$ 0.061	$ 0.060	$ 0.058	$ 0.065	$ 0.061	$ 0.062	$ 0.070	$ 0.077	$ 0.093	$ 0.092	$ 0.090
					No. of Customers	136,345	140,897	146,010	149,534	153,112	156,937	161,513	163,704	165,471	165,505	165,156
		Tampa Electric Co.[2]	3.89%	5.46%	Cost per kWh ($)	$ 0.065	$ 0.060	$ 0.063	$ 0.067	$ 0.073	$ 0.073	$ 0.079	$ 0.078	$ 0.090	$ 0.095	$ 0.095
					No. of Customers	58,542	60,828	62,680	64,168	65,613	67,244	68,787	70,364	71,690	72,385	72,192
		4-Utility Average	4.58%	7.12%	Cost per kWh ($)	$ 0.063	$ 0.061	$ 0.061	$ 0.070	$ 0.065	$ 0.070	$ 0.075	$ 0.080	$ 0.099	$ 0.096	$ 0.098
		State of Florida	4.80%	7.42%	Cost per kWh ($)	$ 0.064	$ 0.062	$ 0.063	$ 0.071	$ 0.066	$ 0.071	$ 0.076	$ 0.082	$ 0.099	$ 0.098	$ 0.102
		United States	3.33%	5.06%	Cost per kWh ($)	$ 0.074	$ 0.073	$ 0.074	$ 0.079	$ 0.079	$ 0.080	$ 0.082	$ 0.087	$ 0.095	$ 0.097	$ 0.103

Notes: [1] - Firm Sales Service 481 General Service 1
[2] - Subtotal Commercial Rate Schedule
[3] - Commercial and Industrial Service combined

Figure 3. Economic Statistics for Natural Gas and Electricity

Historic Fuel Price Comparison

The comparison of natural gas and electricity cost must be made on a one-to-one comparison based on fuel energy content. The price of natural gas is typically based on units of $/ft^3 or $/1000 ft^3 and electricity is based on units of $/kWh. The conversion of each fuel to a common unit of energy (¢/kBtu) is shown below.

$/therm of natural gas = $/ft^3 x 96.7 ft^3/therm (or $/1000ft^3 x 0.0967 1000ft^3/therm)
¢/kBtu of natural gas = $/therm x therm/100 kBtu x 100 ¢/$ (or the same as $/therm)
¢/kBtu of electricity = $/kWh x kWh/3.413 kBtu x 100 ¢/$ (or ¢/kBtu = $/kWh x 29.3)

The historical fuel prices are shown for both residential and commercial customers for the past 40 years in Figure 4. Fuel costs are presented as cents per kBtu (¢/kBtu). There was a time, in the 1970's, when the commercial cost of electricity was at least 6 times higher than the commercial cost of natural gas (6:1 electric to natural gas fuel cost ratio). As shown in the figure, this price difference has gradually reduced to a 2:1 or less price difference. When the efficiency of a natural gas appliance is taken into account, this price difference is even further reduced (i.e., more fuel used when appliance efficiency is less than 1). For these reasons, natural gas appliance efficiency (and equipment cost) is now playing a more important role in the economic selection of natural gas versus electric appliances.

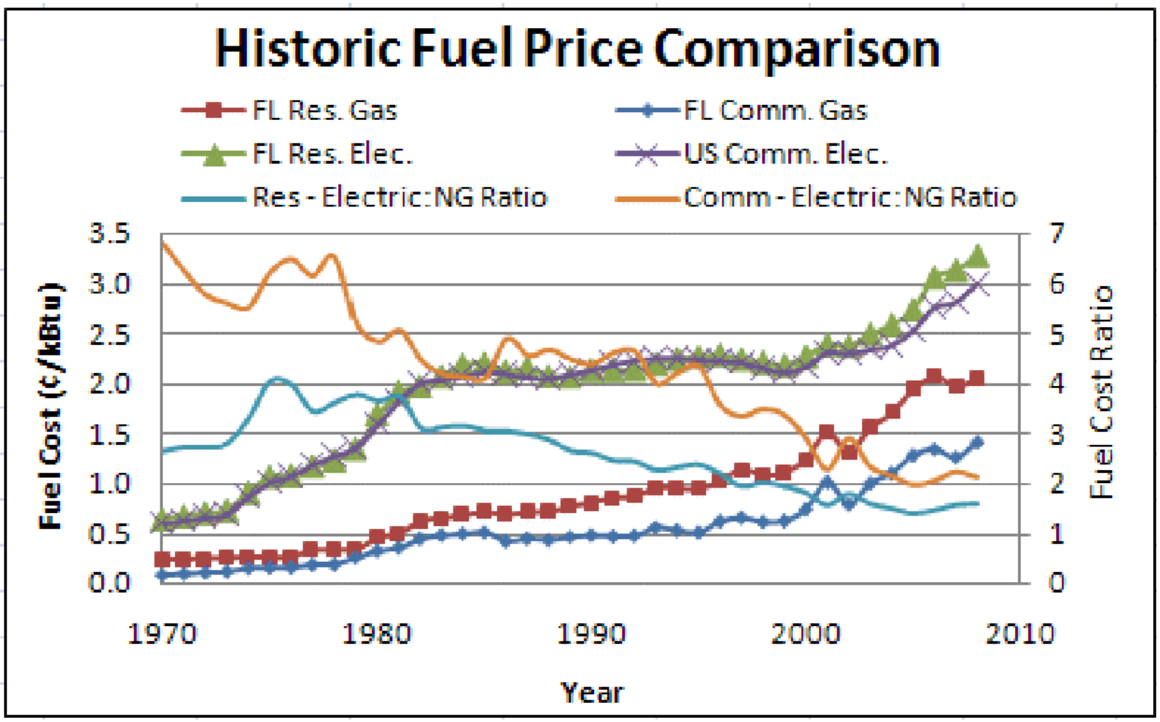

Figure 4. Historic Fuel Price Comparison

Historical Accuracy of Inflation Rate Predictions

This report presents a method by which to calculate fuel escalation rates using the greater of the 5-year or 10-year fuel inflation rate. An historical review of the accuracy of this methodology is provided here to offer some measure of confidence when using this technique. The EIA provides historical cost information for the average natural gas cost in the State of Florida for both residential and commercial customers. In addition, the average electricity cost throughout the United States is also provided. These cost histories span the last 40 years. Using these fuel cost data, the methodology used to predict fuel escalation rates will be reviewed.

As described previously, the 5-year and 10-year fuel escalation rates were calculated for both natural gas and electricity as shown in Table 2. The data collected is shown chronologically starting in 1970 and, in this example, the first 5-year escalation rate may be calculated for the year 1975. Similarly, the 10-year fuel escalation rate may be calculated starting in the year 1980. Also shown is an alternative escalation rate calculation method which is based on a fixed point in time. The fixed point in time is selected as the year 1970 (herein referred to as Base_{1970}). Escalation rates calculated using the Base_{1970} methodology may be calculated starting with the year 1971.

As an example, the 5-year, 10-year, and Base_{1970} fuel escalation rates (r_{esc}) for the State of Florida average residential natural gas price (FL Res. Gas in Table 1) is calculated as:

$$r_{esc}\,1975_{5\text{-}yr} = \left(\$0.26496 / \$0.24272\right)^{1/5} - 1 = 0.01769\ (1.77\%)$$

$$r_{esc}\,1980_{10\text{-}yr} = \left(\$0.46416 / \$0.24272\right)^{1/10} - 1 = 0.06698\ (6.70\%)$$

$$r_{esc}\,1971_{Base1970} = \left(\$0.24562 / \$0.24272\right)^{1/1} - 1 = 0.01195\ (1.20\%)$$

$$r_{esc}\,1972_{Base1970} = \left(\$0.25722 / \$0.24272\right)^{1/2} - 1 = 0.02944\ (2.94\%)$$

The data shown in Table 2 were calculated through year 2008 and will be used to provide an historical perspective of this methodology over the past three decades. In addition, the prediction of fuel prices through the year 2019 is also presented. Note that the 1975_{Base1970} and 1980_{Base1970} fuel escalation rates match the calculations using the 5-year and 10-year methodology since the base year, and hence the mathematical calculation, is the same for each of these years.

Table 2. Fuel Cost Data for Residential Customers

Fuel Cost Data:	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
FL Res. Gas ($/therm)	$0.243	$0.246	$0.257	$0.261	$0.276	$0.265	$0.272	$0.341	$0.342	$0.358	$0.464	$0.513	$0.637
Esc Rate - 5 Yr						1.77%	2.04%	5.82%	5.57%	5.36%	11.87%	13.57%	13.30%
Esc Rate - 10 Yr											6.70%	7.65%	9.50%
Esc Rate - Base 1970		1.20%	2.94%	2.46%	3.23%	1.77%	1.90%	4.99%	4.39%	4.41%	6.70%	7.05%	8.38%
FL Res. Elec. ($/kWh)	$0.022	$0.023	$0.024	$0.025	$0.031	$0.037	$0.037	$0.040	$0.042	$0.046	$0.058	$0.066	$0.068
Esc Rate - 5 Yr						10.72%	9.98%	10.89%	11.09%	8.23%	9.63%	12.15%	10.92%
Esc Rate - 10 Yr											10.17%	11.06%	10.90%
Esc Rate - Base 1970		4.55%	4.45%	4.35%	9.07%	10.72%	9.05%	9.01%	8.51%	8.60%	10.17%	10.45%	9.80%

The future prediction for both natural gas and electricity are plotted in the following figures. In these figures, the price for natural gas represents the Florida state-wide average natural gas price, and for electricity, the average electricity cost as reported by Florida's four largest utilities for residential customers and throughout the United States for commercial customers. The fuel escalation rate calculated for each specific year, starting in 1980, is used to predict the future cost of fuel projected out through the year 2019 (solid colored lines in each figure). The future prediction of fuel based on the 2008 fuel escalation rates are also shown in each figure (dotted line).

At the left of Figure 5, the predicted future fuel price for natural gas in the State of Florida using the greater of the 5-year and 10-year inflation rates are shown. The predictions are shown from 1980 – 1994 at the top left and for 1995 – 2008 at the bottom left of the figure. Similar plots are shown at the right of the figure for predicted future fuel price using the $Base_{1970}$ methodology as the basis for the fuel inflation rate calculation. Also shown in these figures is the actual fuel cost from 1970 through 2008.

In these figures, a deviation from actual fuel cost up through the year 2008 represents the fuel price prediction error associated with each methodology presented. The relative scatter between the annual fuel cost predictions (the colored lines) identify the degree of uncertainty associated with each year's fuel cost prediction.

The plots at the left of each figure show how using the short-term prediction methodology, using the greater of the 5-year and 10-year fuel escalation rates, can lead to predictions that far exceed the actual cost of the fuel (i.e., using 10-years or less as the basis for the prediction). Under-predictions of future fuel costs is also highly likely given the volatile nature of fuel prices. The plots at the right of each figure show how using a longer period of time to predict the future cost of fuel (i.e., using 20-years or more as the basis for the prediction) reduces, to some degree, the inaccuracies associated with a short-term fuel price prediction methodology.

When a short-term prediction methodology is selected, recent changes to fuel prices are assumed to be indications of long-term trends and potential adjustments to fuel prices in future years are ignored (e.g., market corrections, changes in federal policy, efficiency improvements in fuel collection or production, demand reductions due to higher fuel cost, etc.). In contrast, a long-term prediction methodology includes all market forces that influence the price of a fuel over a long period of time. When a longer period of time is used as the basis for the fuel escalation rate calculation, the entire historic trend of fuel prices is included in the future price prediction. However, there remains the possibility that each of these methods may under- or over-predict future fuel prices. The short-term prediction methodology continually adjusts the prediction of future fuel prices based on recent events which, in turn, can lead to under- or over-predictions of future fuel costs and , therefore, a higher degree of uncertainty. And a long-term prediction methodology may under-estimate future predictions when the rate of increase in fuel price is higher than shown in past years. The long-term prediction methodology can also over-estimate future fuel prices when a fuel's cost remains relatively flat for long periods of time.

It could be argued that the prediction of future fuel cost is more art than science, however, we as scientists and engineers should choose a methodology that more closely resembles the trends of past years and adjust that methodology as necessary, to the best of our ability .

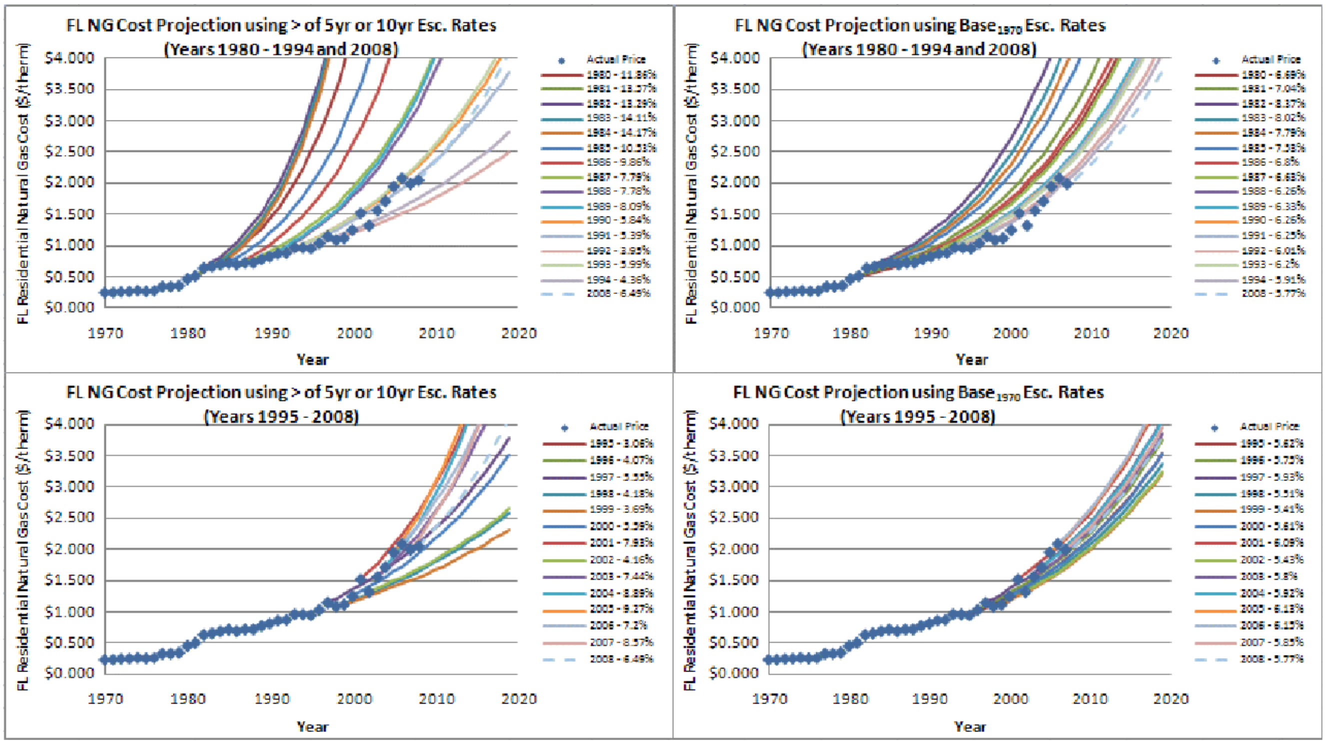

Figure 5. State of Florida Residential Natural Gas Fuel Price Predictions

Referring again to plots at the top of Figure 5, note that the future cost predictions tend to over-estimate actual costs with both methodologies when the time period used to calculate fuel escalation rates is less than 15-years (i.e., mid-1980 predictions). Reviewing the plots at the bottom of each figure show the future cost estimated by each methodology in the out-years of this example (e.g. 1995 – 2008). Note that the 5-year or 10-year methodology continues to show inaccuracies compared to the actual cost of fuel whereas the $Base_{1970}$ methodology more closely represents actual fuel cost, at least in this historic perspective. However, this example uses hindsight as the basis for comparison and predicting future fuel costs "blind" with no knowledge of how actual fuel cost might change in the future is a fundamental challenge for any economic analysis.

Fuel cost volatility also plays an important role in fuel cost prediction accuracy. The volatility of natural gas fuel prices has been far greater than that of electricity, especially over the past decade. Price volatility can lead to inaccurate fuel cost predictions when short-term price changes are considered (i.e., using 10-years or less as the basis for the prediction).

Given the following assumptions:

1) history is the best predictor of future fuel cost,
2) a long-term (i.e., using 20-years or more as the basis for the prediction) methodology is shown to better predict the future fuel cost of natural gas with a greater confidence in out-years (a tighter band of annual predictions), and
3) that both of these methodologies are similarly accurate for moderately changing fuel costs (e.g., electricity),

one could argue that predictions made using a long-term methodology may, to some degree, better represent future fuel costs. Careful selection of the methodology used for predicting future fuel costs is an important aspect of any economic analysis, especially when the economic analysis compares costs associated with different fuel types. Even the slightest misjudgment in calculating fuel escalation rates could inevitably bias the analysis toward one type of fuel.

The following figures show the actual fuel cost and annual predictions for Florida's four largest utilities average residential electric cost, State of Florida commercial natural gas costs, and the United States average commercial electric costs. The United States average residential electric costs are also included in the lower left graph in the first figure below for comparison purposes (i.e., FL vs U.S. costs are nearly identical). As with the previous figure, note that the tight band of predictions in the lower right graph of each figure show that more accurate fuel cost predictions are made when a long-term fuel cost prediction methodology is used.

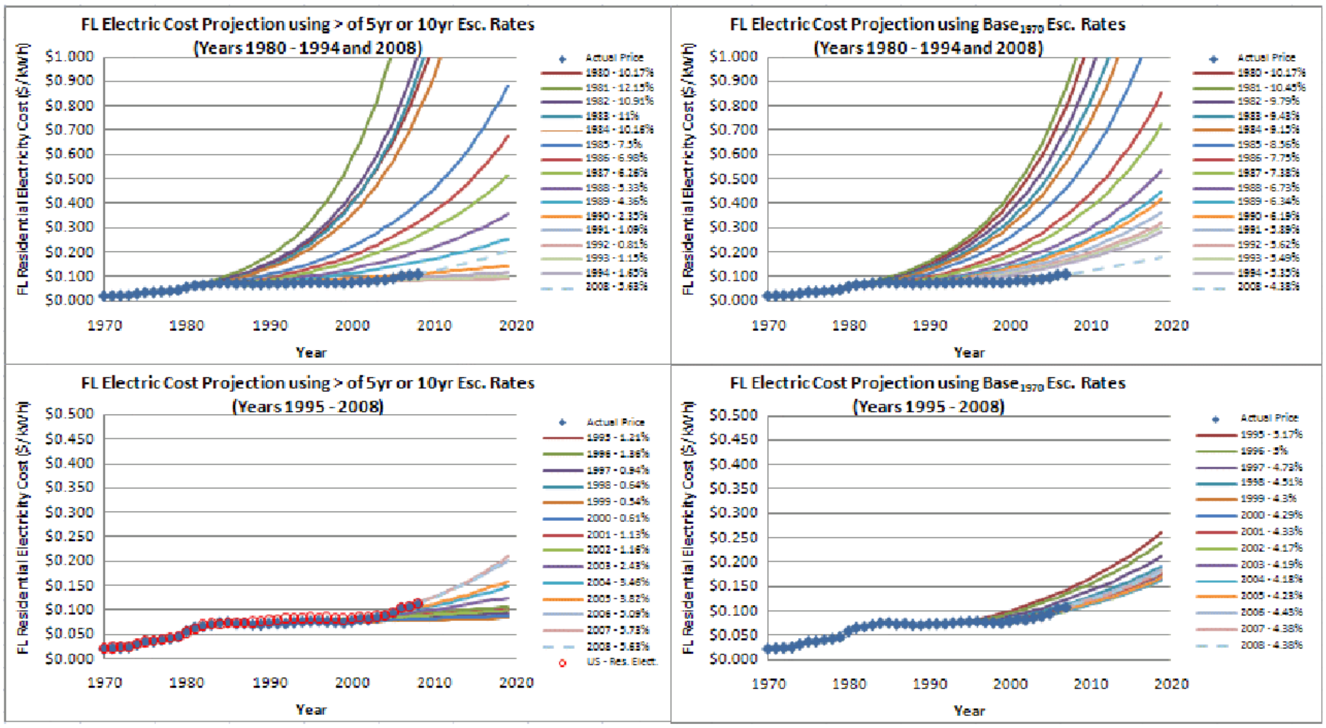

Figure 6. Florida's Four Largest Utilities Average Residential Electric Price Predictions

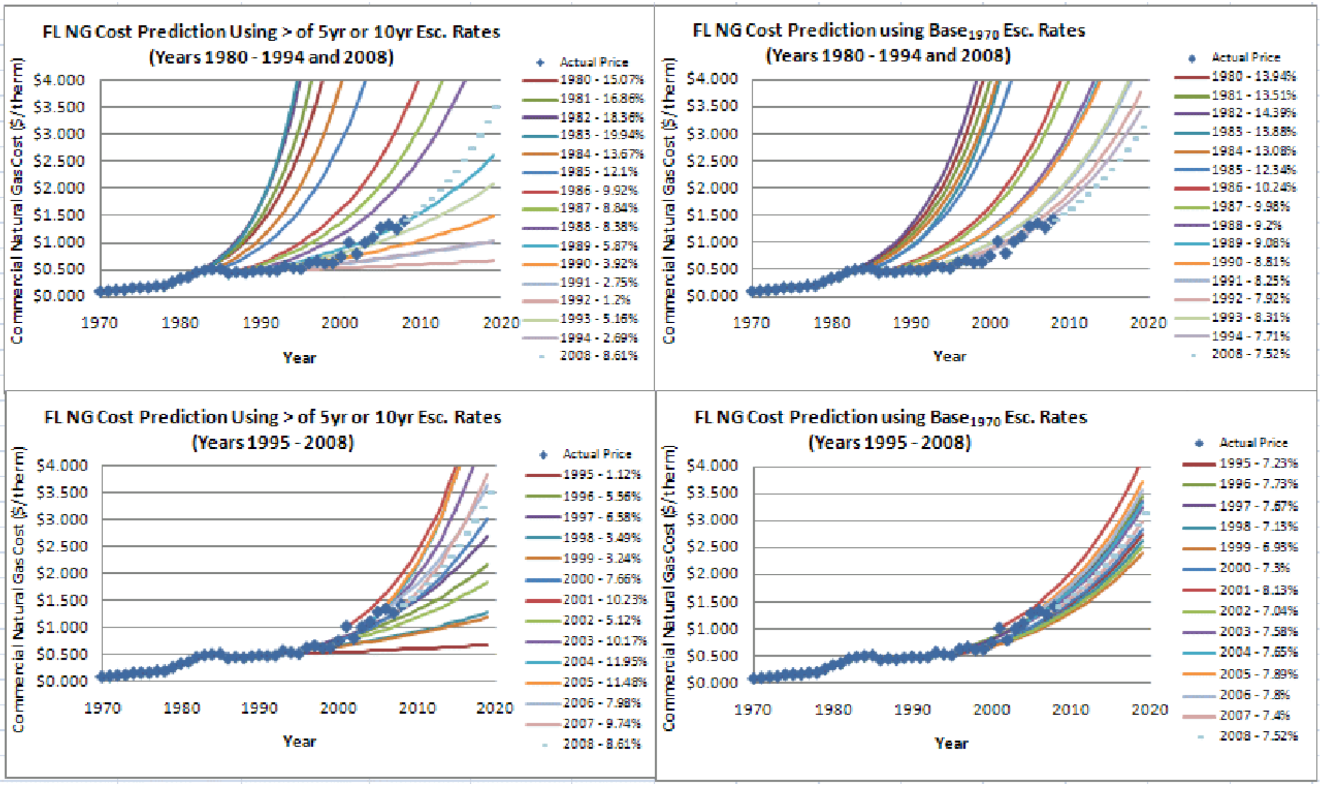

Figure 7. State of Florida Commercial Natural Gas Fuel Price Predictions

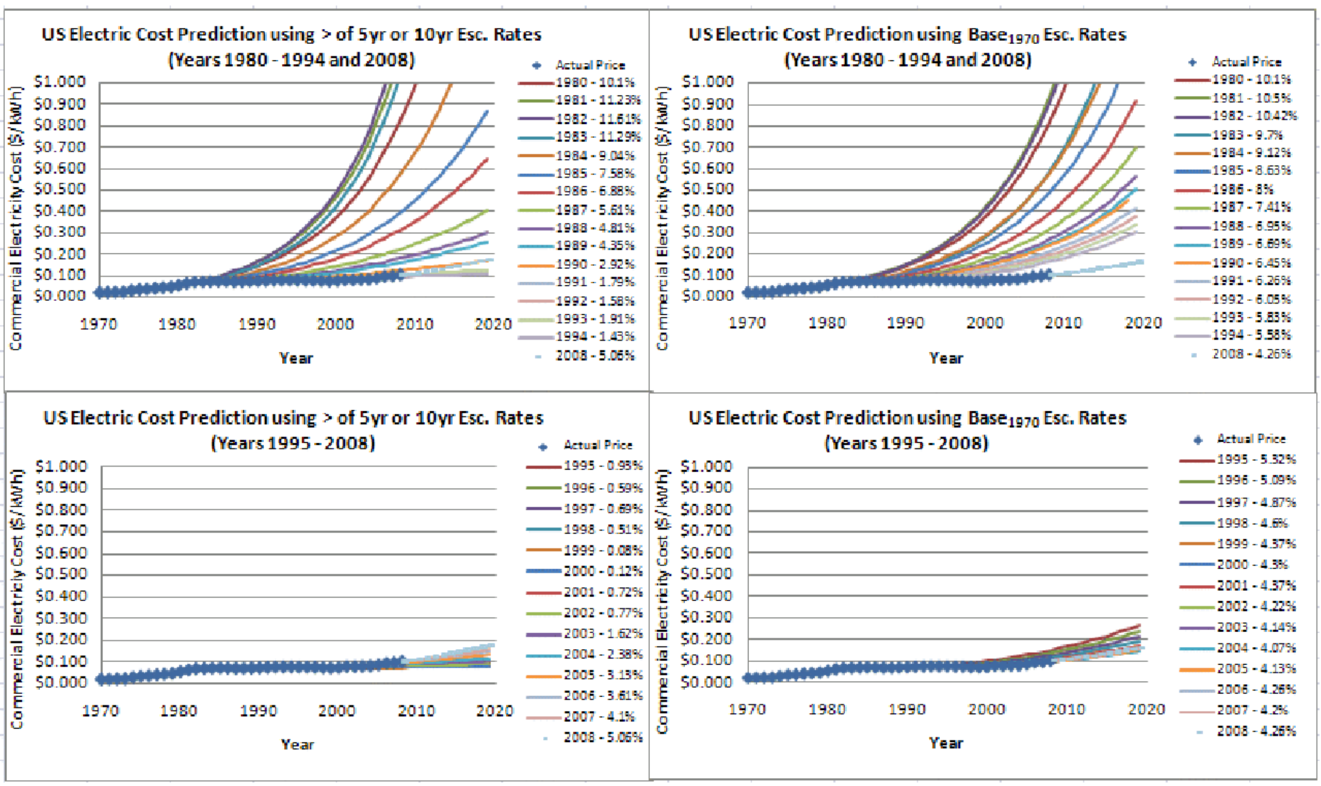

Figure 8. United States Average Commercial Electric Price Predictions

APPENDIX A - 9B-13.0071 Cost Effectiveness of Amendments to Energy Code

9B-13.0071 Cost Effectiveness of Amendments to Energy Code.
"The Cost Effectiveness Test for Amendments to the Florida Energy Efficiency Code for Building Construction", a document approved by the Florida Building Commission on June 9, 2009, is hereby adopted by reference. A copy of the document can be obtained from www.floridabuilding.org. Proposed amendments to the Florida Energy Efficiency Code for Building Construction shall demonstrate cost effectiveness applying the test herein adopted.

Rulemaking Authority 553.9061(3) FS. Law Implemented 553.9061(3) FS. History–New 8-17-09.

APPENDIX B - Cost Effectiveness Test for Amendments to the Florida Energy Efficiency Code for Building Construction

The following are the criteria for the cost-effective test which shall be used to determine whether proposed increases in energy efficiency to residential and commercial buildings as defined in Section 13-101 of the Code result in a positive net financial impact:

(I) Energy Analysis Methodology:

The energy analysis necessary to determine energy savings for Energy Conservation Measures (ECMs) for residential and commercial buildings shall be conducted using the Energy Gauge published by the Florida Solar Energy Center. The analysis shall be conducted for both single EMCs and packages of ECMs. Each ECM shall be evaluated for cost effectiveness based on calculation of energy savings it provides when modeled with a package of ECMs that all together achieve the target percent efficiency improvement as established by law for the given Code edition.

(II) Economic Analysis Assumptions:

The following economic assumptions shall be used in conducting the cost-effective analysis for residential and commercial buildings:

(1) The cost of an ECM shall be the full, installed incremental cost of improvements. The incremental cost shall be equal to the difference between the baseline measure cost and the improved measure cost unencumbered by any federal tax credits, utility incentives or state rebates, with an option to consider encumbering utility incentives.

(2) Study life period. The economic analysis shall be conducted using cash flow analysis over a 30-year study period.

(3) ECM service life. The economic evaluation shall be conducted using the appropriate service lives of the measures.

(4) Mortgage Parameter values:

(a) Mortgage interest rate for residential buildings shall be the greater of the most recent 5-year average and 10-year average simple interest rate for fixed rate, 30-year mortgages computed from the Primary Mortgage Market Survey (PMMS) as reported by Freddie Mac. The residential mortgage down payment rate shall be 10%.

(b) Mortgage interest rate for commercial buildings shall be the greater of the most recent 5-year average and 10-year average simple interest rate for fixed rate, 30-year mortgages computed from the Primary Mortgage Market Survey (PMMS) as reported by Freddie Mac plus 2%. The commercial buildings mortgage down payment rate shall be 20%.

(5) Annual rate parameter values.

(a) The General inflation rate shall be the greater of the most recent 5-year and 10-year Annual Compound Inflation Rate (ACIR) computed from the annual average Consumer Price Index (CPI) as reported by the U.S. Bureau of Labor Statistics. ACIR shall be calculated as follows:

ACIR = [(ending value) / (starting value)] ^ {1.0 / [(ending year) – (starting year)]} – 1.0.

(b) The Discount rate shall be general inflation rate plus 2%.

(c) The Fuel escalation rate shall be the greater of 5-year and 10-year ACIR computed from revenue-based prices as reported by Florida Public Service Commission minus the general inflation rate. ACIR shall be calculated as follows:

ACIR = [(ending value) / (starting value)] ^ {1.0 / [(ending year) – (starting year)]} – 1.0.

(d) The baseline electricity and natural gas prices used in the analysis shall be as follows:

(1) For residential buildings, the statewide, revenue-based average residential price for the most recent available 12 months as provided by the Florida Public Service Commission shall be used; and
(2) For commercial buildings, the statewide, revenue-based average commercial price for the most recent available 12 months as provided by the Florida Public Service Commission shall be used

(6) The present value cash flow streams of the benefits and costs for ECMs and packages of ECMs shall be calculated as follows:

(a) Benefits – the annual present value benefits cash flow stream shall be calculated as follows:

(i) The present value of the energy cost savings for years 1 through 30 with energy savings determined in accordance with clause (I) multiplied by the baseline electricity and natural gas prices as specified by clause (II)(5)(d), escalated at the general inflation rate plus the fuel escalation rate, calculated as follows:

PV Energy Cost Savings = {[(Annual Energy Savings) * (Baseline Fuel Cost)] * [(General Inflation Rate) + (Fuel Escalation Rate)] ^Year} / [(Discount Rate) ^Year].

(ii) The present value of any salvage value, applied in the 30th year of the study period, for ECMs that have been replaced during the study period and for which the service life of the replacement has not been reached by the end of the 30th year. Salvage value shall be calculated as follows:

PV Salvage Value = [(ECM final replacement cost) * (remaining ECM life) / (full ECM service life)] / [(1+Discount Rate) ^30].

(b) Costs – the annual present value cost cash flow stream be calculated as follows:

(i) The down payment cost applied in year 0, calculated as the full cost of the improvements (ECMs) as specified in clause (II)(1) multiplied by the down payment rate as specified in clause (II)(4)(a) for residential buildings or as specified in clause (II)(4)(b), whichever is appropriate.

(ii) The annual mortgage payment on the balance of the ECM costs after the down payment has be subtracted for years 1 through 30, as calculated at the mortgage rate specified by clause (II)(4)(a) for residential buildings or as specified by clause (II)(4)(b) for commercial buildings.

(iii) For all ECMs with service lives less than 30 years, replacement costs shall be applied to the annual cost cash flow stream. Excepting the 30th year of the study period, replacement costs shall be applied during each year for which ECM end of life has been reached. Replacement cost shall be the original ECM cost inflated at the general inflation rate, calculated as follows:

Replacement Cost = (Original ECM Cost)*(1+General Inflation Rate) ^ (Replacement Year).

(iv) Where incremental maintenance costs exist, they shall be incorporated into the annual cost cash flow stream during the year(s) the maintenance costs occur. All such maintenance costs shall be inflated at the General Inflation Rate over the study period and calculated as follows:

Maintenance Cost = (Base Maintenance Cost) * (1 + General Inflation Rate) ^ (Maintenance Year)

(v) For years 1 through 30, the above annual costs shall be summed and this summation shall be brought to its present value by discounting at the rate specified in clause (II)(5)(b), calculated as follows:

Annual Present Value Cost = [(Mortgage Cost) + (Replacement Cost) + (Maintenance Cost)] / [(1+ Discount Rate) ^Year].

(7) The Present Value Benefit-to-Cost (PVBC) Ratio shall be calculated as the sum of the annual present value benefits for years 1 through 30 divided by the sum of the annual present value costs for years 0 through 30.

(III) Economic Indicators of Cost Effectiveness:

The following economic indicators shall be used to determine whether the cost-effective test results in a "positive net financial impact":

(1) Present Value Benefit-to-Cost Ratio (PVBC). A value of 1.0 or greater shall be used for present value cost-to-benefit ratio (PVCB);

(2) Internal Rate of Return (IRR).

A value equal to 8% shall be used for IRR on investments for residential and a value equal to 7% shall be used for IRR on investments for commercial.

(3) Levelized Cost of Conserved Energy (LCCE).

(a) For residential applications, a value equal to the statewide residential revenue-based retail cost of electricity adjusted at the fuel escalation rate over one-half of the life of the measure (yields average over the measure life) shall be used for LCCE.

(b) For commercial applications, a value equal to the statewide commercial revenue-based retail cost of electricity adjusted at the fuel escalation rate over one-half of the life of the measure (yields average over the measure life) shall be used for LCCE

(IV) Evaluation Methodology for Measures and Packages of Measures:

The ECM and packages of ECMs shall be evaluated as follows:

(1) Multiple packages of ECMs shall be created that result in the target percentage efficiency increase for each Code cycle update (20, 30, 40 and 50%) based on comparison to the 2007 Code (without the 2009 supplement).

(2) Each ECM shall be evaluated using cost effectiveness indicators (PVBC, IRR, LCCE), within their specific package of ECMs. PVBC shall be considered the primary measure with IRR and LCEE used as measures for illustration and communication of individual ECMs and packages of ECMs comparative economic viability.

(3) Validation of the cost effectiveness of the Code changes shall mean that a number of ECM packages evaluated to comply with the statutory percent energy efficiency increase requirements have a greater benefit than cost as measured in present value dollars.

(V) Definitions:

Benefit-to-Cost Ratio: The sum of the present value of the benefits from an investment divided by the sum of the present value of the costs of the investment.

Consumer: A class of economic system participant that makes no distinction between the owner of the building and the utility rate payer.

Discount rate*:* The periodic compound interest rate at which future cash flow streams are discounted back to their present value (PV).

Energy Conservation Measure (ECM): An improvement to a building, a building system or a building component that is intended to reduce building energy consumption.

Fuel Escalation Rate: The periodic rate at which the price of fuel increases minus the General Inflation Rate.

General Inflation Rate: The periodic rate at which general consumer prices increase.

Internal Rate of Return (IRR): The discount rate at which the Net Present Value of an investment exactly equals zero. IRR is also sometimes referred to as return on investment or ROI.

Levelized Cost of Conserved Energy (LCCE): The Levelized Cost of an energy conservation investment divided by the annual energy savings produced by the investment.

Present Value (PV): The worth of a future cash flow in today’s dollars as calculated using the Discount Rate.