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Creating Energy Independence

# Developing G-RIM and Participants Tests for Specific Commercial Programs for the Associated Gas Distributors of Florida

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**Submitted to**

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# Abstract

The Florida Solar Energy Center created an economic assessment tool targeted towards seven common commercial appliances. This assessment tool calculates the gas rate impact measure and participants test score for selecting natural gas equipment over comparable electric equipment based on a 20-year analysis period. This type of analysis provides an indication of whether or not the specific appliance program favors the end use customer and/or the utility company as economic beneficiaries based on whether the natural gas appliance will have lower life-cycle costs than a comparable electric appliance. In most cases, given the current assumptions, natural gas appliances are able to achieve participant test scores and gas rate impact measures greater than 1 which indicates a favorable outcome.


# Introduction

Section 366.81, Florida Statutes, authorizes the Florida Public Service Commission (FPSC) to regulate electric and natural gas energy conservation programs. A regulated utility must develop plans and implement energy conservation programs according to the rules established by the FPSC. In 1996, the FPSC adopted Rule 25-17.009, Florida Administrative Code, which establishes the methodology for cost-effectiveness assessment of natural gas programs.

Rule 25-17.009 requires that each gas utility that seeks to recover costs for an existing, new, or modified demand side management program shall perform a cost-effectiveness assessment by means of the Participants Test and the Gas Rate Impact Measure (G-RIM) Test in the format set forth in Form PSC/CMP/18, entitled the "Florida Public Service Commission Cost Effectiveness Manual for Natural Gas Utility Demand Side Management Programs." As long as the programs offered pass the Participants and G-RIM Tests with a score of one or greater, it is deemed cost effective and beneficial for a utility company to offer to its customers.

The Florida Solar Energy Center (FSEC) has developed a method for calculating the cost-effectiveness of commercial natural gas conservation programs covering several typical appliance types. Since these appliance types are used in a wide variety of building, several generic building types were integrated into the analysis. Typical electric and natural gas appliance cost, installation and maintenance cost, associated energy use and fuel pricing, and inflation rate inputs allow the determination of life-cycle costs for these appliances over a 20-year period.

The intent of the assessment was to develop a detailed worksheet that, when given the associated costs and energy use for appliances used in "typical" buildings, would calculate the resulting scores for both the Participants Test and the Gas Rate Impact Measure. This analysis uses a benefit-to-cost ratio approach which, when completed, provides a measure of economic viability for a particular appliance. The analysis tool is based on a similar worksheet for residential appliance programs and was modified to target commercial applications. To that end, the worksheet developed for this project allows for the input of first-cost, operating and maintenance costs, and typical energy use according to the equipment and building type selected for analysis. In addition, the worksheet allows selection of multiple appliances in each building (i.e., one or

more of the appropriate appliance types may be selected for a particular building). The remainder of this report details the assumptions and operating methodology used within the economic analysis tool.

## Commercial Appliance Incentive Programs

The Florida Solar Energy Center identified the calculations needed to perform G-RIM and Participant Tests for five Commercial Appliance Incentive programs. While there are five types of appliances to be considered, a total of seven programs may be evaluated using the economic assessment tool as defined in Table 1. Each commercial appliance may be analyzed individually or in combination, as applicable, to determine if a natural gas or electric fuel source would provide a lower life-cycle cost for the appliance(s).

**Table 1. Commercial Appliance Incentive Programs**

| Program | Appliance | Equipment Type |
|---|---|---|
| 1 | Domestic Hot Water | Tank Water Heater |
| 2 | | Tankless Water Heater |
| 3 | Commercial Cooking | Deep Fryer |
| 4 | | Oven/Range |
| 5 | Pool Heating | Water Heater |
| 6 | Dehumidification | Desiccant Dehumidifier |
| 7 | Drying | Clothes Dryer |

## Commercial Building Types

The appliance equipment described in Table 1 can be used in many types of commercial buildings. Several typical building types were identified as possible candidates for the equipment selected for study. These building types are generic in type and represent small and large buildings, buildings with and without cooking appliances, and general cleaning services. For building types not included in these generic categories, the large commercial hospitality building type may be used along with the specific equipment used in that building. This allows this assessment tool to be used on virtually any building type. Table 2 describes the building types selected for study along with the types of appliances found in these buildings.

**Table 2. Commercial Building Equipment Assumptions**

| Building Type | Equipment Assumptions | | | | |
|---|---|---|---|---|---|
| | Water Heating | Cooking | Pool | Dehumidifier | Clothes Drying |
| Small Commercial Non-Food Service | X | | | X | |
| Large Commercial Non-Food Service | X | | | X | |
| Small Commercial Food Service | X | X | | X | |
| Large Commercial Food Service | X | X | | X | |
| Large Commercial Hospitality | X | X | X | X | X |
| Small Commercial Cleaning Service | X | | | X | X |

## Electric Utility Cost

A key aspect of economic analysis is selecting the utility rates used for calculations. The electric rate structures for Florida's four largest electric utility companies were used to calculate a customer-weighted average cost of electricity. Since electric utility rate structures change based on the amount of electricity used, the rate category closest to the commercial building types selected for study is used for this analysis. The General Service Demand category was chosen as the representative electric utility rate. From the four utility rate structures, a single customer-weighted average electricity rate for both energy (kWh) and demand (kW) was calculated. The cost of electricity will be considered to be the same throughout the day, meaning that no time-of-day variations in energy charges will be applied. The cost of electricity is applied towards the savings calculated when a customer changes the appliance fuel source from electric to natural gas. Table 3 describes the electric utility rates used for this analysis.

**Table 3. Utility Rates for Commercial General Service Demand (GSD-1)**

| Category | Utility Company | | | | Customer Weighted |
|---|---|---|---|---|---|
| | FPL | Progress | Tampa Elec. | Gulf Power | |
| Customer Charge | $ 33.05 | $ 10.62 | $ 42.00 | $ 35.00 | **$ 29.57** |
| Base Rate | $ 0.01930 | $ 0.03654 | $ 0.02113 | $ 0.02458 | **$ 0.02339** |
| Fuel Charge | $ 0.05834 | $ 0.06623 | $ 0.06766 | $ 0.05758 | **$ 0.06059** |
| Total Energy Rate | $ 0.07764 | $ 0.10277 | $ 0.08879 | $ 0.08216 | **$ 0.08398** |
| Demand Charge | $ 7.52 | $ 3.71 | $ 7.25 | $ 5.42 | **$ 6.53** |
| Customers | 93289 | 29790 | 12572 | 15522 | **151173** |

## Natural Gas Utility Cost

Natural gas rates are based on the annual fuel use. Since this analysis is geared towards calculating the economics for multiple building types, the rate used for a specific analysis is based on the total natural gas use as determined by the type of equipment selected for a particular building type. Natural gas utilities determine cost using a range of annual fuel use categories. For a given economic assessment, the total building natural gas usage will be used to determine the gas utility cost for that particular building. For this analysis, annual fuel use is typically in the range of 6000-59999 therms as is highlighted in Table 4. This table is merely an example for a single company and the cost of natural gas is formally entered on the Cost Data worksheet for each specific utility company.

**Table 4. Customer Natural Gas Rates for Florida City Gas as of January 2009**

| Annual Fuel Use (therms) | | Customer Charge | Fuel Rate | Energy Charge |
|---|---|---|---|---|
| Min | Max | | | |
| 0 | 99 | $ 8.00 | $ 0.56231 | $ 0.09304 |
| 100 | 219 | $ 9.50 | $ 0.52248 | $ 0.09304 |
| 220 | 599 | $ 11.00 | $ 0.49531 | $ 0.04875 |
| 600 | 1199 | $ 12.00 | $ 0.43663 | $ 0.03115 |
| 1200 | 5999 | $ 15.00 | $ 0.31715 | $ 0.02499 |
| 6000 | 24999 | $ 30.00 | $ 0.27467 | $ 0.02452 |
| 25000 | 59999 | $ 80.00 | $ 0.27618 | $ 0.02394 |

# Equipment Energy Use Data

Determining an accurate representation of annual energy use is the basis of this economic assessment tool. Once the base energy use is determined for a particular application, the associated natural gas usage may be calculated based on appliance efficiency levels. Assumptions for equipment energy use were collected from a variety of sources and provide a *representative magnitude* of energy use given the appliance type and the building type selected for study. The following assumptions are made to identify the annual energy use for each appliance type described in Table 1. Electric demand for each appliance is based on the rated electric capacity for each appliance. When considering appliance electric demand, this economic analysis tool allows an appliance demand diversity factor to be used to more accurately represent the "average" demand of appliances as they cycle throughout the day.

## *Water Heater*

Water heater energy use was derived from a previous report describing the energy use of Florida buildings[1] and information obtained from a Food Service Technology Center report on water heating systems in restaurants[2]. The annual energy use reported in the Florida buildings report are estimated based on the ASHRAE Handbook – HVAC Applications Chapter 49[3]. In small office buildings, for example, the annual energy use for a standard electric water heater is reported as 2,600 kWh. For each building type, total building water heater energy use is the product of the number of hot water heaters and the unit energy use.

**Table 5. Water Heater Energy Use for Typical Commercial Buildings**

| Building Type | Number of Units | Electric | | | Gas | |
|---|---|---|---|---|---|---|
| | | Energy Use (kWh) | Total Energy Use (kWh) | Demand (kW) | Energy Use (therms) | Total Energy Use (therms) |
| Small Commercial Non-Food Service | 1 | 2,600 | 2,600 | 10 | 134 | 134 |
| Large Commercial Non-Food Service | 3 | 4,576 | 14,268 | 15 | 236 | 708 |
| Small Commercial Food Service | 3 | 20,230 | 60,690 | 15 | 1,042 | 3,126 |
| Large Commercial Food Service | 3 | 20,230 | 60,690 | 15 | 1,042 | 3,126 |
| Large Commercial Hospitality | 3 | 30,295 | 90,885 | 20 | 1,560 | 4,680 |
| Small Commercial Cleaning Services | 2 | 22,037 | 44,074 | 15 | 1,135 | 2,270 |

[1] "Reducing Energy Use in Florida Buildings", R. Raustad, M. Basarkar, R. Vieira, FSEC-CR-1763-08.
[2] "Energy Efficiency Potential of Gas-Fired Water Heating Systems in a Quick Service Restaurant", A. Karas, D. Fisher, FSTC Report 5011.07.19, Food Service Technology Center, October 2009.
[3] American Society of Heating, Refrigeration and Air Conditioning Engineers, 2003. ASHRAE Handbook, HVAC Applications, Atlanta, GA.

Also note that the total water heater energy use for a particular building should not change based on the number of water heaters installed in the building. The unit water heating energy will be adjusted based on the number of water heaters, but the total water heater energy use for a particular building type remains fixed for a given analysis. The total water heater energy may, however, be changed as other more accurate information becomes available.

For this analysis, the energy use for a gas tank water heater or a gas or electric tankless water heater is then based on the ratio of efficiencies for these water heaters. Conversion of the base "energy" to either electric or natural gas usage is a simple matter of using conversion factors. Efficiency levels were assumed to be 0.89 and 0.92 for electric tank and tankless water heaters and 0.59 and 0.79 for gas tank and tankless water heaters, respectively. Table 5 describes the per unit standard tank water heater assumptions made for this analysis based on building type and fuel source. Efficiency levels may also be modified as necessary.

Following the previously described conversion methodology, the energy use for an electric tankless water heater used in a small office building would be 2,600 kWh multiplied by 0.89/0.92 or 2,515 kWh. The calculation of gas water heater energy use simply uses a conversion factor to change from the base energy use to the required amount of natural gas needed to supply that same amount of energy (i.e., 3414 Btu/KWh divided by 100,000 Btu/therm). The different efficiencies of these appliances must be accounted for in this conversion process. Natural gas usage is estimated at 134 and 100 therms for gas tank and tankless water heaters, respectively.

The energy use for water heating for other building classifications were estimated based on combinations of annual energy use for other building types described in the previously mentioned report. The FSTC report was reviewed to ensure that these energy use assumptions agreed with other independent sources. The electric demand for water heaters is estimated based on the ratings of typical water heater equipment. For example, the electric demand for tank and tankless water heaters used in this analysis is estimated to be 10 kW and 25 kW, respectively. Multiple water heaters are used to meet the increased demand for other building types. These initial assumptions may be changed to represent other equipment as necessary. The analysis tool allows a diversity factor to be used to more accurately represent the "average" demand of appliances as they cycle throughout the day.

## *Deep Fryers and Oven/Ranges*

Deep fryers and oven/ranges are used in a variety of applications and the end use energy is primarily based on the amount of food processed each day. The energy use of gas and electric cooking equipment, and peak demand for electric cooking equipment, was determined through the use of a life-cycle and energy cost calculator provided by the Food Service Technology Center[4]. The Food Service Technology Center (FSTC) is a scientific testing facility for benchmarking the energy performance of equipment used in commercial kitchens. The FSTC website provides a tool to calculate energy use based on the amount of food cooked each day.

[4] Food Service Technology Center, San Ramon, CA, 2008 Fisher-Nickel, Inc. http://www.fishnick.com/saveenergy/tools/calculators/

This calculator was used to provide an estimate of energy use and peak demand for fryers and conventional ovens using both natural gas and electricity as the fuel source. The FSTC program defaults were used to identify typical energy use for these commercial cooking appliances. Simulation inputs are shown in Table 6. Using these default inputs, the amount of food prepared each day is the only remaining input required to calculate the annual energy use.

**Table 6. Simulation Inputs for Fryers and Ovens/Ranges**

| Input | Electric | | Gas | |
|---|---|---|---|---|
| | Fryer | Oven/Range | Fryer | Oven/Range |
| Preheat Energy | 2.0 kWh | 2.3 kWh | 14,000 Btu | 15,000 Btu |
| Idle Energy Rate | 1 kW | 5 kW | 12,000 Btu/h | 23,000 Btu/hr |
| Efficiency | 78% | 50% | 42% | 37% |
| Capacity | 68 lb/hr | 90 lb/hr | 61 lb/hr | 100 lb/hr |
| Duration | 16 hrs/day | 12 hrs/day | 16 hrs/day | 12 hrs/day |
| | 365 days/yr | | | |
| # of Preheats/day | 1 | | | |

Table 7 shows daily energy use (using the FSTC calculator) as a function of the amount of daily food preparation, which varied from 10 to 600 pounds per day. For electric equipment the associated peak demand is also calculated.

**Table 7. Fuel Use Statistics for Fryers (left) and Ovens/Ranges (right)**

| lb/day | Electric | | Gas | Electric | | Gas |
|---|---|---|---|---|---|---|
| | kWh/yr | kW | Therms/yr | kWh/yr | kW | Therms/yr |
| 10 | 7,207 | 1.2 | 783 | 22,615 | 5.2 | 1,057 |
| 50 | 10,118 | 1.7 | 953 | 23,941 | 5.5 | 1,122 |
| 100 | 13,757 | 2.4 | 1,165 | 25,599 | 5.8 | 1,204 |
| 150 | 17,396 | 3.0 | 1,376 | 27,257 | 6.2 | 1,285 |
| 200 | 21,035 | 3.8 | 1,588 | 28,915 | 6.6 | 1,367 |
| 250 | 24,674 | 4.2 | 1,800 | 30,573 | 7.0 | 1,448 |
| 300 | 28,313 | 4.8 | 2,012 | 32,231 | 7.4 | 1,529 |
| 350 | 31,952 | 5.5 | 2,223 | 33,889 | 7.7 | 1,611 |
| 400 | 35,591 | 6.1 | 2,435 | 35,547 | 8.1 | 1,692 |
| 450 | 39,230 | 6.7 | 2,647 | 37,204 | 8.5 | 1,773 |
| 500 | 42,869 | 7.3 | 2,859 | 38,862 | 8.9 | 1,855 |
| 550 | 46,508 | 8.0 | 3,070 | 40,520 | 9.3 | 1,936 |
| 600 | 50,147 | 8.6 | 3,282 | 42,178 | 9.6 | 2,017 |

A regression analysis was performed on these data to develop a relationship between energy use and electric demand based on the amount of food prepared each day. In this analysis, the amount of food prepared each day for fryers/ovens were assumed to be 300/100, 100/200, and 200/100 pounds per day for buildings classified as Small Commercial Food Service, Large Commercial

Food Service, and Large Commercial Hospitality, respectively. These inputs, or the underlying regression analysis, may be changed as necessary to perform other economic assessments.

## *Pool Heater*

An FSEC solar collector sizing guide describing Florida pool heating economics shows that a typical central Florida covered pool measuring 30' x 15' requires 87 MBTU/year (25,489 kWh/year) of heating energy. When a pool cover is not used, the required heating energy increases by a factor of 2.1. Inputs to this economic assessment tool include the COP of the electric heat pump, area of the pool, and whether or not the pool is covered. Although this tool includes calculations for pool heater equipment demand, the demand diversity for the electric heat pump unit will be set to 0 in this analysis since pool heaters would not typically be operated during on-peak periods. If electric demand is to be considered for a particular analysis, the electric demand is currently assumed to be equal to 0.02% of the annual energy use. The electric demand is automatically calculated based on pool surface area, heat pump COP, and whether or not the pool is covered. These inputs may be changed as necessary to perform other economic assessments.

## *Desiccant Dehumidifier*

A report[5] prepared by CDH Energy Corp. describes energy use of NovelAire electric and gas-fired desiccant units for two different commercial building applications. A 16,000 $ft^2$ retail store and a 2,100 $ft^2$ office building. From this report it was determined that the annual energy use of a desiccant dehumidifier used in a Tampa, FL small office application is 1,256 kWh and 139 therms for an electric and natural gas-fired unit, respectively. The demand estimate for the electric unit is 1.3 kW. For the large office application, annual energy use was estimated at 14,867 kWh and 2,118 therms for an electric and natural gas-fired unit, respectively, and would require 8 of the smaller units used for the small office application. The demand estimate for the large office building, considering the required 8 units as documented in this report, is 10.4 kW. These units would typically be operated during on-peak periods and the entire demand for the electric units will be included in the analysis (i.e., demand diversity = 100%). These inputs may be changed as necessary to perform other economic assessments.

## *Clothes Drying*

Estimating annual energy use for commercial clothes drying establishments is a difficult task since the type of drying equipment and the annual energy use vary widely among establishments. The equipment energy use for commercial drying equipment would be far better estimated by the natural gas industry by simply reviewing annual energy requirements for select businesses and averaging these results. The equipment cost estimates for commercial drying equipment would also be more accurately represented when provided by an industry which sells or rents this type of equipment in large quantities.

[5] "Evaluation of the NovelAire Desiccant Unit in Commercial Applications", CDH Energy Corp., Final Report, March 2009.

A typical assumption for residential clothes drying is 3.3 kWh for electric and 0.22 therms + 0.21 kWh (turning the drum) for natural gas per load of clothes (assuming a 45 minute drying cycle). Adjusting for the electricity consumed by a natural gas dryer, this analysis uses a net electrical energy use of 3.1 kWh for electric dryers. For this analysis it was assumed that a small commercial cleaning service would operate 10 dryers, dry 12 loads per day per dryer, operate 365 days per year and consume 13,578 kWh and 964 therms annually for *each* electric and gas appliance, respectively. The electric demand is assumed to be 5 kW per dryer for electric clothes dryers. These inputs may be changed as necessary to perform other economic assessments.

# Appliance, Installation, and Maintenance Costs

For this analysis, the end user of the tool is responsible for determining the associated equipment cost for each appliance type. Inputs have been defined to allow the equipment, installation, maintenance, and other associated costs to be entered based on the specific building classification. An entry is provided to allow input for avoided electrical cost for breaker and wire size reductions when natural gas appliances are used in new construction. These costs are automatically zeroed for retrofit and retention analysis (e.g., G32 on Equipment Summary worksheet). Care should be used when modifying the costs in these cells so as not to change the cell formula. Since this analysis considers the incentive a utility may pay to a customer to exchange a single electric appliance for a comparable natural gas appliance, inputs are provided to identify the number of appliances used for a specific application. In this way, multiple incentives applicable to a specific appliance program may be included in the analysis as appropriate. These data are entered on the Equipment Summary worksheet.

# Economic Assessment Tool Inputs

Inputs to the economic assessment tool are made up of two distinct worksheets. An assumptions page and an equipment summary page. The assumptions for the analysis include an assortment of inputs used to define the analysis. Any input field which may be modified is highlighted with a light blue background within these worksheets, although other input assumptions may be made as necessary. The input requirements for each of these worksheets are described here.

## *Cost Data Worksheet*

The costs associated with specific utility company meter equipment and fuel charges are organized on this worksheet. Figures 1-3 show an example of the type of information contained here. Costs may be specific to an individual utility company, a specific natural gas rate class, or based on the type of program (e.g., new construction, retrofit, retention) or equipment classification (e.g., water heater, cooling equipment, etc.). The costs entered on this worksheet are automatically updated on the Assumptions worksheet as necessary. On the assumptions worksheet, cells highlighted in orange represent data that are automatically updated from the cost data worksheet.

| | Florida City Gas | | | | | | | | | | | FPUC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Service Line:** | GS-1 | GS-100 | GS-220 | GS-600 | GS-1,200 | GS-6,000 | GS-25,000 | GS-60,000 | GS-120,000 | GS-250,000 | GS-1,250,000+ | GS-1 | GS-2 |
| (Max Usage per Class) | 100 | 220 | 600 | 1200 | 6000 | 25000 | 60000 | 120000 | 250000 | 1250000 | 1E+12 | 600 | 1E+12 |
| Feeder or Supply Main | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | | $1,000 |
| Project Main | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 |
| Pipe and Piping (Service Line) | $955 | $1,258 | $1,481 | $2,075 | $2,383 | $3,131 | $3,878 | $11,425 | $14,851 | $17,515 | $24,386 | $925 | $925 |
| **Meter:** | | | | | | | | | | | | | |
| Meter Cost | $50 | $50 | $209 | $209 | $614 | $614 | $699 | $1,121 | $1,400 | $1,700 | $15,816 | $523 | $523 |
| Meter Set | $25 | $25 | $71 | $71 | $472 | $472 | $949 | $996 | $996 | $2,138 | $18,100 | $77 | $77 |
| **Regulator:** | | | | | | | | | | | | | |
| Regulator Cost | $15 | $15 | $15 | $15 | $90 | $350 | $1,383 | $1,383 | $1,383 | $2,766 | $8,154 | $188 | $188 |
| Regulator Install | $12 | $12 | $12 | $12 | $260 | $260 | $260 | $260 | $260 | $260 | $260 | $75 | $75 |
| **TOTAL** | **$1,057** | **$1,360** | **$1,788** | **$2,382** | **$3,819** | **$4,827** | **$7,169** | **$15,185** | **$18,890** | **$24,379** | **$66,716** | **$1,788** | **$1,788** |
| | | | | | | | | | | | | | |
| **Rate Schedule:** | Florida City Gas | | | | | | | | | | | FPUC | |
| Customer Charge | $8 | $10 | $11 | $12 | $15 | $30 | $80 | $150 | $250 | $300 | $500 | $20 | $33 |
| ECCR | $0.09304 | $0.09304 | $0.04875 | $0.03115 | $0.02499 | $0.02452 | $0.02394 | $0.01795 | $0.01643 | $0.01643 | $0.01643 | $0.39136 | $0.39136 |
| Distribution Charge | $0.56213 | $0.52248 | $0.49513 | $0.43663 | $0.31715 | $0.27487 | $0.27618 | $0.27477 | $0.18084 | $0.17191 | $0.12225 | $0.31715 | $0.31715 |
| PGA Recovery Factor | $0.60160 | $0.60160 | $0.60160 | $0.60160 | $0.60160 | $0.60160 | $0.60160 | $0.60160 | $0.60160 | $0.60160 | $0.60160 | $0.02506 | $0.02506 |

**Figure 1. Utility Specific Equipment and Rate Cost Data**

| **Administrative Costs:** | FL City Gas | FPUC | Peoples | Indiantown | St Joe | Chesapeake | Sebring |
|---|---|---|---|---|---|---|---|
| New Customer Admin Cost | $1.61 | $2.61 | $3.61 | $4.61 | $5.61 | $6.61 | $7.61 |
| Gas Facility O&M Cost | $21.66 | $22.66 | $23.66 | $24.66 | $25.66 | $26.66 | $27.66 |
| | | | | | | | |
| **Financial Data:** | FL City Gas | FPUC | Peoples | Indiantown | St Joe | Chesapeake | Sebring |
| Discount Rate | 5.720% | 8.740% | 8.500% | 8.500% | 8.500% | 6.830% | 6.830% |
| **Depreciation Rates:** | | | | | | | |
| Service Lines | 3.300% | 3.300% | 3.300% | 3.300% | 3.300% | 3.300% | 3.300% |
| Development Main | 3.300% | 3.300% | 3.300% | 3.300% | 3.300% | 3.300% | 3.300% |
| Meter | 3.800% | 3.800% | 3.800% | 3.800% | 3.800% | 3.800% | 3.800% |
| Supply Mains | 3.300% | 3.300% | 3.300% | 3.300% | 3.300% | 3.300% | 3.300% |

**Figure 2. Utility Specific Administrative and Financial Cost Data**

| | Florida City Gas | | | FPUC | | | Peoples Gas | | |
|---|---|---|---|---|---|---|---|---|---|
| **Annual EC Program Cost:** | New Const. | Retrofit | Retention | New Const | Retrofit | Retention | New Const. | Retrofit | Retention |
| Water Heating Tank | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 |
| Water heating Tankless | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 |
| Cooking Deep Fryer | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 |
| Cooking Oven/Range | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 |
| Pool Heating | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 |
| Desiccant Dehumidifier | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 |
| Clothes Drying | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 | $36.96 |

**Figure 3. Utility and Program Type Specific Cost Data**

## *Assumptions Worksheet*

At the top of the assumptions page are the inputs used to define the equipment types selected for a particular building type and the electric rate structure. The specific building type is first selected based on the generic types of buildings selected for this analysis (Table 2). Specific equipment types are then chosen at the left using the check boxes provided. Only equipment specific to a given building classification can be chosen for the analysis. The specific gas utility and the type of conservation program is also selected from pull-down menus.

Although this analysis will typically use the customer-weighted average electric rate derived from Florida's four largest utility companies, an input selection allows alternative electric rates to be used. Based on these inputs, the analysis results are presented in the form of the G-RIM and Participants test scores along with the resulting reduction in carbon emissions. Green highlighted cells automatically present the test scores that exceed 1 (or 0 for the Carbon

Reduction column). Detailed economic analysis for each equipment type can be printed from this same location. In addition, the analysis assumes that these equipment types are the only types of gas equipment installed in the building. If other gas equipment is present, a custom input allows the user to enter the fraction of total equipment gas usage for this specific appliance (i.e., enter the fraction of appliance gas usage to total building gas usage).

The following example economic analysis result is shown for inputs representing the customer-weighted average electric utility rate for Florida's four largest electric utility companies, a Large Commercial Hospitality building classification, the gas utility selected as Florida City Gas, and a New Construction program type. Note that these choices are selected from pull-down menus at the top right of this figure. All allowed equipment selection options are chosen for this building type by choosing the associated check boxes at the left. Customer allowances (or incentives) are not included in this example and are set to 0. When customer incentives are considered, the Participants Test score increases and the G-RIM test score decreases. In this analysis tool, the customer incentive is entered at the right of this summary table (not shown) and automatically "pulled" to this table as required based on selected building type.

** Entries in Blue may be modified **

Gas Utility: **Florida City Gas**

SUMMARY RESULTS - Participants and RIM tests

| Electric Rate | Building Type Selection | Gas Utility | Program Type |
|---|---|---|---|
| *Weighted Average* | *Large Commercial Hospitality* | *Florida City Gas* | *New Construction* |

| Equipment Selection Option | PrintSummaryReport | Allowance (per Unit) | Participants Test | G-RIM Test | Carbon Reduction (tons CO2/yr) | Fraction of Equipment Gas Usage To Total Gas Usage |
|---|---|---|---|---|---|---|
| ☑ | Water Heating - Tank (3) | $0 | 1.609 | 1.484 | 41.853 | |
| ☐ | Water Heating - Tankless | $0 | 0.000 | 0.000 | 0.000 | |
| ☑ | Cooking - Deep Fryer (2) | $0 | 1.120 | 1.481 | 14.325 | |
| ☑ | Cooking - Oven/Range (1) | $0 | 1.762 | 1.481 | 12.362 | |
| ☑ | Pool Heating (1) | $0 | 0.639 | 1.483 | 4.090 | |
| ☑ | Desiccant Dehumidifier (8) | $0 | 0.871 | 1.474 | 0.085 | |
| ☑ | Clothes Drying (10) | $0 | 1.134 | 1.489 | 49.310 | |

**Figure 4. General Inputs and Analysis Results**

The financial data (economic indicators of inflation rates), program administration costs incurred by the utility, investment costs for gas mains and meter, and electric and natural gas utility costs are also entered on the Assumptions worksheet. Exceptions are for cells highlighted in orange where data is pulled from the Cost Data worksheet as necessary. These data can be changed, but will be overwritten the next time the Building Type, Gas Utility Co, or Program Type is changed at the top of this worksheet or anytime the building gas usage changes for any reason.

The financial data include the general inflation rate, fuel and non-fuel escalation rates, and any inflation rates associated with customer taxes. These inflation rates were initially calculated in accordance with rules established by the Florida Building Commission pursuant to rule 9B-13.0071 – Cost Effectiveness of Amendments to Energy Code.

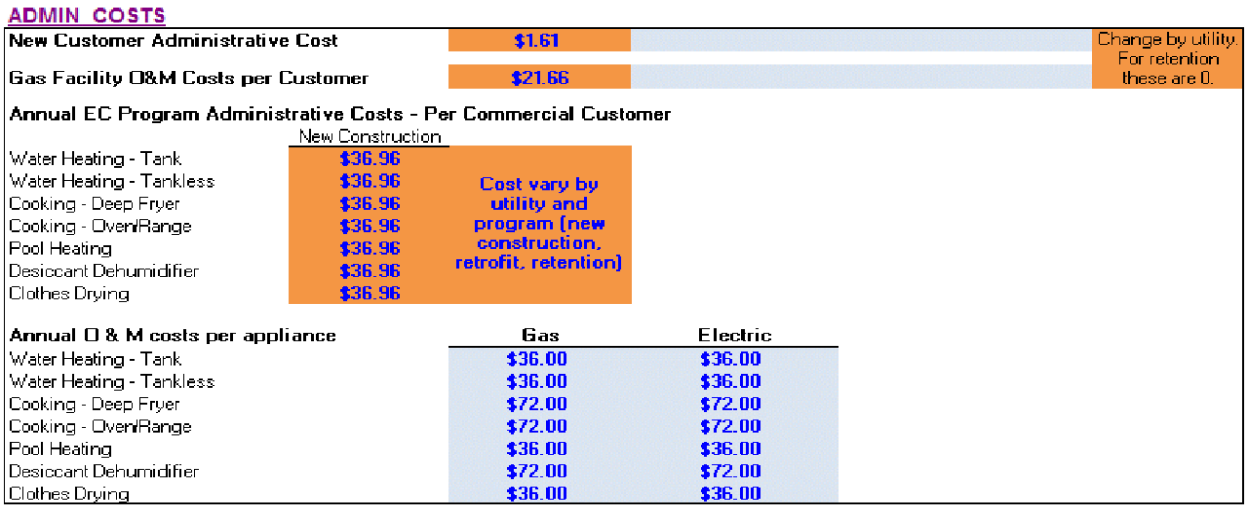
*** Entries in Orange highlighted cells are taken from the Cost Data sheet as necessary and may NOT be modified on this worksheet ***

FINANCIAL DATA

| | | | | | |
|---|---|---|---|---|---|
| **Discount Rate** | 5.72% | | | | |
| **General Inflation Rate** | 3.19% | | | | |
| **Customer Tax Rate** | | | | | |
| Gas | 2.50% | | | | |
| Electric | 2.56% | | | | |
| **Fuel and O&M Escalators** | | **Non-Fuel Gas Rate Escalators** | | **Non-Fuel Elec. Rate Escalators** | |
| O&M expense | 3.19% | Cust. Charge - Gas | 0.00% | Cust. Charge - Elec | 0.00% |
| Electric Fuel Rate | 7.12% | Gas Base Rate | 8.77% | Electric Base Rate | 7.12% |
| Gas Fuel Rate | 8.77% | | | Electric Demand Charge | 0.00% |

**Figure 5. Financial Inputs**

Administration cost inputs as shown in Figure 6 include any costs incurred by the gas utility while implementing a particular conservation program. Operating and maintenance costs, paid by the utility customer, are also entered here. Utility company administration costs and operating and maintenance costs are identified for each appliance type and used by each specific appliance economic worksheet as appropriate. The costs shown in cells with orange highlights are formally entered on the Cost Data worksheet and automatically written to this worksheet using Microsoft Visual Basic programming language. For this reason, additional rows or columns should not be added to this spreadsheet without modifying these visual basic write statements (i.e., Visual Basic in Excel).



ADMIN COSTS

| | | |
|---|---|---|
| **New Customer Administrative Cost** | $1.61 | Change by utility. For retention these are 0. |
| **Gas Facility O&M Costs per Customer** | $21.66 | |

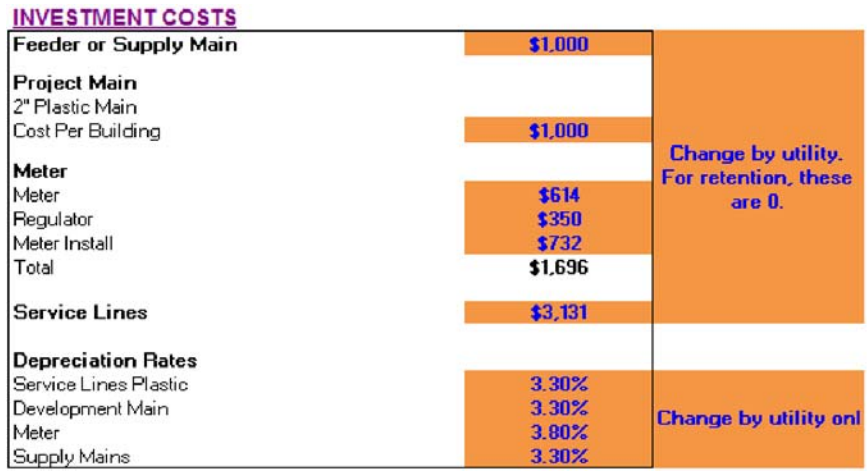
**Annual EC Program Administrative Costs - Per Commercial Customer**

| | New Construction | |
|---|---|---|
| Water Heating - Tank | $36.96 | Cost vary by utility and program (new construction, retrofit, retention) |
| Water Heating - Tankless | $36.96 | |
| Cooking - Deep Fryer | $36.96 | |
| Cooking - Oven/Range | $36.96 | |
| Pool Heating | $36.96 | |
| Desiccant Dehumidifier | $36.96 | |
| Clothes Drying | $36.96 | |

| **Annual O & M costs per appliance** | **Gas** | **Electric** |
|---|---|---|
| Water Heating - Tank | $36.00 | $36.00 |
| Water Heating - Tankless | $36.00 | $36.00 |
| Cooking - Deep Fryer | $72.00 | $72.00 |
| Cooking - Oven/Range | $72.00 | $72.00 |
| Pool Heating | $36.00 | $36.00 |
| Desiccant Dehumidifier | $72.00 | $72.00 |
| Clothes Drying | $36.00 | $36.00 |

**Figure 6. Administrative Cost Inputs**

Utility investment costs for main supply lines, gas meter, and meter installation cost are entered on the Cost Data worksheet and written here for a particular analysis (Figure 4). The depreciation rates used for tax purposes are organized in a similar manner and written here for use in the economic calculations. The costs shown in cells with orange highlights are formally entered on the Cost Data worksheet.



INVESTMENT COSTS

| | | |
|---|---|---|
| **Feeder or Supply Main** | $1,000 | Change by utility. For retention, these are 0. |
| **Project Main** | | |
| 2" Plastic Main | | |
| Cost Per Building | $1,000 | |
| **Meter** | | |
| Meter | $614 | |
| Regulator | $350 | |
| Meter Install | $732 | |
| Total | $1,696 | |
| **Service Lines** | $3,131 | |
| **Depreciation Rates** | | |
| Service Lines Plastic | 3.30% | Change by utility onl |
| Development Main | 3.30% | |
| Meter | 3.80% | |
| Supply Mains | 3.30% | |

**Figure 7. Investment Costs Inputs**

The gas utility cost information follows as shown in Figure 8. This information is formally entered on the Cost Data worksheet and written to this location based on the building's total gas usage. The natural gas costs located on the Cost Data worksheet may be changed to represent the costs of different utilities. Connections charges are not included in this analysis.

REVENUE ITEMS

| Gas Rates | Total Building Energy (therms) | 24,877 |
|---|---|---|
| Customer. Charge | $30.00 | Per Month |
| ECCB | $0.02450 | Per Therm |
| Distribution Charge | $0.27490 | Per Therm |
| PGA Recovery Factor | $0.60160 | Per Therm |

**Figure 8. Gas Utility Revenue Items Inputs**

The average electric rates used for the analysis are located next in the list of inputs as shown in Figure 9. The four largest utilities in the State of Florida are included in this worksheet. These rates are numerically averaged based on the number of customers for each utility company. The specific utility rates, the numerical average, or the customer-weighted average may be used in the analysis as previously described. The rates actually used in the economic calculations are shown at the right of the table.

| General Service Demand (GSD) | COMMERCIAL ELECTRIC RATES | | | | | | User Selection (cell E7) |
|---|---|---|---|---|---|---|---|
| | FPL | Progress Energy | Tampa Elec Co | Gulf Power | Average | Weighted Average | for calculations |
| Cust. Charge | $33.05 | $10.62 | $42.00 | $35.00 | $30.17 | $29.57 | $29.57 |
| Energy Charge | $0.01660 | $0.01618 | $0.01370 | $0.01396 | | | |
| Fuel Charge | $0.05834 | $0.06623 | $0.06766 | $0.05758 | $0.06245 | $0.06059 | $0.06059 |
| Capacity | -- | $0.01547 | $0.00429 | $0.00262 | | | |
| Environmental | $0.00084 | $0.00307 | $0.00228 | $0.00720 | | | |
| Energy Conservation | $0.00186 | $0.00182 | $0.00086 | $0.00080 | | | |
| Total | $0.0776 | $0.1028 | $0.0888 | $0.0822 | $0.08784 | $0.08398 | $0.08398 |
| FLGross Receipts Tax (%) | 2.56% | 2.56% | 2.56% | 2.56% | 2.56% | 2.56% | 2.56% |
| Demand Charge | $7.52 | $3.71 | $7.25 | $5.42 | $5.98 | $6.53 | $6.53 |
| From 2008 FERC Form 1 - 2007 Q4 | | | | | Total Customers | | |
| # of customers (Approx) | 93289 | 29790 | 12572 | 15522 | 151173 | | |

Electric rates as of January 2009

**Figure 9. Electric Utility Rate Structure Inputs**

An equipment and installation cost summary, installation cost detail for each equipment type, and a detailed breakdown of energy use by equipment type is provided at the bottom of the Assumptions worksheet as shown in the following figures. These tables identify the analysis inputs in one strategic location. The data in these tables are also used in the appliance worksheets (e.g., Water Heating) to calculate the economic data required for the analysis. Note that these data do not require adjustment and are the results of other inputs and assumptions provided elsewhere in the workbook. The data presented in the following tables include the appliance multiplier as specified on the Equipment Summary worksheet (e.g., cells A27 – A29). Also note that the appliance type has the number of units appended to the name category. For water heaters, only the selected appliance type (e.g., Tank or Tankless) shows the number of units since only one tank type is applicable to a specific analysis.

| EQUIPMENT and INSTALLATION COST (data pulled from detailed cost tables on Equipment Summary tab at I25:I107 or J25:J107) | Gas | Electric | | Gas | Electric |
|---|---|---|---|---|---|
| **Water Heating - Tank (3)** | | | **Water Heating - Tankless** | | |
| Equipment | $2,268 | $1,677 | Equipment | $2,688 | $2,265 |
| Installation | $4,034 | $2,834 | Installation | $4,034 | $2,834 |
| Service Life Replacement | $2,834 | $2,834 | Service Life Replacement | $2,834 | $2,834 |
| **Cooking - Deep Fryer (2)** | | | **Cooking - Oven/Range (1)** | | |
| Equipment | $8,892 | $9,264 | Equipment | $5,617 | $5,203 |
| Installation | $950 | $350 | Installation | $650 | $350 |
| Service Life Replacement | $350 | $350 | Service Life Replcmnt | $350 | $350 |
| **Pool Heating (1)** | | | **Desiccant Dehumidifier (8)** | | |
| Equipment | $3,250 | $2,840 | Equipment | $28,712 | $35,040 |
| Installation | $600 | $250 | Installation | $4,000 | $2,000 |
| Service Life Replacement | $250 | $250 | Service Life Replcmnt | $2,000 | $2,000 |
| **Clothes Drying (10)** | | | | | |
| Equipment | $26,200 | $24,200 | | | |
| Installation | $6,500 | $2,500 | | | |
| Service Life Replacement | $2,500 | $2,500 | | | |

Note: Service Life Replacement Installation does not include equipment cost.

**Figure 10. Equipment and Installation Cost Summary**

*Pull data from installation costs based on building type - DO NOT CHANGE CELL FORMULAS*

| Large Commercial Hospitality - Installation Cost Detail (Excluding Equipment cost) | Piping | Venting | Installation | Total | Electrical Installation Savings |
|---|---|---|---|---|---|
| Water Heating - Tank (3) | $750 | $450 | $2,834 | $4,034 | $75 |
| Water Heating - Tankless | $750 | $450 | $2,834 | $4,034 | $105 |
| Cooking - Deep Fryer (2) | $300 | $300 | $350 | $950 | $70 |
| Cooking - Oven/Range (1) | $150 | $150 | $350 | $650 | $35 |
| Pool Heating (1) | $350 | $0 | $250 | $600 | $75 |
| Desiccant Dehumidifier (8) | $2,000 | $0 | $2,000 | $4,000 | $200 |
| Clothes Drying (10) | $2,500 | $1,500 | $2,500 | $6,500 | $350 |

**Figure 11. Piping and Equipment Installation Costs Summary**

*Assembled data based on Equipment Selection Option (A10-A18) and Building Type (F3)*

| # of Units | Therm and KWH Usage - Large Commercial Hospitality | Gas | | Electric | | | Single Equipment Gas Use Multiplier | Electrical Breaker and Wiring Savings |
|---|---|---|---|---|---|---|---|---|
| | | % of Total | Therms | KWH | kW Demand | Diversity | | |
| 3 | Water Heating - Tank (3) | 18.8% | 4,681 | 90,885 | 60 | 25% | 1 | 75 |
| 2 | Cooking - Deep Fryer (2) | 12.8% | 3,176 | 42,070 | 7 | 100% | 1 | 70 |
| 1 | Cooking - Oven/Range (1) | 4.8% | 1,204 | 25,599 | 6 | 100% | 1 | 35 |
| 1 | Pool Heating (1) | 16.3% | 4,062 | 33,985 | 7 | 0% | 1 | 75 |
| 8 | Desiccant Dehumidifier (8) | 8.5% | 2,118 | 14,867 | 10 | 100% | 1 | 200 |
| 10 | Clothes Drying (10) | 38.7% | 9,636 | 135,780 | 50 | 30% | 1 | 350 |
| | TOTAL | 100.0% | 24677 | 343186 | | | | |

**Figure 12. Equipment Energy Use Summary**

## *Equipment Summary Worksheet*

The equipment summary worksheet allows input for energy use, equipment and installation cost, appliance life expectancy, and any offsetting cost for electrical equipment. Equipment efficiency inputs are also provided here. Since the equipment used and other costs associated with a particular application may change based on building type, the inputs associated with a particular appliance are repeated for each building type. This allows an analysis to vary equipment costs based on a change in energy use as well as the size of the equipment, or for applications where multiple installations of a single appliance are required for a specific building.

The first table simply acts as a reminder of the underlying building and equipment assumptions made when developing this economic analysis tool.

| Table 1. Building Classification and Equipment Summary | | | | | |
|---|---|---|---|---|---|
| **Building Type** | **Water Heating** | **Cooking** | **Pool** | **Desiccant Dehumidifier** | **Clothes Drying** |
| Small Commercial Non Food Service | X | | | X | |
| Large Commercial Non Food Service | X | | | X | |
| Small Commercial Food Service | X | X | | X | |
| Large Commercial Food Service | X | X | | X | |
| Large Commercial Hospitality | X | X | X | X | X |
| Small Commercial Cleaning Services | X | | | X | X |

**Figure 13. Building Type and Associated Appliance Assumptions**

The following table identifies the life expectancy of each appliance type. The value selected for life expectancy is used in the appliance worksheets to identify the year that future replacement costs are applied. These inputs may be changed according to the specific appliance selected for study.

*Enter appliance life expectancy*

| Average Appliance Life in Years | | |
|---|---|---|
| **Appliance Type** | **Gas** | **Electric** |
| Water Heating - Tank | 12 | 12 |
| Water Heating - Tankless | 15 | 15 |
| Cooking - Deep Fryer | 10 | 10 |
| Cooking - Oven/Range | 13 | 13 |
| Pool Heating | 10 | 10 |
| Desiccant Dehumidifier | 12 | 12 |
| Clothes Drying | 10 | 10 |

**Figure 14. Equipment Life Expectancy Inputs**

The next set of tables identify the energy use, electric demand, electric demand diversity factor, water heater efficiency levels, and costs associated with each appliance, in this case for the Small Commercial Non-Food Service building. Each building type contains two sets of tables, the first table pertains to energy use, and the second table pertains to the associated appliance costs.

The majority of information in these tables are entered as the *unit cost* for a single appliance whether it be for equipment demand, equipment cost, installation costs, or avoided electrical costs. The number of units for any given application is entered at the left of the tables. The number of units input is used as a multiplier for the costs shown in each table. For this reason, care should be used when entering the energy use (kWh) for each equipment type such that the total building energy use (i.e., kWh multiplied by the number of units) provide a realistic value. The formula for cooking equipment is based on a regression analysis of detailed data and should not be altered without access to other more accurate information (e.g., Equipment Assumptions cell D51). Refer to and understand the formula for these inputs prior to modifying these cells.

For each building type, the inputs are organized into two distinct tables. As with the Assumptions worksheet, each input that requires user attention is highlighted with a light blue background. The other non-highlighted cells are automatically calculated based on fixed assumptions, although these cells may also be changed as necessary. Note that the energy use inputs may include a correction for the number of appliances. Altering these inputs should use the same syntax shown in the corresponding cell (e.g. total energy divided by number of units). A backup copy of the spreadsheet should be maintained in the case where non-highlighted cells are modified.

** Entries in Blue may be modified **

# of Units

| | Small Commercial Non Food Servic | Gas | Electric | | | | Gas: | Electric: |
|---|---|---|---|---|---|---|---|---|
| | | Therms | KWH | kW Demand | Demand Diversity | | | |
| 1 | Water Heating - Tank | 134 | 2,600 | 10 | 25% | Assumes EF = | 0.59 | 0.89 |
| 1 | Water Heating - Tankless | 100 | 2,515 | 25 | 15% | Assumes EF = | 0.79 | 0.92 |
| 1 | Desiccant Dehumidifier | 139 | 1,256 | 1.3 | 100% | | | |

| | Installed Cost Detail (excl equip) | Piping | Venting | Installation | Total | Electrical Cost | Equipment Cost: Natural Gas | Equipment Cost: Electric |
|---|---|---|---|---|---|---|---|---|
| | Water Heating - Tank | $250 | $150 | $945 | $1,345 | 35 | $756 | $559 |
| | Water Heating - Tankless | $250 | $150 | $945 | $1,345 | 35 | $896 | $755 |
| | Desiccant Dehumidifier | $250 | $0 | $250 | $500 | 25 | $3,589 | $4,380 |

**Figure 15. Energy and Cost inputs for Small Commercial Non-Food Service Building Type**

In the first table, or group of data in Figure 15, the base energy use for the appliance is identified. Inputs highlighted in blue are identified as likely to change based on specific analysis assumptions. For this building type, only water heaters and desiccant dehumidifiers may be considered in the analysis.

The water heater base energy use (2600 kWh) is entered for the Water Heating – Tank. This input represents the annual energy use for the Small Commercial Non-Food Service building type. Multipliers entered in column A will account for the incremental cost of operating more than one appliance. For example, if this building had 2 water heaters, the value displayed in the kWh column is automatically changed to 1,300 to represent a total building hot water energy use of 2,600 kWh (i.e., the amount of hot water usage does not change simply because two water heaters are purchased). Other associated inputs are also entered on a per unit basis. The associated electrical energy for the electric tankless water heater and the natural gas usage for the gas-fired water heaters are automatically calculated. For other equipment, in this case the desiccant dehumidifier, the electric and natural gas usage is manually entered (via light blue highlighted inputs). For other building types, these inputs may be manually entered or calculated based on regression analysis (e.g., cooking equipment) or other formula to allow automation of inputs.

The electric demand, demand diversity, and water heater efficiencies are also located here. The demand diversity factor allows the user to enter the cyclic fraction of the kW Demand that applies towards electric cost. For example, if the appliance is rated at 10 kW and the appliance is determined to provide a 25% duty cycle throughout the day, a diversity factor of 25% is used. This means that the electric demand associated with that appliance, as pertaining to energy costs, is 25% of the rated electric demand. If utility demand charges do not apply, set the appliance kW Demand or Demand Diversity factor to 0. An exception to the demand diversity exists with the cooking equipment. The regression analysis previously described automatically calculates the demand diversity for cooking equipment based on the FSTC's life-cycle and energy cost

calculator and enters this information into the kW Demand category. For this reason, a Diversity Override input is provided. In most cases, an override of 100% is used since the kW Demand data already includes the impact of cycling for commercial cooking equipment.

The second table, or group of data, identifies the costs associated with each appliance. Gas piping and venting costs, avoided electrical installation costs (i.e., breaker and wiring size differences), and equipment cost are entered here. These costs are entered on a per unit basis. If more than one piece of equipment is to be included in the analysis, the number of units input to the left of these tables accounts for multiple installations (and therefore multiple customer incentives). In most cases, unit costs may be modified. The exception to this rule is the installation cost for water heaters. These costs are derived from an average of several contractor estimates received for gas-to-gas installations to replace existing water heaters (cell B118). Since these replacement costs only account for the connection of the water heater to existing infrastructure, the average costs of these estimates is assumed to be the installation cost for both electric and natural gas water heaters. These costs may be changed as necessary as other more accurate data becomes available.

The basic use for inputs in this area of the analysis tool are:

1. The energy use and cost data for specific appliances
2. The energy use and cost data for appliances by building type (i.e., changes in costs based on changes in appliance load for specific building types)
3. An input for multiple appliances to more accurately account for customer incentives
4. Input for net electrical equipment costs (e.g., the difference in cost due to a change [reduction] in breaker or wire size)
5. A location from which data is accessed when selecting a building type in cell F7 on the assumptions page. These data are written to the associated summary tables.
6. Specialized controls for specific appliances (e.g., pool cover used, demand diversity overrides, regression analysis for specific appliances, etc.)

The following figures show the tables (or sets of data) for each building type selected for study. As previously mentioned, the inputs shown with blue highlights are likely to change based on specific analysis assumptions.

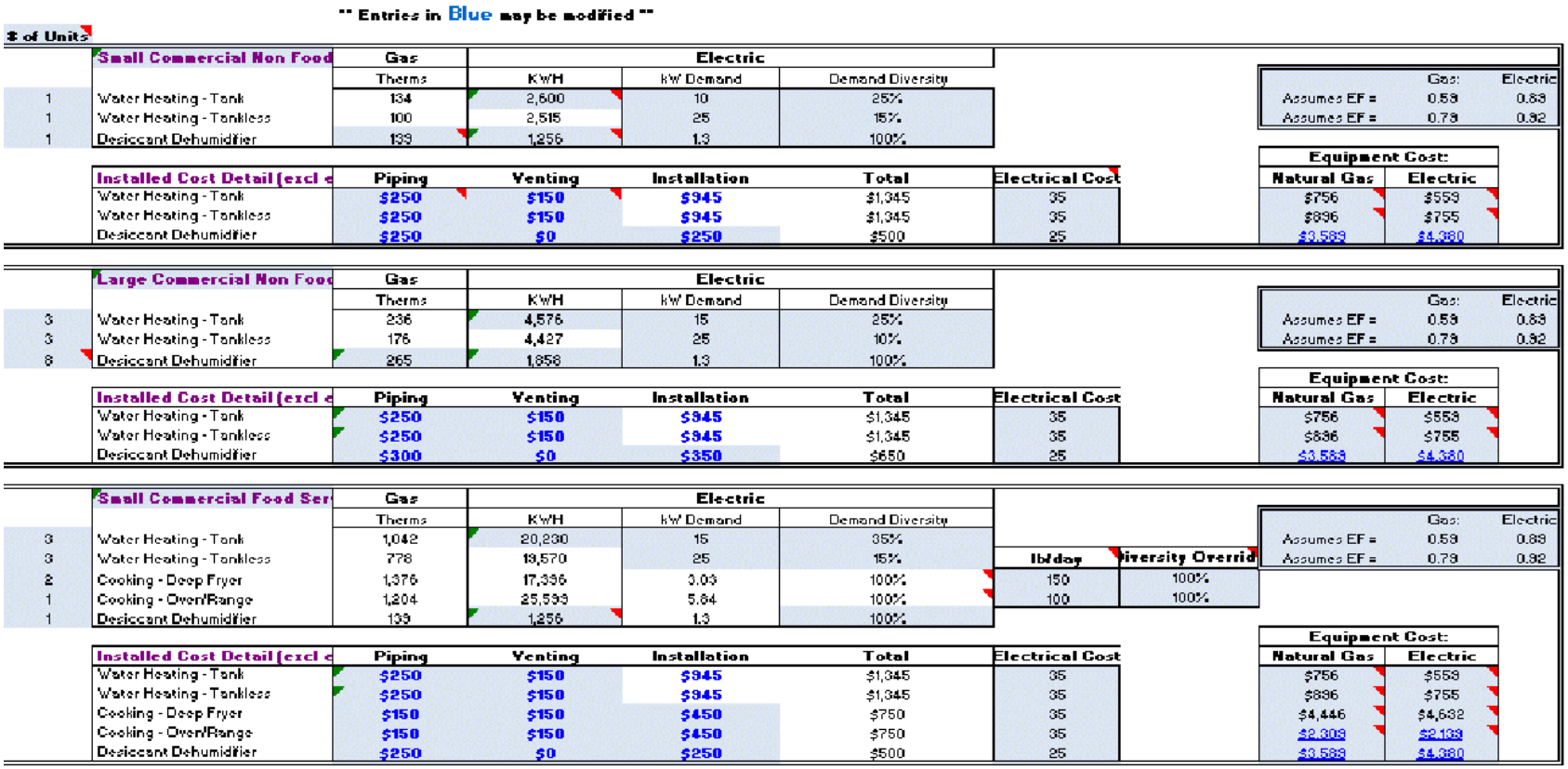
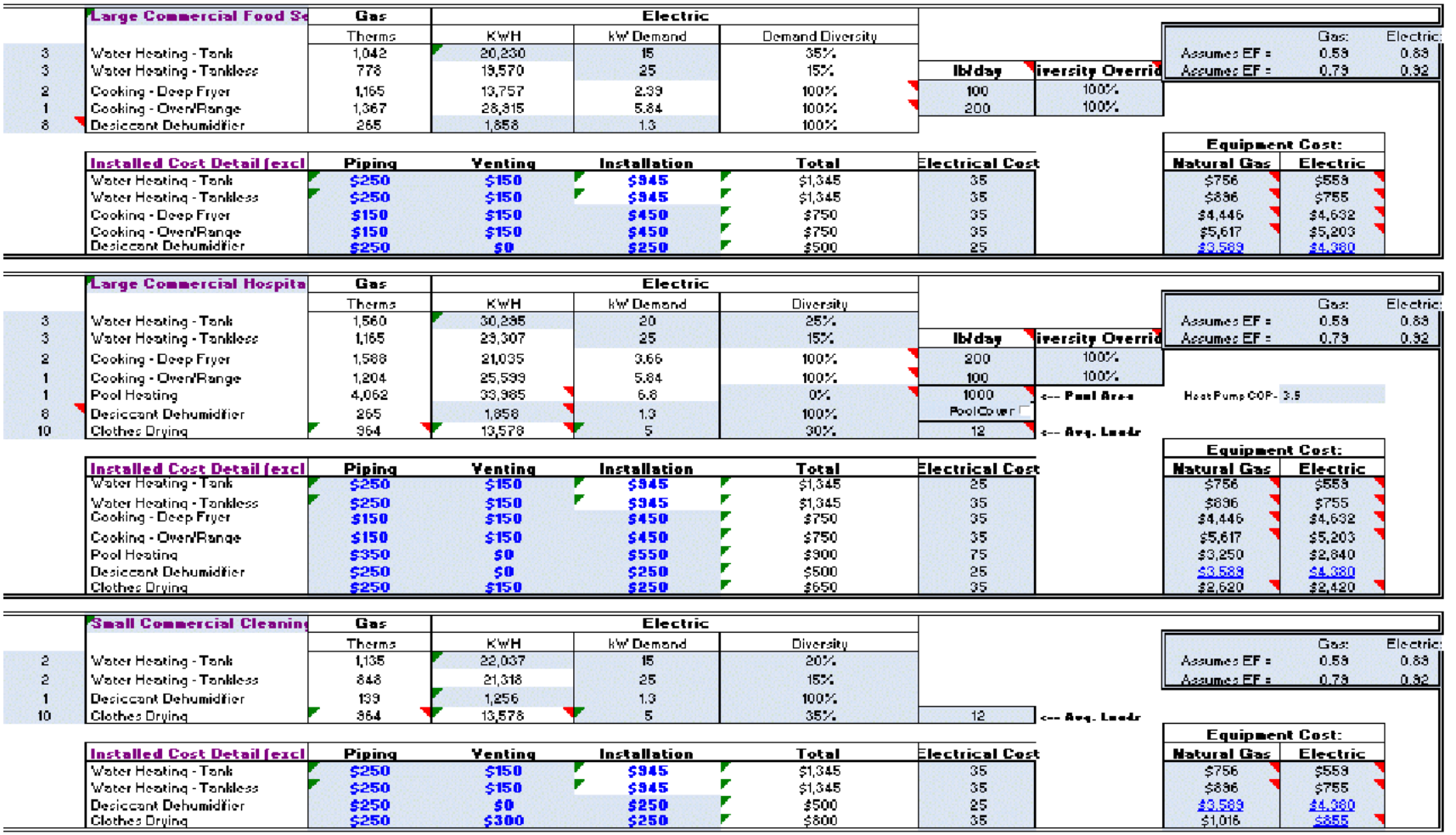



**Figure 16. Equipment Energy Inputs by Building Type**



| | Large Commercial Food Se | Gas | Electric | | | | | | | Gas: | Electric: |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Therms | KWH | kW Demand | Demand Diversity | | | | Assumes EF = | 0.59 | 0.88 |
| 3 | Water Heating - Tank | 1,042 | 20,230 | 15 | 35% | | | | Assumes EF = | 0.78 | 0.92 |
| 3 | Water Heating - Tankless | 778 | 19,570 | 25 | 15% | lb/day | iversity Overrid | | | | |
| 2 | Cooking - Deep Fryer | 1,165 | 13,757 | 2.39 | 100% | 100 | 100% | | | | |
| 1 | Cooking - Oven/Range | 1,367 | 28,815 | 5.84 | 100% | 200 | 100% | | | | |
| 8 | Desiccant Dehumidifier | 265 | 1,858 | 1.3 | 100% | | | | | | |

| Installed Cost Detail (excl | Piping | Venting | Installation | Total | Electrical Cost | Equipment Cost: Natural Gas | Electric |
|---|---|---|---|---|---|---|---|
| Water Heating - Tank | $250 | $150 | $945 | $1,345 | 35 | $756 | $559 |
| Water Heating - Tankless | $250 | $150 | $945 | $1,345 | 35 | $886 | $755 |
| Cooking - Deep Fryer | $150 | $150 | $450 | $750 | 35 | $4,446 | $4,632 |
| Cooking - Oven/Range | $150 | $150 | $450 | $750 | 35 | $5,617 | $5,203 |
| Desiccant Dehumidifier | $250 | $0 | $250 | $500 | 25 | $3,589 | $4,360 |

| | Large Commercial Hospita | Gas | Electric | | | | | | | Gas: | Electric: |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Therms | KWH | kW Demand | Diversity | | | | Assumes EF = | 0.59 | 0.88 |
| 3 | Water Heating - Tank | 1,560 | 30,285 | 20 | 25% | | | | Assumes EF = | 0.78 | 0.92 |
| 3 | Water Heating - Tankless | 1,165 | 29,307 | 25 | 15% | lb/day | iversity Overrid | | | | |
| 2 | Cooking - Deep Fryer | 1,588 | 21,035 | 3.66 | 100% | 200 | 100% | | | | |
| 1 | Cooking - Oven/Range | 1,204 | 25,599 | 5.84 | 100% | 100 | 100% | | | | |
| 1 | Pool Heating | 4,062 | 33,985 | 6.8 | 0% | 1000 | <-- Pool Area | | Heat Pump COP= 3.5 | | |
| 8 | Desiccant Dehumidifier | 265 | 1,858 | 1.3 | 100% | Pool Cover | | | | | |
| 10 | Clothes Drying | 364 | 13,578 | 5 | 30% | 12 | <-- Avg. Loads | | | | |

| Installed Cost Detail (excl | Piping | Venting | Installation | Total | Electrical Cost | Equipment Cost: Natural Gas | Electric |
|---|---|---|---|---|---|---|---|
| Water Heating - Tank | $250 | $150 | $945 | $1,345 | 25 | $756 | $559 |
| Water Heating - Tankless | $250 | $150 | $945 | $1,345 | 35 | $886 | $755 |
| Cooking - Deep Fryer | $150 | $150 | $450 | $750 | 35 | $4,446 | $4,632 |
| Cooking - Oven/Range | $150 | $150 | $450 | $750 | 35 | $5,617 | $5,203 |
| Pool Heating | $350 | $0 | $550 | $900 | 75 | $3,250 | $2,840 |
| Desiccant Dehumidifier | $250 | $0 | $250 | $500 | 25 | $3,589 | $4,360 |
| Clothes Drying | $250 | $150 | $250 | $650 | 35 | $2,620 | $2,420 |

| | Small Commercial Cleanin | Gas | Electric | | | | | | | Gas: | Electric: |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Therms | KWH | kW Demand | Diversity | | | | Assumes EF = | 0.59 | 0.88 |
| 2 | Water Heating - Tank | 1,135 | 22,037 | 15 | 20% | | | | Assumes EF = | 0.78 | 0.92 |
| 2 | Water Heating - Tankless | 848 | 21,318 | 25 | 15% | | | | | | |
| 1 | Desiccant Dehumidifier | 139 | 1,256 | 1.3 | 100% | | | | | | |
| 10 | Clothes Drying | 364 | 13,578 | 5 | 35% | 12 | <-- Avg. Loads | | | | |

| Installed Cost Detail (excl | Piping | Venting | Installation | Total | Electrical Cost | Equipment Cost: Natural Gas | Electric |
|---|---|---|---|---|---|---|---|
| Water Heating - Tank | $250 | $150 | $945 | $1,345 | 35 | $756 | $559 |
| Water Heating - Tankless | $250 | $150 | $945 | $1,345 | 35 | $886 | $755 |
| Desiccant Dehumidifier | $250 | $0 | $250 | $500 | 25 | $3,589 | $4,360 |
| Clothes Drying | $250 | $300 | $250 | $800 | 35 | $1,016 | $855 |

**Figure 17. Equipment Energy Inputs by Building Type (cont.)**

# Economic Analysis

A complete economic analysis is provided for each appliance type selected for a particular analysis. As previously described, only select appliance types are allowed for a particular building type as defined in Table 2. These worksheets are designed to be self-standing, require no additional input, and are used for data verification and reporting purposes as required.

Each worksheet is automatically enabled based on the Equipment Selection Option check box in cell A10-A16 on the Assumptions worksheet. Only selected appliances display the associated appliance worksheet. These worksheets are organized into 5 discrete sections. The sections associated with a specific appliance are:

- a summary of the model inputs
- the itemized calculations (tables) for the Participants Test
- a summary of the Participants Test and resulting score
- the itemized calculations (tables) for the Gas Rate Impact Measure Test
- a summary of the Gas Rate Impact Measure Test and resulting score

The first section identifies the model inputs as defined on the Assumptions and Equipment Summary worksheets. Inputs highlighted in yellow are specific to the type of appliance described on the worksheet. The input data referenced here are "pulled" from the Assumptions or Equipment Summary worksheet as necessary. For example, gas and electric equipment and installation costs are specific to the input data for the specific appliance type (e.g., water heating - tank) described for the building type selected for study. This yellow highlighted input data is found on the Equipment Summary worksheet. Non-highlighted inputs are found on either the Assumptions worksheet or the Equipment Summary worksheet as appropriate.

An example water heating economic analysis is shown on the following seven pages. It includes the economic calculations and associated results for both the Participants test and Gas Rate Impact Measure test as directed in the Florida Public Service Commission's Cost Effectiveness Manual for Natural Gas Utility Demand Side Management Programs document (provided as Appendix A in this report). These tables, while configured for water heating, are representative of the format for all of the appliances. The following results are also meant to provide an example output. These results will vary based on the specific assumptions made for a particular analysis.

Note that the electric utility customer charge shown in the first section (line item under part VIII – Customer Chg) is not included in the life-cycle cost analysis and is assumed to be a base cost for all customers (i.e., all customers are already connected to the electric grid and are therefore charged a monthly customer charge). This analysis also assumes that the base electric rate category will not change when a customer changes the fuel source for one or more appliances (i.e., the customer remains on the general service demand electric utility rate structure). Also note that the associated utility customer charge for gas customers (line item under part III –

Customer Chg) is pro-rated in the life-cycle cost analysis based on the ratio of appliance gas usage to total building gas usage for each appliance considered in the analysis (Ref. Table 4 – Gas Customer Charge).

## Associated Gas Distributors of Florida - Energy Conservation Filing 2009
## Commercial New Construction Program

***Other Equipment Included in Analysis: Cooking - Deep Fryer (2), Cooking - Oven/Range (1), Pool Heating (1), Desiccant Dehumidifier (8), Clothes Drying (10)***

| | | |
|---|---|---|
| **Gas:** | **Water Heating - Tank (3)** | |
| **CO2:** | **23.4 tonnes CO2/year** | |
| **Allowance:** | **$0** | |
| **Gas Utility:** | **Florida City Gas** | |
| I. | **Installed Cost Data** | |
| | Equipment | $2,268 |
| | Installation | $4,034 |
| | Total Customer Cost | $6,302 |
| | Replacement Installation | $2,834 |
| | Total Replacement (incl Equip) | $5,102 |
| | Utility Rebate | $0 |
| II. | **Operating Data** | |
| | Therms Consumed | 4,681 |
| | Total Building Therms | 24,877 |
| | O&M (excluding energy) | $58 |
| III. | **Rates and Charges** | |
| | ECCR | $0.0245 |
| | Distribution Charge | $0.2749 |
| | Commodity Charge | $0.6016 |
| | Taxes & Fees | 2.50% |
| | Customer Chg | $30.00 |
| | Average Life (years) | 12 |
| | Appliance Therms /Total Therms | 18.8% |
| | EC Program Adm. Cost | $36.96 |
| IV. | **New Customer Installation Costs** | |
| | Supply Main | $1,000 |
| | Development Main | $1,000 |
| | Service | $3,131 |
| | Meter | $1,696 |
| | Total | $6,827 |
| V. | **New Customer Admin. Cost $/month** | $1.61 |

| | | |
|---|---|---|
| **Elec:** | **Water Heating - Tank (3)** | |
| **CO2:** | **65.25 tonnes CO2/year** | |
| **Rate:** | **Weighted Average** | |
| **Bldg:** | **Large Commercial Hospitality** | |
| VI. | **Electric Cost Data** | |
| | Equipment | $1,677 |
| | Installation | $2,834 |
| | Breaker and Wiring Savings | $75 |
| | Total Customer Cost | $4,586 |
| VII. | **Energy Conserved Data** | |
| | Monthly Demand kW | 15 |
| | Annual kWh | 90,885 |
| | O&M (excluding energy) | $36 |
| VIII. | **Electric Rates and Charges** | |
| | Electric Rate per kW | $6.53 |
| | Electric Rate per kWh | $0.0840 |
| | Electric Fuel rate | $0.0606 |
| | Electric Base rate | $0.0234 |
| | Electric Taxes & Fees | 2.56% |
| | Customer Chg | $29.57 |
| | Average Life in Yrs | 12 |

**Associated Gas Distributors of Florida - Energy Conservation Filing 2009**

**Commercial New Construction Program**

**Water Heating - Tank (3)**

*Other Equipment Included in Analysis: Cooking - Deep Fryer (2), Cooking - Oven/Range (1), Pool Heating (1), Desiccant Dehumidifier (8), Clothes Drying (10)*

**Table 1 - Electric KWH/KW Cost**

| Year | Cost Per KWH | Annual KWH | Cost Per kW | Monthly Demand kW | Tax Rate | Electric Cost |
|---|---|---|---|---|---|---|
| A | B | C | D | E | F | (B*C+12*D*E) *(1+F) |
| 2010 | $0.0840 | 90,885 | $6.53 | 15.00 | 2.6% | **$9,034** |
| 2011 | $0.0900 | 90,885 | $6.53 | 15.00 | 2.6% | **$9,592** |
| 2012 | $0.0964 | 90,885 | $6.53 | 15.00 | 2.6% | **$10,189** |
| 2013 | $0.1032 | 90,885 | $6.53 | 15.00 | 2.6% | **$10,828** |
| 2014 | $0.1106 | 90,885 | $6.53 | 15.00 | 2.6% | **$11,513** |
| 2015 | $0.1185 | 90,885 | $6.53 | 15.00 | 2.6% | **$12,247** |
| 2016 | $0.1269 | 90,885 | $6.53 | 15.00 | 2.6% | **$13,034** |
| 2017 | $0.1359 | 90,885 | $6.53 | 15.00 | 2.6% | **$13,876** |
| 2018 | $0.1456 | 90,885 | $6.53 | 15.00 | 2.6% | **$14,778** |
| 2019 | $0.1560 | 90,885 | $6.53 | 15.00 | 2.6% | **$15,744** |
| 2020 | $0.1671 | 90,885 | $6.53 | 15.00 | 2.6% | **$16,779** |
| 2021 | $0.1790 | 90,885 | $6.53 | 15.00 | 2.6% | **$17,888** |
| 2022 | $0.1917 | 90,885 | $6.53 | 15.00 | 2.6% | **$19,076** |
| 2023 | $0.2054 | 90,885 | $6.53 | 15.00 | 2.6% | **$20,348** |
| 2024 | $0.2200 | 90,885 | $6.53 | 15.00 | 2.6% | **$21,711** |
| 2025 | $0.2356 | 90,885 | $6.53 | 15.00 | 2.6% | **$23,171** |
| 2026 | $0.2524 | 90,885 | $6.53 | 15.00 | 2.6% | **$24,735** |
| 2027 | $0.2704 | 90,885 | $6.53 | 15.00 | 2.6% | **$26,410** |
| 2028 | $0.2896 | 90,885 | $6.53 | 15.00 | 2.6% | **$28,205** |
| 2029 | $0.3103 | 90,885 | $6.53 | 15.00 | 2.6% | **$30,127** |

**Table 2 - Gas Fuel Charge**

| Year | Cost Per Therm | Annual Therms | Tax Rate | Gas Cost |
|---|---|---|---|---|
| A | B | C | D | B*C *(1+D) |
| 2010 | $0.6016 | 4,681 | 2.5% | **$2,886** |
| 2011 | $0.6544 | 4,681 | 2.5% | **$3,139** |
| 2012 | $0.7117 | 4,681 | 2.5% | **$3,415** |
| 2013 | $0.7742 | 4,681 | 2.5% | **$3,714** |
| 2014 | $0.8421 | 4,681 | 2.5% | **$4,040** |
| 2015 | $0.9159 | 4,681 | 2.5% | **$4,394** |
| 2016 | $0.9962 | 4,681 | 2.5% | **$4,779** |
| 2017 | $1.0836 | 4,681 | 2.5% | **$5,199** |
| 2018 | $1.1786 | 4,681 | 2.5% | **$5,655** |
| 2019 | $1.2820 | 4,681 | 2.5% | **$6,150** |
| 2020 | $1.3944 | 4,681 | 2.5% | **$6,690** |
| 2021 | $1.5167 | 4,681 | 2.5% | **$7,277** |
| 2022 | $1.6497 | 4,681 | 2.5% | **$7,915** |
| 2023 | $1.7944 | 4,681 | 2.5% | **$8,609** |
| 2024 | $1.9518 | 4,681 | 2.5% | **$9,364** |
| 2025 | $2.1230 | 4,681 | 2.5% | **$10,185** |
| 2026 | $2.3092 | 4,681 | 2.5% | **$11,078** |
| 2027 | $2.5117 | 4,681 | 2.5% | **$12,050** |
| 2028 | $2.7319 | 4,681 | 2.5% | **$13,107** |
| 2029 | $2.9715 | 4,681 | 2.5% | **$14,256** |

**Table 3 - Gas Energy Charge**

| Year | Rate Per Therm | Annual Therms | Tax Rate | Gas Cost |
|---|---|---|---|---|
| A | B | C | D | B*C *(1+D) |
| 2010 | $0.2994 | 4,681 | 2.5% | **$1,436** |
| 2011 | $0.3257 | 4,681 | 2.5% | **$1,562** |
| 2012 | $0.3542 | 4,681 | 2.5% | **$1,699** |
| 2013 | $0.3853 | 4,681 | 2.5% | **$1,848** |
| 2014 | $0.4191 | 4,681 | 2.5% | **$2,011** |
| 2015 | $0.4558 | 4,681 | 2.5% | **$2,187** |
| 2016 | $0.4958 | 4,681 | 2.5% | **$2,379** |
| 2017 | $0.5393 | 4,681 | 2.5% | **$2,587** |
| 2018 | $0.5866 | 4,681 | 2.5% | **$2,814** |
| 2019 | $0.6380 | 4,681 | 2.5% | **$3,061** |
| 2020 | $0.6940 | 4,681 | 2.5% | **$3,329** |
| 2021 | $0.7548 | 4,681 | 2.5% | **$3,621** |
| 2022 | $0.8210 | 4,681 | 2.5% | **$3,939** |
| 2023 | $0.8930 | 4,681 | 2.5% | **$4,284** |
| 2024 | $0.9714 | 4,681 | 2.5% | **$4,660** |
| 2025 | $1.0565 | 4,681 | 2.5% | **$5,069** |
| 2026 | $1.1492 | 4,681 | 2.5% | **$5,513** |
| 2027 | $1.2500 | 4,681 | 2.5% | **$5,997** |
| 2028 | $1.3596 | 4,681 | 2.5% | **$6,523** |
| 2029 | $1.4789 | 4,681 | 2.5% | **$7,095** |

**Table 4 - Gas Customer Charge**

| Year | Monthly Customer Charge | Annual Customer Charge | Ratio - Appliance to Total | Tax Rate | Pro-Rated Customer Charge |
|---|---|---|---|---|---|
| A | B | C | D | E | C*D*(1+E) |
| 2010 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2011 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2012 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2013 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2014 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2015 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2016 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2017 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2018 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2019 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2020 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2021 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2022 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2023 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2024 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2025 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2026 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2027 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2028 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |
| 2029 | $30.00 | $360.00 | 18.81% | 2.5% | **$69** |

# Participants Test - Results

**Appliance Type:**
**Water Heating - Tank (3)**

**Utility Rate - Weighted Average**
**Building Type - Large Commercial Hospitality**

*Other Equipment Included in Analysis: Cooking - Deep Fryer (2), Cooking - Oven/Range (1), Pool Heating (1), Desiccant Dehumidifier (8), Clothes Drying (10)*

| | Benefits | | | | Costs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | Avoided Electric KWH/KW Cost | Gas Rebate | Avoided Electric Appliance O&M | **TOTAL BENEFITS** | Gas Equipment Cost | Electric Equipment & Installation Cost | Gas Installation Cost | Gas Appliance O & M | Gas Supply Cost | Gas Energy Charge | Gas Customer Charge | **TOTAL COSTS** |
| | Table 1 | | | | | | | | Table 2 | Table 3 | Table 4 | |
| 1 | 3 | 4 | 5 | 3 thru 5 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 7 thru 13 |
| 2010 | $9,034 | $0 | $36 | **$9,070** | $2,268 | ($4,586) | $4,034 | $58 | $2,886 | $1,436 | $69 | **$6,166** |
| 2011 | $9,592 | $0 | $37 | **$9,629** | $0 | $0 | $0 | $59 | $3,139 | $1,562 | $69 | **$4,831** |
| 2012 | $10,189 | $0 | $38 | **$10,227** | $0 | $0 | $0 | $61 | $3,415 | $1,699 | $69 | **$5,245** |
| 2013 | $10,828 | $0 | $40 | **$10,868** | $0 | $0 | $0 | $63 | $3,714 | $1,848 | $69 | **$5,695** |
| 2014 | $11,513 | $0 | $41 | **$11,554** | $0 | $0 | $0 | $65 | $4,040 | $2,011 | $69 | **$6,185** |
| 2015 | $12,247 | $0 | $42 | **$12,290** | $0 | $0 | $0 | $67 | $4,394 | $2,187 | $69 | **$6,718** |
| 2016 | $13,034 | $0 | $43 | **$13,077** | $0 | $0 | $0 | $70 | $4,779 | $2,379 | $69 | **$7,297** |
| 2017 | $13,876 | $0 | $45 | **$13,921** | $0 | $0 | $0 | $72 | $5,199 | $2,587 | $69 | **$7,927** |
| 2018 | $14,778 | $0 | $46 | **$14,824** | $0 | $0 | $0 | $74 | $5,655 | $2,814 | $69 | **$8,612** |
| 2019 | $15,744 | $0 | $48 | **$15,792** | $0 | $0 | $0 | $76 | $6,150 | $3,061 | $69 | **$9,357** |
| 2020 | $16,779 | $0 | $49 | **$16,829** | $0 | $0 | $0 | $79 | $6,690 | $3,329 | $69 | **$10,168** |
| 2021 | $17,888 | $0 | $51 | **$17,939** | $0 | $0 | $0 | $81 | $7,277 | $3,621 | $69 | **$11,049** |
| 2022 | $19,076 | $0 | $52 | **$19,128** | $3,306 | ($6,575) | $4,130 | $84 | $7,915 | $3,939 | $69 | **$12,869** |
| 2023 | $20,348 | $0 | $54 | **$20,402** | $0 | $0 | $0 | $87 | $8,609 | $4,284 | $69 | **$13,049** |
| 2024 | $21,711 | $0 | $56 | **$21,767** | $0 | $0 | $0 | $89 | $9,364 | $4,660 | $69 | **$14,183** |
| 2025 | $23,171 | $0 | $58 | **$23,229** | $0 | $0 | $0 | $92 | $10,185 | $5,069 | $69 | **$15,416** |
| 2026 | $24,735 | $0 | $59 | **$24,795** | $0 | $0 | $0 | $95 | $11,078 | $5,513 | $69 | **$16,756** |
| 2027 | $26,410 | $0 | $61 | **$26,472** | $0 | $0 | $0 | $98 | $12,050 | $5,997 | $69 | **$18,214** |
| 2028 | $28,205 | $0 | $63 | **$28,268** | $0 | $0 | $0 | $101 | $13,107 | $6,523 | $69 | **$19,800** |
| 2029 | $30,127 | $0 | $65 | **$30,193** | $0 | $0 | $0 | $105 | $14,256 | $7,095 | $69 | **$21,525** |

**Present Value of Benefits** **$247,451**

**Present Value of Costs** **$153,751**

**Benefit/Cost Ratio** **1.61**

## Associated Gas Distributors of Florida - Energy Conservation Filing 2009
## Commercial New Construction Program

**Appliance Type**
Water Heating - Tank (3)

**Utility Rate - Weighted Average**
**Building Type - Large Commercial Hospitality**

ıer Equipment Included in Analysis: Cooking - Deep Fryer (2), Cooking - Oven/Range (1), Pool Heating (1), Desiccant Dehumidifier (8), Clothes Drying (1

| | | | |
|---|---|---|---|
| Fuel Rate Escalator | 8.77% | Depreciation Rate - Supply Main | 3.30% |
| Gas Energy Charge Escalator | 8.77% | Depreciation Rate - Development Main | 3.30% |
| Gas Customer Charge Escalator | 0.00% | Depreciation Rate - Service Line | 3.30% |
| O&M/Inflation Escalator | 3.19% | Depreciation Rate - Meter | 3.80% |

**Table 1**

**Revenue - Energy Charge**

| 1 | 2 | 3 | 2*3 |
|---|---|---|---|
| Year | Therms | Base Rate | Total Charge |
| 2010 | 4,681 | $0.2994 | **$1,401** |
| 2011 | 4,681 | $0.3257 | **$1,524** |
| 2012 | 4,681 | $0.3542 | **$1,658** |
| 2013 | 4,681 | $0.3853 | **$1,803** |
| 2014 | 4,681 | $0.4191 | **$1,961** |
| 2015 | 4,681 | $0.4558 | **$2,133** |
| 2016 | 4,681 | $0.4958 | **$2,321** |
| 2017 | 4,681 | $0.5393 | **$2,524** |
| 2018 | 4,681 | $0.5866 | **$2,745** |
| 2019 | 4,681 | $0.6380 | **$2,986** |
| 2020 | 4,681 | $0.6940 | **$3,248** |
| 2021 | 4,681 | $0.7548 | **$3,533** |
| 2022 | 4,681 | $0.8210 | **$3,843** |
| 2023 | 4,681 | $0.8930 | **$4,180** |
| 2024 | 4,681 | $0.9714 | **$4,546** |
| 2025 | 4,681 | $1.0565 | **$4,945** |
| 2026 | 4,681 | $1.1492 | **$5,379** |
| 2027 | 4,681 | $1.2500 | **$5,851** |
| 2028 | 4,681 | $1.3596 | **$6,364** |
| 2029 | 4,681 | $1.4789 | **$6,922** |

**Table 1a**

**Revenue - Cost of Gas**

| 1 | 2 | 3 | 2*3 |
|---|---|---|---|
| Year | Therms | Fuel Rate | Total Charge |
| 2010 | 4,681 | $0.6016 | **$2,816** |
| 2011 | 4,681 | $0.6544 | **$3,063** |
| 2012 | 4,681 | $0.7117 | **$3,331** |
| 2013 | 4,681 | $0.7742 | **$3,624** |
| 2014 | 4,681 | $0.8421 | **$3,941** |
| 2015 | 4,681 | $0.9159 | **$4,287** |
| 2016 | 4,681 | $0.9962 | **$4,663** |
| 2017 | 4,681 | $1.0836 | **$5,072** |
| 2018 | 4,681 | $1.1786 | **$5,517** |
| 2019 | 4,681 | $1.2820 | **$6,000** |
| 2020 | 4,681 | $1.3944 | **$6,527** |
| 2021 | 4,681 | $1.5167 | **$7,099** |
| 2022 | 4,681 | $1.6497 | **$7,722** |
| 2023 | 4,681 | $1.7944 | **$8,399** |
| 2024 | 4,681 | $1.9518 | **$9,135** |
| 2025 | 4,681 | $2.1230 | **$9,937** |
| 2026 | 4,681 | $2.3092 | **$10,808** |
| 2027 | 4,681 | $2.5117 | **$11,756** |
| 2028 | 4,681 | $2.7319 | **$12,787** |
| 2029 | 4,681 | $2.9715 | **$13,908** |

## Associated Gas Distributors of Florida - Energy Conservation Filing 2009
## Commercial New Construction Program

**Appliance Type**
Water Heating - Tank (3)

**Utility Rate - Weighted Average**
**Building Type - Large Commercial Hospitality**

Other Equipment Included in Analysis: Cooking - Deep Fryer (2), Cooking - Oven/Range (1), Pool Heating (1), Desiccant Dehumidifier (8), Clothes Drying (10)

**Table 2**

**Revenue - Customer Charge**

| 1 | 2 | 3 | 4 | 3*4 |
|---|---|---|---|---|
| Year | Monthly Customer Charge | Annual Customer Charge | Ratio Therms To Total Consumed | Prorated Annual Customer Charge |
| 2010 | $30.00 | $360.00 | 18.81% | **$68** |
| 2011 | $30.00 | $360.00 | 18.81% | **$68** |
| 2012 | $30.00 | $360.00 | 18.81% | **$68** |
| 2013 | $30.00 | $360.00 | 18.81% | **$68** |
| 2014 | $30.00 | $360.00 | 18.81% | **$68** |
| 2015 | $30.00 | $360.00 | 18.81% | **$68** |
| 2016 | $30.00 | $360.00 | 18.81% | **$68** |
| 2017 | $30.00 | $360.00 | 18.81% | **$68** |
| 2018 | $30.00 | $360.00 | 18.81% | **$68** |
| 2019 | $30.00 | $360.00 | 18.81% | **$68** |
| 2020 | $30.00 | $360.00 | 18.81% | **$68** |
| 2021 | $30.00 | $360.00 | 18.81% | **$68** |
| 2022 | $30.00 | $360.00 | 18.81% | **$68** |
| 2023 | $30.00 | $360.00 | 18.81% | **$68** |
| 2024 | $30.00 | $360.00 | 18.81% | **$68** |
| 2025 | $30.00 | $360.00 | 18.81% | **$68** |
| 2026 | $30.00 | $360.00 | 18.81% | **$68** |
| 2027 | $30.00 | $360.00 | 18.81% | **$68** |
| 2028 | $30.00 | $360.00 | 18.81% | **$68** |
| 2029 | $30.00 | $360.00 | 18.81% | **$68** |

**Table 3**

**Gas Costs**

| 1 | 2 | 3 | 2*3 |
|---|---|---|---|
| Year | Therms | Gas Supply Rate | Gas Supply Cost |
| 2010 | 4,681 | $0.6016 | **$2,816** |
| 2011 | 4,681 | $0.6544 | **$3,063** |
| 2012 | 4,681 | $0.7117 | **$3,331** |
| 2013 | 4,681 | $0.7742 | **$3,624** |
| 2014 | 4,681 | $0.8421 | **$3,941** |
| 2015 | 4,681 | $0.9159 | **$4,287** |
| 2016 | 4,681 | $0.9962 | **$4,663** |
| 2017 | 4,681 | $1.0836 | **$5,072** |
| 2018 | 4,681 | $1.1786 | **$5,517** |
| 2019 | 4,681 | $1.2820 | **$6,000** |
| 2020 | 4,681 | $1.3944 | **$6,527** |
| 2021 | 4,681 | $1.5167 | **$7,099** |
| 2022 | 4,681 | $1.6497 | **$7,722** |
| 2023 | 4,681 | $1.7944 | **$8,399** |
| 2024 | 4,681 | $1.9518 | **$9,135** |
| 2025 | 4,681 | $2.1230 | **$9,937** |
| 2026 | 4,681 | $2.3092 | **$10,808** |
| 2027 | 4,681 | $2.5117 | **$11,756** |
| 2028 | 4,681 | $2.7319 | **$12,787** |
| 2029 | 4,681 | $2.9715 | **$13,908** |

**Associated Gas Distributors of Florida - Energy Conservation Filing 2009**
**Commercial New Construction Program**

**Appliance Type**
Water Heating - Tank (3)

**Utility Rate - Weighted Average**
**Building Type - Large Commercial Hospitality**

ıer Equipment Included in Analysis: Cooking - Deep Fryer (2), Cooking - Oven/Range (1), Pool Heating (1), Desiccant Dehumidifier (8), Clothes Drying (1

**Table 4**

**Investment Carrying Costs**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 6*7*8 |
|---|---|---|---|---|---|---|---|---|
| Year | Supply Main | Development Main | Service Line | Meter | Total Investment | Cost of Debt | Ratio of Therms Consumed To Total | Investment Carrying Cost |
| 2010 | $1,000 | $1,000 | $3,131 | $1,696 | $6,827 | 5.72% | 18.81% | **$73** |
| 2011 | $967 | $967 | $3,028 | $1,632 | $6,594 | 5.72% | 18.81% | **$71** |
| 2012 | $935 | $935 | $2,928 | $1,570 | $6,368 | 5.72% | 18.81% | **$69** |
| 2013 | $904 | $904 | $2,831 | $1,510 | $6,149 | 5.72% | 18.81% | **$66** |
| 2014 | $874 | $874 | $2,738 | $1,453 | $5,939 | 5.72% | 18.81% | **$64** |
| 2015 | $845 | $845 | $2,648 | $1,398 | $5,736 | 5.72% | 18.81% | **$62** |
| 2016 | $817 | $817 | $2,561 | $1,345 | $5,540 | 5.72% | 18.81% | **$60** |
| 2017 | $790 | $790 | $2,476 | $1,294 | $5,350 | 5.72% | 18.81% | **$58** |
| 2018 | $764 | $764 | $2,394 | $1,245 | $5,167 | 5.72% | 18.81% | **$56** |
| 2019 | $739 | $739 | $2,315 | $1,198 | $4,991 | 5.72% | 18.81% | **$54** |
| 2020 | $715 | $715 | $2,239 | $1,152 | $4,821 | 5.72% | 18.81% | **$52** |
| 2021 | $691 | $691 | $2,165 | $1,108 | $4,655 | 5.72% | 18.81% | **$50** |
| 2022 | $668 | $668 | $2,094 | $1,066 | $4,496 | 5.72% | 18.81% | **$48** |
| 2023 | $646 | $646 | $2,025 | $1,025 | $4,342 | 5.72% | 18.81% | **$47** |
| 2024 | $625 | $625 | $1,958 | $986 | $4,194 | 5.72% | 18.81% | **$45** |
| 2025 | $604 | $604 | $1,893 | $949 | $4,050 | 5.72% | 18.81% | **$44** |
| 2026 | $584 | $584 | $1,831 | $913 | $3,912 | 5.72% | 18.81% | **$42** |
| 2027 | $565 | $565 | $1,771 | $878 | $3,779 | 5.72% | 18.81% | **$41** |
| 2028 | $546 | $546 | $1,713 | $845 | $3,650 | 5.72% | 18.81% | **$39** |
| 2029 | $528 | $528 | $1,656 | $813 | $3,525 | 5.72% | 18.81% | **$38** |

**Table 5**

**Incremental Customer Costs**

| 1 | 2 | 3 | 4 | 5=3*4 | 6 | 8=6*4 | 5+8 |
|---|---|---|---|---|---|---|---|
| Year | Monthly Adm. Cost | Annual Adm. Cost | Ratio Therms To Total Consumed | Annual Ratio Adm. Cost | Annual O&M Cost | Annual Ratio O&M Cost | Total Incremental Adm. & O&M Cost |
| 2010 | $1.61 | $19 | 18.81% | $3.57 | $21.66 | $4 | **$8** |
| 2011 | $1.66 | $20 | 18.81% | $3.76 | $22.35 | $4 | **$8** |
| 2012 | $1.71 | $21 | 18.81% | $3.95 | $23.06 | $4 | **$8** |
| 2013 | $1.77 | $21 | 18.81% | $3.95 | $23.80 | $4 | **$8** |
| 2014 | $1.83 | $22 | 18.81% | $4.14 | $24.56 | $5 | **$9** |
| 2015 | $1.88 | $23 | 18.81% | $4.33 | $25.34 | $5 | **$9** |
| 2016 | $1.94 | $23 | 18.81% | $4.33 | $26.15 | $5 | **$9** |
| 2017 | $2.01 | $24 | 18.81% | $4.52 | $26.98 | $5 | **$10** |
| 2018 | $2.07 | $25 | 18.81% | $4.70 | $27.85 | $5 | **$10** |
| 2019 | $2.14 | $26 | 18.81% | $4.89 | $28.73 | $5 | **$10** |
| 2020 | $2.20 | $26 | 18.81% | $4.89 | $29.65 | $6 | **$10** |
| 2021 | $2.27 | $27 | 18.81% | $5.08 | $30.60 | $6 | **$11** |
| 2022 | $2.35 | $28 | 18.81% | $5.27 | $31.57 | $6 | **$11** |
| 2023 | $2.42 | $29 | 18.81% | $5.46 | $32.58 | $6 | **$12** |
| 2024 | $2.50 | $30 | 18.81% | $5.64 | $33.62 | $6 | **$12** |
| 2025 | $2.58 | $31 | 18.81% | $5.83 | $34.69 | $7 | **$12** |
| 2026 | $2.66 | $32 | 18.81% | $6.02 | $35.80 | $7 | **$13** |
| 2027 | $2.75 | $33 | 18.81% | $6.21 | $36.94 | $7 | **$13** |
| 2028 | $2.83 | $34 | 18.81% | $6.40 | $38.12 | $7 | **$14** |
| 2029 | $2.92 | $35 | 18.81% | $6.59 | $39.33 | $7 | **$14** |

# RIM Test - Results

**Appliance Type**
**Water Heating - Tank (3)**

**Utility Rate - Weighted Average**
**Building Type - Large Commercial Hospitality**

*Equipment Included in Analysis: Cooking - Deep Fryer (2), Cooking - Oven/Range (1), Pool Heating (1), Desiccant Dehumidifier (8), Clothes Drying*

| | Incremental Revenue Energy Charge | Incremental Revenue Cost of Gas | Incremental Revenue Customer Charge | **Total Gas Revenue** | Gas Supply Cost | Investment Carrying Cost | Incremental Customer Costs | Program Cost | **Total Costs** |
|---|---|---|---|---|---|---|---|---|---|
| | **Table 1** | **Table 1A** | **Table 2** | | **Table 3** | **Table 4** | **Table 5** | | |
| 1 | 2 | 3 | 4 | 2 thru 4 | 6 | 7 | 8 | 9 | 6 thru 9 |
| 2010 | $1,401 | $2,816 | $68 | $4,285 | $2,816 | $73 | $8 | $36.96 | $2,934 |
| 2011 | $1,524 | $3,063 | $68 | $4,655 | $3,063 | $71 | $8 | $36.96 | $3,179 |
| 2012 | $1,658 | $3,331 | $68 | $5,057 | $3,331 | $69 | $8 | $36.96 | $3,445 |
| 2013 | $1,803 | $3,624 | $68 | $5,495 | $3,624 | $66 | $8 | $36.96 | $3,735 |
| 2014 | $1,961 | $3,941 | $68 | $5,970 | $3,941 | $64 | $9 | $36.96 | $4,051 |
| 2015 | $2,133 | $4,287 | $68 | $6,488 | $4,287 | $62 | $9 | $36.96 | $4,395 |
| 2016 | $2,321 | $4,663 | $68 | $7,051 | $4,663 | $60 | $9 | $36.96 | $4,769 |
| 2017 | $2,524 | $5,072 | $68 | $7,664 | $5,072 | $58 | $10 | $36.96 | $5,176 |
| 2018 | $2,745 | $5,517 | $68 | $8,330 | $5,517 | $56 | $10 | $36.96 | $5,619 |
| 2019 | $2,986 | $6,000 | $68 | $9,054 | $6,000 | $54 | $10 | $36.96 | $6,101 |
| 2020 | $3,248 | $6,527 | $68 | $9,843 | $6,527 | $52 | $10 | $36.96 | $6,626 |
| 2021 | $3,533 | $7,099 | $68 | $10,700 | $7,099 | $50 | $11 | $36.96 | $7,197 |
| 2022 | $3,843 | $7,722 | $68 | $11,632 | $7,722 | $48 | $11 | $36.96 | $7,818 |
| 2023 | $4,180 | $8,399 | $68 | $12,646 | $8,399 | $47 | $12 | $36.96 | $8,494 |
| 2024 | $4,546 | $9,135 | $68 | $13,750 | $9,135 | $45 | $12 | $36.96 | $9,230 |
| 2025 | $4,945 | $9,937 | $68 | $14,950 | $9,937 | $44 | $12 | $36.96 | $10,030 |
| 2026 | $5,379 | $10,808 | $68 | $16,255 | $10,808 | $42 | $13 | $36.96 | $10,900 |
| 2027 | $5,851 | $11,756 | $68 | $17,674 | $11,756 | $41 | $13 | $36.96 | $11,847 |
| 2028 | $6,364 | $12,787 | $68 | $19,218 | $12,787 | $39 | $14 | $36.96 | $12,877 |
| 2029 | $6,922 | $13,908 | $68 | $20,898 | $13,908 | $38 | $14 | $36.96 | $13,997 |

**Present Value of Benefits** **$146,625**

**Present Value of Costs** **$98,773**

**Benefit/Cost Ratio** **1.48**

# APPENDIX A – Cost Effectiveness Manual for Natural Gas Utility Demand Side Management Programs

# FLORIDA PUBLIC SERVICE COMMISSION

# COST EFFECTIVENESS MANUAL FOR

# NATURAL GAS UTILITY

# DEMAND SIDE MANAGEMENT PROGRAMS

FLORIDA PUBLIC SERVICE COMMISSION
2540 SHUMARD OAK BOULEVARD
TALLAHASSEE, FLORIDA 32399-0850

(PSC/ECR/018-G)

## DSM MANUAL INTRODUCTION

**The "Florida Energy Efficiency and Conservation Act," Sections 366.80-.85 and 403.519, Florida Statutes, requires the Florida Public Service Commission to review natural gas utility conservation programs for cost-effectiveness. This manual describes the minimum data requirements for the cost-effectiveness analyses the Commission uses to evaluate utility conservation programs. This manual is incorporated by reference in Rule 25-17.009, Florida Administrative Code.**

**There are two tests for both load building and load reduction conservation programs: The Participants Test and the Gas Rate Impact Measures (RIM) Test. The Participants Test measures the impact of the program on participating customers. The Gas RIM Test is an indirect measure of the program impact on customer rates. Rates will go down more than they otherwise would have if the change in utility revenues minus the change in utility costs is positive. Rates will go up more than they otherwise would have if the change in utility revenues minus the change in utility costs is negative. In evaluating conservation programs, the Commission will review the results of both tests to determine cost-effectiveness.**

**This manual comprises five cost benefit (C.B.) Forms: C.B. FORM 1 is a list of general assumptions. These general assumptions must be applied to all programs in order to determine cost-effectiveness. C.B. FORM 2 is a list of costs and benefits for a load-building Participants Test. C.B. FORM 3 (pages 1 and 2) is a list of costs and benefits for a load-building RIM Test. C.B. Form 4 is a list of costs and benefits for a load reduction Participants Test. C.B. Form 5 is a list of costs and benefits for a load reduction RIM Test.**

**The delineation of the various ways of expressing test results is not meant to discourage the continued development of additional variations for expressing cost-effectiveness.**

C.B. FORM 1

## GENERAL ASSUMPTIONS

1. Life of program ___20___ years.

2. Average natural gas therm consumption per appliance _____.

3. Program peak consumption per installed appliance:

   Summer ____ Therms
   Winter ____ Therms

4. Appliances installed per program _____ units/yr.

5. Average number of participants _____ yr.

6. Avoided KWH per appliance _____.

7. Avoided therms per appliance _____.

8. Incentive payment per appliance _____.

9. Any other cost or benefit not captured in the cost-effectiveness forms.

10. Escalation Rate: Escalation rates should be established for 1) Gas and pipeline transportation costs; 2) Capital costs associated with the program; and, 3) O&M costs associated with the program. These escalation rates should be applied for the life of the program.

11. Discount Rate: the after-tax incremental cost of capital.

All costs and benefits should be listed on an annual basis in net present values.

P = FV SUB n ~ LEFT [ 1 OVER {(1 + i) SUP n} RIGHT ]

Where FVn = the future value of the investment at the end of n years.

n = 1 for an uneven stream of costs and benefits

i = discount rate

P = the present value of the future sum of

C.B. FORM 2

# PARTICIPANTS TEST
## (Load Building Scenario)

## BENEFITS

1. **Electric Bill Savings:(Avoided KWHs) X ($ Per KWH)**

2. **Incentive Payment: Total Incentive $ Received.**

## COSTS

1. **Incremental Participant Costs:**

   A. **Equipment Costs: (Gas Appliance Cost) - (Electric Baseline Appliance Cost)**

   B. **Installation Costs: Customer Main Extension Costs (CIAC), Customer Piping and Venting Cost)**

   C. **Incremental O&M Costs**

2. **Gas Bill Increases:**

   A. **(Incremental Therm Usage) X (Cost of Gas)**

   B. **(Incremental Therm Usage) X (Energy Charge)**

   C. **Customer Charge (For New Gas Customers Only.)**

# GAS RIM TEST
## (Load Building Scenario)

## BENEFITS

1. **Revenue Increases:**

   A. **(Incremental Therm Usage) X (Gas, Pipeline Transportation Charges are included in the cost of gas)**

   B. **(Incremental Therm Usage) X (Energy Charge)**

   C. **(Projected # of New Participants to the System) X (Customer Charge)**

## COSTS

1. **Increased Gas (Commodity) Costs:**

   A. **Gas (Pipeline Transportation Charges are included in the cost of gas)**

2. **Non-Fuel Energy (Supply/Capacity) Costs:**

   A. **Mains**

   B. **Measurement and Regulator Station Equipment**

   C. **Depreciation Expense on Capital Items**

   D. **Taxes Other than Income Taxes**

3. **Customer Charge-Related Costs**

   A. **Service Lines**

   B. **Meters**

   C. **House Regulator Valves**

   D. **Piping & Venting**

**E. Incremental O&M:**

**a. Costs in this category include meter reading expenses, records and collection expenses, sales expenses, administrative and general expenses, and maintenance of other equipment.**

**b. Depreciation Expense on Capital Items.**

**c. Taxes other than income taxes.**

**5. Incentive Payments: Utility Rebates/Incentives Paid to Participants.**

C.B. FORM 4

# PARTICIPANTS TEST
## (Load Reduction Scenario)

## BENEFITS

1. **Gas Bill Savings:**

   A. **(Decremental Therm Usage) X (Cost of Gas)**

   B. **(Decremental Therm Usage) X (Energy Charge)**

2. **Incentive Payment: Total Incentive $ Received.**

## COSTS

1. **Incremental Participant Costs:**

   A. **Equipment Costs: (Gas Appliance Cost) - (Gas Baseline Appliance Cost)**

   B. **Incremental O&M Costs**

C.B. FORM 5

# GAS RIM TEST
## (Load Reduction Scenario)

## BENEFITS

1. **Decreased Gas (Commodity) Costs:**

   A. **Gas (Pipeline Transportation Costs are included in the cost of gas)**

2. **Avoided Non-Fuel Energy (Supply/Capacity) Costs:**

   A. **Mains**

   B. **Measurement and Regulator Station Equipment**

   C. **Depreciation Expense on above capital items**

   D. **Taxes**

## COSTS

1. **Revenue Decrease:**

   A. **(Decremental Therm Usage) X (Cost of Gas)**

   B. **(Decremental Therm Usage) X (Energy Charge)**

2. **Incentive Payments: Total Incentive $ Paid to Participants**