AUSTIN ENERGY'S TARIFF PACKAGE: 2015 COST OF SERVICE STUDY AND PROPOSAL TO CHANGE BASE ELECTRIC RATES	§ § § §	**BEFORE THE CITY OF AUSTIN IMPARTIAL HEARINGS EXAMINER**

AELIC'S OBJECTION TO THE REBUTTAL TESTIMONY OF MARK DOMBROSKI AND MOVE TO HAVE ADMITTED CERTAIN EVIDENCE UNDER RULES 106 AND 107 OF THE TEXAS RULES OF EVIDENCE

TO THE HONORABLE JUDGE HERRERA:

COMES NOW, Texas Legal Services Center ("TLSC") on behalf of Austin Energy Low Income Consumers ("AELIC") and objects to the Rebuttal Testimony of Mark Dombroski, stating the following:

I.

At page 41 of Mr. Dombroski's rebuttal testimony he contends AELIC based its position that an inverted block rate design promotes conservation " on general knowledge, not any specific documentation or study." Although Mr. Dombroski's cites AELIC RFI 1-2, he has mischaracterized it. Mr. Dombroski did provide the copy of the AELIC RFI which shows AE had its own study that AELIC relied upon regarding AELIC's position that inverted block rates promote conservation. Therefore, in fundamental fairness and pursuant to Rules 106 and 107 of the Texas Rules of Evidence, AE is asking to have admitted at the same time AE admits Mr. Dombroski's Rebuttal testimony the remainder of AELIC RFI 1-2 as well as a copy of AE's own study referenced in that RFI response. These documents are attached as AELIC Ex. No. 1

Respectfully Submitted,

Texas Legal Services Center
2101 Interstate 35 South, Suite 300
Austin, Texas 78741
512.477.6000
512.474.6576(FAX)

By:
Lanetta M. Cooper
State Bar No. 04780600
lcooper@tlsc.org; oyesapa@yahoo.com

AUSTIN ENERGY 2016 MAY 23 PM 2:06

Randall Chapman
State Bar No. 04129800
rchapman@tlsc.org

Attorneys for AE Low Income Consumers

CERTIFICATE OF SERVICE

The undersigned certifies that TLSC has served a copy of the attached document upon all known parties of record by email and to the Impartial Hearing Examiner on the 23rd day of May 2016

Lanetta M. Cooper

AUSTIN ENERGY'S TARIFF PACKAGE: 2015 COST OF SERVICE STUDY AND PROPOSAL TO CHANGE BASE ELECTRIC RATES	§ § § §	**BEFORE THE CITY OF AUSTIN IMPARTIAL HEARINGS EXAMINER**

AELIC EXHIBIT NO. 1

Description of Exhibit: Completion of AELIC response to AE RFI that was referenced in Dombrowski Rebuttal testimony.

AELIC Response to AE RFI No. 1-2

AE1-2. AE RFI No. 1-2: On page 5 under the topic 'Rate Design' for page 3, please provide all supporting documentation and studies for each of the statements listed below. In addition, please indicate whether each statement is a fact or opinion.

a. "An inverted block rate design promotes energy efficiency."

b. "The design of an inverted block rate requires the initial block or first two blocks, depending upon the number of rating tiers, to be priced below average cost."

c. "AE's first tier represents the most inelastic usage tier."

d. "Rates should be significantly below cost."

e. "A rate design promoting energy efficiency requires low fixed charges."

f. "Under an inverted block rate design the average price to a customer is smoothed because each price tier is incrementally added to the bill."

Answer:

a. Fact based on my general knowledge and on AE's own study. See AE Response to ICA RFI No. 1-22. See also App B to AE's rate filing package.
b. Fact based on pure mathematics. See AE's response to Rourke No. 1-5; App B to AE's rate filing package, and App M-53 to AE's rate filing package.
c. Fact based on my general knowledge of elasticity of demand studies for electric pricing. Did not rely upon specific documentation.
d. My opinion given the fact that AE has five rating tiers; that the amount of revenues that can be realized is limited to its embedded costs; that AE has a fixed charge that creates a countering effect to the inclining block nature of the first block and perhaps second blocks.; and that the first tier is the least susceptible to price changes.
e. Opinion based on general knowledge and on AE's recognition of the conservation effect of inverted block rates. For instance see executive summary of attached study; however, did not review any specific study or document to answer the rfi.
f. Fact based on general math concepts. No study or document.

Prepared by: LMC

Sponsored by: Lanetta Cooper

CHRISTENSEN
ASSOCIATES
ENERGY CONSULTING

Residential Rate Study for the Kansas Corporation Commission

Final Report

Daniel G. Hansen
Michael T. O'Sheasy

April 11, 2012

Christensen Associates Energy Consulting, LLC
800 University Bay Drive, Suite 400
Madison, WI 53705-2299

Voice 608.231.2266 Fax 608.231.2108

Executive Summary

This report documents a residential rate study that Christensen Associates Energy Consulting, LLC (CA Energy Consulting) conducted on behalf of the Kansas Corporation Commission (KCC). The KCC is interested in studying rates that can encourage conservation and/or provide efficient rates. "Conservation" refers to providing customers with incentives to reduce energy consumption. "Efficient rates" are those that provide customers with prices that reflect the marginal cost to serve them, which in theory leads to the most efficient use of resources (e.g., electricity generators). These two goals do not always coincide. For example, a TOU rate may have low off-peak prices to reflect the fact that only low-cost generators are needed to serve off-peak loads. While this price is efficient, it provides less incentive to conserve in off-peak hours than an equivalent flat price (in which the price is the same across all hours).

We used data from Kansas City Power & Light (KCP&L), Westar Energy (Westar), and Midwest Energy (Midwest) to analyze several alternative residential rate structures. The rate structures included in the study are:

- Flat rate;
- Straight-fixed variable (SFV) rate;
- Inclining block rate (IBR);
- Time-of-use (TOU) rate; and
- Day-type TOU rate.

The flat rate is included primarily as a reference case, in which the price does not vary by time or with the level of customer use. SFV rates address the utility's incentive to promote conservation and energy efficiency by increasing the fixed monthly customer charge and reducing the throughput volumetric rate, thereby recovering all utility fixed costs through fixed charges rather than through volumetric rates. An IBR is intended to provide an incentive to conserve by increasing the rate a customer pays as its usage level increases. TOU rates are intended to provide efficient price signals by charging rates that are based on the average cost to serve customers. TOU rates therefore give customers an incentive to reduce usage during high-cost hours (e.g., summer afternoons) and increase usage during low-cost hours (e.g., overnight hours). Day-type TOU rates add a "dynamic" component to TOU rates that provides customers with a significant incentive to reduce usage on the hottest, most costly days to serve them.

Each of these rate structures affects customers differently depending on their usage levels and patterns. The relationship between bill impacts and customer usage levels is of interest because stakeholders often wish to avoid adverse bill impacts for low-income customers, and low-income customers are often believed to use less electricity than other customers. The advantages and disadvantages of each rate structure are described in the full report.

Research Approach

The following steps were used to evaluate the alternative rate structures of interest:

1) Design revenue-neutral alternative residential rates for each utility;
2) Estimate customer-level bill impacts for each rate structure at historical loads;

3) Evaluate the relationship between bill impacts and customer usage levels;
4) Simulate the changes in customer usage levels and patterns (i.e., "demand response") in response to the new rate structures; and
5) Estimate the potential for utility revenue loss (revenue attrition) due to mispricing the new rate options.

Design revenue-neutral alternative residential rates for each utility: Separate revenue-neutral rates were designed for each utility using utility-specific residential customer usage data and Southwest Power Pool (SPP) price data (to design the TOU and day-type TOU rates). The rates were designed so that they produced the same amount of total revenue as the current rate produces.

Estimate customer-level bill impacts for each rate structure at historical loads: Each customer's bill was calculated for both their current rate and each alternative rate structure using historical loads.

Evaluate the relationship between bill impacts and customer usage levels: To evaluate the relationship between bill impacts and customer usage levels, the bill impacts are displayed as scatter plots against each customer's average monthly usage (in kWh). This allows for an easy examination of how bill impacts vary with customer usage level.

Simulate customer demand response to each rate structure: Simulation was used to estimate the changes in load that could be expected from each rate structure. We used evidence from existing studies on customer price responsiveness to provide estimates of the potential magnitude of the load changes (which, depending on the rate, could be an overall increase, an overall reduction, or shifting from high- to low-cost hours) that might be expected from each rate structure.

Estimate the potential for utility revenue loss (revenue attrition) due to mispricing the new rate options: The final step was to examine the potential for utility *revenue attrition*, or lost revenues, due to self selection and demand response. Revenue attrition due to *customer self selection* can occur when the utility sets rates without accounting for the tendency of customers to select the rate that is most beneficial for them (i.e., gives them the lowest bill). Revenue attrition due to *customer demand response* can occur when the utility sets rates using historical load profiles but customers modify their usage patterns in response to the pricing signals of their new rate.

Research Implementation

We used utility-specific customer data to calculate bill impacts for each rate structure. KCP&L and Westar provided us with 2007 hourly data from their residential load research samples. Midwest did not have a load research sample, and instead provided us with 2009 monthly billing data for its residential customers.

The rates within the alternative structures were set to produce the same total revenue as the existing base residential rate for the available sample customers. Therefore, the first step in the rate design process was to calculate the total revenue (accounting for the sample weights) from the base residential rate. The assumptions used when setting the rates were (a) all customers are on the rate (i.e., there is no customer selection issue), and (b) the historical load profiles are retained (i.e., we ignore the potential effect of demand response on customers' usage and bills).

For each of the rate structures, we calculated customer-level bills using the available customer-level load data, the "base" residential rates, and the newly designed rates. We then calculated "instant" bill impacts, which are the bill impacts before the customers modify their load profiles in response to the new price signals. For ease of analysis, scatter plots of bill impacts verses customer's average monthly usage were used. For some of the rate structures, such as IBR or SFV, the bill impacts are strongly related to customer size. For others, such as TOU, this is not the case.

Research Results

Bill Impacts

Tables ES.1 through ES.3 provide results that summarize the bill impact analyses. Four statistics are provided for each utility and rate structure:

- The share of customers that experienced a bill increase of 10% or more on the new rate structure;
- The share of customers that experienced a bill decrease of 10% or more on the new rate structure;
- The average percentage bill impact for customers who use an average of 500 kWh per month or less; and
- The average percentage bill impact for customers who use an average of 2,000 kWh per month or more.

These statistics are intended to facilitate comparisons of bill impacts across rate structures and utilities. Following are the key observations from these tables:

- The flat, TOU, and day-type TOU rates do not produce large percentage load impacts for very many customers (as shown in the "Greater than 10% column").
- The bill impacts for the flat, TOU, and day-type TOU rates are not strongly related to customer usage levels (as illustrated by the similarity of the average bill impacts in the "Low Use " and "High Use" columns).

- The high customer charge in the SFV rate leads to large bill increases for low-use customers (e.g., 27.4 percent for KCP&L's low-use customers). The percentage bill decreases for high-use customers on this rate structure are smaller in magnitude (e.g., 5.7 percent for KCP&L's high-use customers).
- Despite the fact that IBR and SFV have opposite effects by customer usage levels, combining the two rate structures is not enough to offset SFV's adverse bill impacts for low-use customers.

Table ES.1: Summary of Bill Impacts by Rate Structure, *KCP&L*

Rate Structure	Share of Customers by Bill Impact Amount		Average Bill Impact by Customer Usage	
	Greater than 10%	Less than -10%	Low Use (<500 kWh/mo.)	High Use (>2,000 kWh/mo.)
Flat rate	1.3%	0.0%	0.1%	0.6%
SFV	15.1%	0.0%	27.4%	-5.7%
IBR	4.9%	0.0%	-6.6%	10.4%
IBR + SFV	3.9%	0.0%	21.2%	2.6%
TOU	0.3%	0.0%	-0.5%	-0.2%
Day-type TOU	0.3%	0.0%	-0.5%	-0.5%

Table ES.2: Summary of Bill Impacts by Rate Structure, *Westar*

Rate Structure	Share of Customers by Bill Impact Amount		Average Bill Impact by Customer Usage	
	Greater than 10%	Less than -10%	Low Use (<500 kWh/mo.)	High Use (>2,000 kWh/mo.)
Flat rate	0.0%	0.0%	-0.1%	2.6%
SFV	35.9%	6.6%	46.6%	-10.1%
IBR	5.6%	0.0%	-1.5%	8.9%
IBR + SFV	28.8%	0.0%	42.2%	-4.8%
TOU	0.0%	0.0%	0.1%	1.9%
Day-type TOU	0.0%	0.0%	1.4%	1.5%

Table ES.3: Summary of Bill Impacts by Rate Structure, *Midwest*

Rate Structure	Share of Customers by Bill Impact Amount		Average Bill Impact by Customer Usage	
	Greater than 10%	Less than -10%	Low Use (<500 kWh/mo.)	High Use (>2,000 kWh/mo.)
Flat rate	0.0%	0.0%	-2.2%	3.9%
SFV	19.5%	0.4%	20.7%	-8.8%
IBR	6.0%	0.0%	-7.3%	[illegible]
IBR + SFV	13.7%	0.0%	16.7%	1.9%

The customer-level bill impacts shown above are those that occur before customers take actions to adapt to the new rate structures (e.g., by shifting or reducing load). Of course, the goal of most of these rate structures is to provide customers with incentives to change behavior. The primary incentive goal of each rate structure can be summarized as follows:

- **SFV:** Eliminates the utility's disincentive to encourage conservation and energy efficiency. As a side effect, SFV reduces the customer-level incentive to conserve because the volumetric rate has been reduced.
- **IBR:** Discourages increases in consumption levels, particularly for high-use customers who face the high tail-block price. Note that low-use customers may experience a *decrease* in their incentive to conserve because they face the relatively low initial block price.
- **TOU:** Encourages customers to shift intra-day load from peak to off-peak hours.
- **Day-type TOU:** Builds upon standard TOU by providing added incentives to reduce usage on high-cost days.

Demand Response

To evaluate the potential magnitude of the usage changes described above, we developed simple elasticity-based models to simulate the changes in usage for each of these rate structures. The results of these simulations show that SFV leads to small increases in overall usage; IBR leads to small decreases in overall usage; TOU leads to decreases in peak-period usage and increases in off-peak period usage; and day-type TOU produces larger shifts of usage from peak to off-peak periods on higher-priced days.

Revenue Attrition

Finally, the report examined the potential for utility revenue attrition (recovering less revenue than forecast) due to customer self selection and demand response. That is, when the utility sets the rates for an optional pricing program, it does not know which customers will select the rate, or how the customers who select the rate will modify their load profiles in response to the new price signals. Our analysis provided an indication of the scale of this potential problem by assuming that customers select the rate that provides them with the lowest bill (customer self selection); and by simulating customer demand response using a range of price responsiveness parameters (i.e., price elasticities). The results indicated that both types of revenue attrition (i.e., due to customer self selection and demand response) are more pronounced for SFV and IBR than they are for TOU and day-type TOU.

ICA 1-22. A. Has the residential inclining block rate structure produced any evidence that the rate design has reduced energy use per meter?

B. Please provide any such evidence.

C. Provide any price elasticity estimates which Austin Energy has derived from the rate structure.

D. Provide any residential price elasticity estimates which Austin Energy utilizes in designing the rate structure

ANSWER:

Please refer to Attachment 1: 2012 Conservation Pricing Signal Impacts.

Prepared by: BE
Sponsored by: Mark Dombroski

NewGen Strategies & Solutions

3420 Executive Center Drive
Suite 165
Austin, TX 78731
Phone: (512) 479-7900

Memorandum

To: Barksdale English

From: Tony Georgis, Grant Rabon, and Justin Rasor

Date: December 12, 2015

Re: 2012 Conservation Pricing Signal Impacts

In support of the broader Regulatory Consulting Services to Austin Energy (AE), NewGen Strategies and Solutions, LLC (NewGen) is evaluating the impacts of the 2012 conservation rate pricing signal on residential energy consumption. As a result of the 2011 Rate Study, AE updated customer rates and implemented new rate structures. One of the objectives of the 2011 Rate Study and subsequent rates was to develop rates aligned with AE's commitment to energy conservation. As a result, the residential customer class rates were redesigned to send pricing signals to further support energy conservation.

The 2012 rates were updated and structurally changed to include five tiers or "blocks" of monthly consumption starting with the first tier of 0 to 500 kilowatt-hours (kWh) up to the final tier of 2,501 kWh or more. The rates also included seasonal price signals, which increased prices in the summer periods (e.g. June through September) as customers typically use more electricity. This increase in costs as customers consume more electricity and increased costs during the summer months, sends a strong pricing signal to customers to conserve electricity as it could significantly reduce their monthly bills. The AE Residential customer class includes both single family detached and multifamily homes. Single family and multifamily each represent roughly 50% of the total customers or meters within the full Residential customer class. Table 1 summarizes the Residential-Austin Rate and the tiered rate structure.

Table 1
Residential – Austin (Inside City) Rate

Charge	Oct. – May	Jun. – Sept.
Customer Charge	$10.00 per month	$10.00 per month
Energy Charges		
0 – 500kWh	$0.018 per kWh	$0.033 per kWh
501 – 1,000kWh	$0.056	$0.080
1,001 – 1,500kWh	$0.072	$0.091
1,501 – 2,500kWh	$0.084	$0.110
2,501kWh and greater	$0.096	$0.114
Power Supply Adjustment	See Tariff	See Tariff
Community Benefit Charge	See Schedule	See Schedule
Regulatory Charge	See Schedule	See Schedule

Note: the Residential – Outside Austin rate includes three pricing tiers, not five as shown of the inside city rate above.

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This memo evaluates how the 2012 rates and pricing signals may have impacted residential customer consumption amounts and patterns. While it is difficult, if not impossible, to precisely state the exact amount of energy conserved directly due the 2012 rates, we are able to evaluate consumption patterns prior to and after the rates were implemented and identify outcomes and any consumption reductions. This memo report summarizes the initial results of our work, including the following:

- The change in residential customer consumption since the implementation of the conservation rates on October 1, 2012;
- The methodology used to "normalize" the consumption data to account for differences in weather or broader market trends (e.g. more efficient appliances, improved home construction, etc.);
- The suggested impact of the conservation rate signal; and
- Potential opportunities for AE to use and optimize the data and results in future program and operational decisions.

Executive Summary

To best understand and attempt to quantify the impact the 2012 conservation rate change had on residential consumption levels, one must "normalize" the annual consumption data for each customer and the electric system as a whole. Normalizing the electric consumption data attempts to remove the influence of specific variables (such as weather) on the level of electric consumption from year to year. By removing these key variables' influence on the electric consumption results, other variables (such as the rate change) may be evaluated for their impact on the actual consumption results. To normalize the consumption data, NewGen utilized average residential monthly consumption data from 1999 to September 2012, the month before the new rates took effect. Using this consumption data and monthly temperature data (e.g. heating and cooling degree days[1]) for the same period, we performed a regression analysis to quantify how consumption is correlated with and changes due to the temperature. This regression allowed us to identify and eliminate the impact that the weather had on consumption levels. In addition, the regression allowed us to generally account for the year over year impact of broader, market driven efficiencies such as the efficiency improvements in appliances, lighting, home construction, motors, air conditioning, etc.

The regression was then used to project what the "normalized" consumption for the period of fiscal year (FY) 2010[2] through 2015. This normalized projection of consumption was then compared to the actual consumption levels to better understand and identify the impacts of the conservation pricing signal rates. The weather and market normalized analysis suggests the implementation of the conservation pricing structure in October 2012 (FY 2013) contributed to a material and significant reduction in electricity consumption in the residential customer class. Figure 1 compares and calculates the

[1] A degree day is a numerical representation of the difference in the average ambient temperature for the day and a certain setpoint (i.e. 65 degrees). Cooling degree days reflect a need for air conditioning, while heating degree days reflect a need for heating.
[2] Austin Energy's Fiscal Year is October 1 through September 30.

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difference in the annual normalized (i.e. projected) and actual electric consumption for the residential customer class.

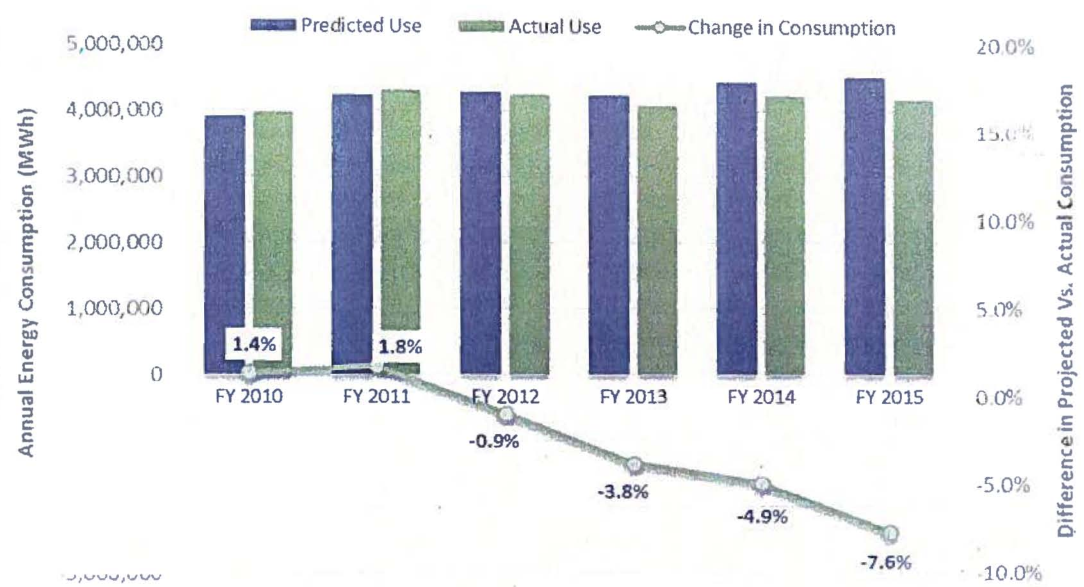

Figure 1: Projected vs. Actual Energy Consumption

Figure 1 shows the projected and actual consumption levels for FY 2010 through FY 2012 at similar levels in the years prior to the implementation of the conservation pricing rates beginning in FY 2013. In the first year of the conservation pricing signal, FY 2013, the analysis suggests a 3.8% reduction in the projected consumption levels with 4.9% and 7.6% in the subsequent years. FY 2012 projected consumption levels do exhibit a slight decline in comparison to the prior two years. However, this slight decline is not unexpected and within a reasonable projected or forecasted difference. FY 2012 also began on October 1, 2011, directly after the hottest summer on record for Austin. This may have led to a potential customer behavioral change as FY 2012 came directly after what were likely some of the highest customer bills in recent years from the record heat. The monthly projected and actual data also suggests customers reduced consumption in the fall of 2011 (beginning of FY 2012) after the record heat.

As intended by the implementation of the 2012 conservation rate pricing signal, as the rates and electric bills increased, customers began changing behaviors and conserving electricity. This relationship between price or rate increases and resulting reductions in electricity consumption is commonly known as elasticity of demand. Our research shows the long-term elasticity of demand (e.g. the measure of customers' reduction in consumption related to a price increase after a two to three year period) is approximately two to three times higher than the short-term elasticity of demand. This research suggests that as customers have more time to adjust to pricing signals, they conserve more electricity as

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they change behaviors and purchase energy efficient goods and products. This trend is also reflected in Figure 1.

While quantifying the exact reduction in consumption directly attributable to the 2012 rate change is likely impossible, we can identify trends in consumption patterns and estimate the impact of the rates by identifying and eliminating the most influential variables. The results of our analysis clearly suggest the implementation of the 2012 conservation rate structure resulted in a significant reduction in energy consumption. Finally, and aligned with our research regarding elasticity of demand, the longer term conservation results for FY 2014 and FY 2015 in Figure 1 are increasing and higher than the first year. Thus, if AE continues evaluating the impact of the conservation rates in subsequent years, they may observe the consumption reductions stabilizing at 10% to 12% per year as illustrated in the 2015 data, which is approximately two to three times as much the first year (FY 2013) reduction of 3.8%.

Scope of Work and Methodology Overview

Task 4 (Task) of NewGen's Regulatory Consulting Services includes evaluating and identifying the impacts of the 2012 conservation rate pricing signal on residential customer consumption and behaviors. As the conservation pricing signal was intended to promote energy efficiency and reduce consumption, NewGen primarily focused our analysis on the residential billing and consumption data to identify the potential reductions in consumption attributed to the conservation pricing signal. While the primary goal of the Task is identifying the potential reductions in residential energy consumption, the Task also includes the examination of the 2012 conservation rates' influence on customer interest, and use and adoption of AE's Customer Energy Solutions or demand side management (DSM) programs. At AE's request, this memo report and related results are focused on and summarize the residential billing analysis and related changes in residential consumption. Subsequent reports to AE will integrate the remaining Task elements including the DSM evaluation, conclusions, and findings.

To evaluate and attempt to quantify the change in consumption attributable to the 2012 conservation rates, NewGen applied an industry accepted methodology to "normalize" the annual consumption data for each customer and the electric system as a whole. Normalizing the electric consumption data attempts to remove the influence of specific variables (such as weather) on the level of electric consumption from year to year. By removing these key variables' influence on the electric consumption, the impact of the pricing signal may be analyzed for its contribution to changes in consumption patterns. A summary of the methodology and approach to determine the impact on consumption for the conservation rates is included below.

Billing Database and Data Gathering

To examine the potential impacts of the conservation rates, NewGen used the existing AE billing databases or **[the CIS and CCB systems]** as the foundation for normalizing and projecting the residential consumption levels. Once the regression was calculated, it was applied to each customer bill for FY 2010 through FY 2015 to project a weather normalized consumption profile. This normalized profile was then compared to the actual consumption levels to determine the differences.

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Weather and Broader Market Trend Normalization and Regression Analysis:

To normalize the consumption data, NewGen relied upon and leveraged portions of an existing AE weather normalization model. AE currently uses this weather normalization model to forecast load for budgeting and financial purposes. NewGen used portions of the existing AE model, as it has historical residential consumption data by month from 1999 through September 2012, the month before the conservation rates took effect. Using this historical consumption data and monthly temperature data (e.g. heating and cooling degree days) for the same period, we performed a regression analysis to quantify how consumption is correlated and varies with the temperatures. The regression analysis also identified an annual general reduction in consumption levels that represents the broader market trend and impacts of more efficient products, appliances, and homes. The regression only included data through September 2012 to ensure the regression formula and projections were not affected by the significant change in rates and rate structure after October 1, 2015. By applying the results of the regression, it allows us to identify and eliminate the impact that the weather had on consumption levels and generally account for the year over year impact of broader, market driven efficiencies. Please note, the regression NewGen developed is slightly different than the one currently calculated and included in the AE regression and forecast model. The regression used to support this Task and analysis was developed using data prior to the implementation of the 2012 conservation rates and also includes a variable to account for broader or market-wide conservation behaviors and improvements in energy efficiency.

The results of the regression analyses provided an R-squared value of 0.97. R-squared values for a regression are a statistical measure of how close the data points align with the fitted regression line. The higher the R-squared value the more closely the regression analysis fits and projects the data. For example, the 0.97 value means that 97% of the monthly consumption data points are explained by the regression.

Projected and Actual Monthly Consumption

Using the regression results, the FY 2010 through FY 2015 customer bills for the entire residential customer class were recalculated. By recalculating the consumption with the regression formula, it creates a projected consumption based on the temperatures for each month and takes into account an annual reduction in consumption based on broader energy efficiency market trends. The projected consumption levels were then compared to the actual consumption to estimate the change in consumption patterns associated with the 2012 conservation rates.

Outcomes and Results

Table 2 shows the results of the projected consumption for FY 2010 through FY 2015 compared to the actual consumption.

Table 2
Projected and Actual Residential Class Consumption

Year	Projected Consumption (MWh)	Actual Consumption	Difference (Actual vs. Projected)

		(MWh)		
FY 2010	3,916,845	3,971,957	55,112	1.4%
FY 2011	4,236,819	4,313,108	76,289	1.8%
FY 2012	4,284,709	4,245,712	(38,996)	-0.9%
FY 2013	4,239,601	4,080,281	(159,320)	-3.8%
FY 2014	4,442,228	4,225,378	(216,850)	-4.9%
FY 2015	4,523,698	4,177,829	(345,869)	-7.6%

As Figure 1 and Table 2 show, there is a clear trend in the difference between the projected and actual consumption in the years after the conservation rates were implemented in FY 2013. The regression projected consumption levels for FY 2010 through FY 2012 that remained relatively stable, within +/- 1.8% of the actual consumption for each year. However, beginning in FY 2013 with the new conservation rates, the actual consumption levels are materially and significantly less than the projected or "normalized" consumption. In the first year of the conservation rates, the analysis suggests a 3.8% reduction in the projected consumption levels with 4.9% and 7.6% in the subsequent years. It is also important to note Table 2 also shows the reductions in electricity consumption growing in each year following the implementation of the conservation rates. This trend suggests as customers have more time to adjust behaviors and/or consider the new rates in their purchasing of products and equipment, the resulting consumption further declines. These results from FY 2014 and 2015 align with and support academic and research studies on the longer term effects of conservation pricing signals and increasing utility bills and rates. Additional discussion on the short- and long-term effects of the conservation rate structure are included in the Elasticity of Demand portion of the memo below.

As the Residential class includes both multifamily and single family homes, there was a concern that the recent economic recovery and perceived increase in multifamily construction such as apartment or condominium complexes may impact the results. The average multifamily customers consume approximately 650 to 800[3] kWh per month while average single family customers consume 1,000 to 1,600 kWh per month. If, or as, the number of multifamily customers begins to increase dramatically and shift the ratio of multifamily to single family customers within the class, there is a concern it may distort the results and artificially reduce the comparison of actual consumption levels to the projected. However, due to the regression analysis and application of the resulting formula, the results are not dramatically affected by a shifting mix of multifamily and single family customers within the class. The regression formula considers and includes each year's average monthly customer consumption and recalculates the projected consumption based on each individual customers' consumption profile. Thus, the evolving or changing mix in the Residential class housing stock is reflected in the projected results. Furthermore, it appears the growth rates in multifamily customers (approximately 1.5% per year) are not dramatically higher than single family (approximately 0.3% to 1.2% per year) for the past two to three years.

[3] The average monthly consumption is based on the billing database information for 2014 and 2015 with the range representing the inside versus outside City customers.

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Finally, while FY 2012 results show a slight decline in comparison to the previous two years; this slight decline is within a reasonable projected or forecasted difference. This slight decrease in FY 2012 is similar to the FY 2010 and FY 2011 results showing slight increases of actuals versus projected. FY 2012 also began on October 1, 2011, directly after the hottest summer on record for Austin. This may have led to a potential customer behavioral change as FY 2012 came directly after what were likely some of the highest customer bills in recent years from the record heat. A comparison of the monthly projected and actual data also suggests customers reduced consumption in the fall of 2011 (beginning of FY 2012) after the record 2011 summer heat. The actual consumption levels for the fall months at the beginning of FY 2012 were typically lower than the projected amounts. NewGen further examined the FY 2012 consumption data and regression analysis in an attempt to identify a variable that may further improve the precision of the regression projections, but there were no other statistically valid indicators to include.

Elasticity of Demand

As intended by the implementation of the conservation pricing signal in October 2012, as the rates and electric bills increased with greater consumption levels, customers began changing behaviors and conserving electricity. This relationship between price or rate increases and resulting reductions in electricity consumption is commonly known as elasticity of demand. Elasticity of demand is a common economics term used to measure the market responsiveness (elasticity) related to the change in consumption or demand of a particular product due to the change in its price. Understanding the elasticity of demand for electric rates is important in designing rates to achieve conservation goals.

Elasticity of demand is typically represented as a ratio of the percent change in demand divided by the percent change in price. These ratios are typically negative, which indicate as prices increase the demand or consumption decreases. The elasticity of demand also changes and typically increases as more customers become aware of the changes and are provided more time to adjust to the new pricing signals. For example, as the rates were implemented in October 2012 some customers began making adjustments to behaviors or implementing energy efficiency measures early in the FY, while most customers likely took the first six months to a year to fully realize the impacts to their total bills and begin making adjustments. As time went on, and more customers had time to adjust behaviors, the amount of conservation increased.

Our secondary market research identified short-term elasticity of demand in the range of -0.08 to -0.24. This data suggests each 10% increase in electricity bills would result in a reduction of 0.8% to 2.4% in customer consumption in the short-term (e.g. one to two years). Our research also showed long-term (e.g. two years or more) elasticity of demand was in the range -0.30 to -0.75 with some case studies as much as -1.0. As the data show, the long term elasticity of demand is approximately two to three times higher than the short term elasticity of demand. This general trend in the short- and long-term elasticity of demand is clearly seen in Table 2 and Figure 1 as the difference between the actual and projected consumption grows each year after the rates were implemented. The difference between the "normalized" or projected and actual consumption in FY 2013 is -3.8% and grows to -7.6% in FY 2015, or approximately double the short term amount.

Elasticity of demand is often used to project customer behavior with changing electric rates and support the design of rates such as AE's inclining block rate. Using or integrating elasticity of demand in rate

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analyses and revenue projections allows utilities to better understand and optimize the relationship between increasing the rates and impacts to system loads or consumption. For example, if AE were to implement a conservation pricing signal in other customer classes, it should use the short- and long-term elasticity of demand to facilitate the design of the rates and achieve a specified or targeted amount of conservation (e.g. 5% less than normalized). AE may also consider incorporating elasticity of demand to help project and forecast system consumption for the Residential customer class as it nears the long-term elasticity of demand impacts. Thus, if AE continues tracking the impact of the conservation rates in subsequent years, they may observe the consumption reductions stabilizing at approximately 10% to 12% per year, or approximately three times the amount of the first year reductions. This may also help to improve system load and revenue forecasts for the utility.

Future Analysis

Additional analyses of the conservation pricing signal may yield key information in supporting and optimizing the design and implementation of AE's Customer Energy Solutions or energy efficiency programs. Task 4 includes additional examination of the conservation rates that may provide insight into market segmentation and the calculation of the residential customer class' elasticity of demand. By leveraging the geographical information (e.g. zip codes or general premise locations) available for the Residential customer class and consumption patterns available through the analysis complete to date, we can develop maps across AE's service territory to identify, cross reference, and evaluate:

- Areas that include concentrations of larger residential electricity consumers;
- Areas that include more efficient customers;
- Areas or types of customers that responded the most to the conservation pricing signals;
- Areas that included the highest or lowest monthly bills as a percentage of median income and their adoption of AE's Customer Energy Solutions;
- Consumption profiles based on census related data such as income levels, home sizes, home values, etc.;
- The roles of income, house vintage/type, inside or outside city, and family size and their influence on conservation from rates and participation in Customer Energy Solutions;
- Others as directed by AE.

This additional analysis and resulting market segmentation should support AE's Customer Energy Solutions offerings by informing and further improving conservation related programs for customers. The information can help AE better target and capture potential Customer Energy Solutions participants, identify segments approaching saturation/diminishing returns, and identify market segments that are under/overserved. NewGen also plans to develop more discrete regression analyses to support the development of AE's specific elasticity of demand ratio for the conservation rates.

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Findings and Conclusions

- The regression analysis performed on the monthly average consumption and temperature data is highly correlated and a valid regression to project or "normalize" the actual annual consumption for comparison to actual levels.
- While quantifying the exact reduction in consumption directly attributable to the 2012 rate change is likely impossible, the results of the regression analysis strongly suggest the conservation pricing signal implemented in October 2012 (beginning of FY 2013) have resulted in material and significant reductions in residential electricity consumption. Prior to the rate change, the projected and actual annual consumption were closely aligned, while FY 2013 through FY 2015 each showed substantial and increasing levels of conservation.
- The analysis suggests significant reductions in energy consumption in FY 2013, FY 2014, and FY 2015 of 3.8%, 4.9%, and 7.6% respectively as compared to weather normalized projections.
- Our research shows long-term (e.g. two years or more) elasticity of demand generally two to three times higher than the short-term elasticity of demand. This suggests AE may see further conservation due to the conservation rates and reductions in actual compared to normalized consumption levels. These levels may reach 10% to 12% or more over the next few years.
- AE should consider integrating elasticity of demand in rate analyses and revenue projections to better understand and optimize the relationship between increasing the rates and impacts to system loads or consumption. For example, if AE continues tracking the impact of the conservation rates in subsequent years, they may observe the consumption reductions stabilizing at approximately 10% to 12% per year, or approximately three times the amount of the first year reductions. This may also help to improve system load and revenue forecasts for the utility.
- Additional analyses based on these initial results may yield key market segmentation information that is valuable to supporting and optimizing the design or implementation of AE's Customer Energy Solutions programs. These additional analyses may also lead to the calculation of the elasticity of demand for AE's residential customers and greater insight into which types of customers responded to the pricing signal.

If you have any questions or comments regarding these initial results of the impact of the conservation pricing signal, please feel free to contact Tony Georgis at tgeorgis@newgenstratgies.net or Grant Rabon at grabon@newgenstratgies.net.