VOLUME 3:

LOAD ANALYSIS AND LOAD FORECASTING

KANSAS CITY POWER & LIGHT COMPANY (KCP&L)

INTEGRATED RESOURCE PLAN

4 CSR 240-22.030

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KCP&L
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HIGHLIGHTS

- KCP&L expects energy consumption to grow .6% and peak demand to grow .7% annually from 2015-2035.
- Residential energy consumption is expected to provide the most growth over the next 20 years.
- KCP&L customers are expected to grow .5% annually from 2015-2035.
- Key forecast uncertainties include the future mix of customers, the impact of rising prices, technological advancement in renewable energy sector, and energy efficiency.

PURPOSE: This rule sets minimum standards for the maintenance and updating of historical data, the level of detail required in analyzing loads, and the purposes to be accomplished by load analysis and by load forecast models. The load analysis discussed in this rule is intended to support both demand-side management efforts of 4 CSR 240-22.050 and the load forecast models of this rule. This rule also sets the minimum standards for the documentation of the inputs, components, and methods used to derive the load forecasts.

SECTION 1: SELECTING LOAD ANALYSIS METHODS

The utility may choose multiple methods of load analysis if it deems doing so is necessary to achieve all of the purposes of load analysis and if the methods are consistent with, and calibrated to, one another. The utility shall describe and document its intended purposes for load analysis methods, why the selected load analysis methods best fulfill those purposes, and how the load analysis methods are consistent with one another and with the endues consumption data used in the demand-side analysis as described in 4 CSR 240-22.050. At a minimum, the load analysis methods shall be selected to achieve the following purposes:

1.1 PURPOSE: IDENTIFICATION OF END-USE MEASURES

(A) To identify end-use measures that may be potential demand-side resources, generally, those end-use measures with an opportunity for energy and/or demand savings;

1.2 PURPOSE: DERIVATION OF DATA SET OF HISTORICAL VALUES

(B) To derive a data set of historical values from load research data that can be used as dependent and independent variables in the load forecasts;

1.3 PURPOSE: ANALYSIS OF IMPACTS OF IMPLEMENTED DSM AND DEMAND-SIDE RATES ON LOAD FORECASTS

(C) To facilitate the analysis of impacts of implemented demand-side programs and demand-side rates on the load forecasts and to augment measurement of the effectiveness of demand-side resources necessary for 4 CSR 240-22.070(8) in the evaluation of the performance of the demand-side programs or rates after they are implemented; and

1.4 PURPOSE: PRESERVATION OF LOAD ANALYSIS IN HISTORICAL DATABASE

(D) To preserve, in a historical database, the results of the load analysis used to perform the demand-side analysis as described in 4 CSR 240-22.050, and the load forecasting described in 4 CSR 240-22.030.

SECTION 2: HISTORICAL DATABASE FOR LOAD ANALYSIS

The utility shall develop and maintain data on the actual historical patterns of energy usage within its service territory. The following information shall be maintained and updated on an ongoing basis and described and documented in the triennial compliance filings:

2.1 CUSTOMER CLASS DETAIL

(A) Customer Class Detail. At a minimum, the historical database shall be maintained for each of the major classes;

KCP&L maintains a historical database of its loads for each major class, which are Residential, Small General Service (SGS), Medium General Service (MGS), Large General Service (LGS), Large Power (LP), Lighting and Sales for Resale (SFR). In addition, SGS, MGS, LGS and LP are split into the subclasses commercial and industrial. This data begins in May 2005 for KCP&L and will be maintained with at least 10 years of history going forward. Beginning with this IRP filling, KCP&L forecasts its loads for each major class, which are Residential, Commercial Small General Service (SGS), Commercial Big (The sum of MGS, LGS, and LP), Industrial (The sum of SGS, MGS, LGS, and LP), Lighting, and Sales for Resale (SFR).

2.2 LOAD DATA DETAIL

(B) The historical load database shall contain the following data:

2.2.1 ACTUAL AND WEATHER NORMALIZED ENERGY, AND NUMBER OF CUSTOMERS

1. For each jurisdiction for which it prepares customer and energy and demand forecasts, for each major class, to the actual monthly energy usage and number of customers and weather-normalized monthly energy usage;

MetrixND files are used to maintain this data for each subclass listed in 22.030 (2) (A). These files also contain the models used to forecast the number of customers and weather-normalize and forecast monthly energy sales.

2.2.2 ACTUAL AND WEATHER NORMALIZED DEMANDS

2. For each jurisdiction and major class, estimated actual and weather-normalized demands at the time of monthly system peaks; and

Actual and weather-normalized coincident demands are provided in the *load research* folder of the workpapers. This data is available beginning in May 2004 at which time the load research sample converted from revenue class to CCOS. The loads are currently weather normalized when a rate case is prepared.

2.2.3 ACTUAL AND WEATHER NORMALIZED SYSTEM PEAK DEMANDS

3. For the system, actual and weather normalized hourly net system load;

Actual and weather-normalized Net System Input (NSI) is contained in the MetrixLT files.

2.3 LOAD COMPONENT DETAIL

(C) The historical database for major class monthly energy usage and demands at time of monthly peaks shall be disaggregated into a number-of-units component and a use-per-unit component, for both actual and weather-normalized loads.

2.3.1 UNITS COMPONENT

1. The number-of-units component shall be the number of customers, square feet, devices, or other units as appropriate to the customer class and the load analysis method selected by the utility. The utility shall select the units component with the intent of providing meaningful load analysis for demand-side analysis and maintaining the integrity of the database over time.

The number-of-units is the number of customers for residential and SGS commercial. For the other subclasses, mWh sales are modeled because it is more stable than kWh sales per customer and the model fit statistics are higher. In the big commercial and Industrial customer classes, the size of customers varies more than in the smaller classes and use per customer can vary substantially as customers enter or exit the class.

2.3.2 UPDATE PROCEDURE

2. The utility shall develop and implement a procedure to routinely measure and regularly update estimates of the effect of departures from normal weather on class and system electric loads. The estimates of the effect of weather on historical major class and system loads shall incorporate the nonlinear response of loads to daily weather and seasonal variations in loads.

KCP&L has developed a MetrixND model for each subclass of kWh sales that both forecasts and weather normalizes sales or sales per unit. These models will update weather normalized sales at the subclass level whenever these models are updated. This procedure is automatic. Major class level demands are currently weather normalized only for a rate case and this process is not automatic as it requires a large number of manual steps. Heating and cooling degree days calculated with different base temperatures were tested and kept in the models if statistically significant so that nonlinear weather response functions could be represented.

2.3.3 WEATHER MEASURES AND ESTIMATION OF WEATHER EFFECTS DESCRIPTION AND DOCUMENTATION

3. The utility shall describe and document the methods used to develop weather measures and the methods used to estimate the effect of weather on electric loads. If statistical models are used, the documentation shall include at least: the functional form of the models; the estimation techniques employed; and the relevant statistical results of the models, including parameter estimates and tests of statistical significance. The data used to estimate the models, including the development of model input data from basic data, shall be included in the workpapers supplied at the time the compliance report is filed;

In this IRP filing, KCP&L used different methods to model the effects of weather for normalization and for forecasting. One reason for using different methods is that the sample period for WN needed to cover the entire period that historical data was available so that data could be WN. On the other hand, the forecasting models often need a more recent shorter sample period since the focus is on calibrating an end-use forecast to recent data. The method of WN used in this IRP filing is different than that used in the rate cases because it is designed to WN many years of data whereas the rate case models are based on only two years of data. Also the method used here is much less labor intensive and can be updated more routinely.

Degree days computed at different base temperatures were tested in explaining the effects of weather on sales and system load. Degree days computed with more than one base temperature were tested in the same model to determine if the load response is nonlinear. The statistical results of model estimation in the weather normalization models of monthly sales are presented in this section. Additional information is available in the MetrixND model files that are included in the electronic workpapers. This additional information includes formulas that define the explanatory variables, plots and tables of residuals, plots and tables of actual, weather-normalized and predicted values, plots and tables of explanatory variables and model statistics and coefficients. The model coefficients were estimated using ordinary least squares regression in MetrixND. The estimation period generally includes January 2000 to July 2014 for the residential and Industrial classes and May 2005 to July 2014 for the commercial classes.

Table 1 WN Model for MO Residential Sales

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	555.740	9.710	57.231	0.00%	
BinaryVars.trend1	1.910	1.212	1.576	11.70%	
BinaryVars.trend2	-98.011	33.282	-2.945	0.37%	
BinaryVars.Jan	72.996	10.657	6.850	0.00%	
BinaryVars.Dec	76.822	9.716	7.907	0.00%	
WthrTrans.cddTrend1	-28.770	6.445	-4.464	0.00%	
WthrTrans.cddTrend2	267.094	185.674	1.439	15.22%	
WthrTrans.hddTrend1	63.991	7.033	9.099	0.00%	
WthrTrans.hddTrend2	-434.267	190.366	-2.281	2.38%	
WthrTrans.cdd65shoulder	-150.991	133.066	-1.135	25.82%	
WthrIndex.CDD65_Index	2113.781	175.586	12.038	0.00%	
WthrIndex.CDD70_Index	289.565	138.560	2.090	3.82%	
WthrIndex.HDD55_Index	1608.935	60.555	26.570	0.00%	

Table 2 WN Model for MO Small GS Commercial Sales

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	1062.547	21.558	49.288	0.00%	
WthrTrans.Cdd60trend1_SML	-230.058	44.830	-5.132	0.00%	
WthrTrans.Cdd60trend2_SML	2919.519	666.997	4.377	0.00%	
WthrTrans.Hdd55trend1_SML	-118.522	65.788	-1.802	7.45%	
WthrTrans.Hdd55trend2_SML	1905.190	779.812	2.443	1.63%	
BinaryVars.trend1	-23.926	5.519	-4.335	0.00%	
WthrIndex.CDD60_Index	2612.724	117.770	22.185	0.00%	
WthrIndex.HDD55_Index	1827.590	145.383	12.571	0.00%	

Table 3 WN Model for MO Big GS Commercial Sales (MGS, LGS and LP)

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	263913632.995	4279847.308	61.664	0.00%	
WthrTrans.Hdd55trend1_BIG	-22241323.436	16660700.953	-1.335	18.49%	
WthrTrans.Hdd55trend2_BIG	292179313.219	240092109.977	1.217	22.65%	
WthrTrans.Cdd55trend1_BIG	-12448111.849	15540768.558	-0.801	42.50%	
WthrTrans.Cdd55trend2_BIG	97677221.591	258445329.305	0.378	70.63%	
BinaryVars.trend1	9953397.526	2718286.138	3.662	0.04%	
BinaryVars.trend2	-234563327.821	68504712.529	-3.424	0.09%	
BinaryVars.trend3	149915498.686	64647632.293	2.319	2.24%	
WthrIndex.HDD55_Index	293131055.029	26866971.249	10.910	0.00%	
WthrIndex.CDD55_Index	481211531.889	24097662.095	19.969	0.00%	

Table 4 WN Model for MO Industrial Sales (SGS, MGS, LGS and LP)

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	134779787.810	830244.027	162.338	0.00%	
WthrIndex.CDD55_Index	65935509.669	4895008.473	13.470	0.00%	
BinaryVars.trend1	-855075.048	94161.755	-9.081	0.00%	
BinaryVars.trend2	-21092808.395	2499906.296	-8.437	0.00%	
BinaryVars.Feb	-5898323.331	1543793.786	-3.821	0.02%	
BinaryVars.Apr	-5312704.196	1455682.278	-3.650	0.04%	
BinaryVars.Nov	-4025488.260	1504964.175	-2.675	0.82%	
IND_SalesWn.Jun09	-13286809.545	5190610.752	-2.560	1.14%	
IND_SalesWn.May09	-14358219.724	5191301.311	-2.766	0.63%	
IND_SalesWn.aug2005	-19024693.622	5230030.173	-3.638	0.04%	
IND_SalesWn.Feb14	17975122.767	5432537.909	3.309	0.12%	

Table 5 WN Model for KS Residential Sales

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	700.731	9.623	72.821	0.00%	
BinaryVars.trend1	1.219	1.265	0.964	33.66%	
BinaryVars.trend2	-139.442	34.623	-4.027	0.01%	
WNAvgUse.Jan	118.019	11.077	10.655	0.00%	
WNAvgUse.Dec	113.140	10.107	11.194	0.00%	
WthrTrans.cddTrend1	-26.440	6.775	-3.902	0.01%	
WthrTrans.cddTrend2	371.661	193.686	1.919	5.68%	
WthrTrans.hddTrend1	35.235	7.332	4.806	0.00%	
WthrTrans.hddTrend2	-472.343	197.833	-2.388	1.81%	
WthrTrans.cddShoulder	-511.783	138.652	-3.691	0.03%	
WthrIndex.HDD55_Index	1828.568	61.080	29.937	0.00%	
WthrIndex.CDD65_Index	3444.708	85.440	40.317	0.00%	
WthrIndex.CDD75_Index	-309.759	49.401	-6.270	0.00%	
WNAvgUse.Jul11	112.031	33.756	3.319	0.11%	

Table 6 WN Model for KS Small GS Commercial Sales

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	988.221	19.576	50.481	0.00%	
WthrTrans.Hdd55trend2_SML	935.978	1082.883	0.864	38.95%	
WthrTrans.Hdd55trend1_SML	-18.289	75.410	-0.243	80.89%	
WthrTrans.Cdd60trend1_SML	-112.730	61.661	-1.828	7.05%	
WthrTrans.Cdd60trend2_SML	1707.459	1045.798	1.633	10.57%	
BinaryVars.trend1	-30.896	11.696	-2.642	0.96%	
BinaryVars.trend2	933.487	553.468	1.687	9.48%	
BinaryVars.trend3	-2104.039	1622.363	-1.297	19.77%	
BinaryVars.trend4	1541.066	1352.550	1.139	25.73%	
WthrIndex.HDD55_Index	1352.353	120.517	11.221	0.00%	
WthrIndex.CDD60_Index	2248.555	94.617	23.765	0.00%	

Table 7 WN Model for KS Big GS Commercial Sales (MGS and LGS)

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	195918132.476	2487196.129	78.771	0.00%	
WthrTrans.Hdd50trend1_BIG	538368.160	9350082.537	0.058	95.42%	
WthrTrans.Cdd55trend1_BIG	-1316825.060	9314854.745	-0.141	88.79%	
WthrTrans.Hdd50trend2_BIG	6919780.709	132424176.816	0.052	95.84%	
WthrTrans.Cdd55trend2_BIG	-13377701.042	155264846.363	-0.086	93.15%	
BinaryVars.trend1	5245404.000	1594014.890	3.291	0.14%	
BinaryVars.trend2	-200553780.974	42991733.829	-4.665	0.00%	
BinaryVars.trend3	181659475.311	41997724.813	4.325	0.00%	
WthrIndex.HDD50_Index	150240176.383	15170183.777	9.904	0.00%	
WthrIndex.CDD55_Index	314262552.368	14383838.576	21.848	0.00%	

Table 8 WN Model for KS Industrial Sales (SGS, MGS and LGS)

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	15168520.084	2302774.966	6.587	0.00%	
StrucVars.XOther_IND	8479093.630	2077683.952	4.081	0.01%	
StrucVars.XCool55_IND	21885842.411	1398964.147	15.644	0.00%	
IND_Sales.Aug10	1639494.151	609698.300	2.689	0.83%	
IND_Sales.Feb10	4757169.050	604702.427	7.867	0.00%	
IND_Sales.Nov06	1505471.898	615910.337	2.444	1.62%	
IND_Sales.Oct13	1416451.832	605155.534	2.341	2.11%	
IND_Sales.Jan09	-1830106.532	604019.512	-3.030	0.31%	
AR(1)	0.906	0.042	21.733	0.00%	

2.4 ASSESSMENTS

(D) For each major class specified pursuant to subsection (2)(A), the utility shall provide, on a seasonal and annual basis for each year of the historical period—

For the current KCP&L filing, historical sales and customers broken out by class cost of service for residential and industrial customers were available beginning in January 2000. Commercial class cost of service data was available beginning May 2005. Going forward, KCP&L will maintain this data for at least the previous 10 years.

2.4.1 HISTORIC END-USE DRIVERS OF ENERGY USAGE AND PEAK DEMAND

1. Its assessment of the historical end-use drivers of energy usage and peak demand, including trends in numbers of units and energy consumption per unit;

Historical plots of customers and kwh/customer for energy usage and peak demand can be found in *Appendix 3A*.

2.4.2 WEATHER SENSITIVITY OF ENERGY AND PEAK DEMAND

2. Its assessment of the weather sensitivity of energy and peak demand.

The following plots illustrate the weather response function of daily energy and peak demand for each major class. This data is weather normalized in the rate case process during which the weather response function is represented with an equation estimated with statistical regression analysis for the time period of January 2012 through March 2014. The blue symbols in the plot represent weekdays and the red symbols represent weekends.

Figure 1: MO Residential Daily Energy vs Average Temp

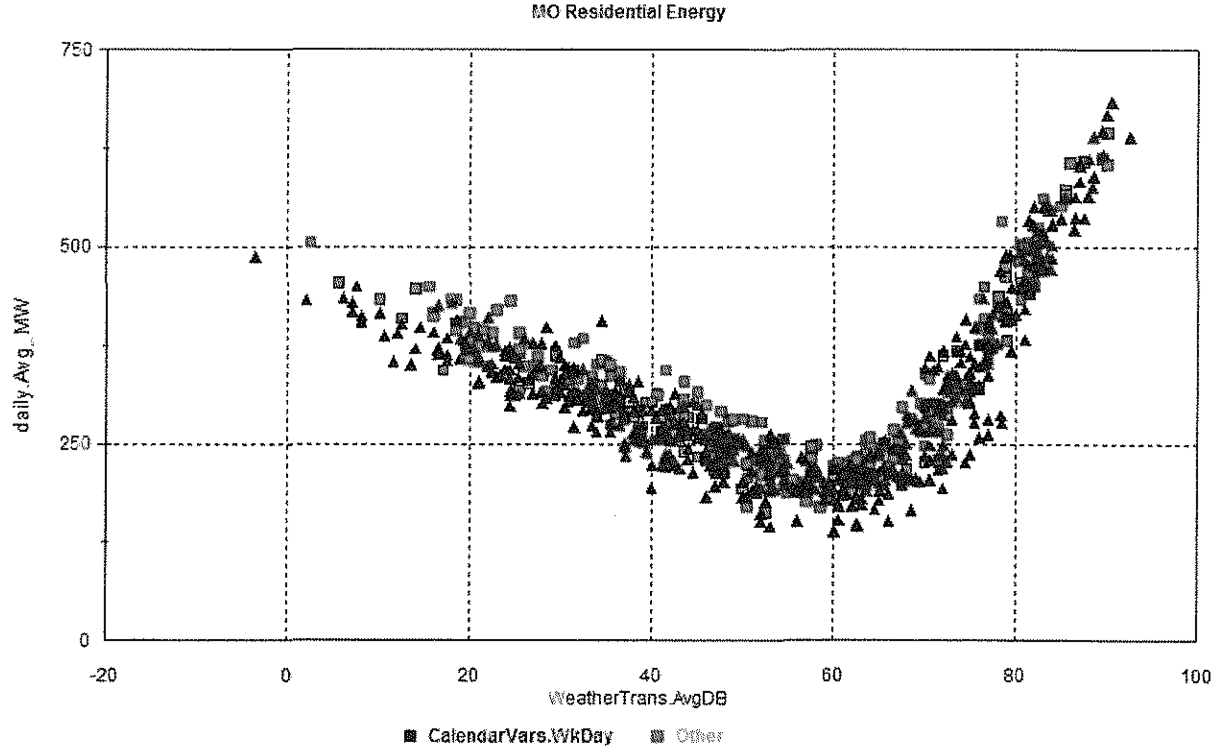


Figure 2: MO Residential Daily Peak Demand vs Average Temp

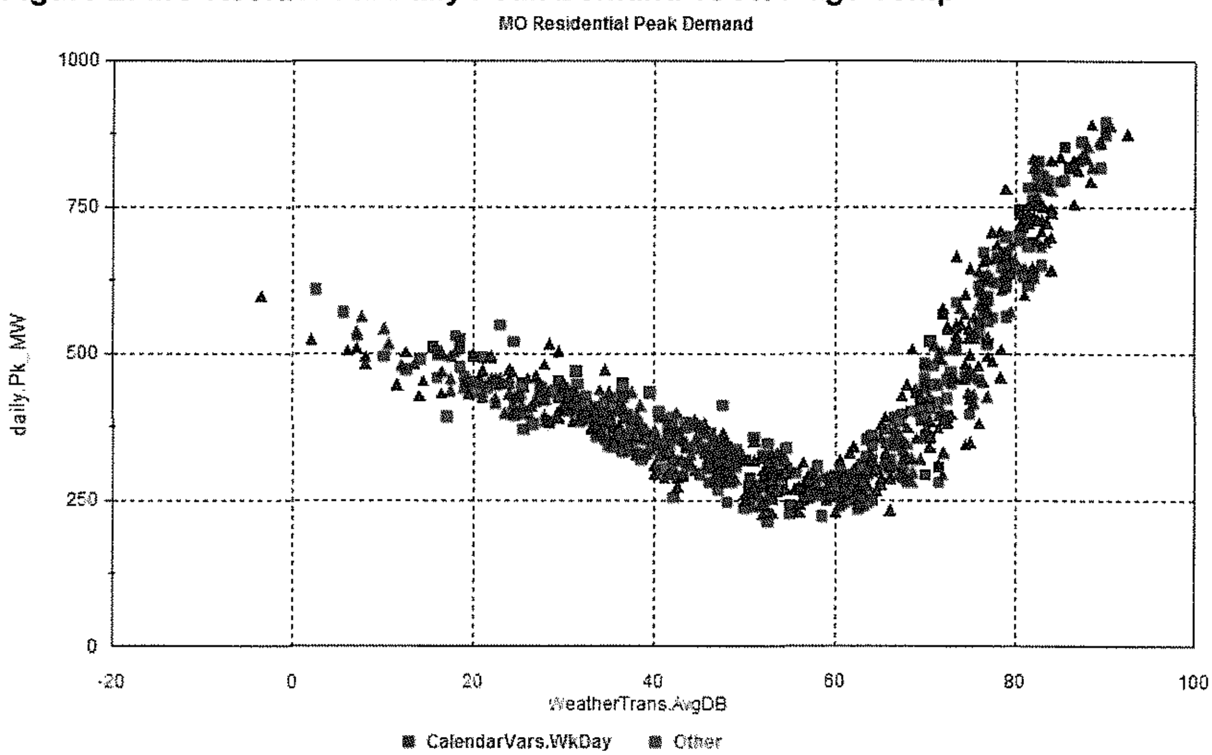


Figure 3: MO Small General Service Daily Energy vs Average Temp

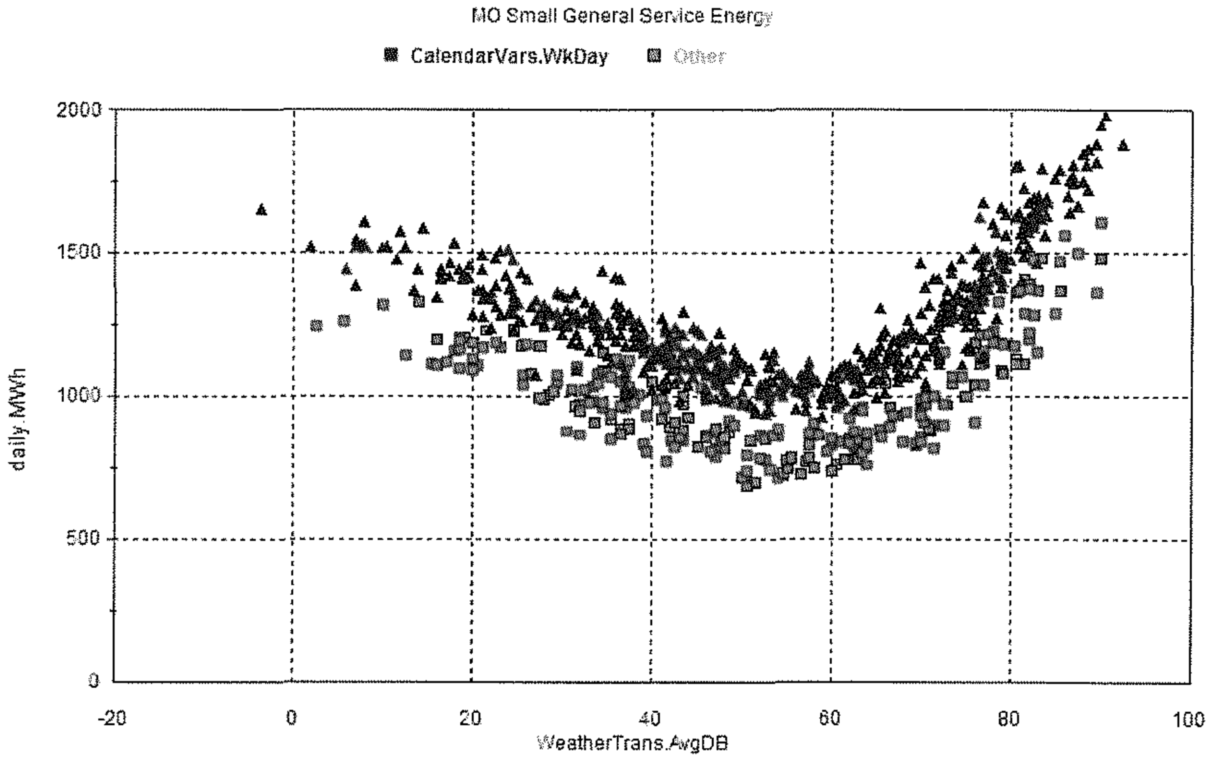


Figure 4: MO Small General Service Daily Peak vs Average Temp

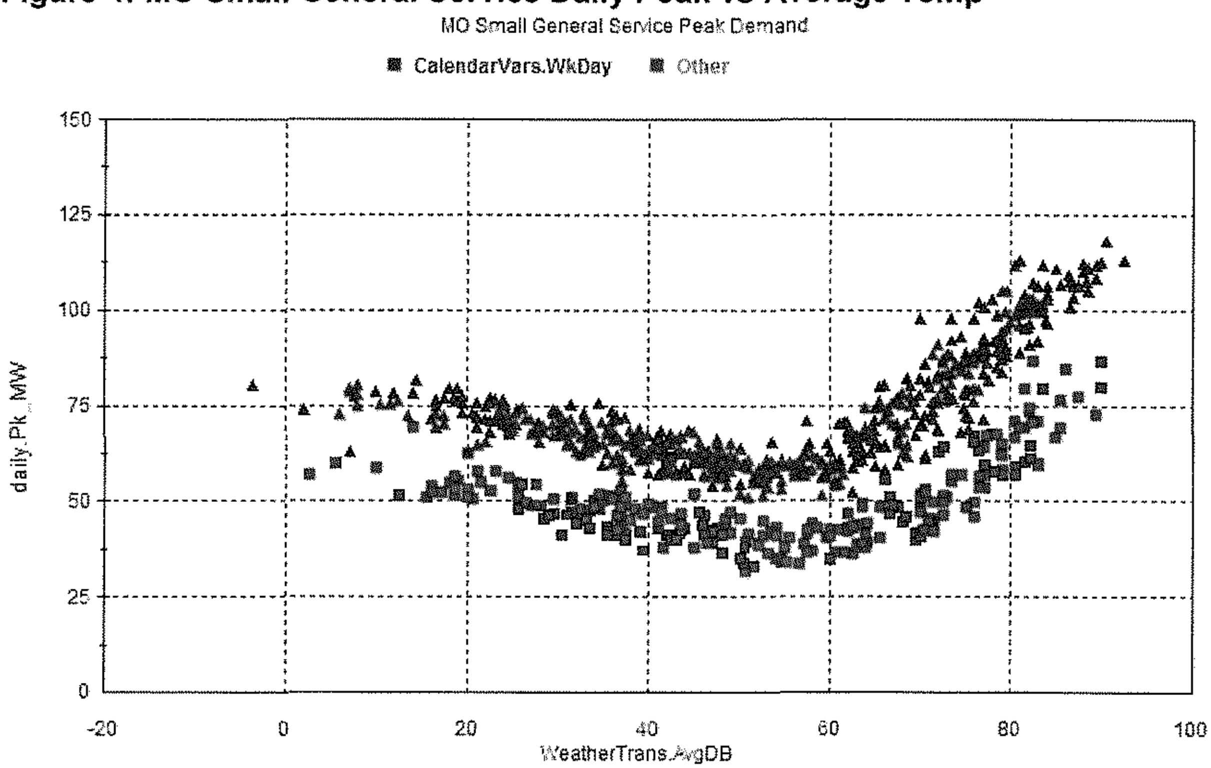


Figure 5: MO Medium General Service Daily Energy vs Average Temp

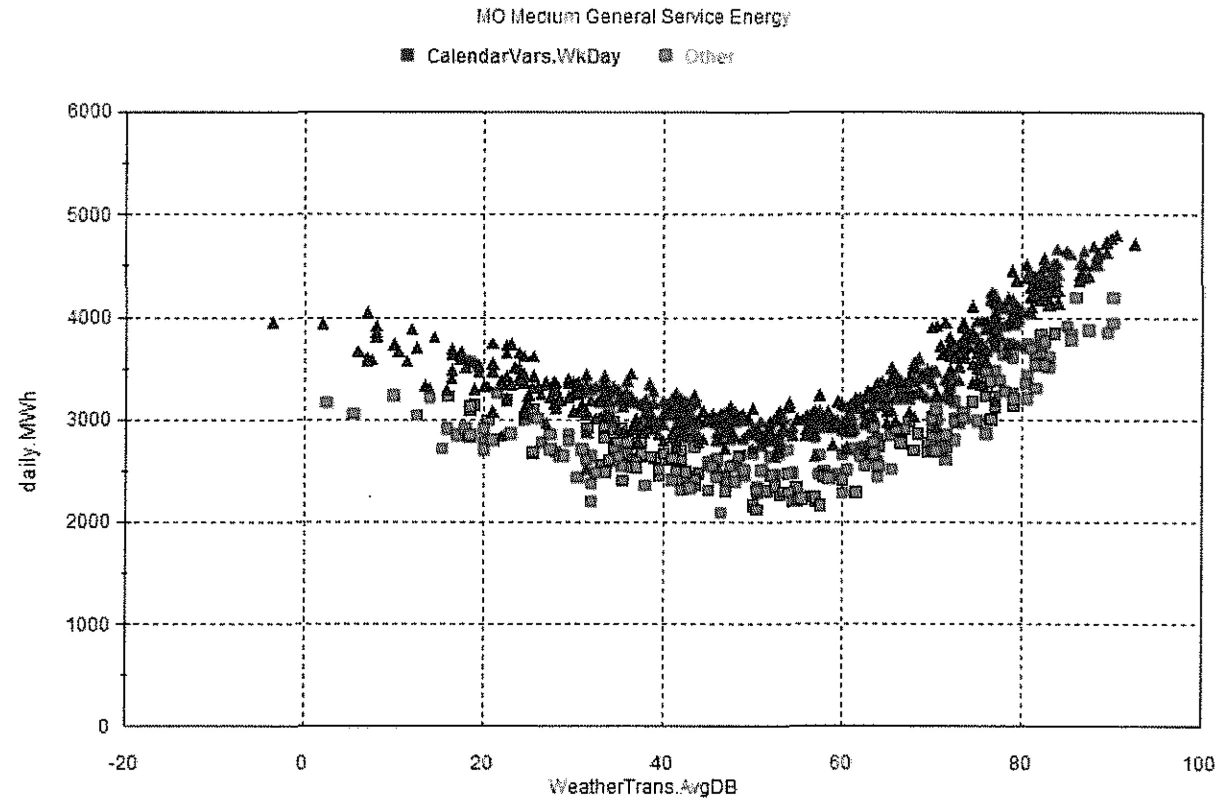


Figure 6: MO Medium General Service Daily Peak Demand vs Average Temp

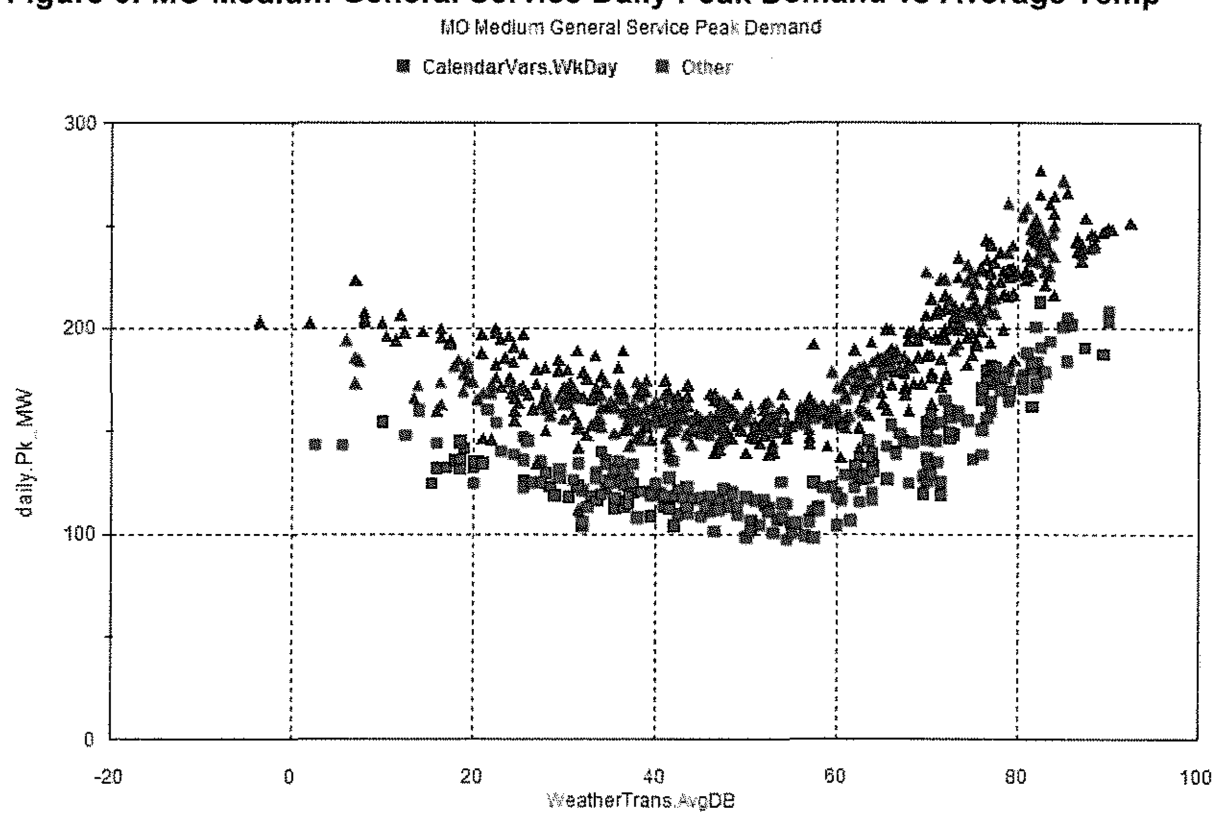


Figure 7: MO Large General Service Daily Energy vs Average Temp

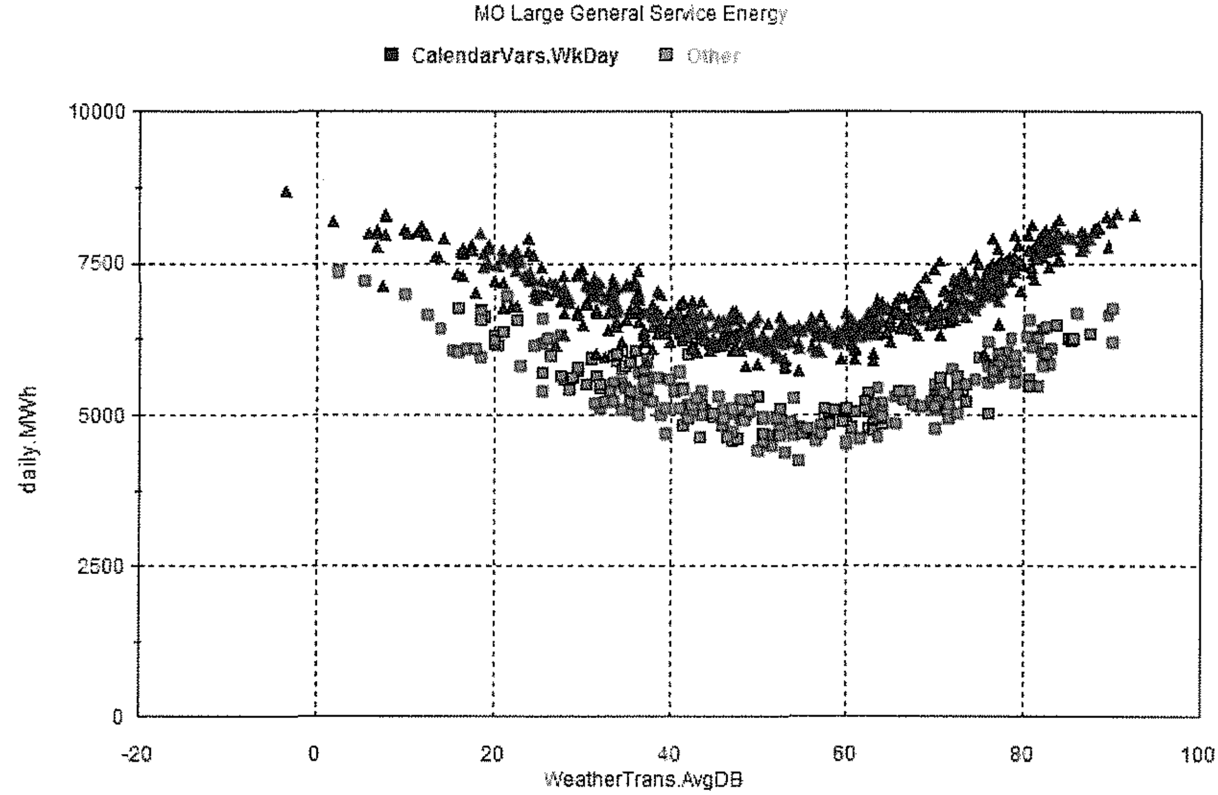


Figure 8: MO Large General Service Daily Peak Demand vs Average Temp

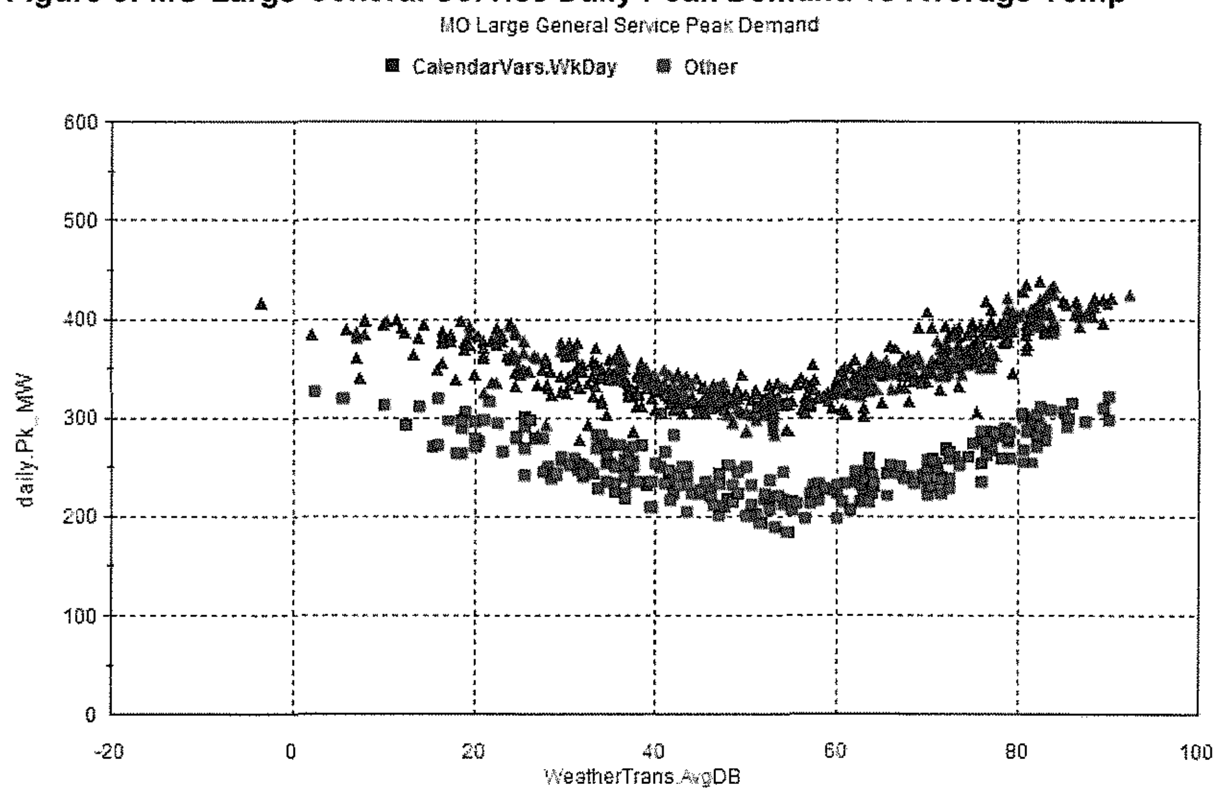


Figure 9: MO Large Power Daily Energy vs Average Temp

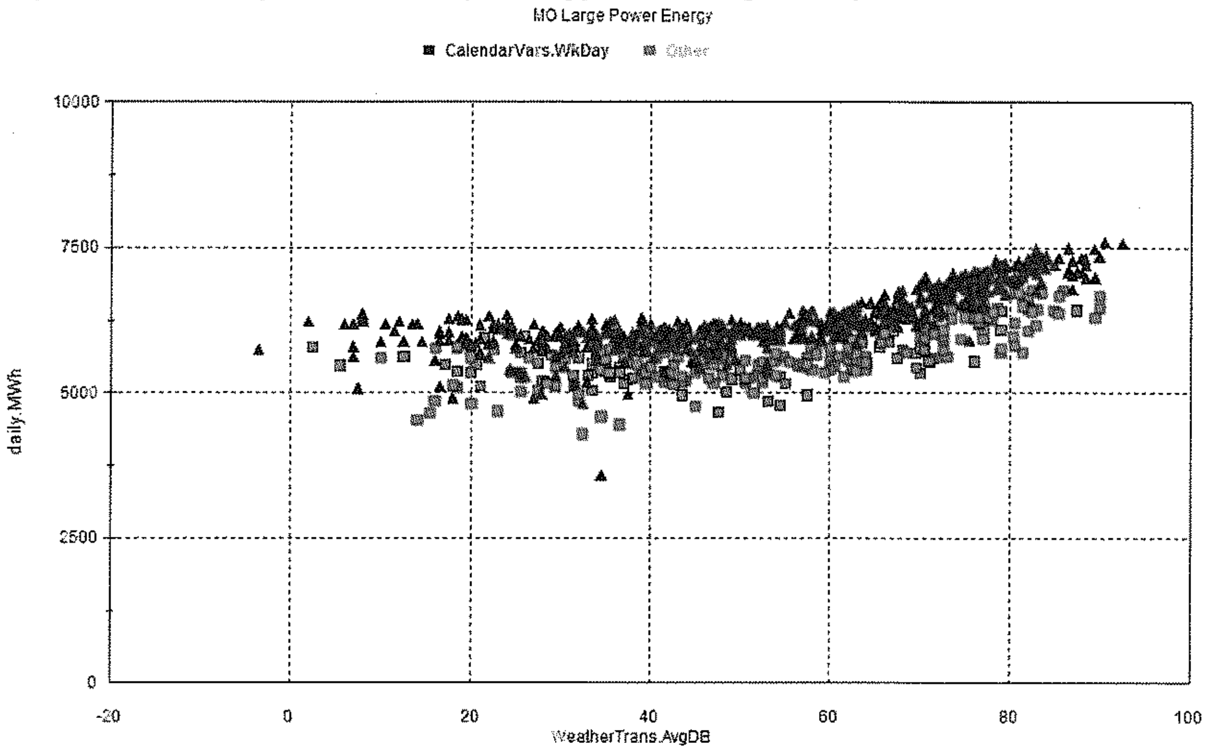


Figure 10: MO Large Power Daily Peak Demand vs Average Temp

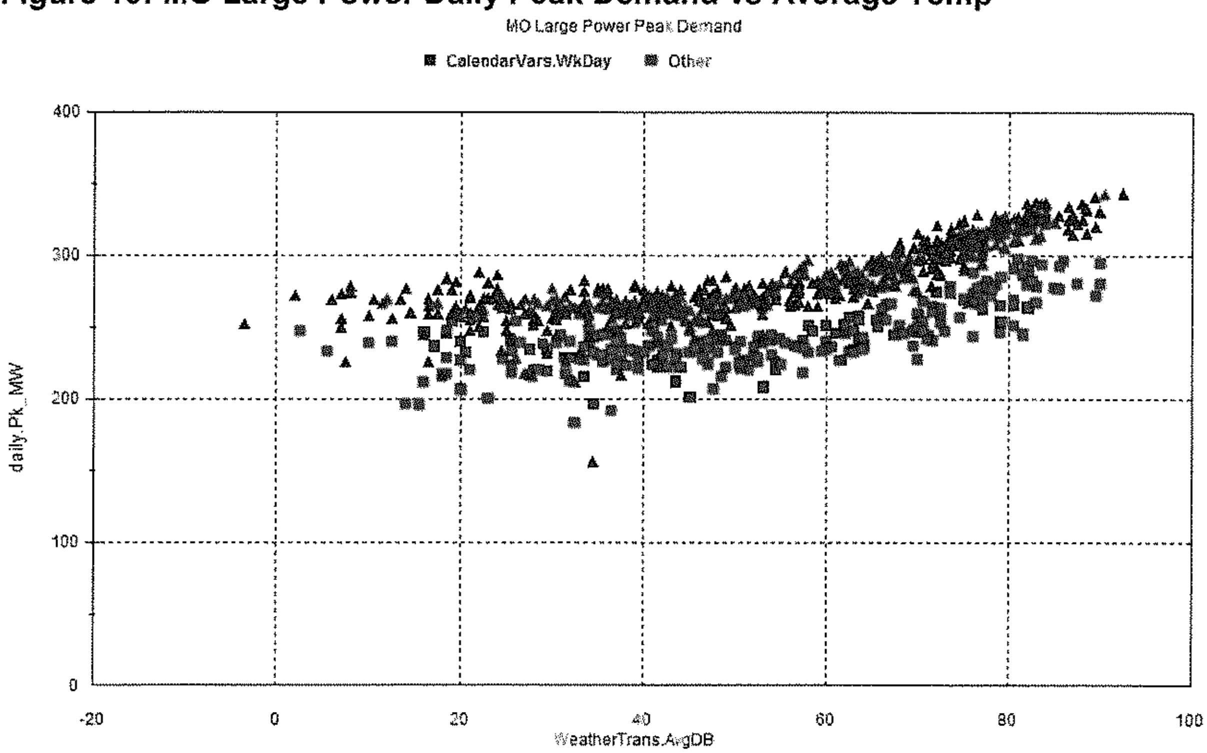


Figure 11: MO Sales for Resale Daily Energy vs Average Temp

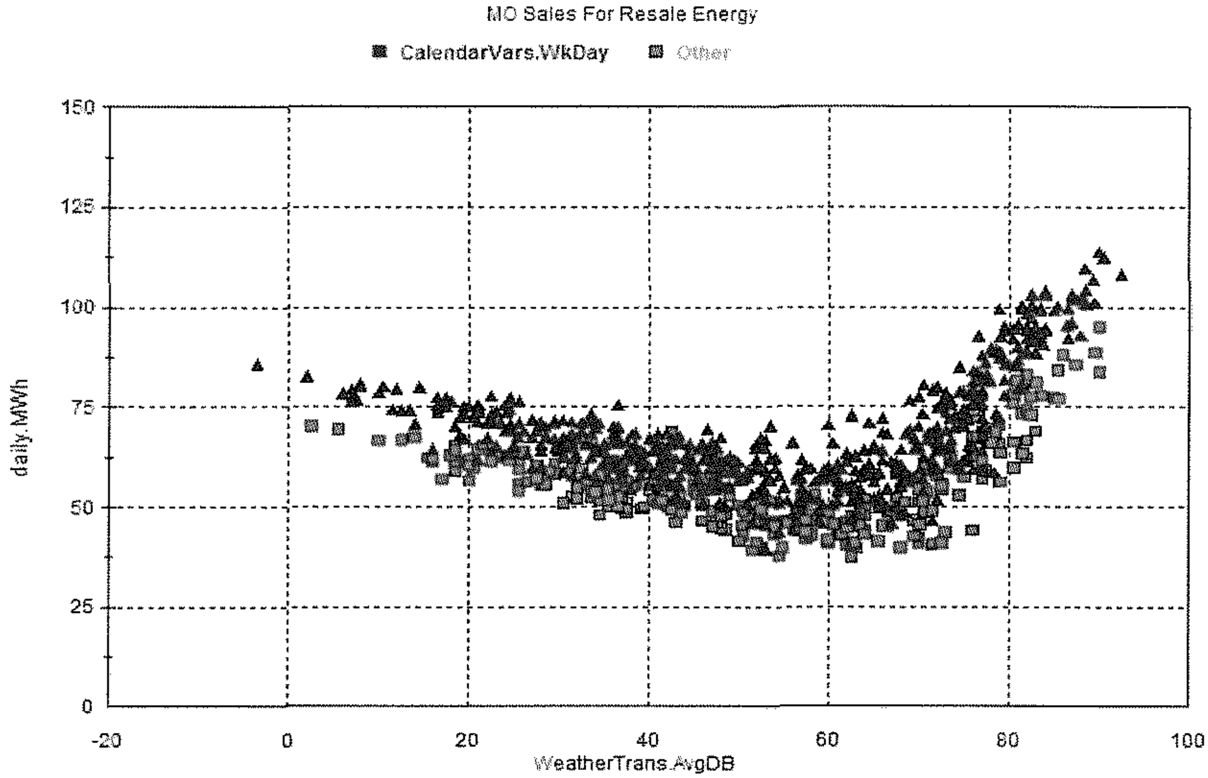


Figure 12: MO Sales for Resale Daily Peak Demand vs Average Temp

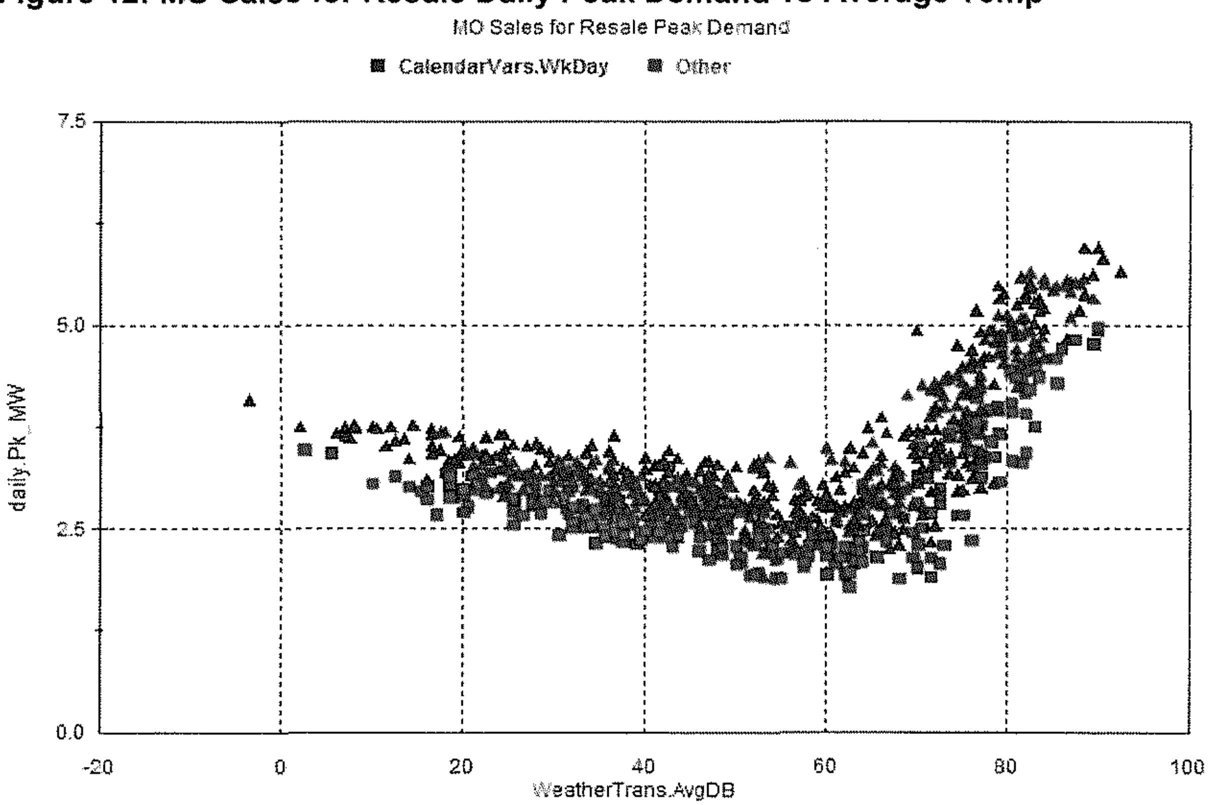


Figure 13: KS Residential Daily Energy vs Average Temp

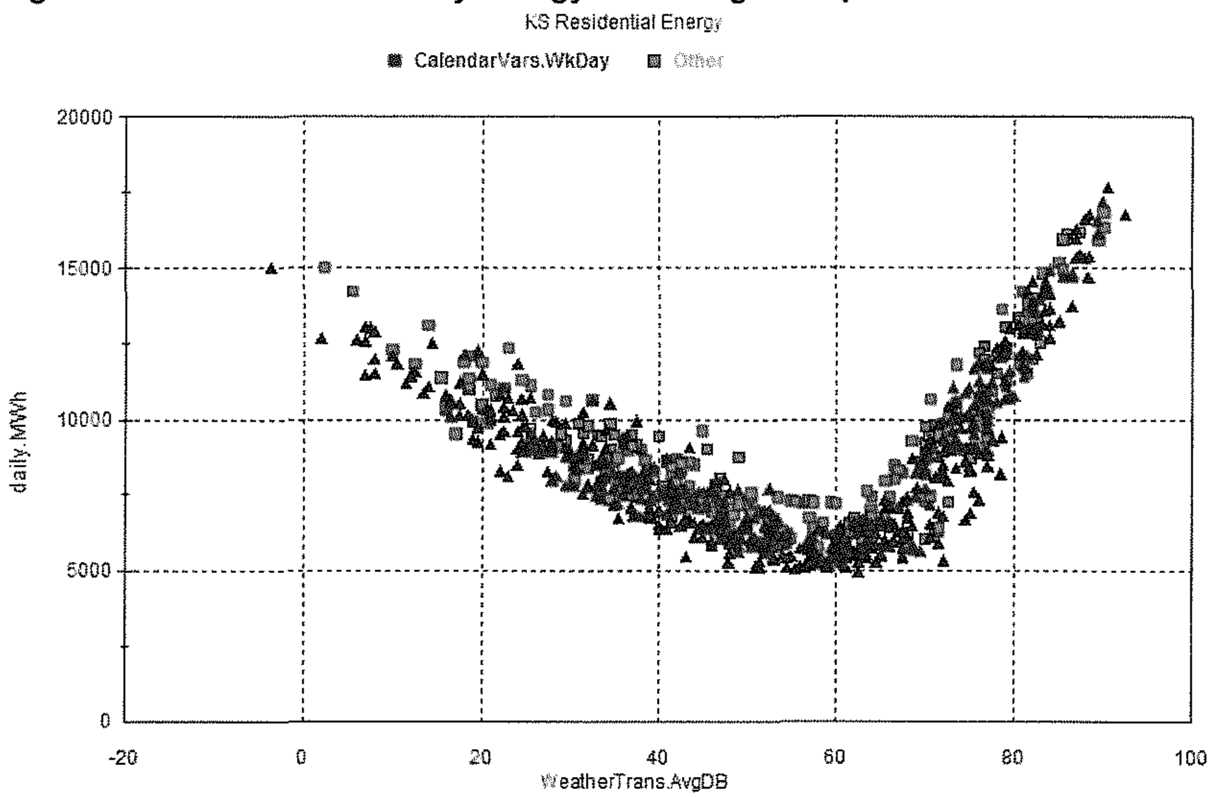


Figure 14: KS Residential Daily Peak Demand vs Average Temp

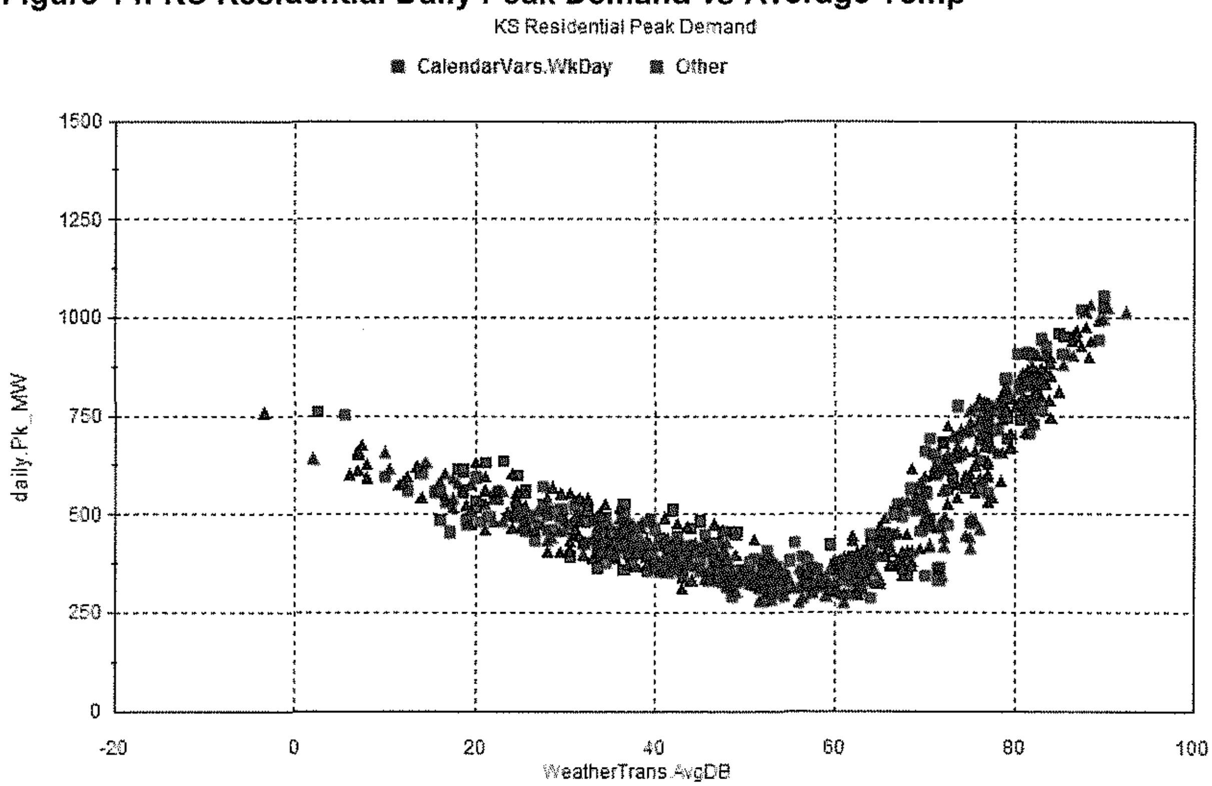


Figure 15: KS Small General Service Daily Energy vs Average Temp

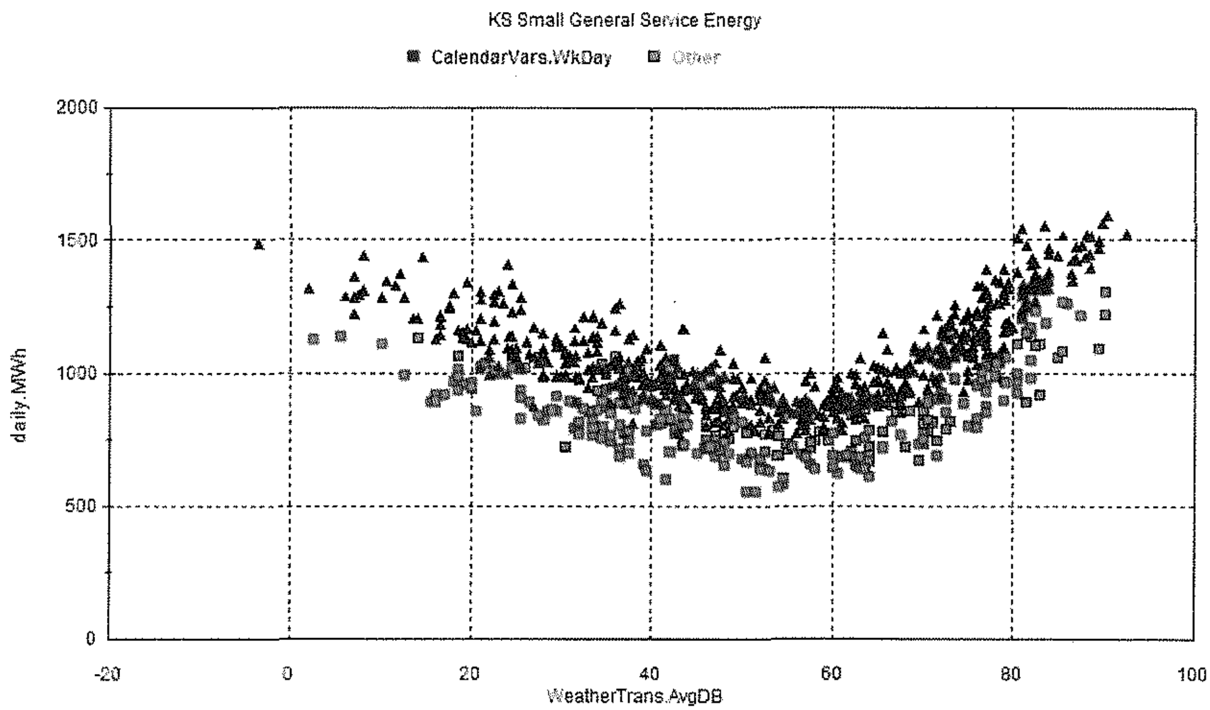


Figure 16: KS Small General Service Daily Peak Demand vs Average Temp

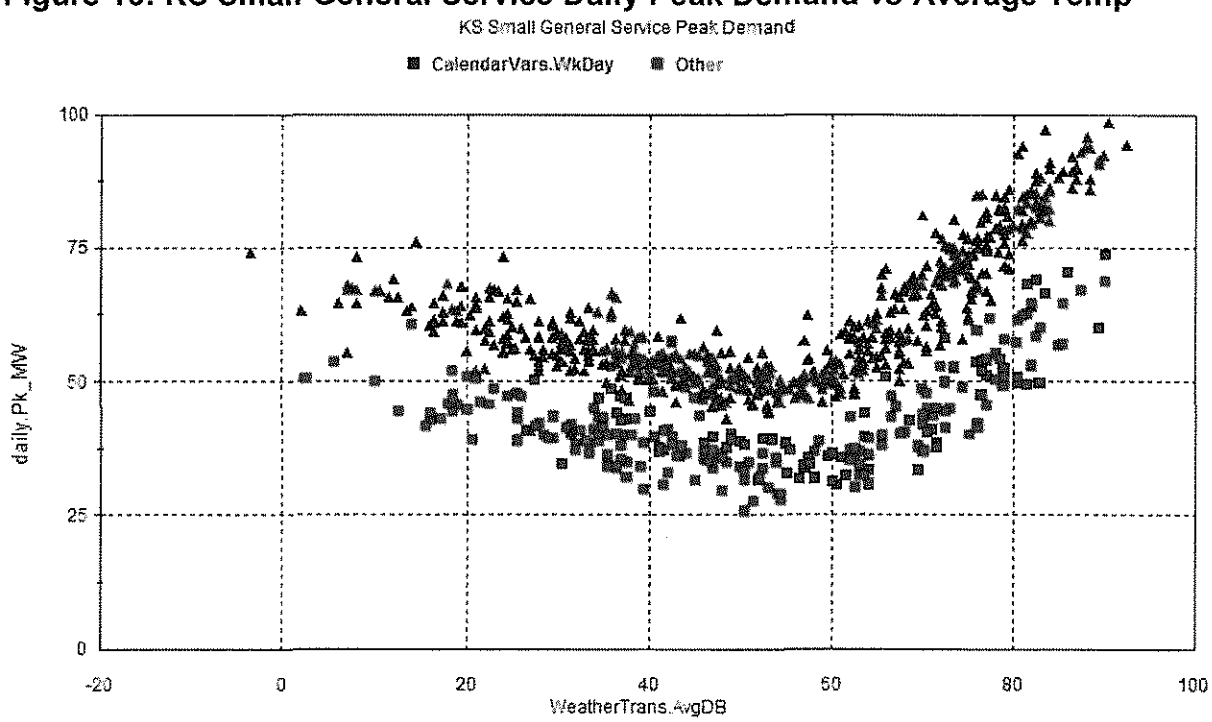


Figure 17: KS Medium General Service Daily Energy vs Average Temp

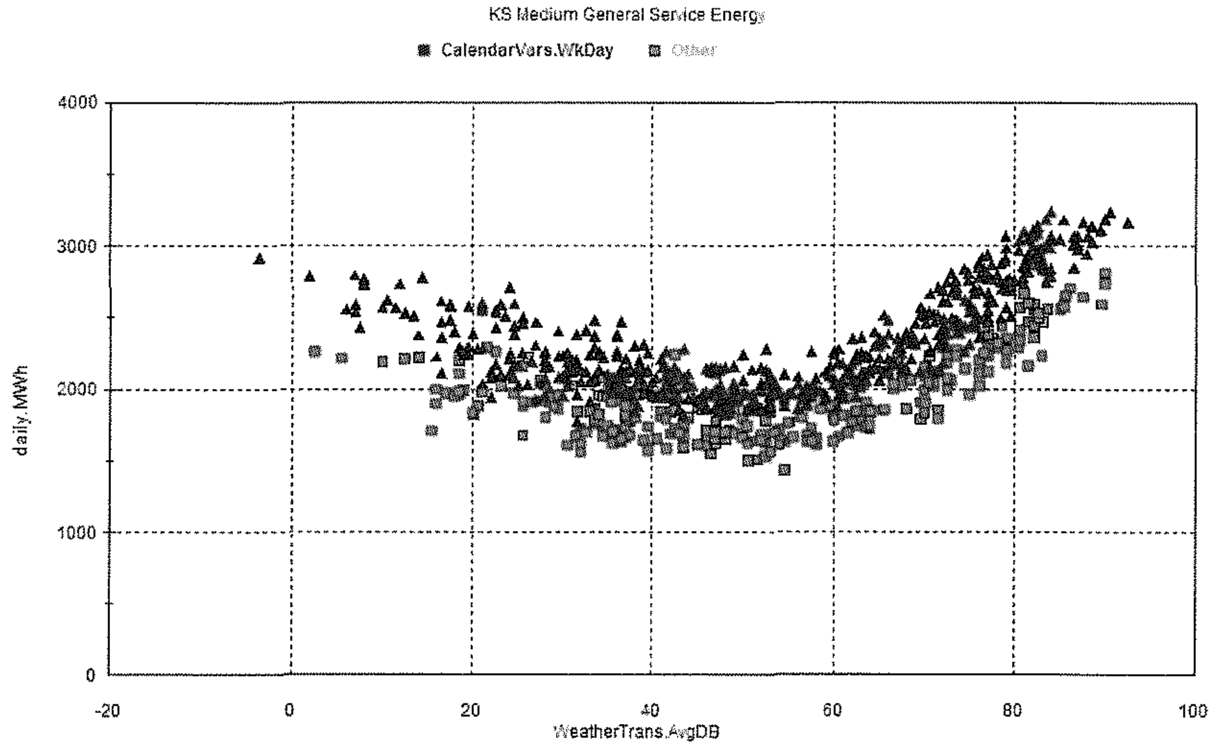


Figure 18: KS Medium General Service Daily Peak Demand vs Average Temp

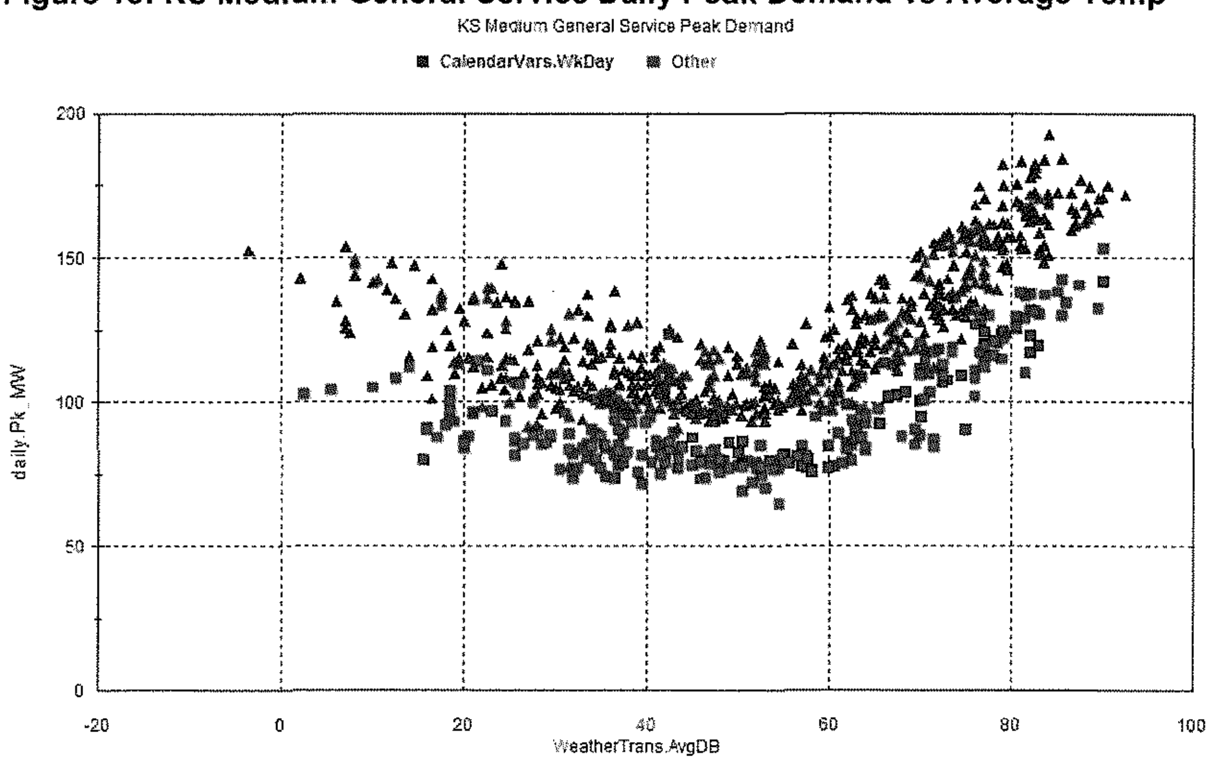


Figure 19: KS Large General Service Daily Energy vs Average Temp

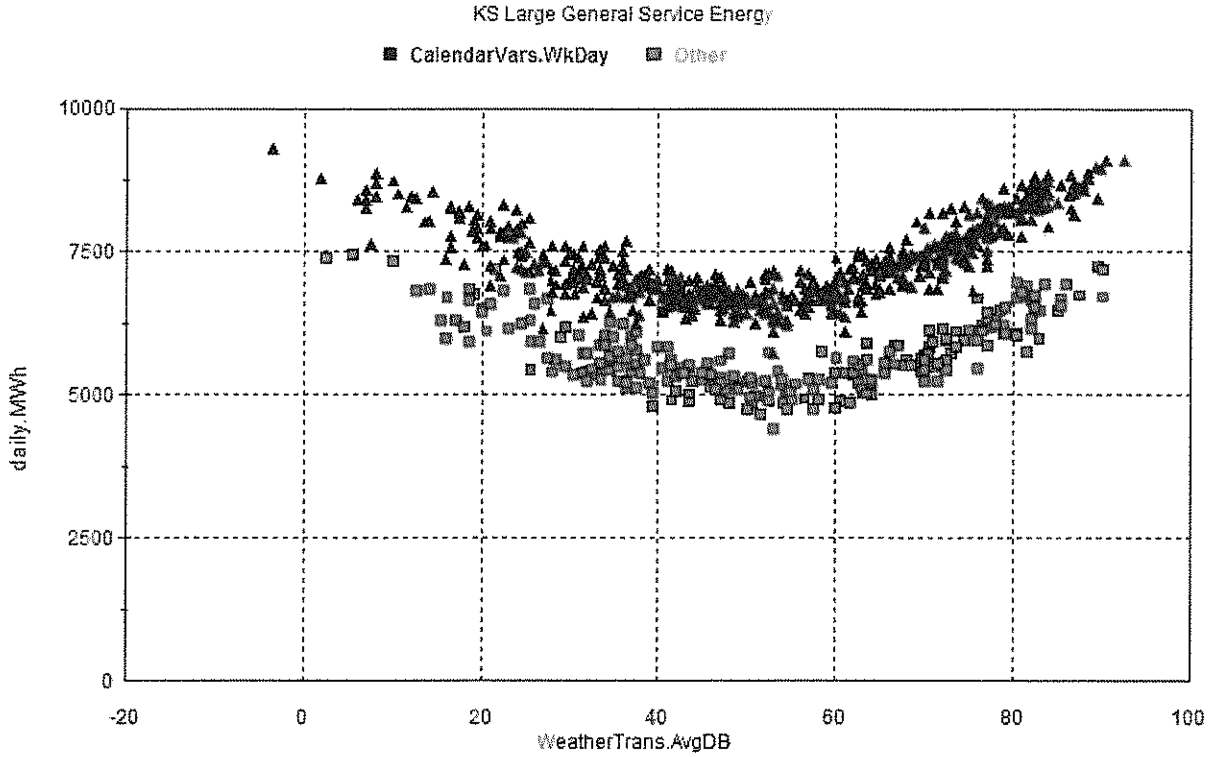


Figure 20: KS Large General Service Daily Peak Demand vs Average Temp

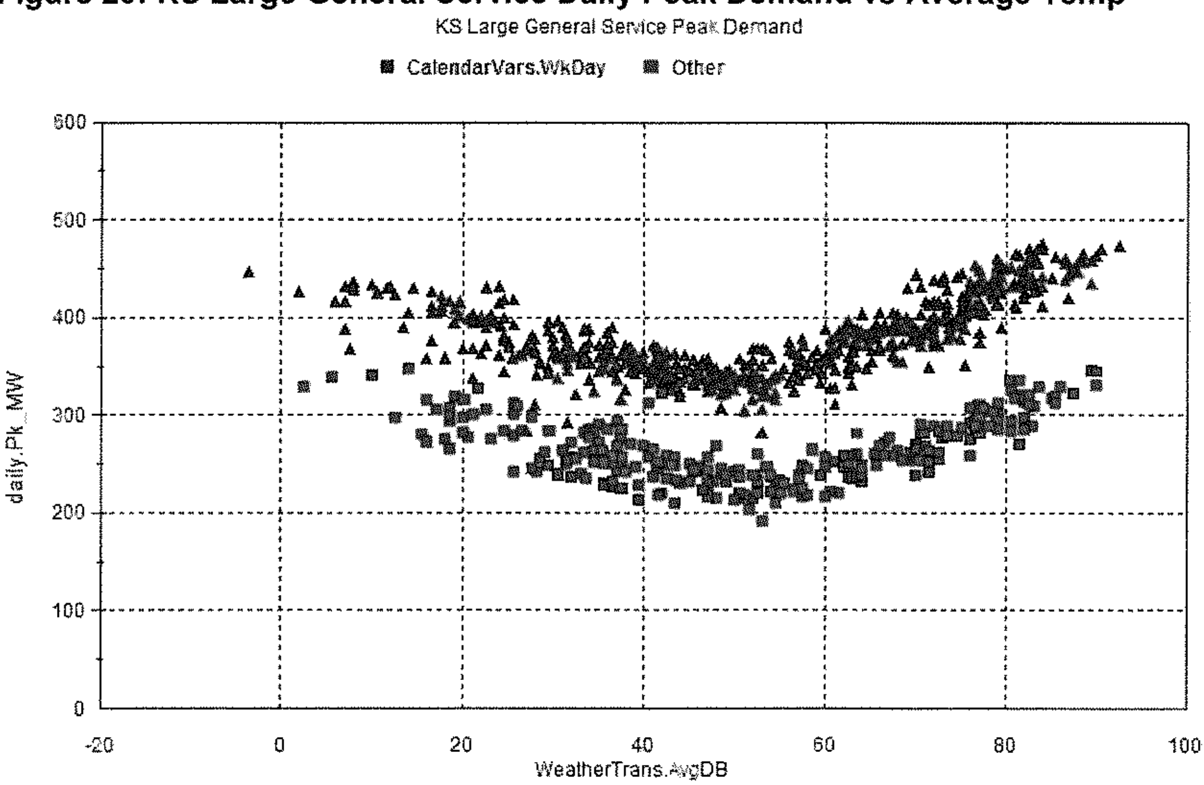


Figure 21: KS Sales for Resale Daily Energy vs Average Temp

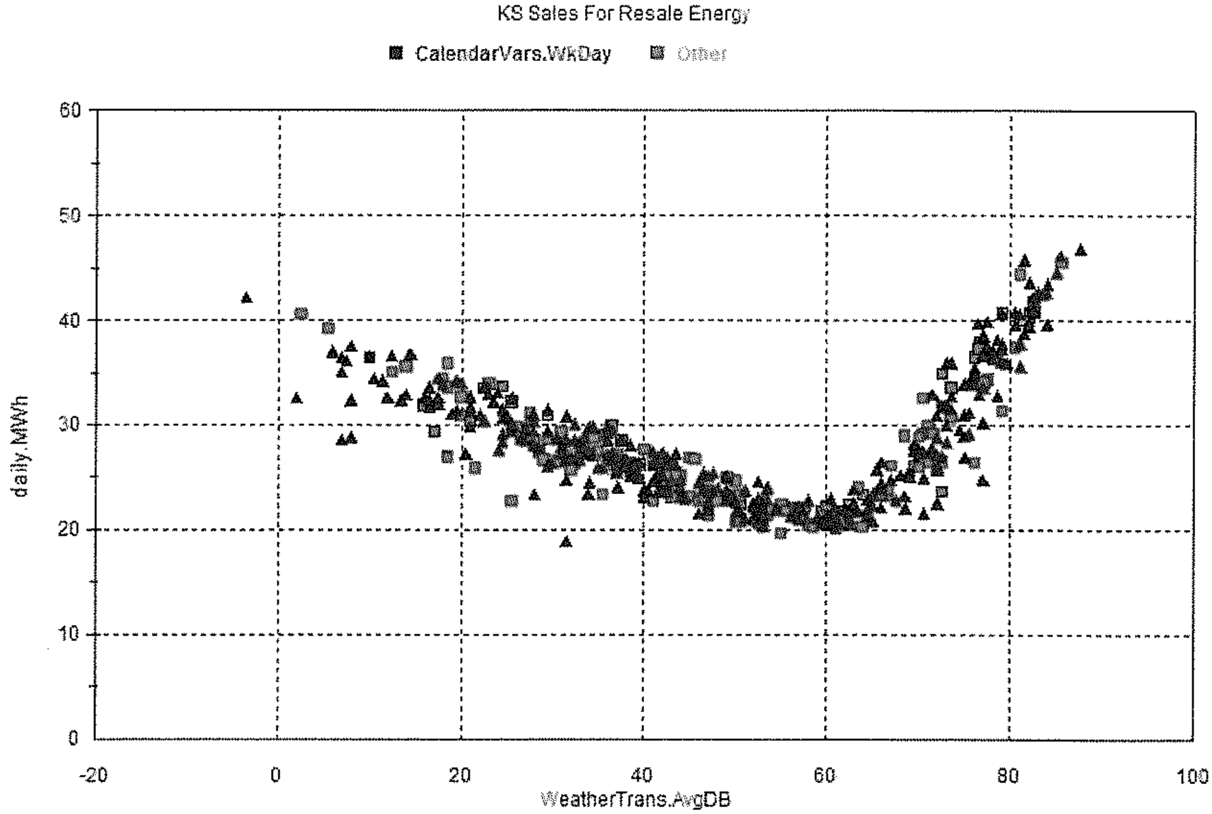
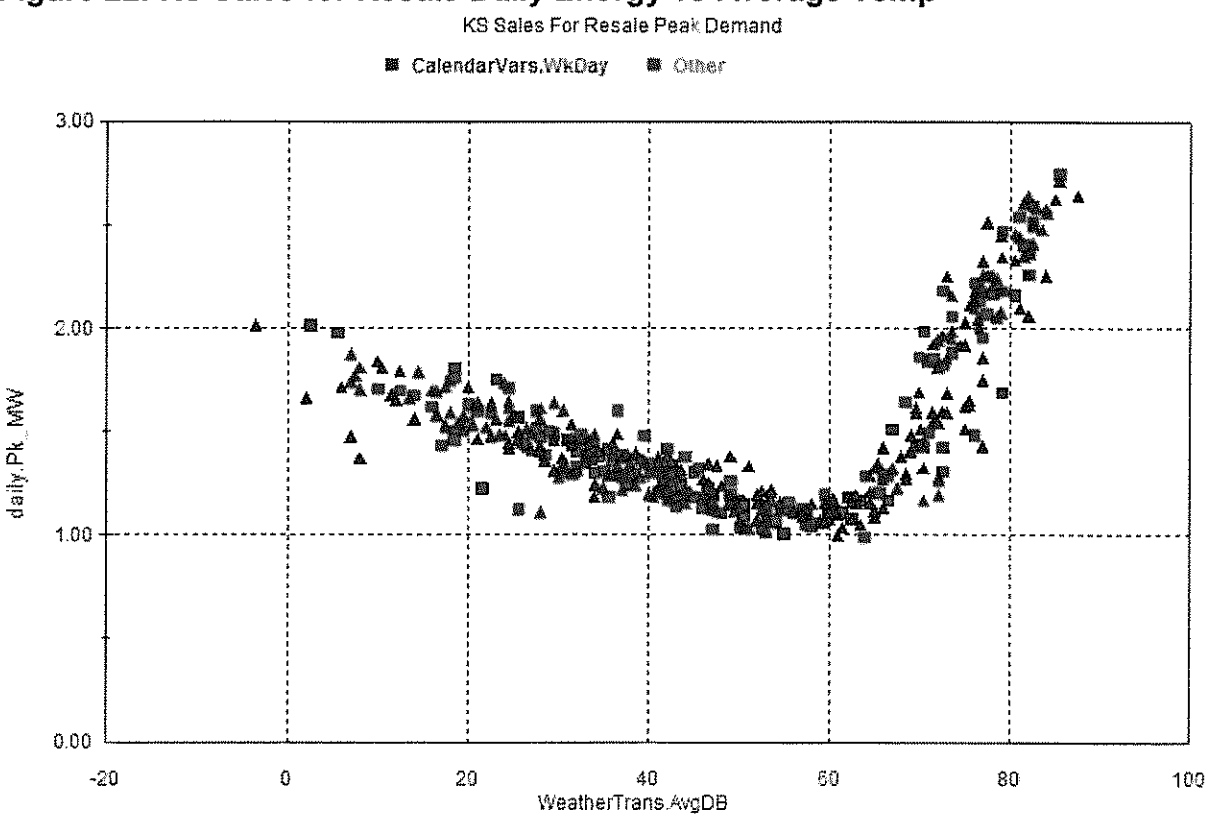


Figure 22: KS Sales for Resale Daily Energy vs Average Temp



and 3. Plots illustrating trends materially affecting electricity consumption over the historical period.

Historical class plots of customers, kwh, average use and peak are provided in *Appendix 3A1.*

2.5 ADJUSTMENTS TO HISTORICAL DATA DESCRIPTION AND DOCUMENTATION

(E) The utility shall describe and document any adjustments that it made to historical data prior to using it in its development or interpretation of the forecasting models; and

KCP&L used binary variables in regression models to explain outliers rather than make adjustments to the data.

2.6 LENGTH OF HISTORICAL DATABASE

(F) Length of Historical Database. The utility shall develop and retain the historical database over the historical period.

For KCP&L, historical sales and customers broken out by class cost of service for residential and industrial customers were available beginning in January 2000. Commercial class cost of service data was available beginning May 2005. Going forward, KCP&L will maintain this data for at least the previous 10 years.

SECTION 3: ANALYSIS OF NUMBER OF UNITS

For each major class, the utility shall describe and document its analysis of the historical relationship between the number of units and the economic and/or demographic factors (explanatory variables) that affect the number of units for that major class. The analysis may incorporate or substitute the results of secondary analyses, with the proviso that the utility analyze and verify the applicability of those results to its service territory. If the utility develops primary analyses, or to the extent they are available from secondary analyses, these relationships shall be specified as statistical or mathematical models that relate the number of units to the explanatory variables.

3.1 IDENTIFICATION OF EXPLANATORY VARIABLES

(A) Choice of Explanatory Variables. The utility shall identify appropriate explanatory variables as predictors of the number of units for each major class. The critical assumptions that influence the explanatory variables shall also be identified and documented.

A forecast of the number of households in the KC metro area from Moody's Analytics was the driver for the number of residential customers of KCP&L. The KC metro area is the same as the Metropolitan Statistical Area (MSA) defined by the US Census Bureau and it includes some counties in both states that are not served by KCP&L. Also, KCP&L's service area includes some counties that are not included in the MSA. Despite these inconsistencies in geographic areas, the number of households in the metro area is a good driver to predict the number of our residential customers because the metro area functions economically as a single entity and the metro area includes the vast majority of our customers. Many people live on one side of the state line and work on the other side. Many people shop on both sides of the state line. And many companies each year move from one side of the state line to the other. Documentation for Moody's forecast of economic activity is provided in the workpapers in the folder *\models\KCP&L Base Case\Data\Economics* and Documentation\Economics.

KCP&L tested the use of county level forecasts from Moody's several years ago, but saw no improvement in forecasting accuracy. This might be because it is difficult to forecast economic activity for a small geographic area, or because economic activity crosses county lines in the metro area.

The residential customer models where test with both households and population used as drivers and the one with the best fit was chosen. If neither was significant or had a positive coefficient, the driver was tested without a constant term in the model, and if still insignificant, a driver was not used. Typically households had the best fit.

The main driver for the number of small general service customers was the number of residential customers. This driver was chosen because it has worked well in the past and because most small commercial customers exist to serve households and these customers will increase in areas where there are new housing developments. Examples of small commercial customers that serve households are medical offices, grocery stores, drug stores, restaurants, churches, schools, hair salons, and movie theaters.

In the models for Big (Medium GS, Large GS and Large Power) commercial customers, both non-manufacturing employment and non-manufacturing gross metro product were tested as drivers and the one with the best fit was chosen. If neither was significant or had a positive coefficient, the driver was tested without a constant term in the model, and if still insignificant, a driver was not used.

3.2 STATISTICAL MODEL DOCUMENTATION

(B) Documentation of statistical models shall include the elements specified in subsection (2)(C) of this rule. Documentation of mathematical models shall include a specification of the functional form of the equations if the utility develops primary analyses, or to the extent they are available if the utility incorporates secondary analyses.

The following tables show the statistics for the variables in the regression models. Additional statistics and residual plots are available in the Metrix ND model files and a word document is located in KCPL\KCPL Model Statistics.docx.

Table 9 MO Residential Customers

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	185843.727	15576.352	11.931	0.00%	
Economics.Households	66.354	19.663	3.375	0.09%	Ths
RUCust.Nov09	1154.847	373.071	3.096	0.23%	
RUCust.Feb06	1394.580	375.758	3.711	0.03%	
RUCust.May12	-928.630	366.464	-2.534	1.22%	
RUCust.Jun00	-1472.177	376.456	-3.911	0.01%	
RUCust.Jul14	-1914.708	513.042	-3.732	0.03%	
BinaryVars.Jan	-376.756	135.505	-2.780	0.61%	
BinaryVars.Feb	516.922	118.283	4.370	0.00%	
BinaryVars.Jun	-682.456	99.700	-6.845	0.00%	
BinaryVars.Aug	-783.613	118.912	-6.590	0.00%	
BinaryVars.Sep	-715.976	137.668	-5.201	0.00%	
BinaryVars.Oct	-755.779	120.389	-6.278	0.00%	
BinaryVars.Dec	-816.663	119.745	-6.820	0.00%	
AR(1)	0.938	0.024	39.502	0.00%	

Table 10 MO Small GS Commercial Customers

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	16607.787	3664.991	4.531	0.00%	
ResCustomers.RU_Cust	0.036	0.015	2.333	2.18%	
SML_Customer.Dec09	-675.130	90.768	-7.438	0.00%	
SML_Customer.Feb10	-281.184	89.609	-3.138	0.23%	
SML_Customer.Apr12	448.631	89.686	5.002	0.00%	
SML_Customer.Oct08	-202.964	89.448	-2.269	2.55%	
SML_Customer.Nov13	-270.088	88.627	-3.047	0.30%	
AR(1)	0.827	0.054	15.189	0.00%	

Table 11 MO Big Commercial Customers (MGS, LGS and LP)

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
ResCustomers.RU_Cust	0.025	0.000	67.500	0.00%	
BIG_Customer.Jul08	165.121	50.219	3.288	0.15%	
BIG_Customer.Aug08	177.785	58.023	3.064	0.29%	
BIG_Customer.Sep08	107.836	50.194	2.148	3.46%	
BIG_Customer.Dec08	160.091	40.865	3.918	0.02%	
BIG_Customer.Jul14	232.788	56.159	4.145	0.01%	
AR(1)	0.932	0.031	30.395	0.00%	

The variable ending with month and year, shown in the table above, is defined as 1 for that month and 0 for all other months.

In the model for big commercial customers in Missouri, the intercept term was dropped so and economic drive so that customer driver would be statistically significant.

Table 12 MO Industrial Customers

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	7.578	12.060	0.628	53.08%	
IND_Customer.LagDep(1)	0.992	0.011	91.858	0.00%	
IND_Customer.Jul03	60.513	11.721	5.163	0.00%	
IND_Customer.Aug03	-66.077	11.724	-5.636	0.00%	
IND_Customer.Aug08	39.716	10.862	3.656	0.04%	
IND_Customer.May14	34.591	10.924	3.166	0.19%	
IND_Customer.Aug09	-36.285	10.980	-3.305	0.12%	
AR(1)	-0.425	0.079	-5.368	0.00%	

Table 13 KS Residential Customers

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
Economics.Households	140.572	218.843	0.642	52.18%	Ths
RUCust.Nov09	921.376	278.496	3.308	0.12%	
RUCust.Apr02	0.000	0.000	0.000	100.00%	
BinaryVars.Feb	243.775	78.539	3.104	0.24%	
BinaryVars.Apr	277.059	90.684	3.055	0.27%	
BinaryVars.May	265.487	90.686	2.928	0.40%	
BinaryVars.Jul	284.952	80.240	3.551	0.05%	
BinaryVars.Oct	-430.239	83.000	-5.184	0.00%	
BinaryVars.Dec	-320.175	83.044	-3.855	0.02%	
AR(1)	1.001	0.001	1839.100	0.00%	

Table 14 KS Small GS Commercial Customers

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
Economics.Total_Households	1.021	0.398	2.565	1.12%	
SML_Customer.Sep05	1280.282	132.862	9.636	0.00%	
SML_Customer.Sep11	-734.893	142.913	-5.142	0.00%	
SML_Customer.Oct11	-1282.904	150.775	-8.509	0.00%	
SML_Customer.Nov11	1034.584	143.780	7.196	0.00%	
SML_Customer.Feb13	-624.393	131.359	-4.753	0.00%	
SML_Customer.Mar14	308.353	132.076	2.335	2.08%	
SML_Customer.May05	-1264.307	131.247	-9.633	0.00%	
SML_Customer.LagDep(1)	0.961	0.016	61.021	0.00%	
AR(1)	-0.401	0.074	-5.462	0.00%	

Table 15 KS Big GS Commercial Customers

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
Economics.Emp_NonMan	0.129	0.069	1.888	6.18%	Ths
BIG_Customer.Nov07	57.057	31.025	1.839	6.88%	
BIG_Customer.Jul08	123.777	30.842	4.013	0.01%	
BIG_Customer.Jul09	54.412	30.813	1.766	8.04%	
BIG_Customer.Dec08	66.982	30.690	2.183	3.14%	
BIG_Customer.LagDep(1)	0.976	0.013	74.761	0.00%	
AR(1)	-0.442	0.089	-4.938	0.00%	

Table 16 KS Industrial Customers

Variable	Coefficient	StdErr	T-Stat	P-Value
Simple	0.391	0.088	4.428	0.000
Trend	-0.109	0.006	-18.678	0.000
Damp Factor	0.987	0.002	566.578	0.000

No economic drivers were significant in the model for industrial customers in Kansas.

SECTION 4: USE PER UNIT ANALYSIS

For each major class, the utility shall describe and document its analysis of historical use per unit by end use.

4.1 END-USE LOAD DETAIL

(A) End-Use Load Detail. For each major class, use per unit shall be disaggregated, where information permits, by end-uses that contribute significantly to energy use or peak demand.

4.1.1 END-USE LOAD INFORMATION

1. The utility shall consider developing information on at least the following end-use loads:

4.1.1.1 Residential Sector

A. For the residential sector: lighting, space cooling, space heating, ventilation, water heating, refrigerators, freezers, cooking, clothes washers, clothes dryers, television, personal computers, furnace fans, plug loads, and other uses;

The list of residential end uses that KCP&L maintains the number of units and energy use per unit include electric furnaces, heat pumps with electric resistance backup, heat pumps with natural gas backup, ground source heat pumps, central air conditioning without a heat pump, window or wall AC units, electric water heaters, electric ovens, cook tops and ranges, full-sized refrigerators, small refrigerators and wine coolers, freezers, dishwashers, clothes washers, electric dryers, TVs, air cleaners, computers, video game systems, hot tubs, swimming pools, electric vehicles and miscellaneous uses.

4.1.1.2 Commercial Sector

B. For the commercial sector: space heat, space cooling, ventilation, water heat, refrigeration, lighting, office equipment, cooking equipment, and other uses; and

KCP&L maintains information on saturations per square foot of floor space and energy use per square foot (EUI) for end uses including heating, cooling, ventilation, electric water heating, electric cooking, refrigeration, outdoor lighting, indoor lighting, and office equipment and miscellaneous uses. In this filing, secondary data from the U.S. DOE for the West North Central region was adopted for both KCP&L Kansas and Missouri. The region includes the states of North Dakota, South Dakota, Minnesota, Iowa, Nebraska, Kansas and Missouri. The results are combined across building types using building type weights. The building types include assembly (theaters, libraries, churches etc.), education, food sales, food service, health care, lodging, small office, large office, mercantile/service, warehouse and other. This data is maintained in *ComIndices_MO.xls* and *ComIndices_KS.xls*. The building types are defined in *2012 NAICS Index File-AEO commercial sectorrev.xls*. These spreadsheets were provided to KCP&L by Itron Inc. through the Energy Forecasting Group (EFG). The spreadsheets are documented in *2014_CommercialSAE.pdf*. These files are provided in the workpapers.

4.1.1.3 Industrial Sector

C. For the industrial sector: machine drives, space heat, space cooling, ventilation, lighting, process heating, and other uses.

KCP&L has a relatively small industrial sector, accounting for approximately 13% of retail sales. KCP&L lacks the concentration of heavy industry that some utilities have. As such, KCP&L has modeled our industrial sector with commercial sector drivers. Major end uses are heating, cooling and other.

4.1.2 MODIFICATION OF END-USE LOADS

2. The utility may modify the end-use loads specified in paragraph (4)(A)1.

4.1.2.1 Removal or Consolidation of End-Use Loads

A. The utility may remove or consolidate the specified end-use loads if it determines that a specified end-use load is not contributing, and is not likely to contribute in the future, significantly to energy use or peak demand in a major class.

In the last few years, KCP&L has dropped several end uses from its residential survey including VCRs, DVD players, printers, fax machines, copier/scanners and attic fans since these do not contribute significantly to energy use or peak demand.

4.1.2.2 Additions to End-Use Loads

B. The utility shall add to the specified end-use loads if it determines that an end-use load currently not specified is likely to contribute significantly to energy use or peak demand in a major class.

KCP&L has recently added replacement of residential HVAC equipment from the 2013 survey. In 2011 KCP&L added electric vehicles (including PHEVs) to our database. KCP&L is currently using DOE projections for this end use and plan to add a question for this end use on our next residential appliance saturation survey.

In our previous residential survey conducted in 2010, KCP&L added mini/wine refrigerators and video game systems and, in 2008, KCP&L added well pumps to the residential survey questionnaire.

4.1.2.3 Modification of End-Use Documentation

C. The utility shall provide documentation of its decision to modify the specified end-use loads for which information is developed, as well as an assessment of how the modifications can be made to best preserve the continuity and integrity of the end-use load database.

KCP&L dropped the end uses listed in the previous section A because VCRs, DVD players, printers, fax machines and copier/scanners are mainly plug loads that do not contribute significantly to energy use. KCP&L added well pumps, video game systems and mini\wine refrigerators because these use substantial amounts of energy and KCP&L believes that these had a significant saturation in our service areas.

KCP&L added electric vehicles because these are likely to significantly impact our energy and peak load in the future based on various projections published in different studies. These studies are included in our workpapers.

4.1.3 SCHEDULE FOR ACQUIRING END-USE LOAD INFORMATION

3. For each major class and each end-use load, including those listed in paragraph (4)(A)1., if information is not available, the utility shall provide a schedule for acquiring this end-use load information or demonstrate that either the expected costs of acquisition were found to outweigh the expected benefits over the planning horizon or that gathering the end-use load information has proven to be infeasible.

KCP&L completed a DSM potential study in 2013. The study collected detailed end-use saturation and efficiency data from our customers in the residential, commercial and industrial sectors. KCP&L provided copies of the completed study to stakeholders' group.

4.1.4 WEATHER EFFECTS ON LOAD

4. The utility shall determine the effect that weather has on the total load of each major class by disaggregating the load into its cooling, heating, and non-weather-sensitive components. If the cooling or heating components are a significant portion of the total load of the major class, then the cooling or heating components of that load shall be designated as end uses for that major class.

KCP&L used statistical regression analysis applied to the load research data to develop HELM like hourly load profiles for each month, for three different day types and for base, heating and cooling loads. The three day types are weekdays, weekends and peak days. Daily temperature was used in the regression models to identify the heating and cooling portions of the loads. The profiles were developed for each CCOS. The regressions were performed in Eviews with the program *createloadshapesccos2.prg.* The data for Eviews was created in SPSS with the program *dataprep2011kcplCCOS.SPS* which matches actual and normal temperatures to the hourly loads.

These load profiles are used in this IRP filing to allocated monthly base, heating and cooling energy to each hour of the month. These profiles are stored in *DTShapesKCPLCCOS.mdb.*

4.2 END-USE DEVELOPMENT

(B) The database and historical analysis required for each end use shall be developed from a utility-specific survey or other primary data. The database and analysis may incorporate or substitute the results of secondary data, with the proviso that the utility analyze and verify the applicability of those results to its service territory. The database and historical analysis required for each end use shall include at least the following:

4.2.1 MEASURES OF THE STOCK OF ENERGY-USING CAPITAL GOODS

1. Measures of the stock of energy-using capital goods. For each major class and end-use load identified in subsection (4)(A), the utility shall implement a procedure to develop and maintain adequate data on the energy-related characteristics of the building, appliance and equipment stock including saturation levels, efficiency levels, and sizes, where applicable. The utility shall update the data before each triennial compliance filing; and

KCP&L has conducted a residential appliance saturation survey every other year for many decades. The surveys have been conducted by mail. The last survey was conducted in the fourth quarter of 2013. Questionnaires were sent to 2,500 households in each jurisdiction and 600 and 766 responses were received from customers in Missouri and Kansas. The survey responses were matched with each customers' billing records for the previous 12 months and with heating and cooling degree days computed for the billing period and the combined data was used in a conditional demand study to estimate the energy used by each type of appliance.

KCP&L conducted a DSM potential study that was completed in 2013. This study collected detailed end-use saturation and efficiency data from our customers in the residential, commercial and industrial sectors. KCP&L provided copies of the final report to the Stakeholders' group.

4.2.2 END-USE ENERGY AND DEMAND ESTIMATES

2. Estimates of end-use energy and demand. For the end-use loads identified in subsection (4)(A), the utility shall estimate monthly energies and demands at the time of monthly system peaks and shall calibrate these energies and demands to equal the weather-normalized monthly energies and demands at the time of monthly peaks for each major class for the most recently available data.

Monthly energies for the end uses that are included in our SAE models are calibrated in the SAE models to monthly billed sales for each CCOS. The coefficients for the base, heating and cooling loads calibrate those loads and the coefficient for the base load raises or lowers all the components of the base load when the base load is calibrated to monthly billed sales.

Monthly demand for the major end uses that are included in our SAE models are calibrated to the time of the monthly system peaks. This is done in the models by taking the hourly system demands and matching them to the hourly class end use demands. This computes the coincident peak by class and end use. To calibrate class end use demands to the weather normalized system peak, the system peak and weather normalized peaks are used to develop a calibration factor that is applied to each class and end use. This process is done for both Missouri and Kansas. This process is completed in an Excel worksheet which is provided in the workpapers.

SECTION 5: SELECTING LOAD FORECASTING MODELS

The utility shall select load forecast models and develop the historical database needed to support the selected models. The selected load forecast models will include a method of end-use load analysis for at least the residential and small commercial classes, unless the utility demonstrates that end-use load methods are not practicable and provides documentation that other methods are at a minimum comparable to end-use methods. The utility may choose multiple models and methods if it deems doing so is necessary to achieve all of the purposes of load forecasting and if the methods and models are consistent with, and calibrated to, one another. The utility shall describe and document its intended purposes for load forecast models, why the selected load forecast models best fulfill those purposes, and how the load forecast models are consistent with one another and with the end-use usage data used in the demand-side analysis as described in 4 CSR 240-22.050. As a minimum, the load forecast models shall be selected to achieve the following purposes:

5.1 CONSUMPTION DRIVERS AND USAGE PATTERNS

(A) Assessment of consumption drivers and customer usage patterns—to better understand customer preferences and their impacts on future energy and demand requirements, including weather sensitivity of load;

KCP&L uses the Statistically Adjusted End-use (SAE) method to forecast energy sales and demand for all classes except lighting and sales for resale. The SAE method creates a forecast of sales at the end-use level and then for each class aggregates the forecasts into base, heating and cooling energy and then calibrates these loads to monthly billed sales using statistical regressions. The SAE models were designed and are supported by staff at Itron Inc. This same staff used to support the end-use models REEPS, COMMEND and INFORM for EPRI.

Our end-use level forecasts are developed using both primary data collected by KCP&L and secondary data and projections produced by the U.S. Department of Energy (DOE) for the West North Central region of the U.S. DOE projections used in our models include projections of saturations for household appliances and equipment used in commercial buildings and projections of efficiencies for appliances, buildings and equipment. DOE has a large professional staff that is responsible for constructing and maintaining energy demand models and for managing contractors. The contractors survey households, businesses and buildings on a regular schedule. Contractors are also used to conduct special studies. DOE's projections are designed to account for changes in consumer preferences, technology and building design practices. Their projections also account for the impacts of appliance and equipment standards. DOE updates its projections at least once a year and KCP&L use the most recently available projections whenever KCP&L updates the models.

KCP&L calibrates DOE appliance saturation projections to the saturation numbers that is obtained from our residential surveys. KCP&L also calibrate DOE's projections of unit energy consumption (UEC) for appliances to the results of the conditional demand study.

Itron hosts an annual meeting for the Energy Forecasting Group (EFG), which supports utilities that use the SAE method to forecast their sales. DOE staff attends the meeting of the EFG (which KCP&L attends) to explain changes in the assumptions, data and methods that have occurred during the previous year. Their slide decks provided during these meetings for the past several years are included in our workpapers. On their website, DOE provides detailed documentation and computer code for their models and assumptions.

5.2 LONG-TERM LOAD FORECASTS

(B) Long-term load forecasts—to serve as a basis for planning capacity and energy service needs. This can be served by any forecasting method or methods that produce reasonable projections (based on comparing model projections of loads to actual loads) of future demand and energy loads;

KCP&L believes that the SAE methodology is the best available for producing our load forecasts. REEPS, COMMEND and INFORM are no longer supported and never were supported as well as the DOE projections. DOE forecasts the impacts of all appliance and equipment standards most of which will substantially increase efficiency.[i] DOE also models trends in appliance ownership and utilization.

The Annual Energy Outlook for 2014 (AEO2014) differed from the previous year's forecast for both the residential and commercial outlooks. The residential outlook had changes for the following:

- 2009 Residential Energy Consumption Survey (RECS)
- Housing stock formation and decay
- Lighting modules
- Weather elasticities
- Removing the regional gas furnace standard
- Miscellaneous electric loads (MELS)
- Residential photovoltaic (PV)

The biggest change with RECS is that there is a smaller share of single family households. The latest outlook has expects a slower household growth than the previous outlook. The lighting modules changed with lighting projections being completely driven by input file specifications, the removal of the torchieres end use category, the addition of the exterior end use category, reducing the cost of halogen light bulbs, and adding a LED alternative to the linear fluorescent end use. Other changes to the outlook include slightly higher electricity prices, declining residential use of other fuels, more mobile use in the computer electricity use section, and a shift in PV use due to lower cost assumptions and higher electricity prices.

For the commercial outlook, changes were made to the following:

- End-use capacity factors
- Data center servers

- Hurdle rate floor
- MELS
- Commercial PV

The majority of the end-use capacity factors decreased in the 2014 outlook compared to the previous outlook, which affected the adoption of efficient equipment for some commercial uses. Since data servers will grow at a similar rate to that service sector of the economy, the impact of these grew as well in the most recent outlook. Other changes from this outlook include additional MELS coverage, the growth of commercial security systems primarily driven by video surveillance, like residential the increase of electricity prices from the previous outlook, expected growth of commercial video displays, and a similar response to PV changes as explained in the residential outlook above.

5.3 POLICY ANALYSIS

(C) Policy analysis—to assess the impact of legal mandates, economic policies, and rate designs on future energy and demand requirements. The utility may use any load forecasting method or methods that it demonstrates can adequately analyze the impacts of legal mandates, economic policies, and rate designs.

KCP&L believes that the SAE approach is the best available method to incorporate the impacts of appliance and equipment efficiency standards because the DOE is the best qualified institution to estimate these impacts. DOE will also incorporate any federal legal impacts into its forecasts. For example, DOE has incorporated CAFÉ regulations into its forecasts of electric vehicle unit sales, which in turn impacts kWh sales for recharging EVs.

Table 17 Products Covered by DOE Standards[ii]

Covered Product Categories		
Lighting Products: • 3-Way Incandescent Lamp • Candelabra base incandescent lamp • Ceiling Fan Light Kits • Ceiling Fans • Fluorescent lamp ballasts • General Service Fluorescent Lamps • General Service Incandescent Lamps • Incandescent Reflector Lamps • Intermediate Base Incandescent Lamps • Light Emitting Diodes (LEDs) • Medium Base Compact Fluorescent Lamps • Organic Light Emitting Diodes (OLEDs) • Rough Service Lamp • Shatter-Resistant Lamp • Torchieres • Vibration Service Lamp • Mercury Vapor Lamp Ballasts • Metal Halide Lamp Ballast • Metal Halide Lamp Fixtures • High-intensity discharge lamps • Traffic Signal Modules and Pedestrian Modules • Illuminated Exit Signs	**Heating Products:** Residential: • Direct heating equipment • Furnace Fans • Furnaces • Mobile Home Furnace • Pool heaters (Gas Fired) • Residential Boilers • Residential Water heaters • Small Furnaces Commercial: • Commercial warm air furnaces • Packaged boilers • Storage water heaters, instantaneous water heaters, and unfired hot water storage tanks • Unit Heaters	**Space Cooling Products:** Residential: • Central Air Conditioners and Central Air Conditioning Heat Pumps • Room Air Conditioners Commercial: • Packaged terminal air conditioners and packaged terminal heat pumps • Single package vertical air conditioners and single package vertical heat pumps • Small commercial package air conditioning and heating equipment • Large commercial package air conditioning and heating equipment • Very large commercial package air conditioning and heating equipment

Table 18 Products Covered by DOE Standards, continued

Covered Product Categories		
Commercial Refrigeration Products: • Automatic commercial ice makers • Commercial refrigerators, freezers, and refrigerator-freezers • Refrigerated Beverage Vending Machines • Walk-in coolers and walk-in freezers	**Appliances:** Residential: • Clothes dryers • Dehumidifiers • Dishwashers • Kitchen ranges and ovens • Microwave ovens • Refrigerators, Freezers and Refrigerator-Freezers • Residential Clothes washers Commercial: • Commercial clothes washers	**Computers and Electronics:** • Battery Chargers • External Power Supplies, Class A and non-Class A • Television sets
Transformers and Motors: • Electric Motors (medium to large) • Small Electric Motors • Distribution Transformers, MV Dry and Liquid-Immersed	**Plumbing Products:** Residential: • Faucets • Showerheads (except safety shower showerheads) • Urinals • Water closets Commercial: • Commercial Pre-rinse Spray Valves	**Building Products** • None

SECTION 6: LOAD FORECASTING MODEL SPECIFICATIONS

6.1 DESCRIPTION AND DOCUMENTATION

(A) For each load forecasting model selected by the utility pursuant to section 4 CSR 240-22.030(5), the utility shall describe and document its—

6.1.1 DETERMINATION OF INDEPENDENT VARIABLES

1. Determination of appropriate independent variables as predictors of energy and peak demand for each major class. The critical assumptions that influence the independent variables shall also be identified.

In the models of residential use per customer, the independent variables were appliance saturations, appliance UECs, the real price of electricity, real per capita income and persons per household. The appliance saturations and UEC forecasts were adopted from DOE's forecast for the west north central region. The critical assumptions influencing the forecasts of saturations and UECs are discussed in *m067(2013).pdf*, which is supplied in the electronic workpapers and which describes the model assumptions, computational methodology, parameter estimation techniques, and FORTRAN source code. These forecasts incorporate appliance ownership trends, trends in efficiency, updated building standards and technological change.

The forecasts of real per capita income and persons per household were produced by Moody's analytics for the KC metro area. Moody's documents its assumptions in *macromodel.pdf*, *state-model-methodology.pdf* and *assum_metro_midwest.pdf*, which are supplied in the workpapers. These independent variables were used to construct an end-use forecast of residential use per customer for three major end uses: heating, cooling and other, and these were then calibrated to monthly billed sales per customer in a linear regression. This is described in *Residential SAE Modeling Framework* in the file *Res2014SAEUpdate.pdf*.

In the models of commercial and industrial sales and use per customer, the independent variables were equipment saturations and EUIs, the real price of electricity and economic variables. Economic variables were non-manufacturing employment or non-manufacturing GMP or manufacturing employment or manufacturing GMP. The forecasts from DOE incorporate trends in equipment saturations, equipment efficiencies, equipment standards, building standards and technological change. These independent variables were used to construct an end-use forecast of commercial use for three major end uses: heating, cooling and other, and these were then calibrated to monthly billed sales or sales per customer in a linear regression. This is described in *Commercial Statistically Adjusted End-Use Model* in the file *2014_CommercialSAE.pdf.*

A. The utility shall assess the applicability of the historical explanatory variables pursuant to subsection (3)(A) to its selected forecast model.

The explanatory variables used by KCP&L in its forecasting models incorporate the most important drivers of energy use. These drivers are energy standards, building standards, trends in saturations and equipment efficiency, economic growth at the sector level and existing company energy efficiency and DSM programs.

B. To the extent that the independent variables selected by the utility differ from the historical explanatory variables, the utility shall describe and document those differences;

KCP&L has used the SAE approach since 2004 to forecast its loads. The economic drivers for the residential sector have been the number of households in the KC metro area during this time period. This filing is the first time that KCP&L has modeled small commercial (SGS), big commercial (MGS, LGS, and LP) and industrial sales at this level, so these models are new.

For this filing, KCP&L is using updated projections from DOE for 2014 and a June 2014 vintage economic forecast of the KC metro area from Moody's Analytics.

2. Development of any mathematical or statistical equations comprising the load forecast models, including a specification of the functional form of the equations; and

Table 19 MO Residential kWh per Customer

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
StrucVars.XHeat55	0.932	0.025	37.745	0.00%	kWh/cust
StrucVars.XCool65	2.796	0.030	94.557	0.00%	kwh/cust
StrucVars.XOther	0.736	0.008	86.726	0.00%	kWh/cust
RUAvgUse.Jun06	-60.770	23.878	-2.545	1.18%	
RUAvgUse.Jul12	-50.550	23.925	-2.113	3.61%	
BinaryVars.Jan	15.031	6.492	2.315	2.18%	
BinaryVars.Mar	21.949	6.057	3.624	0.04%	
BinaryVars.Jun	-35.322	7.061	-5.003	0.00%	
BinaryVars.Jul	-24.052	7.326	-3.283	0.13%	
BinaryVars.Nov	-15.311	6.441	-2.377	1.86%	
AR(1)	0.518	0.069	7.551	0.00%	

Table 20 MO Small GS Commercial kWh per Customer

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
StrucVars.XHeat55_SML	0.871	0.050	17.457	0.00%	kWh
StrucVars.XCool60_SML	2.198	0.079	27.801	0.00%	Kwh
StrucVars.XOther_SML	0.888	0.016	55.700	0.00%	kWh
SML_AvgUse.Nov08	-166.401	45.571	-3.651	0.04%	
SML_AvgUse.Dec08	-139.047	46.716	-2.976	0.37%	
BinaryVars.Jan	-63.069	17.589	-3.586	0.06%	
BinaryVars.Aug	61.616	18.652	3.303	0.14%	
BinaryVars.Sep	63.646	19.382	3.284	0.15%	
BinaryVars.Oct	48.458	17.253	2.809	0.61%	
BinaryVars.Dec	-94.521	17.845	-5.297	0.00%	
SML_AvgUse.Calib	-59.592	17.912	-3.327	0.13%	
AR(1)	0.475	0.092	5.182	0.00%	

Table 21 MO Big GS Commercial Sales

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	188255277.983	17373644.102	10.836	0.00%	
StrucVars.XHeat55_BIG	601.186	28.533	21.070	0.00%	kWh
StrucVars.XCool55_BIG	2013.932	47.818	42.117	0.00%	Kwh
StrucVars.XOther_BIG	318.757	69.353	4.596	0.00%	kWh
BinaryVars.Mar	4467054.927	2435327.244	1.834	7.09%	
BinaryVars.Sep	8921337.397	2508058.222	3.557	0.07%	
BinaryVars.Oct	12747942.431	2562052.362	4.976	0.00%	
BinaryVars.Dec	13152460.395	2978472.467	4.416	0.00%	
BIG_Sales.Calib	-5511203.506	1835591.226	-3.002	0.37%	

Table 22 MO Industrial Sales

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	63023300.025	9857414.000	6.393	0.00%	
StrucVars.XCool55_IND	84688124.834	3988631.547	21.232	0.00%	kWh
StrucVars.XOther_IND	59374092.045	9955537.693	5.964	0.00%	kWh
IND_Sales.Aug05	-19675499.305	3977458.750	-4.947	0.00%	
IND_Sales.May07	11044510.356	3930851.200	2.810	0.57%	
IND_Sales.Sep12	-14071759.256	3950503.324	-3.562	0.05%	
IND_Sales.Nov12	-13840548.350	3950400.164	-3.504	0.06%	
IND_Sales.Mar13	-12666700.593	4105899.835	-3.085	0.25%	
IND_Sales.Expr1	9155578.043	787331.082	11.629	0.00%	
BinaryVars.Mar	6866492.963	1320245.846	5.201	0.00%	

Table 23 KS Residential kWh per Customer

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
StrucVars.XHeat55	0.929	0.020	46.171	0.00%	kWh/cust
StrucVars.XCool65	2.478	0.025	98.016	0.00%	kwh/cust
StrucVars.XOther	0.789	0.007	105.569	0.00%	kWh/cust
RUAvgUse.Jul11	65.706	26.311	2.497	1.36%	
RUAvgUse.Jun09	59.512	26.326	2.261	2.52%	
BinaryVars.Feb	-45.892	8.348	-5.498	0.00%	
BinaryVars.Mar	-55.568	8.678	-6.404	0.00%	
BinaryVars.Apr	-25.837	7.754	-3.332	0.11%	
BinaryVars.Jun	46.874	7.971	5.880	0.00%	
BinaryVars.Jul	62.510	8.405	7.437	0.00%	
BinaryVars.Nov	-10.817	7.418	-1.458	14.69%	
AR(1)	0.413	0.075	5.513	0.00%	

Table 24 KS Small GS Commercial kWh per Customer

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	404.537	85.028	4.758	0.00%	
StrucVars.XHeat55_SML	0.711	0.043	16.535	0.00%	kWh
StrucVars.XCool60_SML	2.229	0.063	35.355	0.00%	Kwh
StrucVars.XOther_SML	0.511	0.079	6.458	0.00%	kWh
SML_AvgUse.Oct11	-104.473	32.301	-3.234	0.17%	
SML_AvgUse.Apr12	-101.602	32.172	-3.158	0.21%	
SML_AvgUse.Oct13	-193.496	32.484	-5.957	0.00%	
SML_AvgUse.Jul14	128.118	37.561	3.411	0.10%	
AR(1)	0.534	0.094	5.666	0.00%	

Table 25 KS Big GS Commercial Sales

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	87199069.874	10257429.275	8.501	0.00%	
StrucVars.XHeat50_BIG	431.062	23.460	18.374	0.00%	kWh
StrucVars.XCool55_BIG	2002.658	47.041	42.572	0.00%	Kwh
StrucVars.XOther_BIG	614.960	57.047	10.780	0.00%	kWh
BIG_Sales.Calib	-6046172.876	1481226.594	-4.082	0.01%	
AR(1)	0.210	0.107	1.961	5.32%	

Table 26 KS Industrial Sales

Variable	Coefficient	StdErr	T-Stat	P-Value	Units
CONST	15168520.084	2302774.966	6.587	0.00%	
StrucVars.XOther_IND	8479093.630	2077683.952	4.081	0.01%	
StrucVars.XCool55_IND	21885842.411	1398964.147	15.644	0.00%	
IND_Sales.Aug10	1639494.151	609698.300	2.689	0.83%	
IND_Sales.Feb10	4757169.050	604702.427	7.867	0.00%	
IND_Sales.Nov06	1505471.898	615910.337	2.444	1.62%	
IND_Sales.Oct13	1416451.832	605155.534	2.341	2.11%	
IND_Sales.Jan09	-1830106.532	604019.512	-3.030	0.31%	
AR(1)	0.906	0.042	21.733	0.00%	

3. Assessment of the applicability of any load forecast models or portions of models that were utilized by the utility but developed by others, including a specification of the functional forms of any equations or models, to the extent they are available.

The load forecasting models rely on a forecast of economic activity for the KC metro area that was produced by Moody's Analytics. The KC metro area is the same as the Metropolitan Statistical Area (MSA) defined by the US Census Bureau and it includes some counties in both states that are not served by KCP&L. Also, KCP&L's service area includes some counties that are not included in the MSA. Despite these inconsistencies in geographic areas, there are reasons why this forecast is representative of our service areas. Many people live on one side of the state line and work on the other side. Many people shop on both sides of the state line. And many companies each year move from one side of the state line to the other. Documentation for Moody's forecast of economic activity is provided in the workpapers in the folder \KCPL Base Case\Data\Economics.

The load forecasting models also rely on saturation and appliance and equipment utilization forecasts from the DOE. The advantages of the projections from these models is 1) DOE's Forecasting and Analyst staff includes dozens of experts and maintains a large budget for data collection and consultants, 2) DOE has a focus on measuring the impacts of appliance and equipment standards and legal mandates and 3) DOE is very transparent, making available its work and computer code on its website.[iii] KCP&L also relies on the staff that developed and maintained some of EPRI's end-use models recommended and developed the SAE approach for KCP&L and many other utilities. EPRI no longer maintains its end-use forecasting models.

A potential downside of these projections for KCP&L is that the data and models developed by DOE are developed at a regional level rather than specifically for KCP&L, although this can be an advantage when one service area or region has insufficient variation to measure the impact of a variable such as electric price. Cross sectional variation in the data can be an advantage in situations where price or income elasticities are being modeled.

(B) If the utility selects load forecast models that include end-use load methods, the utility shall describe and document any deviations in the independent variables or functional forms of the equations from those derived from load analysis in sections (3) and (4).

KCP&L is not aware of any such deviations.

(C) Historical Database for Load Forecasting. In addition to the load analysis database, the utility shall develop and maintain a database consistent with and as needed to run each forecast model utilized by the utility. The utility shall describe and document its load forecasting historical database in the triennial compliance filings. As a minimum, the utility shall—

1. Develop and maintain a data set of historical values for each independent variable of each forecast model. The historical values for each independent variable shall be collected for a period of ten (10) years, or such period deemed sufficient to allow the independent variables to be accurately forecasted over the entire planning horizon;

The independent variables acquired from Moody's are available back to 1990. These are updated every time that KCP&L acquires a new economic and demographic forecast as revisions to this data far back in time are common.

The independent variables acquired from DOE are also available back to 1990 and these too replace the historical values when each year new spreadsheets are provided to

KCP&L. New studies or data can revise historical estimates of efficiencies and saturations.

The independent variables for natural gas prices of local utilities are maintained back to 1991.

Temperature data is maintained back to 1971 when the Kansas City International Airport opened for business.

2. Explain any adjustments that it made to historical data prior to using it in its development of the forecasting models;

KCP&L staff is not aware of any adjustments made to independent variables used in its load forecasting models.

3. Archive previous projections of all independent variables used in the energy usage and peak load forecasts made in at least the past ten (10) years and provide a comparison of the historical projected values in prior plan filings to actual historical values and to projected values in the current compliance filing; and

KCP&L still possesses the electronic files that it received with the independent variables used in producing energy and peak forecasts during the last ten years. Below KCP&L plots the base, high and low bands for the most important economic and demographic independent variables used in the current and two previous IRP filings.

Figure 23: Households ** Highly Confidential **

[redacted]

KCP&L asked about the change in the household forecast that occurred with that used in this filing, Moody's responded

> "we view the metro area as having solid growth drivers that should enable population growth to outpace the nation. It has below average costs and an extremely diversified economy. Its workforce has an above average educational attainment when compared with the regional average, which will help it attract new businesses. In light of these characteristics, a severe decline in the rate of population growth beginning immediately in the forecast period simply couldn't be justified, hence the revisions. The changes in the household forecast follow directly from changes to population."[iv]

The high and low bands for the current forecast are closer together compared to the previous forecasts. KCP&L requested an explanation, Moody's responded

> "The different properties of the high/low bands I sent most recently are a result of the newer methodology I mentioned. Previously, your data delivery used a

different, older methodology, but it will be migrated to the new one going forward. Since you requested an update of the households data, I used the new methodology since it will match what you will be receiving in the future.

“The new methodology relies on the historical variation in the growth rates of the time series. Growth in households (both in general and for Kansas City) is quite consistent compared with many other economic time series. For KAN, quarterly growth has ranged only from about 0.1% and 0.7%, with a standard deviation of just over 0.1%. This is what is causing the high and low bands to have relatively small divergence. To illustrate slightly further: If households for KAN were 10% higher than the baseline in 2035, that would be equivalent to a quarterly growth rate about a full standard deviation higher than the baseline expectation in every single quarter. KCP&L views that as being too unlikely for the purposes of these high/low bands.”[v]

Figure 24: Employment Non-Manufacturing ** Highly Confidential **

[redacted]

The 2012 and 2015 forecast of non-manufacturing employment shows a substantial drop during and several years after the last recession, then a rapid rebound and then steady robust growth. The 2008 forecast shows only a small drop and no increases until the mid 20s. The current forecast reflects a change in assumptions mentioned in the paragraph above for households for the competitiveness of the KC metro economy.

Figure 25: Employment Manufacturing **Highly Confidential **

[redacted]

In the current forecast, manufacturing employment shows a huge decline during and several years after the last recession. After a strong rebound, employment continues to decline thereafter. Moody's indicates that the decline in employment for manufacturing workers is due to increased productivity from the workers, as manufacturing becomes more automated. The decline in manufacturing employment for the forecast horizon is also consistent with the observed downward trend dating back to the 1990s.

Figure 26: Gross Metro Product Non-Manufacturing ** Highly Confidential **

[redacted]

Real non-manufacturing GMP is growing much faster than employment in all three scenarios. The current forecast was lowered from the previous forecast. Moody's stated that the current forecast was lowered from the previous forecast because the actual or historical data for Missouri fell below their expectations due to national economic fluctuations, and caused the Missouri forecast to be lowered. In turn, the lower pattern was shared down to the Kansas City metropolitan area. Real GMP in the current forecast was also rebased from 2005$ to 2009$.

Figure 27: Gross Metro Product Manufacturing ** Highly Confidential **

[redacted]

While manufacturing employment is flat after 2015, real manufacturing GMP shows strong growth due to increase productivity. The current forecast shows the strongest growth.

When asked about the faster rate of growth in the out years for GMP manufacturing forecast that occurred with that used in this filing, Moody's responded

"In our forecast, the Missouri Gross State Product underperforms US GDP in the near term, before growth outperforms later in the forecast. Much of this fluctuation is due to improvement in the goods market, including manufacturing and construction. Missouri manufacturing employment is expected to outperform the national average. Manufacturing jobs in Missouri will decline in the short-term, as manufacturing productivity gains weigh on employment. However, losses will narrow later in the forecast, as Missouri and its metro areas seem likely to emerge as niche manufacturing locations. A niche manufacturing market is where the state/metro area holds a comparative advantage in producing a specific product, and this advantage will last over the course of the forecast. For example, St. Louis is likely to emerge as a chemical and pharmaceutical manufacturing hub, and St. Joseph is likely to become a niche market for animal health product, and processed food manufacturing. As for construction, our model is based on historical patterns of data. The increases that are in the forecast are based on historical patterns and trends, and not based on any knowledge that KCP&L has of any forthcoming construction projects. Also, the Missouri construction forecast trends similarly to the national forecast, so some of the fluctuation is due to exposure to the national business cycle."[vi]

4. Archive all previous forecasts of energy and peak demand, including the final data sets used to develop the forecasts, made in at least the past ten (10) years. Provide a comparison of the historical final forecasts to the actual historical energy and peak demands and to the current forecasts in the current triennial compliance filing.

KCP&L maintains an archive of the electronic files associated with our previous forecasts of energy use and peak demand for at least the last ten years. The graphs below compare our previous long-run forecasts of NSI and peak demand. The most recent forecast reflects a significant slowdown in economic growth that began in 2008, expectations for slower economic growth and additional energy standards.

Figure 28: Net System Input (NSI) Historical and Forecasts ** High Confidential **

[redacted]

Figure 29: Peak Demand Historical and Forecasts ** High Confidential **

[redacted]

HC

SECTION 7: BASE-CASE LOAD FORECAST

The utility's base-case load forecast shall be based on projections of the independent variables that utility decision-makers believe to be most likely. All components of the base-case load forecast shall assume normal weather conditions. The load impacts of implemented demand-side programs and rates shall be incorporated in the base-case load forecast, but the load impacts of proposed demand-side programs and rates shall not be included in the base-case forecast.

KCP&L's base-case forecast was produced with a base-case economic forecast from Moody's Analytics obtained in June 2014. The forecast included the impacts of KCP&L's implemented energy efficiency and DSM programs on NSI and peak load. The forecast was produced using normal weather.

7.1 MAJOR CLASS AND TOTAL LOAD DETAIL

(A) Major Class and Total Load Detail.

The utility shall produce forecasts of monthly energy usage and demands at the time of the summer and winter system peaks by major class for each year of the planning horizon, and shall describe and document those forecasts in its triennial compliance filings. Where applicable, these major class forecasts shall be separated into their jurisdictional components.

7.1.1 DESCRIBE AND DOCUMENT RELEVENT ECONOMIC AND DEMOGRAPHICS

1. The utility shall describe and document how the base-case forecasts of energy usage and demands have taken into account the effects of real prices of electricity, real prices of competitive energy sources, real incomes, and any other relevant economic and demographic factors. If the methodology does not incorporate economic and demographic factors, the utility shall explain how it accounted for the effects of these factors.

KCP&L accounted for the effects of real electricity prices in two ways. First, the prices of electricity and natural gas were used in the models that forecast the saturations of electric space heating for residential and commercial customers. These models are described in the section of this document for rule 7.B.1. Second, KCP&L assumes a price elasticity of -0.15 in each model of sales or sales per customer. These elasticities are close to the default values in the ERPI models REEPS and COMEND, which ITRON used in the original SAE models that they delivered to KCP&L in 2004. Since, then KCP&L has made some small changes to these values to improve the fit of the models.

In the residential models of kWh per customer, KCP&L assumes an income elasticity of 0.2 for heating and cooling and 0.2 for other uses and a persons-per-household elasticity of 0.2. Moody's forecast of households for the KC metro area were used in the models of residential customers as was described previously in the section for rule 3.B.

7.1.2 DESCRIBE AND DOCUMENT EFFECTS OF LEGAL MANDATES

2. The utility shall describe and document how the forecasts of energy usage and demands have taken into account the effects of legal mandates affecting the consumption of electricity.

KCP&L uses the SAE methodology to forecast kWh sales for residential, commercial and industrial sales. This methodology relies on DOE forecasts of UECs and EUIs, which account for appliance efficiency standards and building codes.[vii]

7.1.3 DESCRIBE AND DOCUMENT CONSISTENCY

3. The utility shall describe and document how the forecasts of energy usage and demands are consistent with trends in historical consumption patterns, end uses, and end-use efficiency in the utility's service area as identified pursuant to sections 4 CSR 240-22.030(2), (3), and (4).

KCP&L forecasts incorporate and thus are consistent with the following trends:

- Electric space heating models explain the rapid rise of electric space heating saturations in the residential and commercial sector as a function of the relative costs of using electricity and natural gas. These costs depend on electricity and natural gas prices and the efficiencies of heat pumps and natural gas furnaces.

- Forecasts of UECs and EUIs used in our models reflect the impacts of energy standards in both the past and the future.

- Forecasts of appliance and equipment saturations reflect the penetration of new devices such as CFL/LED Light Bulbs, HDTVs and the limitations of further increases for appliances that are reaching equilibrium such as dishwashers and central air conditioners.

7.1.4 DESCRIBE AND DOCUMENT WEATHER NORMALIZED CLASS LOADS

4. For at least the base year of the forecast, the utility shall describe and document its estimates of the monthly cooling, heating, and non-weather-sensitive components of the weather-normalized major class loads.

The estimates are shown below. Details for the full 20 years can be found in MO_Fcst.ltm and KS_Fcst.ltm in the END_Use Energy Frequency Transforms.

Figure 30: Estimates of MO Residential Monthly Cooling, Heating, and Base

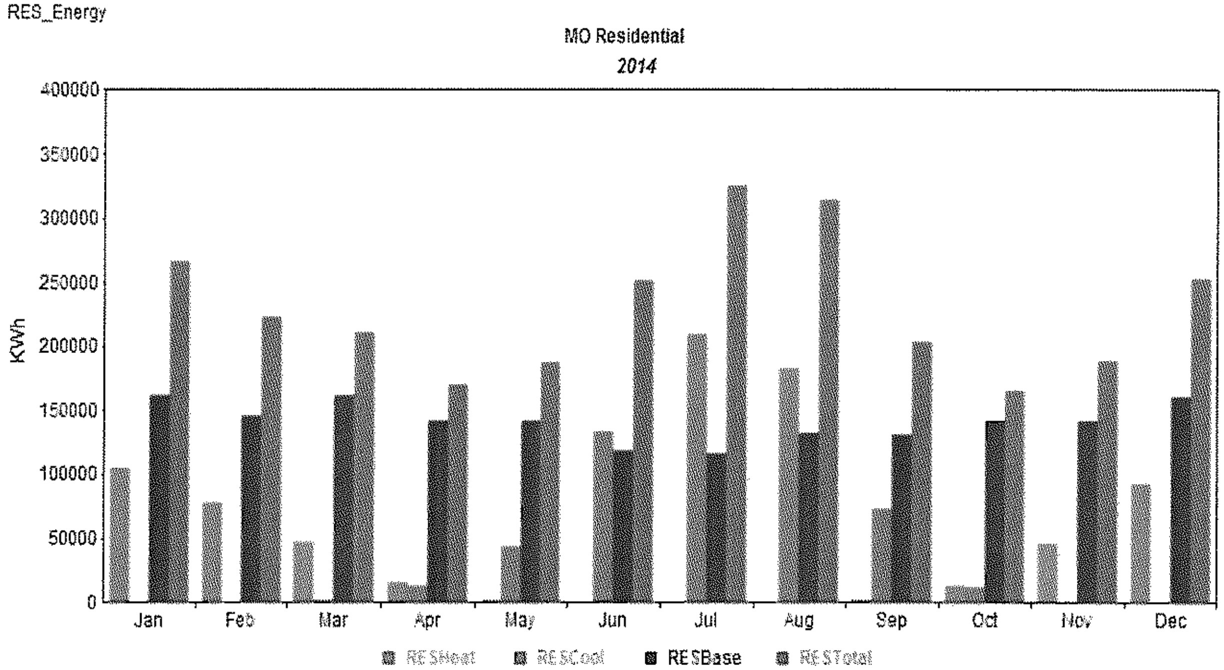


Table 27: Data Table of MO Residential Monthly Cooling, Heating, and Base

Date	RESHeat	RESCool	RESBase	RESTotal
Jan-14	104,866.4	-	161,088.2	265,954.7
Feb-14	78,114.4	-	145,225.2	223,339.5
Mar-14	46,955.1	2,001.8	162,050.7	211,007.6
Apr-14	15,473.1	12,582.1	142,169.5	170,224.6
May-14	1,323.2	43,525.3	142,389.9	187,238.4
Jun-14	-	133,029.9	118,333.1	251,363.0
Jul-14	-	209,550.2	116,051.0	325,601.2
Aug-14	-	182,285.0	131,984.2	314,269.2
Sep-14	1,127.0	72,529.5	130,466.3	204,122.7
Oct-14	12,213.9	11,289.4	141,534.5	165,037.8
Nov-14	46,237.3	488.7	141,818.9	188,544.8
Dec-14	92,431.2	10.3	159,901.3	252,342.8

Figure 31: Estimates of MO Commercial Small General Service Monthly Cooling, Heating, and Base

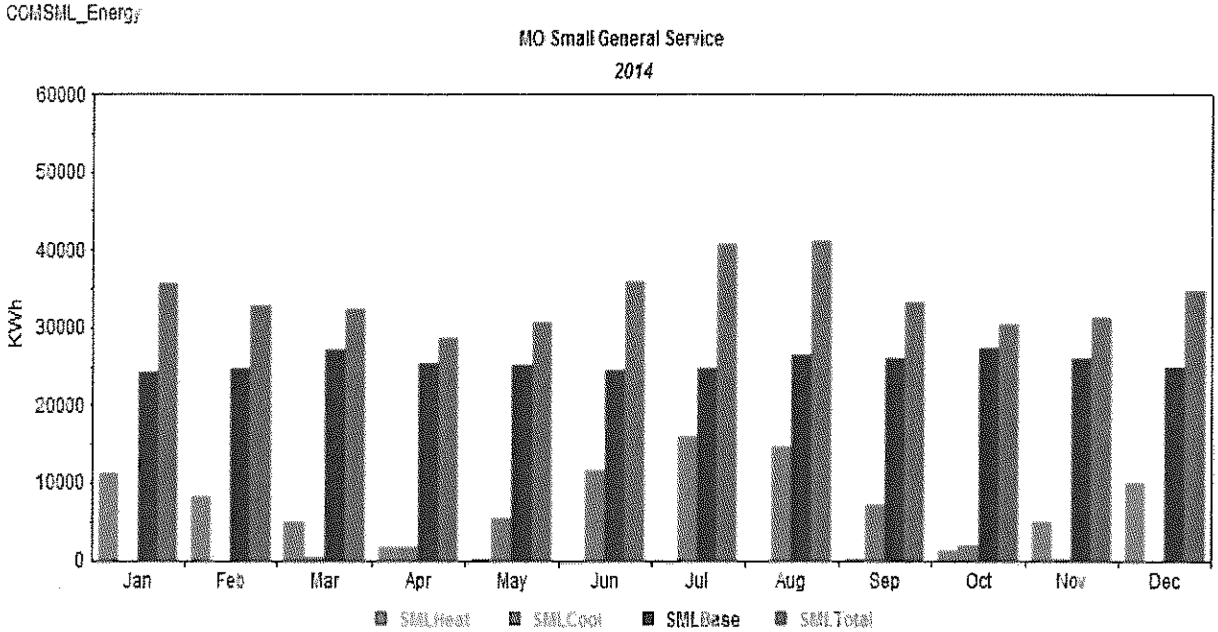


Table 28: Data Table of MO Commercial Small General Service Monthly Cooling, Heating, and Base

Date	SMLHeat	SMLCool	SMLBase	SMLTotal
Jan-14	11,351.9	-	24,263.5	35,615.4
Feb-14	8,278.7	4.6	24,623.1	32,906.4
Mar-14	4,992.7	436.8	27,073.6	32,503.1
Apr-14	1,639.5	1,681.4	25,352.9	28,673.7
May-14	152.6	5,336.3	25,132.5	30,621.4
Jun-14	-	11,519.7	24,408.3	35,928.0
Jul-14	-	15,869.4	24,772.1	40,641.5
Aug-14	-	14,557.6	26,510.5	41,068.1
Sep-14	121.6	7,152.9	26,085.5	33,360.1
Oct-14	1,319.1	1,787.7	27,399.6	30,506.4
Nov-14	4,985.2	187.7	26,021.0	31,193.9
Dec-14	9,995.2	13.5	24,871.5	34,880.2

Figure 32: Estimates of MO Commercial Big (MGS, LGS & LP) Monthly Cooling, Heating, and Base

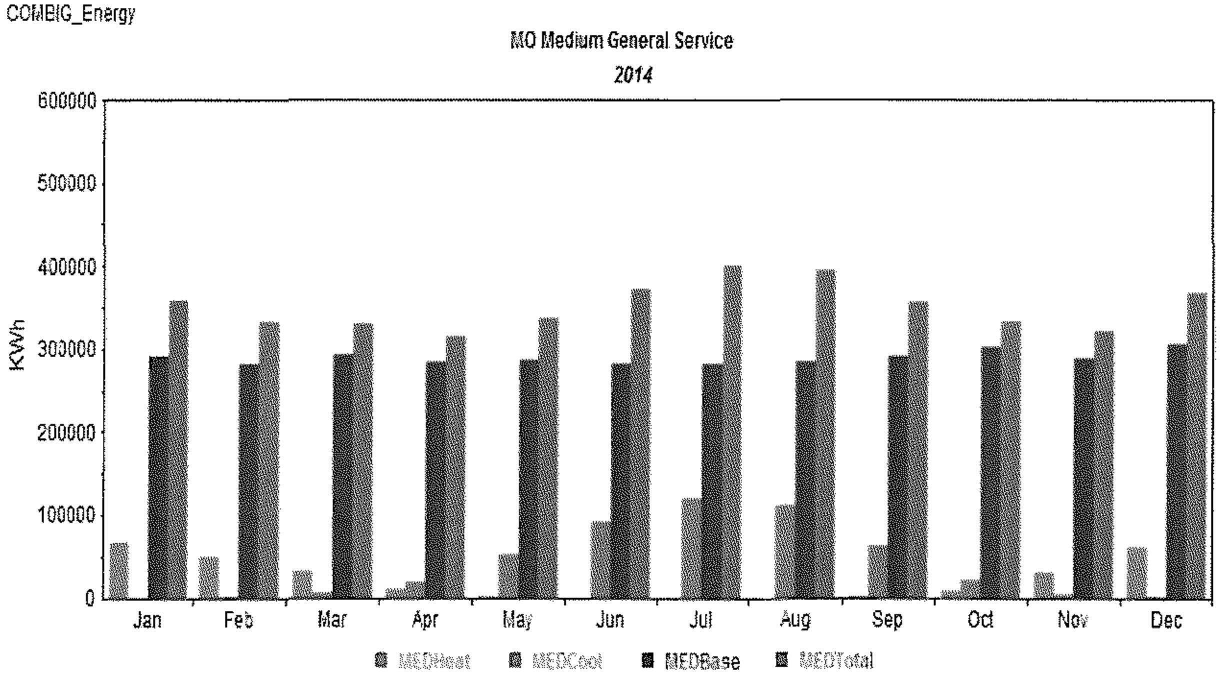


Table 29: Data Table of MO Commercial Big (MGS, LGS & LP) Monthly Cooling, Heating, and Base

Date	MEDHeat	MEDCool	MEDBase	MEDTotal
Jan-14	68,031.2	69.9	291,193.1	359,294.1
Feb-14	50,533.4	350.4	282,014.5	332,898.2
Mar-14	30,883.8	6,332.4	294,104.2	331,320.3
Apr-14	10,038.8	19,155.9	285,279.4	314,474.1
May-14	923.0	51,433.0	285,698.1	338,054.1
Jun-14	-	91,326.1	281,863.3	373,189.4
Jul-14	-	119,854.3	281,498.0	401,352.3
Aug-14	-	110,058.0	283,939.4	393,997.3
Sep-14	742.7	63,275.4	291,861.3	355,879.4
Oct-14	8,058.3	22,018.2	301,724.9	331,801.4
Nov-14	30,435.5	3,517.7	287,820.4	321,773.6
Dec-14	61,118.2	352.4	306,658.4	368,129.0

Figure 33: Estimates of MO Industrial Monthly Cooling, Heating, and Base

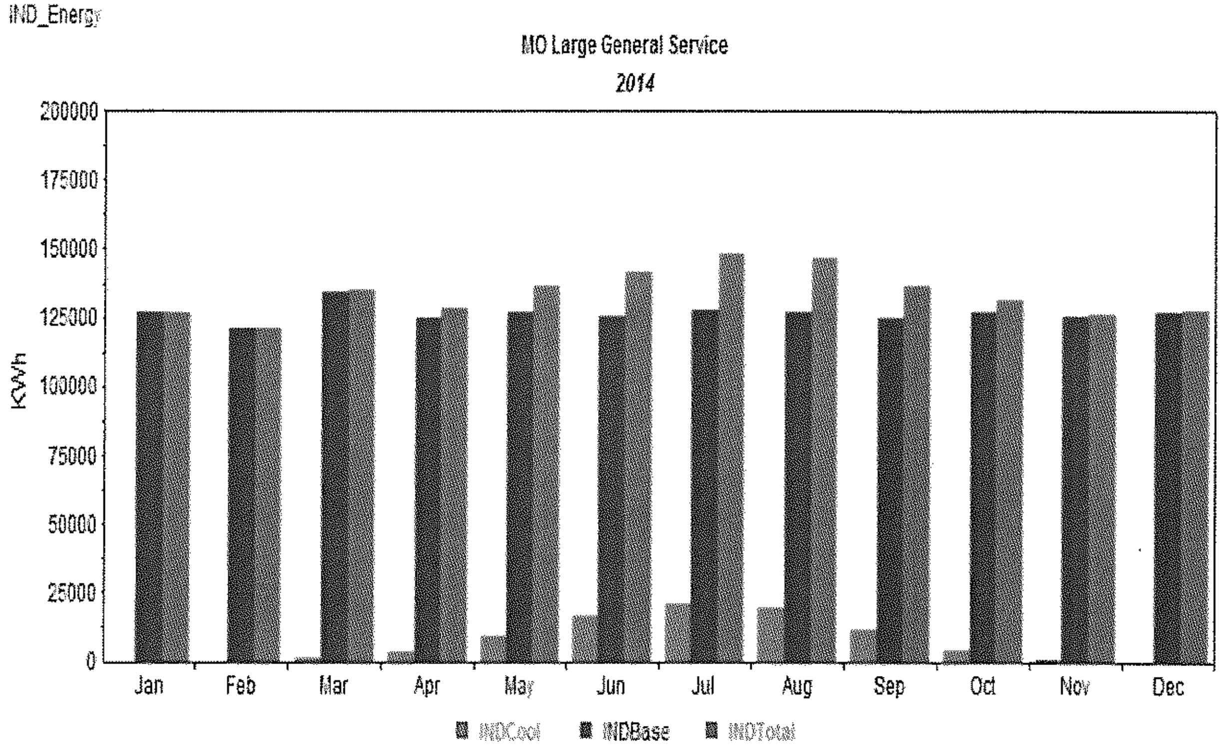


Table 30: Data Table of MO Industrial Monthly Cooling, Heating, and Base

Date	INDCool	INDBase	INDTotal
Jan-14	12.4	126,887.3	126,899.7
Feb-14	67.8	120,849.6	120,917.5
Mar-14	1,144.4	133,943.8	135,088.2
Apr-14	3,469.2	124,990.5	128,459.7
May-14	9,225.2	127,077.6	136,302.7
Jun-14	16,441.5	125,280.9	141,722.4
Jul-14	20,784.2	127,598.6	148,382.8
Aug-14	19,769.6	127,083.3	146,852.9
Sep-14	11,358.5	125,054.6	136,413.1
Oct-14	3,953.2	127,076.8	131,029.9
Nov-14	633.0	125,283.9	125,916.9
Dec-14	63.4	127,306.0	127,369.4

Figure 34: Other MO Load (SFR & Lighting)

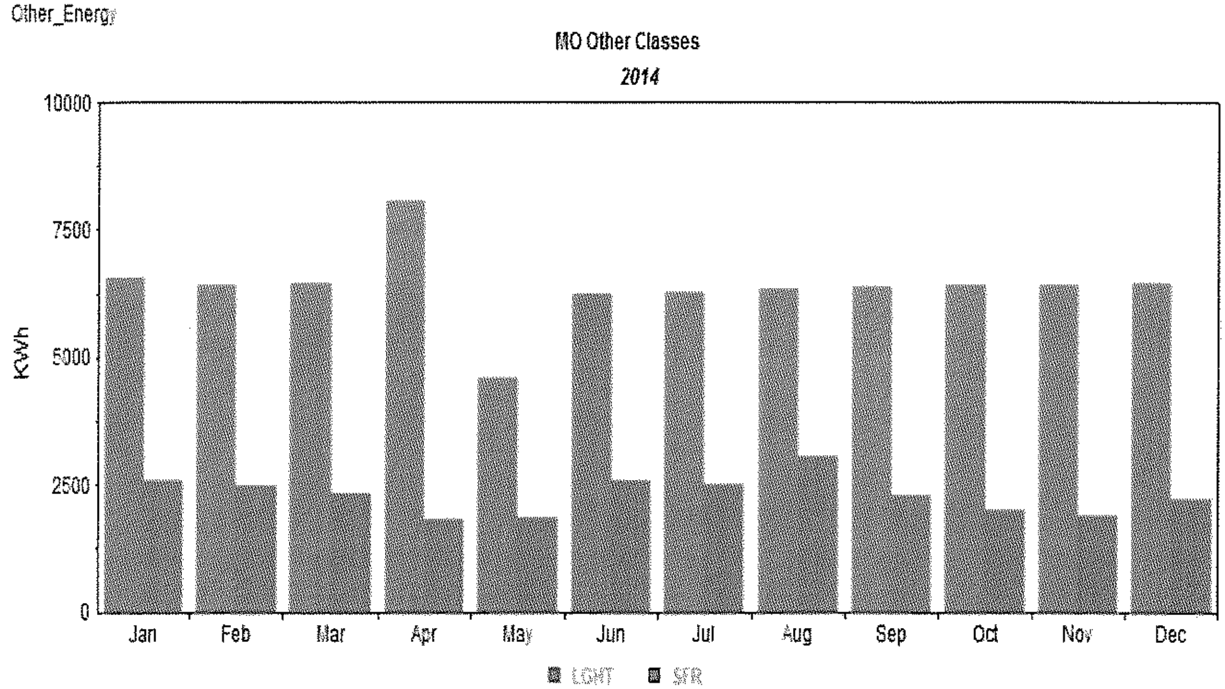


Table 31: Data Table Other MO Load (SFR & Lighting)

Date	LGHT	SFR
Jan-14	6,559.8	2,574.0
Feb-14	6,436.5	2,461.1
Mar-14	6,460.5	2,332.5
Apr-14	8,073.2	1,800.1
May-14	4,592.2	1,845.6
Jun-14	6,255.2	2,569.4
Jul-14	6,288.9	2,527.5
Aug-14	6,340.3	3,048.7
Sep-14	6,378.4	2,301.9
Oct-14	6,412.1	1,981.7
Nov-14	6,435.2	1,884.0
Dec-14	6,457.6	2,225.3

Figure 35: Estimates of KS Residential Monthly Cooling, Heating, and Base

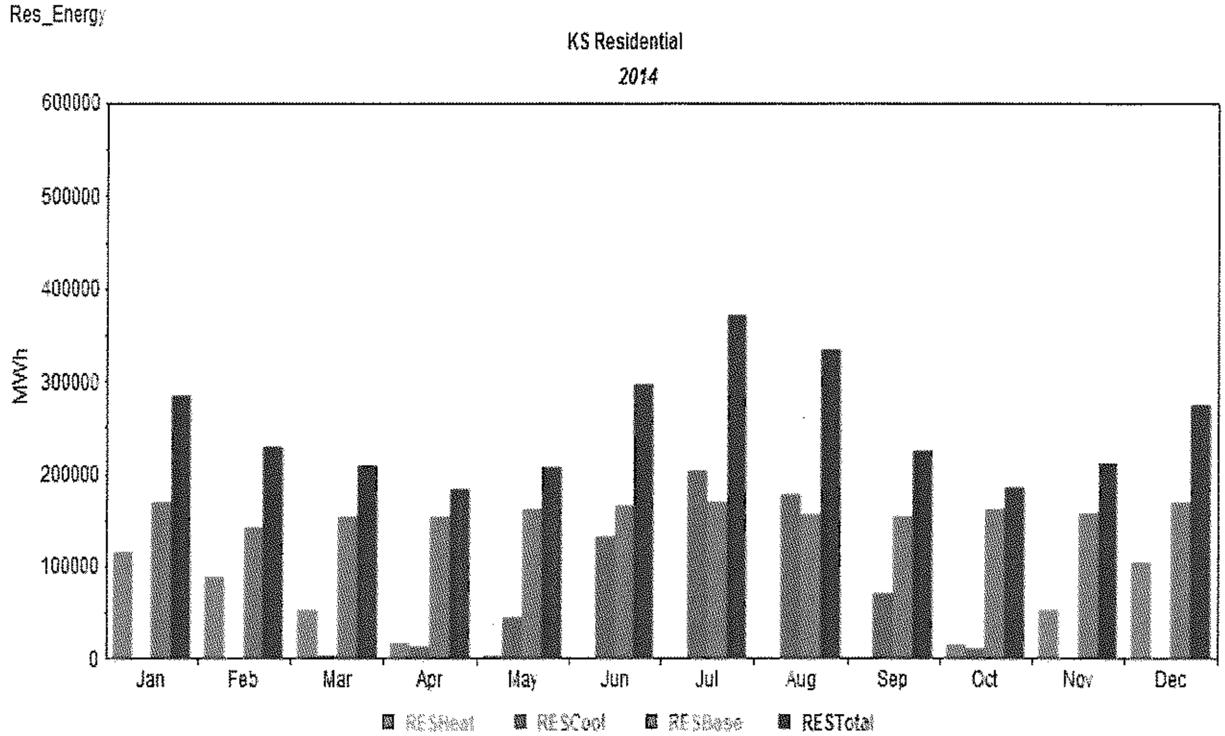


Table 32: Data Table of KS Residential Monthly Cooling, Heating, and Base

Date	RESHeat	RESCool	RESBase	RESTotal
Jan-14	115,242.9	-	168,557.2	283,800.1
Feb-14	87,032.4	-	140,707.5	227,739.9
Mar-14	52,979.9	1,948.3	153,030.0	207,958.2
Apr-14	17,246.5	12,104.6	153,905.9	183,256.9
May-14	1,561.6	44,359.5	161,662.7	207,583.7
Jun-14	-	131,798.1	164,401.7	296,199.8
Jul-14	-	202,920.2	169,006.2	371,926.4
Aug-14	-	177,183.8	155,926.9	333,110.7
Sep-14	1,270.8	70,537.8	152,752.1	224,560.7
Oct-14	13,764.3	10,967.9	161,255.4	185,987.6
Nov-14	52,111.0	474.6	157,478.7	210,064.2
Dec-14	104,546.1	10.0	169,091.2	273,647.3

Figure 36: Estimates of KS Commercial Small General Service Monthly Cooling, Heating, and Base

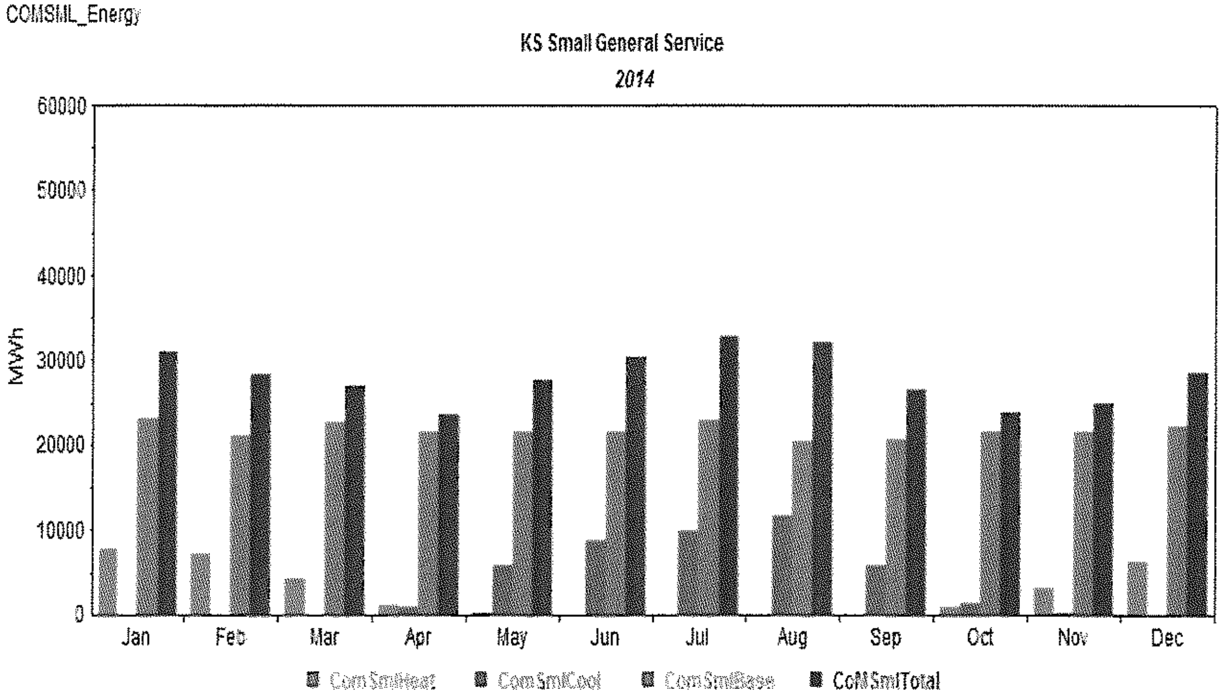


Table 33: Data Table of KS Commercial Small General Service Monthly Cooling, Heating, and Base

Date	ComSmlHeat	ComSmlCool	ɔmSmlBase	oMSmlTotal
Jan-14	7,921.6	-	23,161.0	31,082.6
Feb-14	7,228.3	-	21,163.7	28,392.0
Mar-14	4,199.3	68.5	22,588.9	26,856.7
Apr-14	1,073.0	971.1	21,556.3	23,600.4
May-14	240.2	5,896.9	21,515.5	27,652.6
Jun-14	-	8,683.6	21,603.5	30,287.2
Jul-14	-	9,888.4	22,981.9	32,870.3
Aug-14	-	11,704.3	20,525.0	32,229.2
Sep-14	76.8	5,763.6	20,565.5	26,405.9
Oct-14	834.0	1,442.0	21,511.5	23,787.5
Nov-14	3,151.7	151.4	21,550.3	24,853.4
Dec-14	6,333.6	10.9	22,281.0	28,625.6

Figure 37: Estimates of KS Commercial Big General Service (MGS and LGS) Monthly Cooling, Heating, and Base

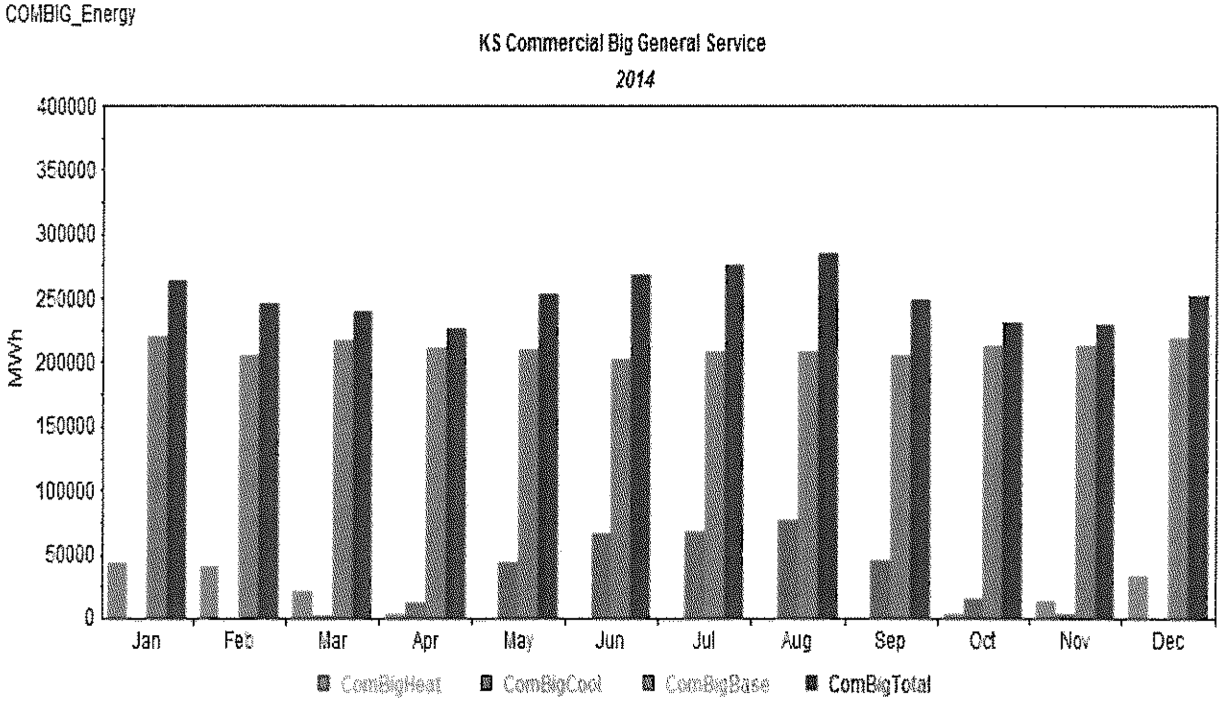


Table 34: Data Table of KS Commercial Big General Service (MGS and LGS) Monthly Cooling, Heating, and Base

Date	ComBigHeat	ComBigCool	ComBigBase	ComBigTotal
Jan-14	43,454.2	-	220,477.4	263,931.7
Feb-14	40,789.9	-	205,421.7	246,211.6
Mar-14	20,433.3	1,235.1	217,736.4	239,404.9
Apr-14	3,643.0	12,123.5	210,459.9	226,226.4
May-14	322.3	43,315.5	210,054.1	253,691.9
Jun-14	-	66,072.9	202,606.5	268,679.4
Jul-14	-	67,496.4	207,615.8	275,112.2
Aug-14	-	76,839.7	207,507.3	284,347.0
Sep-14	123.1	44,194.2	205,190.0	249,507.3
Oct-14	2,354.2	15,379.1	213,107.1	230,840.4
Nov-14	13,798.6	2,456.7	212,607.9	228,863.2
Dec-14	32,722.5	246.1	219,204.7	252,173.3

Figure 38: Estimates of KS Industrial Monthly Cooling, Heating, and Base

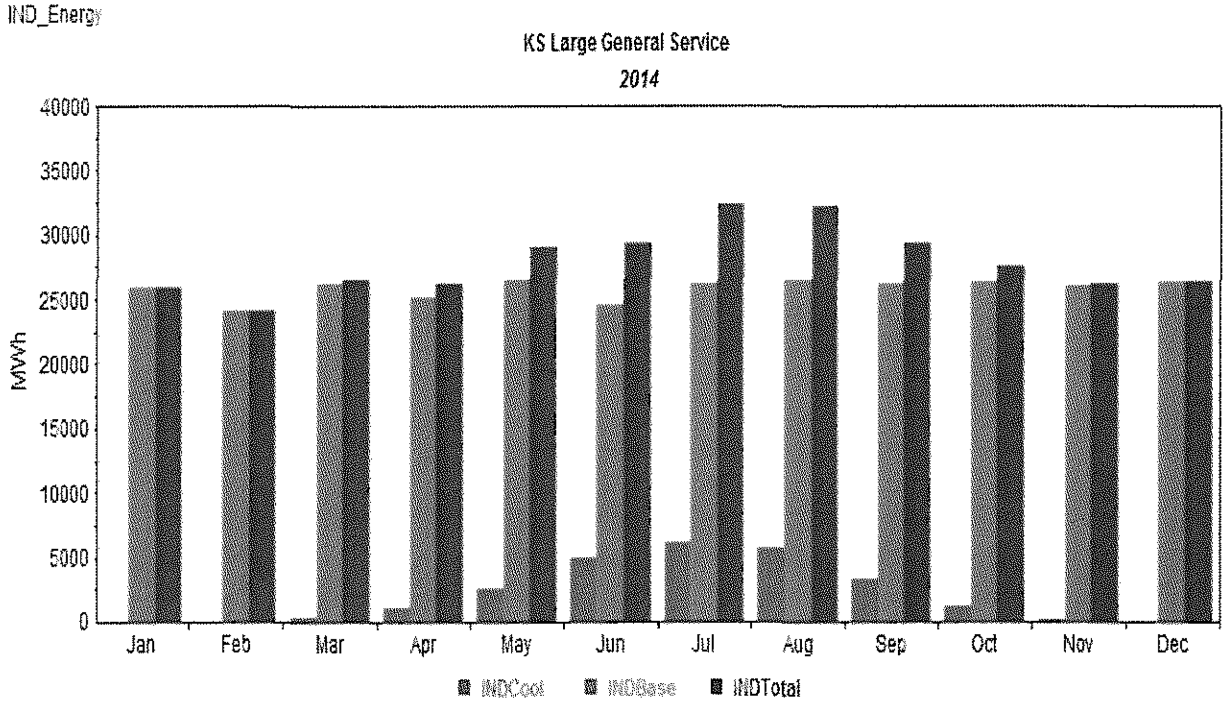


Table 35: Data Table of KS Industrial Monthly Cooling, Heating, and Base

Date	INDCool	INDBase	INDTotal
Jan-14	3.4	25,963.9	25,967.3
Feb-14	18.8	24,091.8	24,110.5
Mar-14	310.2	26,268.8	26,579.0
Apr-14	1,027.7	25,125.5	26,153.2
May-14	2,482.8	26,531.2	29,014.1
Jun-14	4,910.6	24,525.3	29,435.8
Jul-14	6,142.1	26,147.0	32,289.2
Aug-14	5,651.2	26,526.1	32,177.3
Sep-14	3,251.2	26,151.8	29,403.0
Oct-14	1,131.3	26,409.7	27,541.0
Nov-14	180.9	26,056.6	26,237.5
Dec-14	18.1	26,334.0	26,352.1

Figure 39: Other KS Load (SFR & Lighting)

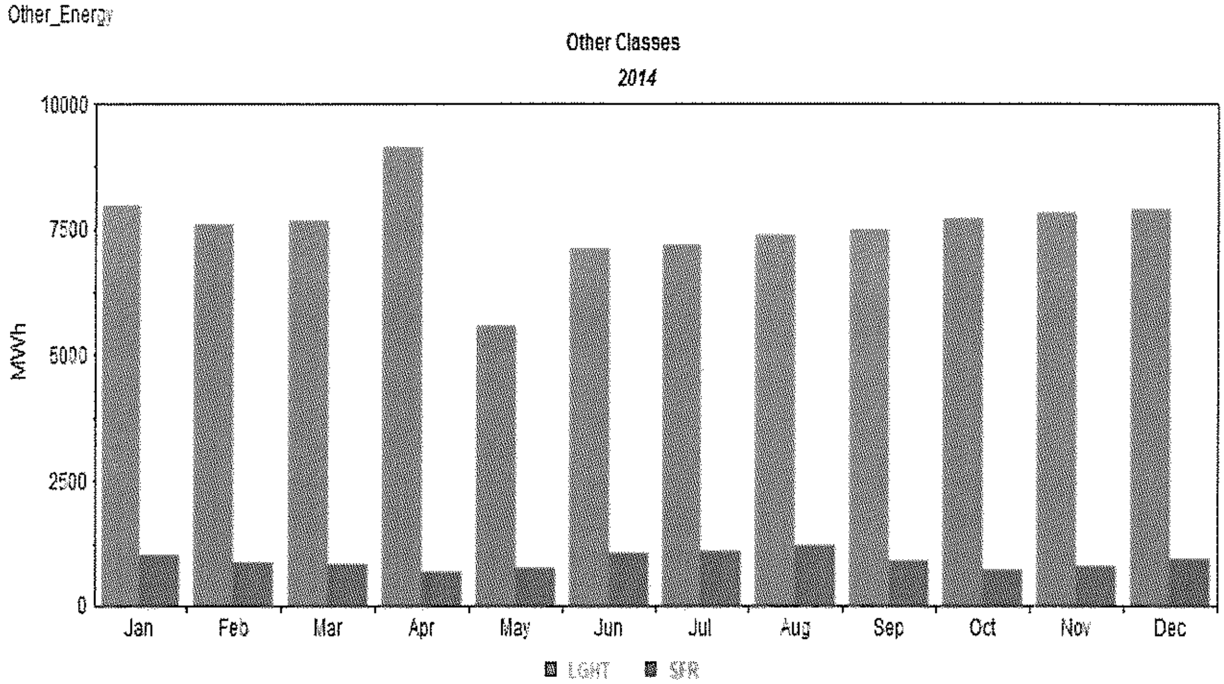


Table 36: Data Table Other KS Load (SFR & Lighting)

Date	LGHT	SFR
Jan-14	7,991.4	1,001.6
Feb-14	7,595.2	845.3
Mar-14	7,668.0	812.5
Apr-14	9,124.7	668.5
May-14	5,576.5	735.3
Jun-14	7,116.1	1,055.9
Jul-14	7,209.0	1,072.7
Aug-14	7,365.6	1,207.7
Sep-14	7,494.0	903.2
Oct-14	7,700.7	720.0
Nov-14	7,834.4	792.6
Dec-14	7,921.2	931.9

7.1.5 DESCRIBE AND DOCUMENT MODIFICATION OF MODELS

5. Where judgment has been applied to modify the results of its energy and peak forecast models, the utility shall describe and document the factors which caused the modification and how those factors were quantified.

The results of all models were used as is except to calibrate the system peak forecast to the weather normalized 2014 peak in each jurisdiction.

The first step is the weather normalization of the jurisdictional hourly load data. After normalizing the hourly loads, the demand side management, mpower and dynamic voltage control reductions at the time of peak are determined. This reduction in load is then added back to the weather normalized data to produce weather normalized monthly gross peaks. The base year weather normalized annual peak is then used to calibrate the jurisdictional peaks that are produced in MetrixLT. This is done by taking the base year normalized peak and using it as the first data point in the calibration process and then applying the annual growth rates from the peak forecast produced in MetrixLT. Then the annual peak is distributed across the months based on the percentage of that month's peak as percent to the annual peak. The percent of each month's contribution to the annual peaks is determined by the output of monthly peaks from MetrixLT. After each jurisdiction has been calibrated, the monthly peaks are then imported back in to MetrixLT and each hour for the peak day is adjusted to reflect the new calibrated peak.

The calibration of the peaks can be found in the jurisdictional system datalyzer folder which is provided in the work papers.

7.1.6 PLOTS OF CLASS MONTHLY ENERGY AND COINCIDENT PEAK DEMAND

6. For each major class specified pursuant to subsection (2)(A), the utility shall provide plots of class monthly energy and coincident peak demand at the time of summer and winter system peaks. The plots shall cover the historical database period and the forecast period of at least twenty (20) years. The plots of coincident peak demands for the historical period shall include both actual and weather-normalized peak demands at the time of summer and winter system peaks. The plots of coincident peak demand for the forecast period shall show the class coincident demands for the base-case forecast at the time of summer and winter system peaks.

Plots for class monthly energy and coincident peak demand at the time of summer and winter system loads are provided in *Appendix 3B*. Energy plots by jurisdiction and system are provided in the file *IRP_7.1.6_KCPL_MWh.xlsx* and peak plots are in the file *IRP_7.1.6_KCPL_Peaks.xlsx.*

7.1.7 PLOTS OF NET SYSTEM LOAD PROFILES

7. The utility shall provide plots of the net system load profiles for the summer peak day and the winter peak day showing the contribution of each major class. The plots shall be provided in the triennial filing for the base year of the forecast and for the fifth, tenth, and twentieth years of the forecast. Plots for all years shall be included in the workpapers supplied at the time of the triennial filing.

The figures below show the load profiles for the base, fifth, tenth, and twentieth years broken out by summer and winter peak days for each major class in Missouri, Kansas and for the system. The plots with data tables are provided in *Appendix 3C.* Plots for additional years can be found in the MetrixLT files (*MO_Fcst*, *KS_Fcst*, and *System*) included in the workpapers.

Figure 40: Base Year (2014) Net System Load Profiles for MO, KS, and System
**** High Confidential ****

[redacted]

HC

Figure 41: Fifth Year (2019) Net System Load Profiles for MO, KS, and System
**** High Confidential ****

[redacted]

HC

Figure 42: Tenth Year (2024) Net System Load Profiles for MO, KS, and System
** High Confidential **

[redacted]

HC

Figure 43: Twentieth Year (2034) Net System Load Profiles for MO, KS, and System ** High Confidential **

[redacted]

HC

7.2 DESCRIBE AND DOCUMENT FORECASTS OF INDEPENDENT VARIABLES

(B) Forecasts of Independent Variables.

The forecasts of independent variables shall be specified, described, and documented.

The forecasts of independent variables were described above in the section for rule 6.C.3 and below in the section for rule for 7.B.3.

7.2.1 DOCUMENTATION OF MATHEMATICAL MODELS

1. Documentation of mathematical models developed by the utility to forecast the independent variables shall include the reasons the utility selected the models as well as specification of the functional form of the equations.

KCP&L acquired forecasts of independent variables from Moody's and DOE as described previously. KCP&L developed its own models to forecast the saturation of electric space heating for residential and commercial customers (*SpaceHeating.xls*). KCP&L has specific tariffs for customers that have electric space heating and the percentage of customers on these tariffs is used as a measure of electric space heating saturations. The models predict both the penetration rate of electric space heating for new customers and the percentage rate of conversion to electric space heating for customers that use natural gas or propane to heat their homes. These rates are driven by the difference in costs to heat a home by electricity and natural gas. These costs are determined by the average natural gas rates for local gas utilities, KCP&L's winter tail-block rates and heating equipment efficiency rates.

The real price differential per million Btu is computed as

$$PD= (1{,}000{,}000/1{,}028{,}000/\text{Gas Furnace Efficiency}*\text{Gas rate} \\ -1{,}000{,}000/(\text{Heat pump Efficiency}*1{,}000)*\text{Electric tail block rate})*CPI_{2005}/CPI_t$$

The heat pump efficiency is Btu out per Watt hour in.

The equation to predict the number of additional customers using electric space heating is

New customers/(1+EXP(-newCust*PD-C_1))+

customers wo electric heat/(1+EXP(-conversions*PD+C_2+incentive*tax credit))

where tax credit = federal tax credits and KCP&L rebates available,

newCust, conversions, incentive, C_1, C_2 are coefficients.

The coefficients were estimated with least squares regression pooling the data for Kansas and Missouri. Equations were estimated separately for residential and commercial customers.

The forecasts for KCP&L and GMO are compared in the figure below.

Figure 44: Residential Space Heating Saturations Highly Confidential ****

Residential Electric Space Heating Saturations

[redacted]

7.2.2 DOCUMENTATION OF ADOPTED FORECASTS DEVELOPED BY ANOTHER ENTITY

2. If the utility adopted forecasts of independent variables developed by another entity, documentation shall include the reasons the utility selected those forecasts, an analysis showing that the forecasts are applicable to the utility's service territory, and, if available, a specification of the functional form of the equations used to forecast the independent variables.

KCP&L used a forecast of economic and demographic variables for the KC metro area that was developed by Moody's Analytics. The reasons for using this forecast, the applicability to KCP&L's service area and documentation for the forecast were discussed in the sections for rules 3 A and 6 A 3.

KCP&L used forecasts of saturations, UECs, EUIs and building efficiencies from DOE. The reasons for using these forecasts, the applicability to KCP&L's service area and documentation for the forecast were discussed in the sections for rules 3 A, 4 A 1 B, 5 A, 5 B AND 6 A 3.

7.2.3 COMPARISON OF FORECAST FROM INDEPENDENT VARIABLES TO HISTORICAL TRENDS

3. These forecasts of independent variables shall be compared to historical trends in the variables, and significant differences between the forecasts and long-term and recent trends shall be analyzed and explained.

Table 37 Economic Growth Rates for KC Metro Area ** Highly Confidential **

[redacted]

Figure 45: Households ** Highly Confidential **

[redacted]

the last recession at the end of 2007, at which time growth slowed substantially. The forecast is for the housing stock to growth rapidly again after the current period of low U.S. economic growth to allow the housing stock to catch up with demographic growth. Then growth slows to a level lower than what KCP&L has seen in the last two decades.

Figure 46: Employment Non-Manufacturing ** Highly Confidential **

[redacted]

Non-manufacturing showed very strong growth in the 1990s, 1.9% per year, then stalled after the 2001 recession, picked up strongly in 2004 and then turned negative during the last recession. Moody's expects growth to rebound strongly after the current slump and then hold at about 1% after that.

Figure 47: Employment Manufacturing ** Highly Confidential **

[redacted]

Manufacturing employment peaked in the late 1990s and has fallen since. It fell precipitously between 1999 and 2003 and again during the last recession. Moody's expects employment to resume its historical decline after KCP&L bounces back from the economic slump.

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Figure 48: Gross Metro Product Non-Manufacturing **Highly Confidential **

[redacted]

Real non-manufacturing gross metro product grew 3% per year during the 1990s, slowed down a bit after that and then declined during the last recession. GMP is growing faster than employment because of increasing productivity, a trend seen nationally and across many service sectors. Moody's expects above trend growth coming out of the current slump and then trend growth after that.

Figure 49: Gross Metro Product Manufacturing **Highly Confidential **

[redacted]

Real gross metro product from the manufacturing sector grew strongly during the 1990s and then fell flat until it plunged during the last recession. Moody's expects rebound growth coming out of the current economic slump and then trend growth after that. GMP for this sector is growing while employment is flat or declining because of increasing productivity, automation of the manufacturing processes and because more labor intensive industries tend to move overseas where there is lower cost labor.

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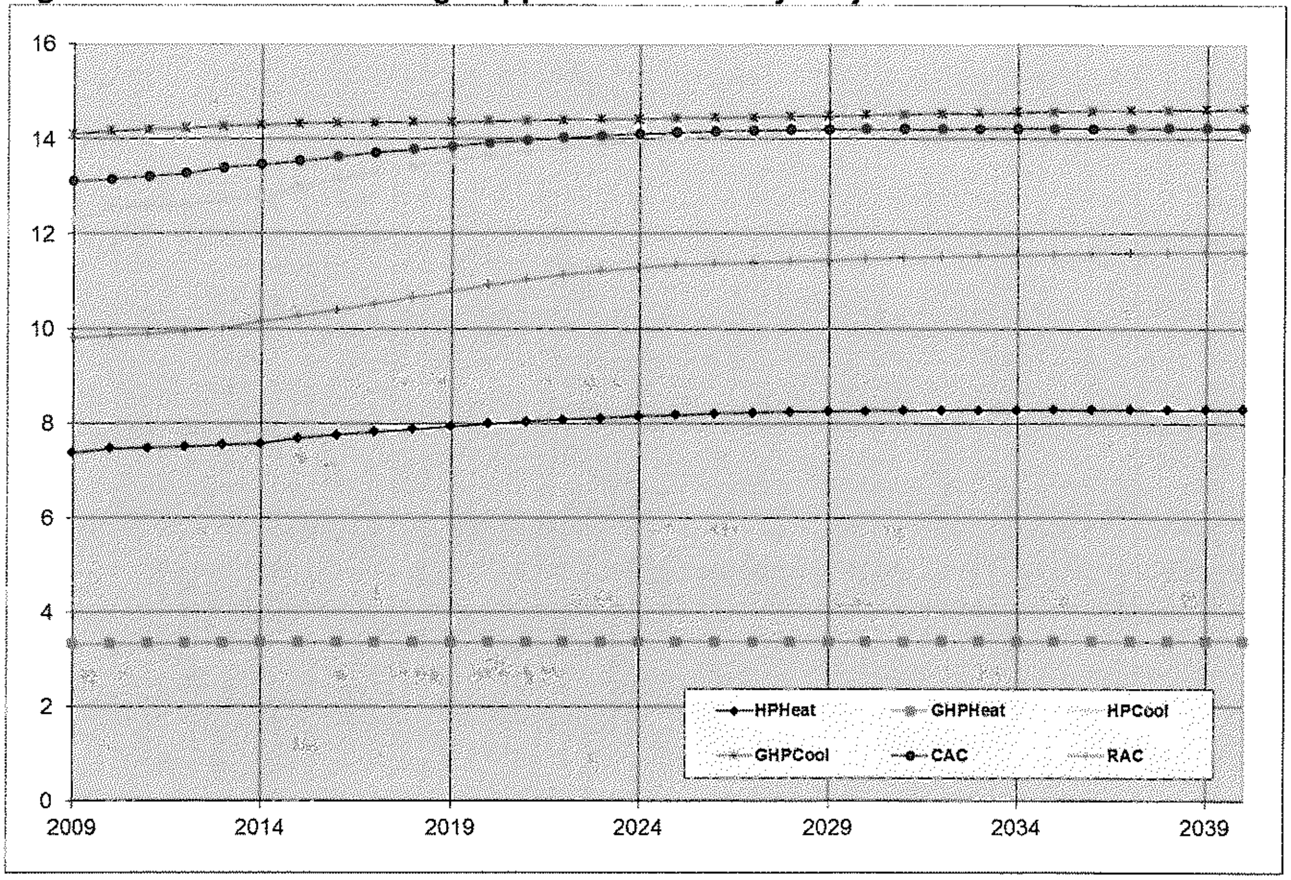
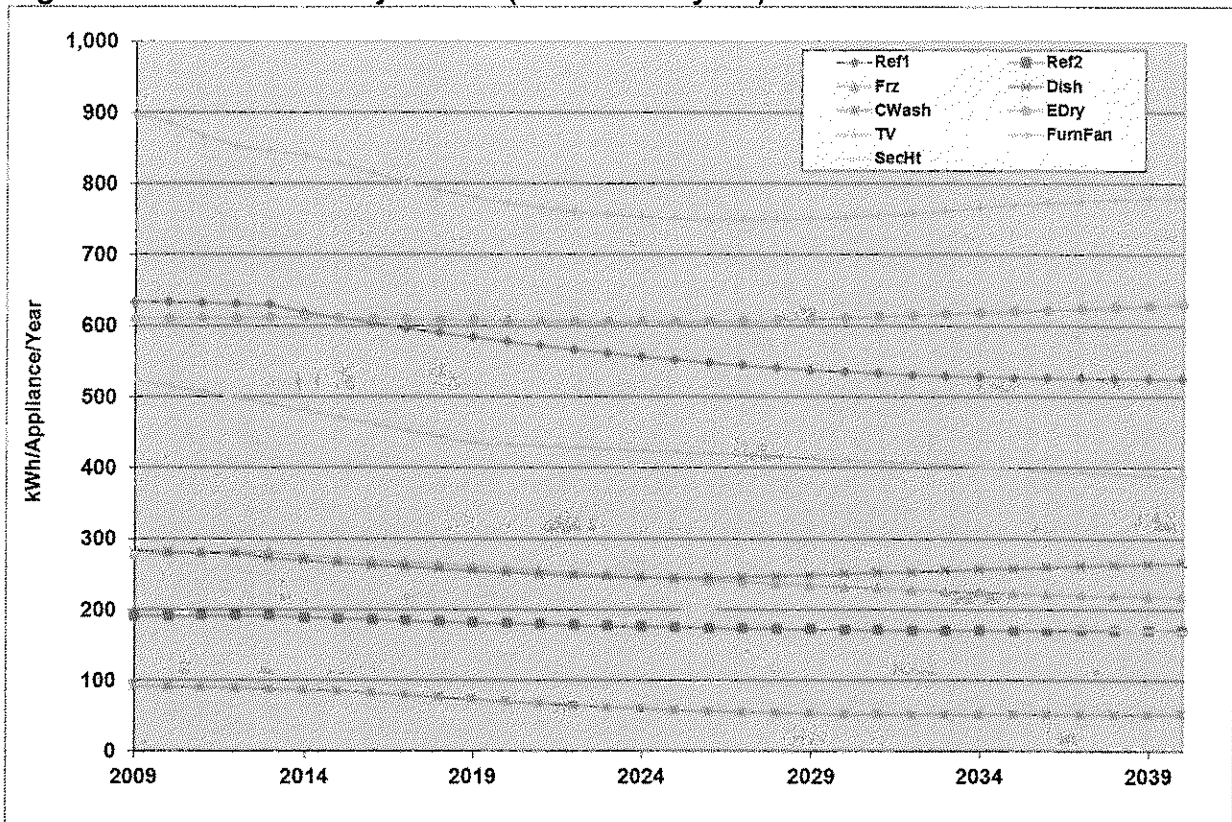
Figure 50: DOE Stock Average Appliance Efficiency Projections



DOE is expecting increases in the stock average appliance efficiencies for residential heating and cooling equipment. This is resulting from appliance standards. In January 2006 a new standard raised the SEER standard by 30 percent for central air conditioners and has continued to increase since that time. This standard impacts the stock average efficiency both from new construction and when units are replaced.

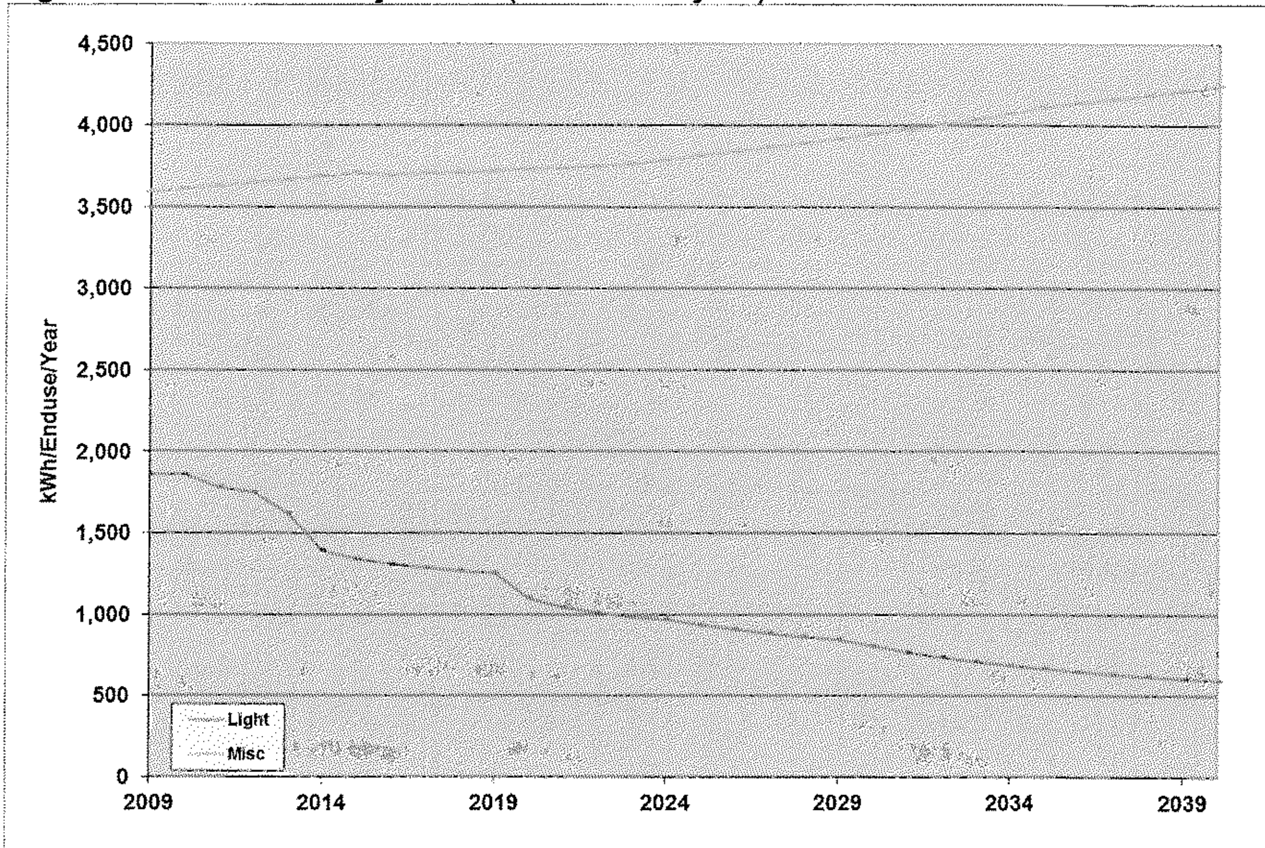
Figure 51: DOE UEC Projections (<1000 kWh/year)



UECs are expected to decline substantially for electric clothes dryers, refrigerators, electric cooking and dishwashers due to appliance efficiency standards.

This year the TV category has been expanded to include all home entertainment equipment such as home audio, video-game consoles, and DVR's. As a result, starting TV intensities are higher causing the intensity now to have a projected decline.

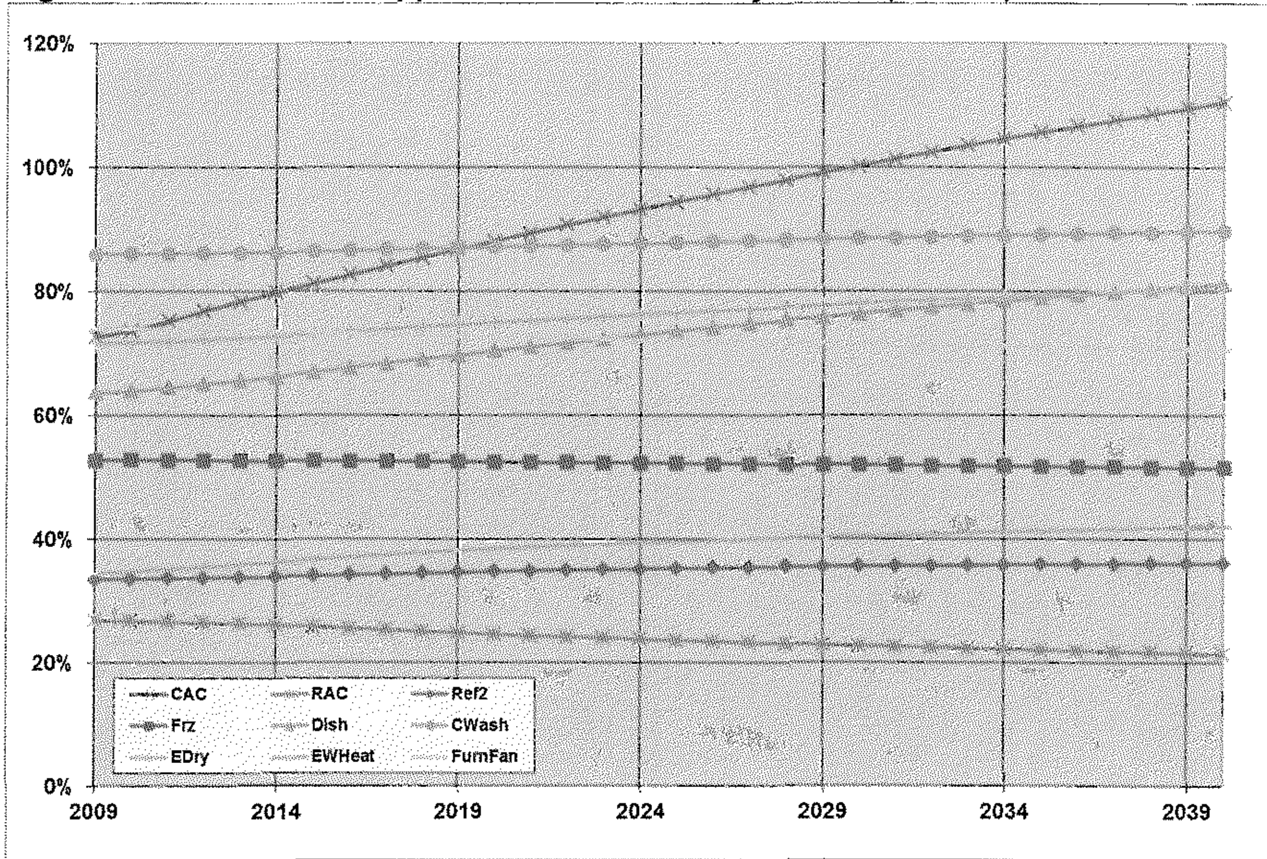
Figure 52: DOE UEC Projections (>1000 kWh/year)



The UEC for lighting is declining because of the increasing sales of CFLs and is expected to decline even more rapidly beginning in 2013 due to a new standard for light bulbs and the increased adoption of LED technology which will gain significant share of the overall lighting technologies going forward.

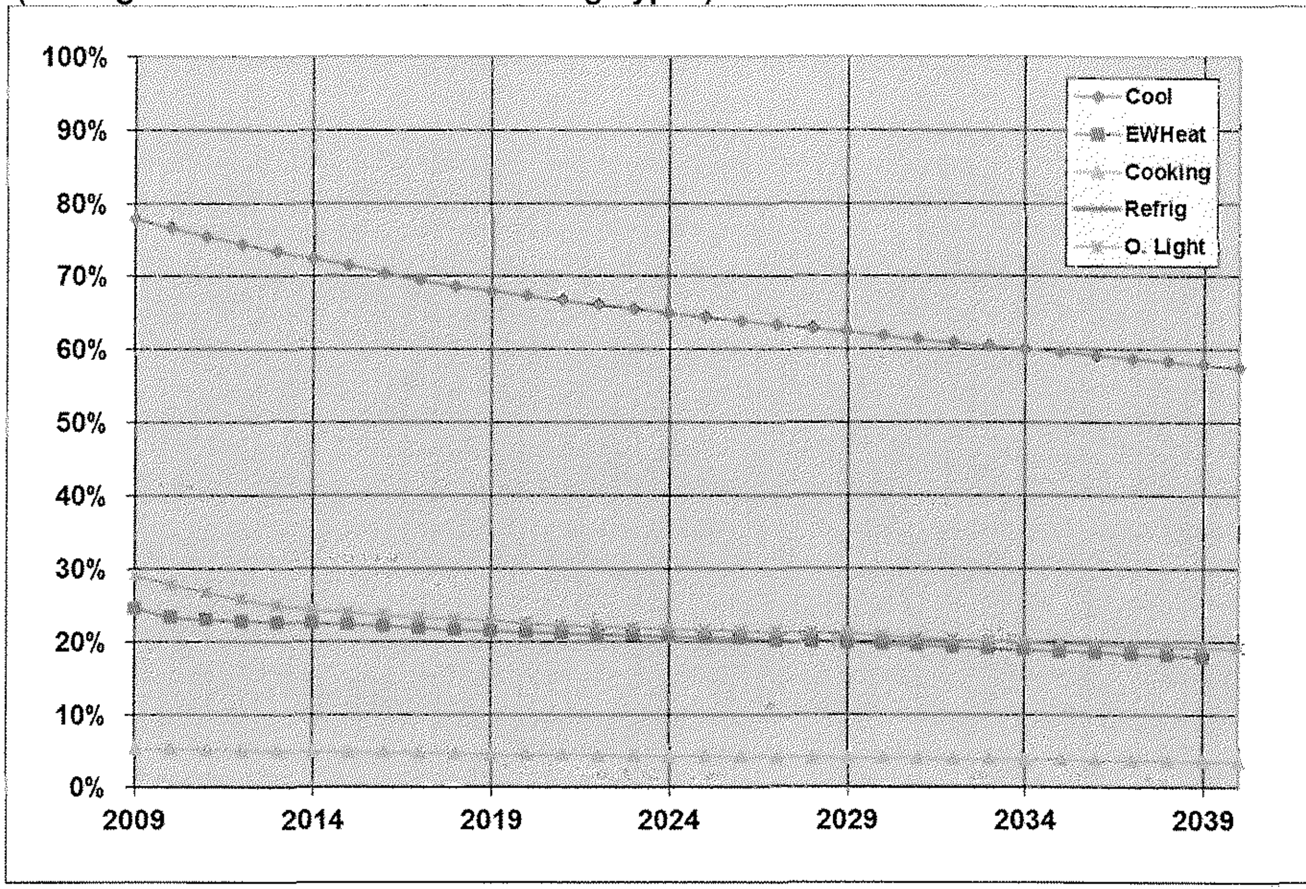
One of the most significant changes is that DOE is now projecting much slower growth in miscellaneous sales. The miscellaneous intensity is expected to average 0.3% over the next ten years compared to the nearly 1.0% in prior forecasts. This is largely the result of calibration into the 2009 RECS.

Figure 53: DOE Electric Appliance Saturation Projections (< 100%)



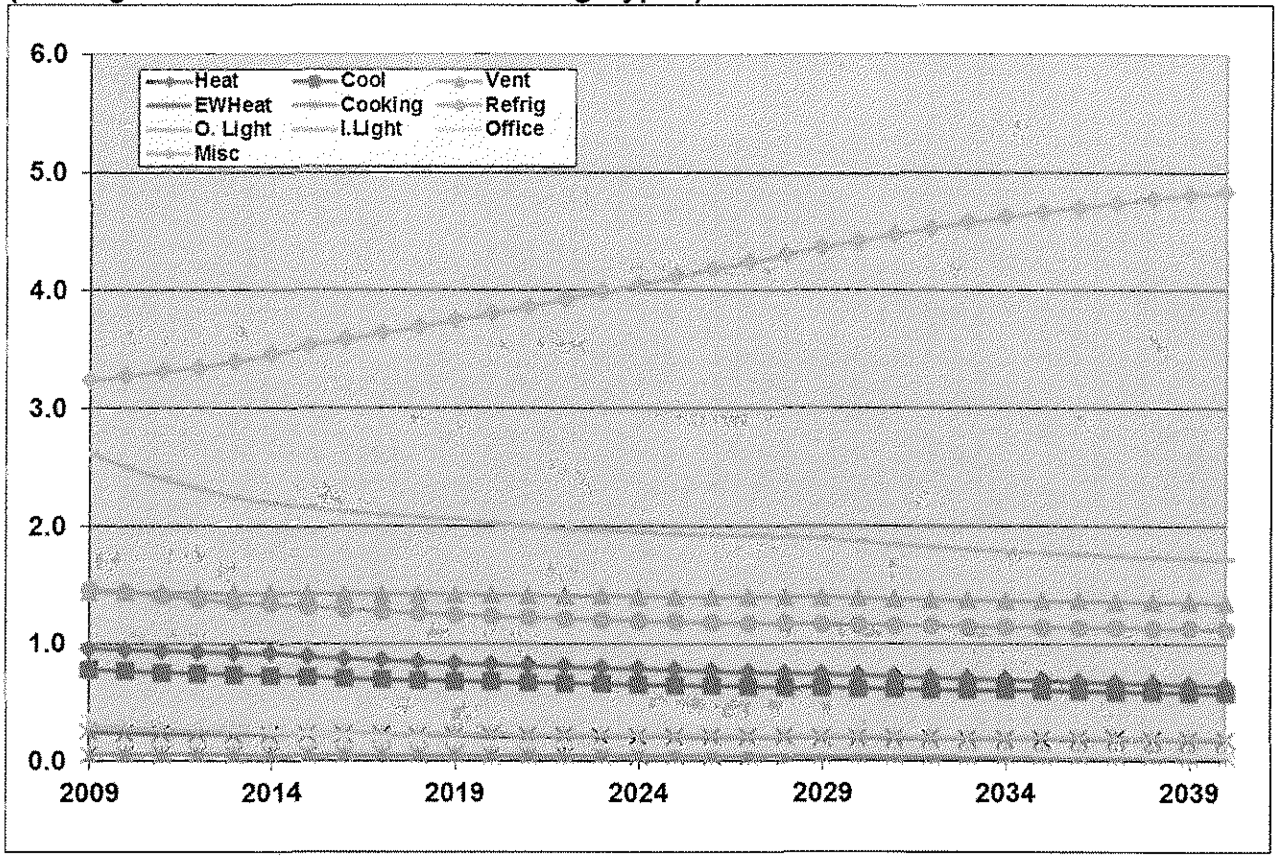
DOE saturation projections shown above are in line with recent historical trends.

Figure 54: DOE Commercial Equipment Saturation Projections (Average over all Commercial Building Types)



DOE commercial sector saturations are mostly in line with trends in recent historical data. The saturation of electric water heating dropped from about 34% in 2004 to 27% in 2014 perhaps because natural gas prices have fallen precipitously. Electric cooking saturations are also falling.

Figure 55 DOE Commercial EUI Projections (Average over all Commercial Building Types)



DOE estimates of the EUI for lighting has been declining since 1995 and started falling more rapidly in 2005, probably because of the use of CFLs, especially for lodging and in recessed fixtures in offices. The refrigeration EUI has been declining historically and started a more rapid decline in 2009, which continues with the projection. New standards for commercial refrigeration equipment went into effect at the beginning of 2010 and updated in 2012.New refrigeration standards will become effective in 2017..[viii] The heating EUI is declining and expected to further decline. A new standard for commercial heating and cooling equipment became effective in April 2007 and November 2004 and updated in 2010.[ix] The EUI for miscellaneous equipment has been rising rapidly and is expected to continue that trend.

7.2.4 SPECIFICATION AND QUANTIFICATION OF FACTORS

4. Where judgment has been applied to modify the results of a statistical or mathematical model, the utility shall specify the factors which caused the modification and shall explain how those factors were quantified.

KCP&L used the forecasts of economic and demographic variables as is from Moody's Analytics.

The projections of appliance saturations from DOE were calibrated to the results of our Residential Appliance Saturation. An additional calibration was made to lighting to account for the KCP&L lighting program that had been in place prior to the implementation of the 2013 federal lighting standard. The adjustment slows the rate of decline.

7.3 NET SYSTEM LOAD FORECAST

(C) Net System Load Forecast. The utility shall produce a forecast of net system load profiles for each year of the planning horizon. The net system load forecast shall be consistent with the utility's forecasts of monthly energy and peak demands at time of summer and winter system peaks for each major class.

KCP&L has produced an hourly forecast for each major class and the sum of these forecasts is the hourly forecast of NSI.

SECTION 8: LOAD FORECAST SENSITIVITY ANALYSIS

(8) Load Forecast Sensitivity Analysis.

The utility shall describe and document its analysis of the sensitivity of the dependent variables of the base-case forecast for each major class to variations in the independent variables identified in subsection 4 CSR 240-22.030(8).

To perform a sensitivity analysis, KCP&L is using a method that was suggested by the Missouri Public Service Commission Staff for KCP&L's IRP. For each customer class, mwh sales were regressed on important driver variables and degree days and the standardized variables are used to show the relative importance of each explanatory variable. KCP&L also show the elasticity for each driver variable as measured by the statistical regression. The sensitivity analysis was first run using the class cost of service groups. Unfortunately, there was not enough data to obtain statically significant results since this data was available only from 2005. The analysis was repeated using revenue classes, residential, commercial and industrial with monthly data available from 2001 to 2014.

Table 38 displays the results for MO residential customers. Among the driving variables, the cooling degree days variable has the largest standardized coefficient, followed by the heating degree days variable. Note that the base temperature for the cooling degree days variable was 65^0 F and the base temperature for the heating degree days variable was 55^0 F. The variable hddPriceRatio variable is heating degree days with a base temperature of 55^0 F times the price of natural gas for MGE's residential customers divided by the price of electricity. The purpose of this variable is to measure the impact of gas and electric prices on electric space heating loads. The variable BDays is the number of billing days averaged over each billing cycle. The regression periods used for these regressions are monthly from January 2001 to July 2014.

Table 38 Missouri Residential

VARIABLE	Standardized Coefficient	t-Statistic	Elasticity
BDays	4,121,350	71.5	0.60
hddPriceRatio	11,552,017	3.4	0.04
resCusCDD65	67,975,438	63.9	0.24
resCusHdd55	35,682,147	11.4	0.14
hddTrend	11,177,932	7.6	-0.03

Table 39 provides the results for Missouri commercial customers. As for residential customers, the two variables with the largest standardized coefficients were heating and cooling degree days. The heating degree day base temperature for the commercial model was the same as the residential model, but the cooling degree day base temperature was 55^0 F. The HDDpriceRatio variable, similar to the same named variable in the residential model, was right behind the heating degree day variable in terms of size of the coefficient. Several economic drivers were tested and the number of households was more significant than non-manufacturing employment or GMP.

Table 39 Missouri Commercial

VARIABLE	Standardized Coefficient	t-Statistic	Elasticity
Total_Households	3,515,752	4.0	0.23
BDays	7,242,942	10.5	0.62
HDDpriceRatio	11,442,528	2.7	0.02
comCusCDD55	40,087,067	29.5	0.11
comCusHdd55	13,463,718	3.4	0.03
HddTrend	8,021,731	4.5	-0.01
Jun02	-1,989,454	-3.0	0.00
Apr03	-1,901,080	-2.9	0.00

The Missouri industrial model results are shown in Table 40. Unlike the commercial and residential models, the largest coefficient is not weather related with model variable prElecCus (which is the industrial electricity price times the industrial customers) closely followed by the industrial electricity prices variable. The cooling degree variable was next in line when it came to largest coefficients. Of the economic variables, the manufacturing employment variable was the most significant. Using industrial customers as a variable was also statistically significant.

Table 40 Missouri Industrial

VARIABLE	Standardized Coefficient	t-Statistic	Elasticity
Emp_Man	4,492,581	3.7	0.51
prElecCus	-11,483,533	-6.8	-0.92
indCus	5,386,241	4.1	0.68
indCusCDD55	9,177,068	14.2	0.07
indPriceElec	11,073,968	7.6	0.67
Aug03	-1,413,506	-3.6	0.00
Aug05	-1,760,902	-4.7	0.00
Nov12	-1,157,553	-3.1	0.00

Table 41 shows the results for residential customers in Kansas. The variables with the largest standardized coefficients are degree days followed by the number of bulling days. The hddPriceRatio variable is the same formula used for the same named variables in the Missouri models.

Table 41 Kansas Residential

VARIABLE	Standardized Coefficient	t-Statistic	Elasticity
BDays	7,754,172	12.8	1.04
resCus	-4,096,171	-5.2	-0.41
hddPriceRatio	6,066,747	1.5	0.02
resCusCDD65	72,460,684	74.8	0.24
resCusHdd55	35,605,488	9.8	0.13
hddTrend	6,096,838	3.3	-0.01

Table 42 shows the results for commercial customers in Kansas. Again the degree day variables represented the variables with the largest coefficients. The other four variables all had coefficient values in the four million range.

Table 42 Kansas Commercial

VARIABLE	Standardized Coefficient	t-Statistic	Elasticity
BDays	4,915,100	10.7	0.59
resCus	4,049,257	5.1	0.37
prElecCus	-4,844,425	-2.8	-0.11
HDDpriceRatio	-4,439,903	-1.8	-0.01
comCusCDD55	31,046,729	27.0	0.12
comCusHdd55	18,375,270	7.1	0.05

Table 43 reports the results of the sensitivity analysis for manufacturing customers in Kansas. The manufacturing employment economic variable had the largest coefficient closely followed by the cooling degree variable. The next largest coefficient was from the prElecCus variable, which had the same formula as the same named variable in the Missouri models.

Table 43 Kansas Industrial

VARIABLE	Standardized Coefficient	t-Statistic	Elasticity
Emp_Man	2,725,600	21.6	1.03
prElecCus	-428,564	-2.7	-0.11
indCusCDD55	2,618,652	16.2	0.08
Sep00	-180,834	-3.0	0.00
Dec00	161,250	2.6	0.00
Feb01	-131,519	-2.2	0.00

8.1 TWO ADDITIONAL NORMAL WEATHER LOAD FORECASTS

(A) The utility shall produce at least two (2) additional normal weather load forecasts (a high-growth case and a low-growth case) that bracket the base-case load forecast. Subjective probabilities shall be assigned to each of the load forecast cases. These forecasts and associated subjective probabilities shall be used as inputs to the risk analysis required by 4 CSR 240-22.060.

KCP&L used two additional economic forecasts from Moody's Analytics to produce high-growth and low-growth load forecast scenarios. These additional scenarios represent economic growth one standard deviation above and below the base case forecast.

In addition to these two scenarios, KCP&L produced an additional scenario representing significant loss of customer.

KCP&L constructed this scenario by subtracting the energy and peak demand from the largest customer in both Kansas and Missouri from the results for the base case scenario. The most recent 12 billing records from each customer were used and the energy and peak from each month was used for that particular month in the forecast. Losses were added to the energy and peak demands.

The corresponding figures below show the base-case, low-case, high-case, and significant loss forecasts for energy and demand. The impact of the last recession and the economic malaise since then are evident in the plot for energy. Growth in the forecast is lower than it was prior to the last recession and this is primarily because U.S. growth prior to the recession was fueled by circumstances that will not be repeated in the forecast horizon such as extremely lax lending standards.

Figure 56: Base, Low, High and Significant Loss Net System Input Forecast ** Highly Confidential **

[redacted]

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Figure 57: Base, Low, High and Significant Loss Peak Demand Forecast ** Highly Confidential **

[redacted]

(B) The utility shall estimate the sensitivity of system peak load forecasts to extreme weather conditions. This information shall be considered by utility decision-makers to assess the ability of alternative resource plans to serve load under extreme weather conditions when selecting the preferred resource plan pursuant to 4 CSR 240-22.070(1).

KCP&L created a forecast scenario using the base case economic scenario and weather from the years with more than 1,700 cooling degree days at KCI. These years were 1980, 1988, 2006 and 2012. The number of cooling degree days those years were 1,746, 1,724, 1,724 and 1,839. The scenario was created by running our computer programs with normal weather computed with those four years instead of with 30 years. In 2014, the peak rose from 3,558 mW to 3,657 mW. In 2020, the peak increased from 3,637 to 3,920 under this scenario. The complete set of results is in a file, *KCPL NSI_Peak*

Monthly_Annual.xls. This file contains monthly NSI and peak load for all forecast scenarios.

The corresponding figures below show the base-case, low-case, high-case, and extreme weather forecasts for energy and demand.

Figure 58: Base, Low, High, and Extreme Weather Energy Forecast ** Highly Confidential **

[redacted]

Figure 59: Base, Low, High, and Extreme Weather Peak Demand Forecast ** Highly Confidential **

[redacted]

(C) The utility shall provide plots of energy usage and peak demand covering the historical database period and the forecast period of at least twenty (20) years.

1. The energy plots shall include the summer, non-summer, and total energy usage for each calendar year. The peak demand plots shall include the summer and winter peak demands.

The figures below represent actual and weather normalized Net System Input (Energy) for summer, non-summer, and total year for the base case forecast. Corresponding tables can be found in *Appendix 3D* and in the file *IRP_8C_KCPL_NSI_Peak.xls*. Weather normalization significantly smooths out the energy plots. Growth in the forecasts is substantially slower than during the period prior to the last recession.

Figure 60: Base Case Actual and Weather Normalized Summer Energy Plots ** Highly Confidential **

[redacted]

Figure 61: Base Case Actual and Weather Normalized Non-Summer Energy Plots Highly Confidential **

[redacted]

Figure 62: Base Case Actual and Weather Normalized Total Energy Plots ** Highly Confidential **

[redacted]

The figures below represent actual and weather normalized peak demand for summer and non-summer for the base case forecast. Annual peak demand plots are not shown, since they are the same as summer demand plots. Corresponding tables can be found in *Appendix 3D* and the file *IRP_8C_KCPL_NSI_Peak.xls.*

Figure 63: Base Case Actual and Weather Normalized Summer Peak Demand Plots **Highly Confidential **

[redacted]

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Figure 64: Base Case Actual and Weather Normalized Winter Peak Demand Plots ** Highly Confidential **

[redacted]

2. The historical period shall include both actual and weather-normalized values. The forecast period shall include the base-case, low-case, and high-case forecasts.

The figures below represent Net System Input (energy) for summer, non-summer, and the whole year for the base, low and high scenario forecasts. Corresponding tables can be found in *Appendix 3D* and the file *IRP_8C_KCPL_NSI_Peak.xls*.

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Figure 65: Base-Case, Low-Case, and High-Case Summer Energy Plots ** Highly Confidential **

[redacted]

Figure 66: Base-Case, Low-Case, and High-Case Non-Summer Energy Plots ** Highly Confidential **

[redacted]

HC

Figure 67: Base-Case, Low-Case, and High-Case Total Energy Plots ** Highly Confidential **

[redacted]

The figures below represent peak demand for summer and non-summer for the base, low, and high scenario forecasts. Annual peak demand plots are not shown, since they are the same as summer demand plots. Corresponding tables can be found in *Appendix 3D* and in the file *IRP_8C_KCPL_NSI_Peak.xls.*

Figure 68: Base-Case, Low-Case, and High-Case Summer Peak Demand Plots ** Highly Confidential

[redacted]

Figure 69: Base-Case, Low-Case, and High-Case Winter Peak Demand Plots ** Highly Confidential

[redacted]

[i] http://www1.eere.energy.gov/buildings/appliance_standards/residential/residential_cac_hp.html
[ii] Multi-Year Program Plan, Building Regulatory Programs, U.S. Department of Energy Energy Efficiency and Renewable Energy Building Technologies Program October 2010.
[iii] http://www.eia.gov/analysis/model-documentation.cfm
[iv] Email from Benjamin Kanigel dated 7/6/2010.
[v] Email to Al Bass from Benjamin Kanigel dated 9/23/2010.
[vi] Email from Christopher Velarides dated 8/20/2014.
[vii] See regulatory_programs_mypp.pdf .
[viii] www1.eere.energy.gov/buildings/appliance_standards/commercial/refrig_equip_final_rule.html and www1.eere.energy.gov/buildings/appliance_standards/commercial/automatic_ice_making_equipment.html
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