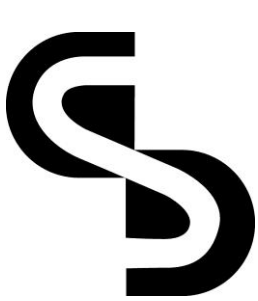


GDS Associates, Inc.
Engineers and Consultants

FINAL REPORT

Missouri Department of Economic Development, Division of Energy

Review of Empire's 2013 Utility Resource Filing Volumes 3 and 5, Pursuant to 4 CSR 240 – Chapter 22

(Case No. EO-2013-0547)

December 2, 2013

GDS Associates, Inc.
1850 Parkway Place
Suite 800
Marietta, GA 30067
770.425.8100
770.426.0303 (Fax)
www.gdsassociates.com

TABLE OF CONTENTS

1.0 INTRODUCTION

On July 1, 2013, pursuant to Chapter 22 of the Missouri Public Service Commission's Rules (4 CSR 240-22), Empire filed information in compliance with the Commission's Electric Utility Resource Planning report requirements. Through an order dated March 30, 2013 in Case No. EO-2013-0405, the Commission granted certain waiver requests made by Empire regarding the July 1, 2013 filing date which was an extension of prescribed April 1, 2013 filing date, and waiver from Commission Rule 4 CSR 240-22.080(5)(A) regarding information for the pre-integration stakeholder meeting. Empire did not seek any other waivers from the technical analysis portion of the IRP Rule for this filing.

The Missouri Department of Natural Resources (MDNR) contracted with GDS Associates, Inc. ("GDS") to provide consulting services to the Division of Energy to identify whether Empire has complied with the provisions of the Electric Utility Resource Planning rules in the following areas:

- Load Analysis & Forecasting
- Demand Side Resources

The Division of Energy was transferred from the Department of Natural Resources (DNR) to the Department of Economic Development (DED) on August 29, 2013 by Executive Order 13-03. The Executive Order transfers "All authority, powers, duties, functions, records, personnel, property, contracts, budgets, matters pending, and other pertinent vestiges of the Division of Energy from the Missouri Department of Natural Resources to the Missouri Department of Economic Development…" The Division of Energy will be referred to as DED/DE.

In addition, GDS has assisted the DED/DE with the issuance of requests for data and reviewed Empire's responses to these data requests.

This report provides the DED/DE with GDS's comments on Empire's compliance filing in Case EO-2013-0547. In the report, we identify and discuss the deficiencies in Empire's filing and recommend remedies to those deficiencies.

This report references the following Empire sources:

- The primary narrative volumes included in Empire's July 2013 Integrated Resource Plan (IRP) filing, referenced by the Volume; and
- Empire's responses to DED/DE data requests, referenced by data request number.

All other sources used by GDS in the preparation of this report are referenced in the report footnotes.

2.0 SUMMARY OF DEFICIENCIES

After reviewing the Load Forecasting and Demand Side Resources sections of Empire's 2013 IRP filing, including supporting documentation, information provided in the discovery process and the requirements of 4 CSR 240-22, GDS has identified the following deficiencies which it brings to the attention of the DED/DE. Following the description of each listed deficiency is an identification of the relevant section of 4 CSR 240-22 to which the deficiency applies. A discussion of each deficiency and a proposed remedy can be found in Sections 3 and 4 of this report.

DEFICIENCY #1 - EMPIRE FAILED TO FULLY ADDRESS AND DOCUMENT ITS ANALYSIS OF THE IMPACT OF EXISTING DSM PROGRAMS AND DSM RATES ON ITS LOAD FORECAST

GDS understands that explicit adjustments for historical DSM programs and DSM rates were not made to historical energy sales and peak demands for modeling purposes. The forecast assumes that these impacts are included in the historical data series. However, GDS is concerned that without any accounting of how much historical DSM (energy and peak load impacts) is included in the load forecast, it is unclear if some of the impacts of proposed demand-side programs and rates may already be included in the base case forecast. (4 CSR 240-22.030(1)(C), 4 CSR 240-22.030(7))

DEFICIENCY #2 - EMPIRE'S REPORTING OF WEATHER NORMALIZED SUMMER AND WINTER PEAK DEMANDS SHOULD REFLECT THE NORMAL PEAKING WEATHER CONDITIONS FOR THE SEASON RATHER THAN FOR THE MONTH IN WHICH THE PEAK OCCURS

Empire should report weather adjusted peak demands for the winter and summer seasons based on normal peaking weather conditions for the entire season rather than for the month in which the peak occurs. Such reporting of peaks would provide a better basis for comparing historical and projected peak demands for the summer and winter seasons. (4 CSR 240-22.030(7))

DEFICIENCY #3 – EMPIRE'S FORECAST SCENARIOS REFLECT TOO NARROW A RANGE OF UNCERTAINTY REGARDING THE ECONOMIC SERIES INPUTS

GDS is not concerned with the process Empire followed in developing the forecast scenarios; rather, the concern is that the forecast scenarios based on the high and low economic outlooks reflect too narrow a range between the two scenarios. This is due to the narrow ranges between the high and low forecasts of the economic inputs. (4 CSR 240-22.030(8))

DEFICIENCY #4 – EMPIRE'S IRP DOES NOT DESCRIBE HOW ITS POTENTIAL DSM RESOURCES WILL PROVIDE COVERAGE OF ALL SIGNIFICANT DECISION-MAKERS

In response to the rule requiring that its potential DSM programs provide coverage of all significant decision makers, Empire states that it meets regularly with an Advisory Group to review Empire's proposed demand side management programs, discuss opportunities for energy efficiency, and receive feedback. It is unclear how regular meetings with an Advisory

Group satisfies the requirement that Empire identify a set of potential demand side resources that provide coverage of all significant decision makers including at least those who choose building design features and thermal integrity levels, equipment and appliance efficiency levels, and utilization levels of the energy-using capital stock. (4 CSR 240-22.050(1)(A)(2))

DEFICIENCY #5 – EMPIRE'S DSM PROGRAM PORTFOLIO DOES NOT EFFECTIVELY COVER THE FULL SPECTRUM OF COST-EFFECTIVE END-USE MEASURES.

While Empire's proposed demand-side programs do address all major market segments, the AEG potential study which supported the development of Empire's potential DSM programs does not broadly cover the full spectrum of end-use measures applicable to these market segments. (4 CSR 240-22.050(1))

DEFICIENCY #6 – EMPIRE'S LOGIC TO DEFEND THE USE OF A 5 YEAR OLD RESIDENTIAL BASELINE STUDY TO INFORM THE DEVELOPMENT OF ITS RESIDENTIAL DSM POTENTIAL ESTIMATES IS FLAWED.

GDS commends Empire on the completion of its baseline studies, but is concerned with the use of a 5 year old residential baseline study to inform the development of its DSM potential estimates. Specifically, GDS is concerned that while appliance saturations and demographics have not changed significantly as noted by Empire[1] it does not follow therefore that that the penetration of energy efficient equipment or the likelihood of a customer participating in a Empire program has not changed. (4 CSR 240-22.050(2) and (3))

DEFICIENCY #7 – EMPIRE'S REVIEW OF DEMAND-SIDE PROGRAMS THAT HAVE BEEN IMPLEMENTED BY OTHER UTILITIES DOES NOT IDENTIFY PROGRAMS THAT WOULD BE APPLICABLE FOR EMPIRE AS REQUIRED BY THE RULE.

On page 5-69 of its IRP Empire states that in order to fulfill this requirement of the IRP rule, it analyzed the demand-side portfolios of six utilities. Empire further states that through this research, it discovered that the set of candidate DSM programs from this IRP does have many commonalities with those of the other utilities that were considered. GDS agrees that there are many commonalities, but there are also many differences. Empire provides no explanation of why programs being offered by other utilities that it identifies as not being offered or planned by Empire are not applicable for Empire. (4 CSR 240-22.050(3)(A))

DEFICIENCY #8 – EMPIRE DOES NOT PROVIDE ANY DESCRIPTIONS OF MAJOR MARKET SEGMENTS, IDENTIFY DECISION-MAKERS OR DESCRIBE PRIMARY MARKET IMPERFECTIONS THAT ARE COMMON TO THE MEMBERS OF THE MARKET SEGMENT AS REQUIRED BY THE RULE

While Empire did identify major market segments in its IRP it did not provide any descriptions, identify decision-makers or describe primary market imperfections that are common to the members of the market segment as required by the rule. This information will help Empire

[1] As stated by Empire in IRP Volume 5, p. 28: *A comparison of the 2008 Energy Management Survey sample to the 2010 U.S. Census demonstrates that there has not been a significant change in residential demographics and a new residential baseline study is unnecessary at this time.*

design programs that better target decision makers and address market barriers. (4 CSR 240-22.050(3)(B))

DEFICIENCY #9 – EMPIRE PRESENTS AN UNSUPPORTED CONCLUSION REGARDING HOW ANTICIPATED ADVANCEMENTS IN METERING AND DISTRIBUTION TECHNOLOGIES DURING THE PLANNING HORIZON WILL AFFECT ITS ABILITY TO IMPLEMENT OR DELIVER POTENTIAL DEMAND-SIDE PROGRAMS.

Empire presents only a single paragraph in its IRP to support its conclusion regarding advanced metering and distribution technologies. Moreover, it presents an unsupported conclusion that current and future advanced technologies that can reasonably be anticipated to surface during the planning horizon are costly, and if utilized would have an impact on customer rates and could impact the cost effectiveness of the demand-side program. While this could be one possible outcome, Empire presents no research or analysis that describes and documents such a conclusion. (4 CSR 240-22.050(3)(D))

3.0 LOAD ANALYSIS AND FORECASTING

Consistent with the requirements of 4 CSR 240-22.030 related to the preparation of energy and peak load forecasts, Empire has prepared a range of forecasts out to the year 2032. These energy and peak load forecasts provide the basis for estimating the utility's future supply resource needs and also provide the load information needed to perform its demand-side resource analysis. Empire presents its load analysis and discusses the forecast methodology employed in Volume 3 of the 2013 Integrated Resource Plan.

Although Empire has been diligent in its compliance with overall requirements of 4 CSR 240-22.030 and has improved its overall forecasting since the last IRP filing, GDS has identified some deficiencies relating to consideration of DSM in the load forecast, weather normalization and forecast scenarios.

The observed deficiencies and proposed remedies in Empire's load analysis and forecast are discussed below.

DEFICIENCY #1 – EMPIRE FAILED TO FULLY ADDRESS AND DOCUMENT ITS ANALYSIS OF THE IMPACT OF EXISTING DSM PROGRAMS ON ITS LOAD FORECAST

4 CSR 240-22.030(1)(C) states that the utility is 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.

4 CSR 240-22.030(7) states that 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.

DISCUSSION

Empire states on page 3-72 of its IRP that IRP forecasts also include the impacts of existing DSM programs. However GDS found no discussion or documentation to support this statement. Similarly, Empire did not perform any analysis of implemented demand-side programs and demand-side rates that are specifically quantified in the load forecast. In response to Data Request No. DED/DE Empire 001-10, Empire stated the following:

> *Explicit adjustments for historical DSM and energy efficiency programs were not made to historical energy sales and peak demands for modeling purposes. The forecast assumes that these impacts are included in the historical data series. When modeling, the regression model will adjust the independent variables to capture historical relationships between the independent and dependent variables assuming the historical relationships will continue in the future. To the*

> *extent that historical DSM and/or energy efficiency programs have been funded in the past and are included in the historical dependent variable, the models assume a similar level of program impacts will continue in the future.*

GDS is concerned that without any accounting of how much historical DSM is included in the load forecast, it is unclear if some of the load impacts of proposed demand-side programs and rates may already be included in the base case forecast.

REMEDY

GDS recommends that Empire should commit to the following action:

In the next triennial compliance IRP filing Empire should summarize the impacts of existing demand-side programs and rates on the load forecast. Empire should perform sufficient analysis, or draw upon analysis performed by its load forecast consultant to provide reasonable estimates of DSM program and DSM rate impacts for the historical data series upon which the load forecast is based.

DEFICIENCY #2 – EMPIRE'S REPORTING OF WEATHER NORMALIZED SUMMER AND WINTER PEAK DEMANDS SHOULD REFLECT THE NORMAL PEAKING WEATHER CONDITIONS FOR THE SEASON RATHER THAN FOR THE MONTH IN WHICH THE PEAK OCCURS

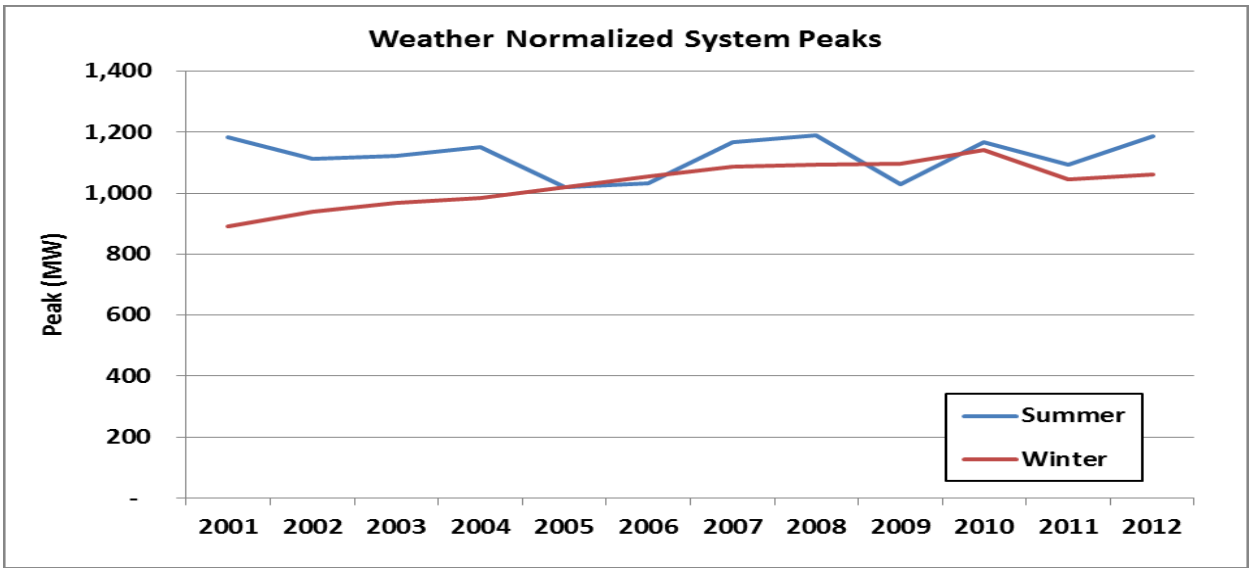
4 CSR 240-22.030(7) states that the utility's base-case load forecast shall be based on projections of the independent variables that utility decision-makers believe to be most likely. All components of the base-case load forecast shall assume normal weather conditions. The load impacts of implemented 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.

DISCUSSION

Empire should report weather adjusted peak demands for the winter and summer seasons based on normal peaking weather conditions for the entire season rather than for the month in which the peak occurs. Such reporting of peaks would provide a better basis for comparing historical and projected peak demands for the summer and winter seasons.

Figure 1 on the following page presents weather normalized system peak demands for the summer and winter seasons as reported by Empire in Volume 3, page 3-18, Figure 3-9 of its IRP. The graph indicates that weather adjusted summer peak series has fluctuated over time and that the values for 2005, 2006, and 2009 appear to be inconsistent with those in other years. As explained by Empire in response to DED/DE Empire 001-4 and 18, weather adjustments for the summer and winter peaks are developed by adjusting the monthly peaks (12 values per year) using normal peaking temperatures for each respective month.

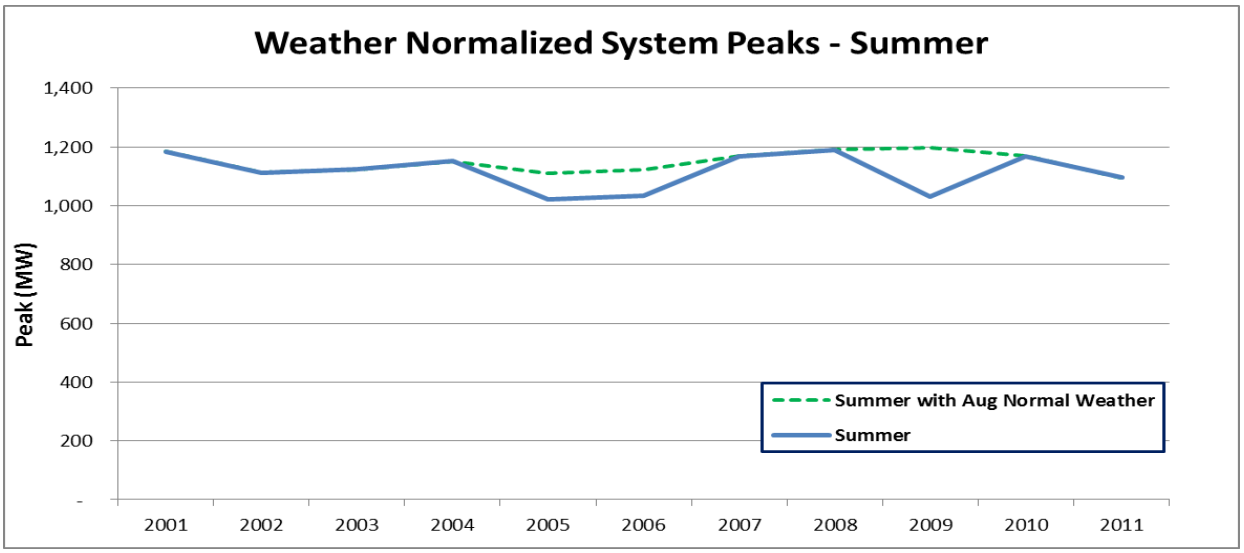
Figure 1
Weather Normalized System Peaks



Empire reports that the summer peaks in 2005 and 2006 occurred in July and are normalized based on a normal peak producing weather in July. The summer peak in 2009 occurred in June and is based on the normal peak producing weather in June. During all other years, the summer peak occurs in August and is based on the normal peak producing weather in August. Empire states in response to DED/DE Empire 001-4 that the large changes in the summer peaks are due to the varying months of the summer peak and the associated monthly normal weather.

Figure 2 compares the weather adjusted peaks from Figure 1 (blue) to normal summer peaks based on the normal peaking conditions for the summer, which occur in August (green dotted).

Figure 2
Weather Normalized System Peaks (based on August normal peaking temperature)



The weather adjusted peaks based on a consistent normal peaking temperature across all years demonstrate what the summer peak for each year would have been during normal peaking conditions for the entire summer and provide a better basis of comparison to projected annual summer peak demands, which reflect the same normal temperature.

REMEDY

GDS recommends that Empire should commit to the following action:

In the next triennial compliance IRP filing Empire should compute weather normalized peak demands using the most extreme normal peaking weather conditions for the summer and winter seasons rather than the values for individual months.

DEFICIENCY #3 – EMPIRE'S FORECAST SCENARIOS REFLECT TOO NARROW A RANGE OF UNCERTAINTY REGARDING THE ECONOMIC SERIES INPUTS

4 CSR 240-22.030(8) states that 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(6)(A).

DISCUSSION

Empire developed forecast scenarios to demonstrate the impacts of high/low economic conditions and extreme/mild weather conditions. The alternative economic outlook scenarios were provided by Moody's Analytics and Itron, Inc. Empire obtained a base case and low case economic outlook from Moody's. The high case outlook was developed by Itron based on differences between the base case and low case. The forecast scenarios based on extreme and mild weather were based on weather inputs developed by Empire.

GDS is not concerned with the process Empire followed in developing the forecast scenarios; rather, the concern is that the forecast scenarios based on the high and low economic outlooks reflect too narrow a range between the two scenarios. This is due to the narrow ranges between the high and low scenarios for the economic inputs.

Table 1 presents the average annual growth rates of the models' economic inputs for the forecast scenarios. There is no difference in projected population growth between the base, high, and low scenarios, and the difference in growth rates for the other variables is minimal.

Table 1
2013-2030 Average Annual Growth Rates

Economic Driver	Base	High	Low
Real Personal Income	**2.11%**	**2.54%**	**1.76%**
Households	**0.53%**	**0.58%**	**0.48%**
Population	**0.56%**	**0.56%**	**0.56%**
Employment	**0.93%**	**1.07%**	**0.79%**
Gross State Product	**2.64%**	**2.78%**	**2.49%**

A review of changes in each of the economic variables for years 1990-2012 is presented in Table 2. Additionally, the standard deviation for the annual growth rate is presented for each variable.

Table 2
Historical and Projected Average Annual Growth Rates – Base Case Forecast[2]

	Real Personal Income	Households	Population	Employment	Gross State Product
1990	**3.32%**	**1.10%**	**0.89%**	**1.19%**	**2.84%**
1991	**1.59%**	**1.26%**	**1.03%**	**2.45%**	**-0.97%**
1992	**4.05%**	**1.25%**	**1.02%**	**3.87%**	**6.32%**
1993	**4.05%**	**1.24%**	**1.01%**	**2.81%**	**6.23%**
1994	**2.49%**	**1.22%**	**0.99%**	**1.74%**	**3.68%**
1995	**4.57%**	**1.17%**	**0.94%**	**3.25%**	**6.55%**
1996	**4.91%**	**1.02%**	**0.79%**	**2.28%**	**4.24%**
1997	**3.20%**	**0.95%**	**0.72%**	**1.69%**	**3.80%**
1998	**4.12%**	**1.04%**	**0.79%**	**1.86%**	**2.03%**
1999	**2.72%**	**0.79%**	**0.66%**	**0.46%**	**2.16%**
2000	**1.50%**	**0.72%**	**0.62%**	**-0.57%**	**2.00%**
2001	**0.91%**	**0.68%**	**0.57%**	**-0.53%**	**1.50%**
2002	**2.02%**	**0.79%**	**0.68%**	**0.18%**	**1.77%**
2003	**0.79%**	**0.89%**	**0.78%**	**1.85%**	**1.78%**
2004	**2.92%**	**1.01%**	**0.90%**	**2.01%**	**2.18%**

[2] Empire's response to DED/DE Empire 001-14.

	Real Personal Income	Households	Population	Employment	Gross State Product
2005	**2.96%**	**0.93%**	**0.82%**	**1.41%**	**1.21%**
2006	**3.92%**	**0.91%**	**0.80%**	**0.96%**	**3.54%**
2007	**-1.36%**	**0.69%**	**0.58%**	**-2.01%**	**-3.04%**
2008	**-2.11%**	**0.58%**	**0.47%**	**-1.73%**	**2.36%**
2009	**2.70%**	**0.66%**	**0.54%**	**0.33%**	**1.95%**
2010	**0.57%**	**1.04%**	**0.62%**	**0.14%**	**2.67%**
2011	**4.69%**	**1.04%**	**0.58%**	**1.07%**	**3.74%**
2012	**3.60%**	**0.91%**	**0.58%**	**2.13%**	**3.65%**
1990-2012	**2.46%**	**0.95%**	**0.76%**	**1.11%**	**2.64%**
Std. Dev.	**1.84%**	**0.20%**	**0.17%**	**1.48%**	**2.15%**
2012-2030	**2.08%**	**0.52%**	**0.56%**	**0.91%**	**2.62%**

The growth rates corresponding to the economic variables for the base case represent the expected, or most likely, economic outlook. Empire needs to perform a more thorough analysis of the uncertainty associated with these projected growth rates.

GDS performed a simulation using the historical growth rates to compute the amounts presented in Table 3. The high and low annual average growth rates are equal to the base case values plus or minus one standard deviation of the simulated long-term historical growth rates. The simulation is based on 1,000 trials of a model that produces long-term historical growth rates for each variable. The long-term growth rate for each trial is computed as the average of growth rates randomly selected from ten historical years. Summary results of the simulation are presented in Table 4.

Table 3
2013-2030 Average Annual Growth Rates
Recommended by GDS

Economic Driver	Base	High	Low
Real Personal Income	**2.11%**	**2.72%**	**1.50%**
Households	**0.53%**	**0.60%**	**0.46%**
Population	**0.56%**	**0.62%**	**0.50%**
Employment	**0.93%**	**1.42%**	**0.44%**
Gross State Product	**2.64%**	**3.34%**	**1.94%**

Table 4
Simulation Results

Statistics	Real Personal Income	Households	Population	Employment	Gross State Product
Trials	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Mean	**2.45%**	**0.95%**	**0.76%**	**1.11%**	**2.63%**
Median	**2.49%**	**0.95%**	**0.76%**	**1.13%**	**2.64%**
Standard Deviation	**0.61%**	**0.07%**	**0.06%**	**0.49%**	**0.70%**
Variance	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**
Skewness	**-0.4442**	**-0.1291**	**-0.0470**	**-0.2434**	**-0.2574**
Kurtosis	**3.39**	**2.73**	**2.72**	**3.07**	**3.34**
Coeff. of Variability	**0.2498**	**0.0705**	**0.0725**	**0.4386**	**0.2648**
Minimum	**-0.09%**	**0.73%**	**0.60%**	**-0.59%**	**0.10%**
Maximum	**4.02%**	**1.14%**	**0.94%**	**2.62%**	**4.87%**
Range Width	**4.12%**	**0.41%**	**0.34%**	**3.21%**	**4.77%**
Mean Std. Error	**0.02%**	**0.00%**	**0.00%**	**0.02%**	**0.02%**

REMEDY

GDS recommends that Empire should commit to the following action:

In the next triennial compliance IRP filing Empire should include load forecast scenarios that represent a broader range of projected growth rates on the economic inputs.

4.0 DEMAND SIDE RESOURCES

Consistent with the requirements of 4 CSR 240-22.050 related to the methods by which demand-side resources shall be developed, analyzed and evaluated, Empire has used the results of its DSM Market Potential Study conducted by Applied Energy Group (AEG) to develop a range of potential DSM portfolios for evaluation in the IRP, including its Planned Portfolio. The Planned Portfolio is defined by AEG as "the realistically achievable portfolio (RAP) that Empire proposes implementing for program years 2013 through 2015."[3] It is this Planned Portfolio that Empire has included in its preferred plan (Plan 2).

Although Empire has been diligent in its compliance with overall requirements of 4 CSR 240-22.050, GDS has found some deficiencies regarding comprehensiveness and market coverage of the proposed DSM portfolio, estimated program participation levels, end use measures analyzed and assessment of the impacts of metering and distribution technologies.

The observed deficiencies and proposed remedies in Empire's consideration of demand-side resources in its 2013 IRP are discussed below.

DEFICIENCY #4 – EMPIRE'S IRP DOES NOT DESCRIBE HOW ITS POTENTIAL DSM RESOURCES WILL PROVIDE COVERAGE OF ALL SIGNIFICANT DECISION-MAKERS

4 CSR 240-22.050(1)(A)(2) states that the utility shall identify a set of potential demand-side resources from which demand-side candidate resource options will be identified for the purposes of developing the alternative resource plans required by 4 CSR 240-22.060(3). A potential demand-side resource consists of a demand-side program designed to deliver one (1) or more energy efficiency and energy management measures or a demand-side rate. The utility shall select the set of potential demand-side resources and describe and document its selection — To provide coverage of: All significant decision-makers, including at least those who choose building design features and thermal integrity levels, equipment and appliance efficiency levels, and utilization levels of the energy-using capital stock.

DISCUSSION

In response to this rule Empire states that it meets regularly with an Advisory Group to review Empire's proposed demand side management programs, discuss opportunities for energy efficiency, and receive feedback. The Advisory Group includes, but is not limited to, the Missouri Public Service Commission Staff (MPSC Staff); the Office of the Public Counsel; Department of Economic Development - Division of Energy (MDED – DE, previously MDNR-Division of Energy), Dogwood Energy and an industrial customer. It is unclear how regular meetings with an Advisory Group satisfies the requirement that Empire identify a set of potential demand side resources that provide coverage of all significant decision makers including at least those who choose building design features and thermal integrity levels, equipment and appliance efficiency levels, and utilization levels of the energy-using capital stock.

REMEDY

[3] Empire 2013 IRP, Volume 5, Demand Side Resource Analysis, p. 168.

GDS recommends that Empire commit to the following action:

To address this deficiency, while this case is pending, and prior to any agreement of the parties in Case EO-2013-0547 Empire should provide a written explanation of how its proposed DSM portfolio will provide coverage of all significant decision makers including at least those who choose building design features and thermal integrity levels, equipment and appliance efficiency levels, and utilization levels of the energy-using capital stock.

DEFICIENCY #5 – EMPIRE'S DSM PROGRAM PORTFOLIO DOES NOT EFFECTIVELY COVER THE FULL SPECTRUM OF END-USE MEASURES FOR ALL CUSTOMER MARKET SEGMENTS

4 CSR 240-22.050(1) states that the utility shall identify a set of potential demand-side resources from which demand-side candidate resource options will be identified for the purposes of developing the alternative resource plans required by 4 CSR 240-22.060(3). A potential demand-side resource consists of a demand-side program designed to deliver one (1) or more energy efficiency and energy management measures or a demand-side rate. The utility shall select the set of potential demand-side resources and describe and document its selection

(A) To provide broad coverage of—

1. Appropriate market segments within each major class;

2. All significant decision-makers, including at least those who choose building design features and thermal integrity levels, equipment and appliance efficiency levels, and utilization levels of the energy-using capital stock; and

3. All major end uses, including at least the end uses which are to be considered in the utility's load analysis as listed in 4 CSR 240-22.030(4)(A)1.;

(B) To fulfill the goal of achieving all cost effective demand-side savings, the utility shall design highly effective potential demand-side programs consistent with subsection(1)(A) that broadly cover the full spectrum of cost-effective end-use measures for all customer market segments;

4 CSR 240-22.050(3)(C) states that the utility should identify a comprehensive list of end-use measures and demand-side programs considered by the utility and develop menus of end-use measures for each demand-side program. The demand-side programs shall be appropriate to the shared characteristics of each market segment. The end-use measures shall reflect technological changes in end-uses that may be reasonably anticipated to occur during the planning horizon.;

DISCUSSION

While Empire's proposed demand-side programs do address all major market segments, the AEG potential study which supported the development of Empire's potential DSM programs does not broadly cover the full spectrum of end-use measures applicable to these market segments. Specifically, the following commercially available energy efficiency measures were not included in the AEG potential study:

Residential Measures

- Energy Star Freezers
- Lighting Occupancy Sensors

C&I Measures

- LED Lighting Fixtures (Interior and Exterior)
- Ductless Mini-Split Heat Pump
- Building Shell Measures
- Demand Controlled Ventilation
- Pool Measures (Pumps, Controls, Heat Pump Water Heating)
- Refrigeration Heat Recovery Water Heating
- Energy Management Systems
- Programmable Thermostats
- Commercial Cooking Equipment
- Commercial Refrigeration Economizers, Motor Controls, Door Heater Controls, Zero Energy Doors and Efficient Compressors

Empire states on page 5-72 of its IRP filing that AEG identified a comprehensive list of end-use measures for each market segment from the 2008 Energy Management Survey, 2010 Commercial and Industrial Baseline Study, technical reference manuals, and input from Empire's Advisory Group. AEG considered and assessed improved technologies that may be reasonably anticipated to occur during the planning horizon. While the process of reviewing surveys, baseline studies and TRMs, and working with Empire's Advisory Group and AEG is a reasonable approach for developing a comprehensive list of end-use measures, it is unclear why many measures that are typically included in DSM potential studies and program planning efforts were overlooked.

GDS is particularly concerned that C&I measures such as LED lighting fixtures and LED retrofit kits were not included in the C&I end use measures identified on page 5-96 of Empire's IRP. The following commercially available LED lighting measures are not included in Empire's C&I measure list:

- LED Retrofit Kits (for Streetlights, Parking Lot Lights and Fuel Pump Canopy Fixtures)
- LED Outdoor Area Fixture
- LED Wallpack
- LED Parking Garage Fixture
- LED Fuel Pump Canopy Fixtures
- LED Downlight
- LED Flood & Spot Light Fixtures
- LED Refrigerated Case Fixture

Prescriptive incentives for all of the above LED measures are included in programs such as the Efficiency Maine Business program.[4]

In addition to the above LED measures, programs such as New Jersey Smart Start Buildings[5] are now offering prescriptive incentives for LED Panels that can replace fluorescent fixtures in offices, schools, hospitality, healthcare and other commercial and industrial applications.

REMEDY

GDS recommends that Empire commit to the following actions:

a. In the next required annual update filing Empire should include a cost effectiveness analysis of the LED lighting measures identified in the above Discussion and present a recommendation regarding the inclusion of prescriptive incentives for such measures in its C&I Energy Efficiency Rebate Program; and

b. In the next triennial compliance IRP filing Empire should include a revised potential study that includes a more complete list of commercial available energy efficiency measures plus those measures that may be reasonably anticipated to be available during the planning horizon.

DEFICIENCY #6 – EMPIRE'S LOGIC TO DEFEND THE USE OF A 5 YEAR OLD RESIDENTIAL BASELINE STUDY TO INFORM THE DEVELOPMENT OF ITS RESIDENTIAL DSM POTENTIAL ESTIMATE IS FLAWED.

4 CSR 240-22.050(2) states that the utility shall conduct, describe, and document market research studies, customer surveys, pilot demand-side programs, pilot demand-side rates, test marketing programs, and other activities as necessary to estimate the maximum achievable potential, technical potential, and realistic achievable potential of potential demand-side resource options for the utility and to develop the information necessary to design and implement cost-effective demand-side programs and demand-side rates. These research activities shall be designed to provide a solid foundation of information ***applicable to the utility*** *about how and by whom energy-related decisions are made and about the most appropriate and cost-effective methods of influencing these decisions in favor of greater long-run energy efficiency and energy management impacts. The utility may compile existing data or adopt data developed by other entities, including government agencies and other utilities,* **as long as the utility verifies the applicability of the adopted data to its service territory.** *The utility shall provide copies of completed market research studies, pilot programs, pilot rates, test marketing programs, and other studies as required by this rule and descriptions of those studies that are planned or in progress and the scheduled completion dates. (****Emphasis added****)*

4 CSR 240-22.050(3) states that the utility shall develop potential demand-side programs that are designed to deliver an appropriate selection of end-use measures to each market segment. The utility shall describe and document its potential demand-side program planning and design process which shall include at least the following activities and elements.

[4] http://www.efficiencymaine.com/docs/Prescriptive_Retrofit_Lighting_Measure_Codes.pdf
[5] http://www.njcleanenergy.com/files/file/NJSSB%202013%20Applications/010-011%20Prescriptive%20Lighting%20-%201-31-13.pdf

DISCUSSION

Empire's IRP identifies two baseline studies that informed its DSM potential study and development of its DSM portfolio. One of these studies is a 2008 Energy Management Survey that Empire commissioned to assist in efforts to develop effective energy efficiency programs and promote energy efficiency among residential customers. A total of 1,960 residential customers within Empire's Missouri, Arkansas, Kansas and Oklahoma service territory completed the four-page questionnaires. The survey included questions on general household characteristics, heating and cooling equipment, appliances, water usage, and energy management. GDS commends Empire on the execution of these baseline studies, but is concerned with the use of a 5 year old residential baseline study to inform the development of its DSM potential estimates. Specifically, GDS is concerned that while appliance saturations and demographics have not changed significantly as noted by Empire[6] it does not follow therefore that that the penetration of energy efficiency measures or the likelihood of a customer participating in a Empire program has not changed.

It is not clear to GDS what the implications of using a 5 year old study are on the potential results because Empire does not provide any details on how the study was used to determine the current saturation of energy efficient equipment in the residential sector or the expected market penetration rates of energy efficiency measures included in the potential analysis. For example, 1(b) in Data request DED/DE Empire 003 asked: *How were estimates of measure level program participation and savings developed?*

Empire's response (which was provided by the Applied Energy Group) is as follows:

Program participation estimates were derived from historic participation, the 2008 Energy Management Survey, 2010 Commercial and Industrial Baseline Study, and realistic implementation conditions.

More information regarding the specific survey data that was used and how it was used to determine participation levels should be provided in the IRP.

REMEDY

GDS recommends that Empire commit to the following action:

To address this deficiency, while this case is pending, and prior to any agreement of the parties in Case EO-2013-0547, Empire should provide a written explanation of how the 2008 Energy Management Survey was used in the DSM Potential Study including:

- Specific survey results that were used, and
- How this data was used in the methodology that was employed by AEG to estimate program participation levels.

[6] As stated by Empire in IRP Volume 5, p. 28: *A comparison of the 2008 Energy Management Survey sample to the 2010 U.S. Census demonstrates that there has not been a significant change in residential demographics and a new residential baseline study is unnecessary at this time.*

DEFICIENCY #7 – EMPIRE'S REVIEW OF DEMAND-SIDE PROGRAMS THAT HAVE BEEN IMPLEMENTED BY OTHER UTILITIES DOES NOT IDENTIFY PROGRAMS THAT WOULD BE APPLICABLE FOR EMPIRE AS REQUIRED BY THE RULE.

4 CSR 240-22.050(3)(A) states that the utility should review demand-side programs that have been implemented by other utilities with similar characteristics and identify programs that would be applicable for the utility.

DISCUSSION

On page 5-69 of its IRP Empire states that in order to fulfill this requirement of the IRP rule, it analyzed the demand-side portfolios of six utilities. Empire further states that through this research, it discovered that the set of candidate DSM programs from this IRP does have many commonalities with those of the other utilities that were considered. GDS agrees that there are many commonalities, but there are also many differences. Table 5-31 - Survey of Comparable EE Portfolios on page 5-70 of the IRP shows that Empire's DSM portfolio does not include the following programs:

Program	Custome	Utilities Participating	Empire
Direct Load Control	Residential	Otter Tail	No
Water Heating	Residential	Otter Tail	No
Thermal Storage Systems	Residential	Otter Tail	No
AC Cycling	Residential	Otter Tail	No
On-Bill Financing	Residential	Otter Tail	No
Low-Income Weatherization (Independent)	Residential	Ameren (MO), OG&E	No
Room AC	Residential	Ameren (MO)	No
Energy Star® New Homes	Residential	Ameren (MO), OG&E	No
Free Audit	Residential	Ameren (MO)	No
Home Performance with Energy Star®	Residential	KCP&L, GMO	No
Solar PV Installation	Residential	KCP&L, GMO	No
Free AC Tune-up/Duct Repair	Residential	OG&E	No
Energy-Efficient New Homes Discount	Residential	Cleco	No
Commercial Design Assistance	C&I	Otter Tail	No
Recommissioning & Retrocommissioning	C&I	Otter Tail, Ameren (MO)	No
EE Improvement Grants	C&I	Otter Tail	No
Plan Review Program	C&I	Otter Tail	No
Peak Pricing Plan	C&I	OG&E	No

Empire provides no explanation of why each of these programs is not applicable for the Empire service area. For example, KCP&L and GMO offer Home Performance with Energy Star which is more comprehensive than Empire's Residential Whole House Efficiency Program. Home Performance with Energy Star is currently offered in 32 states.[7] Also Recommissioning and Retro-commissioning programs offered by Otter Tail, Ameren MO and many other utilities encourage building owners to fine tune a building's electrical, mechanical, and control systems so they operate at optimal efficiency. This process of monitoring, troubleshooting, and adjusting systems in existing buildings can significantly reduce overall energy consumption with minimal financial investment.

[7] http://www.energystar.gov/index.cfm?fuseaction=hpwes_profiles.showFindaProgram

Empire also claims in its utility program comparison table on page 5-70 of its IRP that it offers a C&I new construction program like Ameren Missouri. However Empire does not have either an existing or planned program that helps building owners, builders, developers, architects and engineers design more efficient buildings. For example, Ameren Missouri's Whole Building Performance Incentives provide cash incentives to fund energy modeling in order to accurately quantify potential energy savings and determine the financial viability of efficiency upgrades for the new facility. Energy modeling is often a requirement for LEED™ certification, though LEED™ certification is not a requirement to participate in Ameren Missouri's program.

REMEDY

GDS recommends that Empire commit to the following action:

> To address this deficiency, while this case is pending, and prior to any agreement of the parties in Case EO-2013-0547, Empire should provide a written explanation of why each of the above programs is not applicable to Empire.

DEFICIENCY #8 – EMPIRE DOES NOT PROVIDE ANY DESCRIPTIONS OF MAJOR MARKET SEGMENTS, IDENTIFY DECISION-MAKERS OR DESCRIBE PRIMARY MARKET IMPERFECTIONS THAT ARE COMMON TO THE MEMBERS OF THE MARKET SEGMENT AS REQUIRED BY THE RULE

4 CSR 240-22.050(3)(B) states that the utility should identify, describe, and document market segments that are numerous and diverse enough to provide relatively complete coverage of the major classes and decision-makers identified in subsection (1)(A) and that are specifically defined to reflect the primary market imperfections that are common to the members of the market segment;

DISCUSSION

While Empire does identify major market segments on page 5-71 of its IRP it did not provide any descriptions, identify decision-makers or describe primary market imperfections that are common to the members of the market segment as required by the rule. This information will help Empire design programs that better target decision makers and address market barriers.

The National Action Plan for Energy Efficiency states:[8]

> *Energy efficiency programs should complement, rather than compete with, private and other existing markets for energy efficient products and services. The rationale for utility or third-party investment in efficiency programming is usually based on the concept that within these markets, there are barriers that need to be overcome to ensure that an efficient product or service is chosen over a less efficient product or standard practice. Barriers might include higher initial cost to the consumer, lack of knowledge on the part of the supplier or the customer, split incentives between the tenant who pays the utility bills and the landlord who owns the building, lack of supply for a product or service, or lack of time (e.g., to research efficient options, seek multiple bids—particularly during emergency replacements).*

[8] National Action Plan for Energy Efficiency, U.S. DOE and U.S. EPA, July 2006, p.6-30

Understanding how markets function, including who makes decisions and what barriers decision makers face, is critical to successful program design and implementation.

REMEDY

GDS recommends that Empire commit to the following action:

In the next triennial compliance IRP filing Empire should fully comply with rule 4 CSR 240-22.050(3)(B) by providing description of each market including identification of decision makers and primary market imperfections common to members of the market.

DEFICIENCY #9 – EMPIRE PRESENTS AN UNSUPPORTED CONCLUSION REGARDING HOW ANTICIPATED ADVANCEMENTS IN METERING AND DISTRIBUTION TECHNOLOGIES DURING THE PLANNING HORIZON WILL AFFECT ITS ABILITY TO IMPLEMENT OR DELIVER POTENTIAL DEMAND-SIDE PROGRAMS.

4 CSR 240-22.050(3)(D) states that the utility should assess how advancements in metering and distribution technologies that may be reasonably anticipated to occur during the planning horizon affect the ability to implement or deliver potential demand-side programs.

DISCUSSION

Empire's IRP states on page 5-110 that:

Advancements in metering and distribution technologies, such as two-way communicating meters and programmable thermostats, allow utilities to communicate real-time with the customer and provide customers with a better understanding of their energy consumption. These advanced technologies, and those that can reasonably be anticipated to surface during the planning horizon are costly, and if utilized would have an impact on customer rates and could impact the cost effectiveness of the demand-side program. These technologies are not currently prevalent throughout Empire's territory but could improve demand-side programs, particularly customer behavior programs.

This single paragraph is the only assessment that is presented by Empire. Moreover, it presents an unsupported conclusion that current and future advanced technologies that can reasonably be anticipated to surface during the planning horizon are costly, and if utilized would have an impact on customer rates and could impact the cost effectiveness of the demand-side program. While this could be one possible outcome, Empire presents no research or analysis that describes and documents such a conclusion. There are numerous publicly available research reports and papers on this topic that Empire could have accessed and reported on in its IRP. For example a paper by Navigant Consulting[9] concluded that a number of Smart Grid enabled mechanisms hold great promise for improving residential energy efficiency efforts. The paper concluded that:

- Smart Grid technologies will provide *disaggregated information about household loads that* can be leveraged to identify and monitor energy efficiency opportunities.

[9] Impacts of Smart Grid Technologies on Residential Energy Efficiency E. Gilbert, R. Maslowski, S. Schare, and K. Cooney, Navigant Consulting, 2010

- Significant reductions in electricity usage can be achieved through a multitude of *customer feedback mechanisms*, although uncertainty surrounds the likely magnitude of the energy savings.
- More detailed data available for billing analysis and the analysis of typical energy use patterns will enable better tracking of savings from energy efficiency programs and *enhanced M&V of DSM programs*.
- The two-way communications and disaggregated load data provided by Smart Grid technologies would permit utilities and customers to benchmark equipment performance against a nominal performance rating and isolate abnormal operations due to maintenance or equipment failure issues. This would essentially allow for *automated system and equipment diagnostics*, which have never been available previously.
- *Automated monitoring and control* may result in energy savings through reductions in equipment usage. Permanent reductions can be pre-programmed and automated through a home's Home Area Network (HAN) and "smart" end-use devices, while some demand response events can also result in lasting energy savings.
- Although not traditionally considered in the context of energy efficiency, a Smart Grid enabled distribution system holds considerable potential for energy savings, particularly through *voltage optimization* to reduce distribution line losses using the Smart Grid's monitoring and communication capabilities.

Empire has provided no discussion or assessment of any of the above potential energy efficiency benefits of smart grid.

REMEDY

GDS recommends that Empire commit to the following action:

In the next triennial compliance IRP filing Empire should provide a more extensive assessment of how advancements in metering and distribution technologies that may be reasonably anticipated to occur during the planning horizon will affect its ability to implement or deliver potential demand-side programs. Any conclusions that are reached should be supported by either secondary or primary research such as pilot programs.