GDS Associates, Inc.

Review of the Empire District Electric Company's 2010 Utility Resource Filing Pursuant to CSR 240 - Chapter 22 (Case No. EO-2011-0066)

For the Missouri Department of Natural Resources

PUBLIC VERSION

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On September 3, 2010, pursuant to Chapter 22 of the Missouri's Public Service Commission's Rules (4 CSR 240-22.010 through 4 CSR 240-22.080), the Empire District Electric Company (Empire) filed information in compliance with the Commission's Electric Utility Resource Planning report requirements. Through an order dated June 16, 2010 in Case No. EE-2010-0246, the Commission approved Empire's application for a variance related to the filing certain aspects of the Load Analysis and Forecasting portion of the Integrated Resource Plan. Variances were requested (and granted) related to the requirement to perform end-use forecasting and load analysis as part of the IRP filings and the starting points for data retention for use in the forecast of net system loads and system peak demand. The order also approved Empire's requests for clarifications regarding subclasses and major rate classes.

In turn, the Missouri Department of Natural Resources (MDNR) contracted with GDS Associates, Inc. to identify whether Empire has complied with the provisions of the Electric Utility Resource Planning rules (as modified by waivers) in the following areas: Demand Side Resource Analysis and Screening: Renewable Resource Analysis and Screening; Treatment of demand side resources and renewable resources in developing alternative resource plans, integration analysis, risk analysis, selection of preferred resource plan and development of resource acquisition strategy; DSM implementation and evaluation strategies. In addition, GDS was asked to identify any other deficiencies which it believes would cause the utility's resource acquisition strategy to fail to meet the requirements identified in 4 CSR 240-22.010(2)(A)-(C).

This report provides the MDNR with GDS's comments on Empire's IRP filing. We identify the most significant deficiencies in Empire's filing and recommend remedies to those deficiencies. Even though GDS finds a number of deficiencies with respect to Empire's filing, we would like to commend Empire on its IRP effort. It is noteworthy that Empire engaged the services of the Applied Energy Group (AEG) to perform a conservation potential study for the utility. While not complete, the potential study is an important first step in identifying cost-effective demand-side resources to be included in its integrated resource plan.

This report is organized as follows:

- First, in this section, the major deficiencies associated with Empire's IRP filing are listed.

- Next, GDS's analysis of Empire's IRP filing is provided. Separate sections of the report focus on Load Analysis and Forecasting, Supply-Side Resource Analysis, Demand-Side Resource Analysis, and Integrated Resource Analysis, Risk Analysis and Strategy Selection.
- In each section, specific deficiencies are identified that contribute to Empire's IRP failure to meet the requirements of 4 CSR 240-22.
- Thereafter, recommendations to remedy these deficiencies are offered.

Executive Summary

After reviewing the Empire's filing and information provided in the discovery process to MDNR as well as the requirements of 4 CSR 240-22, GDS wishes to bring a number of deficiencies and concerns to the attention of the MDNR. The deficiencies and proposed remedies are as follows:

Deficiency #1 - Empire's load forecast is not credible

(A) Base Case Load Forecast. Empire's base case forecast is overly optimistic in its expectation of future load growth. The Company's support for its assumptions and statistical models is insufficient. (§22.030(8)(H))

Remedy: Revised filing followed by stakeholder process. Empire should rerun its resource plans with a revised base case load forecast. One possible scenario (which should reflect stakeholder input) would be to used Empire's proposed low growth scenario (i.e., ** [redacted] **) as the base case.

(B) High/Low Load Forecasts. The support for Empire's development of its high and low load growth scenarios is unclear and inadequate. In addition, the basis for the high and low case load forecasts appears to be biased toward stronger growth than can be supported by Empire's analysis. (§22.030(7), §22.060(3), §22.070(2)(A))

Remedy: Revised filing. Empire should rerun its resource plans and risk analysis with different load growth assumptions. Possible scenarios (which should reflect stakeholder input): base case = Empire's proposed low growth scenario (i.e., ** [redacted] **); low case = Empire's historic load growth (i.e., 1.0%); high case = Empire's proposed base case forecast (i.e., ** [redacted] **).

(C) Economic Demographic Drivers. In preparing its load forecast, Empire has not considered any economic or demographic drivers other than customer growth. It has not has taken into account changes in the price of electricity, price of competitive energy sources, or personal income. (§22.030(5)(B)(2)(A), §22.030(6), §22.060(4)(C))

Remedy: Stakeholder process. This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

(D) Sensitivity Analysis. The utility has not provided a summary of the sensitivity analysis required by §22.030(6) that shows how changes in the driver variables affect the forecast. (§22.030(8)(C))

Remedy: Stakeholder process. This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

The basis for GDS's conclusions related to deficiencies in Empire's load forecast are discussed below in our review of Volume II: Load Analysis and Forecasting of Empire's IRP filing, which begins on p. 9.

Deficiency #2 - Demand-side resources have not been treated on an equivalent basis to supply-side resources

(A) Equivalent Treatment of DSM. Empire did not analyze demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process. Empire's DSM portfolio was budget constrained to be no greater than 1% of Empire's 2009 electric revenues. Further, Empire's analysis failed the equivalence requirement with respect to scalability.

Remedy: Revised filing. Empire should be required to estimate program potential with budget constraints that reflect current best-practice, with DSM spending greater than one percent of incremental annual sales. (§22.010(2)(A), §22.060(4)(D), §22.060(3), §22.070(2)(K))

(B) Bottom-Up Analysis. Although the utility estimates related to number of program participants and end-use measure installations and energy savings due to DSM programs, the number of participants appears to be severely budget restrained despite the claim that this is a "bottom-up" analysis. (§22.050(7)(A))

Remedy: Revised filing. Empire should be required to estimate program potential with budget constraints that reflect current best-practice, with DSM spending greater than one percent of incremental annual sales.

(C) End-Use Measures Considered. Empire's portfolio does not include any program directed at consumer electronics or plug loads. Empire's filing is deficient in that its DSM portfolio after 2017 does not include a residential lighting program, even thought lighting accounts for about 15% of residential sales. Significant emphasis is placed on load control measures that have minimal impact on kWh usage. (§22.050(6))

Remedy: Revised filing or stakeholder process. Empire should explain why no residential lighting program is included after 2017. It should justify its omission of measures directed at consumer electronics and plug loads and explain its preference for load control measures.

(D) Interactive Effects. Empire has not provided details of any analysis of interactive effects conducted within the technical potential study. (§22.050(6)(B))

Remedy: Revised filing or stakeholder process. Empire should provide an analysis of interactive effects along with the measure assumptions used to develop the technical potential estimates.

(E) Probable Environmental Benefits Test. A standalone Probable Environmental Benefits Test was not used to screen end-use measures. (22.050(3)(G))

Remedy: Supplemental filing. Empire should provide the results of the Probable Environmental Benefits Test for all end-use measures.

(F) End-Use Measure Assumptions. Empire has not estimated the technical potential of each end-use measure that passes the probable environmental benefits screening test. Further, it should be noted that the estimates submitted in response to MDNR Data Request 39 were provided without the supporting calculations or assumptions. (§22.050(4))

Remedy: Supplemental filing. Empire should provide the results of a standalone PEBT for all end-use measures. Empire should also provide all measure assumptions used to develop the technical potential.

(G) End-Use Measure Technical Potential. Empire has not provided any worksheets or other documentation that show the assumptions that AEG made or how it developed its assessment of the technical, economic and achievable potential for efficiency improvements. Further, the achievable potential in the AEG study was constrained by a budget constraint. The potential study is deficient in this regard. (§22.050(5))

Remedy: Supplemental filing. Empire should be required to provide the assumptions that AEG made and describe how it developed its assessment of the technical, economic or maximum achievable potential.

(H) Marketing Plans. The general delivery plan in the IRP is not comprehensive and does not provide the information required for a detailed marketing plan. (§22.050(6)(D))

Remedy: Supplemental filings and stakeholder process or collaborative. Empire should be required to complete and submit comprehensive program marketing plans for programs that it expects to offer.

(I) Evaluation Plans. The evaluation plans described at the end of each program summary in Volume IV of the IRP filing are not adequate for the purpose of conducting process or impact evaluation plans of the demand-side programs associated with its preferred resource plan. (§22.050(9))

Remedy: Supplemental filings and stakeholder process or collaborative. Empire should complete and submit comprehensive evaluation plans for programs that it expects to offer.

(J) Participation Assumptions. Empire has not clearly defined whether residential tenants and commercial lessees are eligible to participate in its DSM programs. (§22.050(1)(B))

Remedy: Stakeholder process. This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

(K) Renewable Resource Analysis. Although Empire did consider residential solar photovoltaic and wind renewable energy programs in its technical potential analysis, the Company's analysis is deficient in that the same measures were not considered in the commercial and industrial sector analysis. (§22.050(1)(D))

Remedy: Stakeholder process and commitment to studies for next filing. This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

(L) Sensitivity Analysis. It is not clear that Empire has performed any sensitivity analysis related to utility marketing and delivery costs for demand-side programs. (§22.070(2)(L))

Remedy: Stakeholder process. This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

The basis for GDS's conclusions related to deficiencies in Empire's demand-side resource analysis are discussed below in our review of Volume IV: Demand-Side Resource Analysis of Empire's IRP filing, which begins on p. 23.

#3 - Risks associated with critical uncertain factors have not been adequately analyzed

(A) Critical Uncertain Factors. The utility has not conducted a preliminary sensitivity analysis to identify the uncertain factors that are critical to the performance of the resource plan. (§22.010(2)(C), §22.070(2))

Remedy: Stakeholder process. This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

(B) Factors Affecting Load Growth. Not all uncertain factors that are potentially critical were addressed in the IRP. Critical uncertain factors missing include customer growth, SmartGrid and price of electricity. (§22.010(2)(C)(1), §22.010(2)(C)(3))

Remedy: Stakeholder process. This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

(C) Environmental & Regulatory Factors. Empire has not addressed the possible affect of SB 376 (Missouri Energy Efficiency Investment Act) on its resource plan. Also the affect of future state or federal energy efficiency resource standards (EERS) has not been considered. Nationally, Rep. Markey (MA) and Sen. Schumer (NY) have both

introduced versions of the "Save American Energy Act" related to EERS. (§22.010(2)(C)(2), §22.070(2)(C))

Remedy: Stakeholder process. This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

The basis for GDS's conclusions related to deficiencies in Empire's treatment of critical uncertain factors are discussed below in our review of Volume V: Integrated Resource Analysis, Risk Analysis and Strategy Selection of Empire's IRP filing, which begins on p. 45.

#4 - Other supply-side resource analysis issues

(A) Generation Options. Utility scale photovoltaic (PV) options were not considered in the utility's supply-side resource analysis. Empire's treatment of biomass options is very limited. A more thorough analysis of both PV and biomass generation should have been performed. While the Company has considered some distributed generation options, it does not appear to have analyzed customer-based combined heat and power (CHP) options smaller than 5 MW. (§22.040(1))

Remedy: Stakeholder process. This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

(B) Accuracy of Price Forecasts. Empire has provided no evidence that it has considered the accuracy of previous fuel price forecasts prepared by Ventyx as a criterion for selecting that firm as a provider of fuel price forecasts. While the utility relied on Ventyx for most fuel prices, it also relied on EIA for coal. Thus, Empire also needs to consider EIA assumptions and examine its use (or non-use) of the EIA alternative cases. (§22.040(8)(A)(2))

Remedy: Stakeholder process. This is an issue of concern that should be addressed in a stakeholder process with focus on interim use of these forecast sources as well as its use in next filing.

(C) Critical Uncertain Factors Related to Fuel Prices. Empire has not provided sufficient documentation related to how each fuel price forecast was prepared, nor has it clearly identified the critical uncertain factors that drive the price forecasts (from Ventyx and the EIA) and the range of forecasts it has offered. (§22.040(8)(A)(2))

Remedy: Stakeholder process. This is an issue of concern that should be addressed in a stakeholder process with focus on interim use of these forecast sources as well as its use in next filing.

The basis for GDS's conclusions related to deficiencies in Empire's supply-side resource analysis are discussed below in our review of Volume III: Supply-Side Resource Analysis of Empire's IRP filing, which begins on p. 18.

Volume II: Load Analysis and Forecasting

On p. 6 of Volume II: Load Analysis and Forecasting of Empire's IRP filing, it is stated that:

> *Empire will produce class level load forecasts by season using regression analysis at the customer class level using customer, weather, energy usage and trend variables when applicable. In addition, certain industries/companies from the Commercial class will be disaggregated and forecast individually. This method will serve to generate a more accurate forecast by employing intimate knowledge that includes historical consumption trends as well as current and future expansion plans. This method of load forecasting will be used for the upcoming IRP instead of a forecast developed from the sum of energy consumption in end uses such as space heating, air conditioning, etc. that are combined with appliance saturation levels, socio-economic data, and efficiency trend quantifications to reach an "end-use" energy demand. Empire's forecasting models will be fully explained in the IRP report.*
>
> *After the completion of the September 2010 IRP, Empire has agreed to provide the Missouri Public Service Commission Staff with a plan that addresses the feasibility of changing the Company's forecasting method for the IRP filing that will follow the September 2010 filing. This plan will include a proposed time line and cost estimate that can be used for further discussions. The plan will consider the use of economic variables; forecasting at the class cost of service level; and the requirements in the Load Analysis and Forecasting rule that will be in place at the time of the IRP filing that is subsequent to the September 2010 filing.*

Through an order dated June 16, 2010 in Case No. EE-2010-0246, the Commission approved Empire's application for a variance related to the filing of certain aspects of the Load Analysis and Forecasting portion of the Integrated Resource Plan. Variances were requested (and granted) related to the requirement to perform end-use forecasting and load analysis as part of the IRP filings and the starting points for data retention for use in the forecast of net system loads and system peak demand. The order also approved Empire's requests for clarifications regarding subclasses and major rate classes.

However, the fact that Empire has been granted variances with respect to preparing certain aspects of its load forecast does not reduce the Company's responsibility to prepare a reasonable and defendable load forecast. Empire's load forecast is deficient in many aspects:

- **In particular, Empire's filing is deficient in that the utility's base case forecast is overly optimistic in its expectation of future load growth. The utility's support for its assumptions and statistical models is lacking. Additionally, the basis for Empire's development of its high and low load growth scenarios is unclear and inadequate.**

Analysis of Load Analysis and Forecasting Deficiencies

Empire's base forecast shows that its annual energy requirement will increase from 5,263 million kWh in 2009 to ** ** million kWh in 2029, for an annual compound growth rate of ** ** over the 20-year planning horizon. By comparison, Empire's annual energy requirement grew by only 1.0% per annum, 2000-2009 and actually declined between 2005 and 2009.[1] Similarly, Empire's base forecast calls for its net peak load to increase from 1,085 MW in 2009 to ** ** MW in 2029, reflecting an annual compound growth rate of ** ** over the 20-year planning horizon. By comparison, Empire's actual peak load grew by only 1.0% per annum, 2000-2009 and declined between 2005 and 2009.[2] Thus, Empire's base forecast shows faster load growth over the 20-year planning horizon than it experienced during the past decade.

Is Empire's forecast realistic? What is the basis for its expectation that future load growth will advance at a faster rate than it experienced during the past decade? Empire's rationale is as follows: "The base case forecast is based on average customer growth of about ** ** per year over the entire 20-year planning horizon.[3]" (Vol. II, p. S-1) Customer growth is the only driver variable used to prepare its load forecast.[4] "Empire believes that customer growth is not just a driver variable, but a variable that captures the economic impacts of the service territory." (Vol. II, p. 37) Very little support is provided for this assumption.[5] Further, Empire has not fully complied with requirement of 22.030(5)(B)(2)(A), which states:

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[1] Based upon weather-normalized annual energy data provided by Empire in Table 2-14, the historic annual growth rate between 2000 and 2009 would be 2.1%. However, we have not been able to verify that Empire's weather normalization calculations are correct. Our estimate for the growth rate in weather-normalized annual energy (using Empire's equation & its weather data) is 1.2%, not 2.1%.

[2] Based upon weather-normalized annual peak load data provided by Empire in Table 2-12, the historic annual growth rate between 2000 and 2009 would be 2.0%. However, we have not been able to verify that Empire's weather normalization calculations are correct.

[3] It is unclear how Empire has calculated this average customer growth of ** **; customer growth for 2010 is projected to be ** **; the growth rate for 2011 is ** **; and, the annual growth rates for 2013-2029 are ** **. See Table C-4 in Vol. II.

[4] Given that customer growth is the only driver variable used to prepare its forecast, it is surprising that Empire has not categorized customer growth as a critical uncertain factor.

[5] In response to MDNR Data Request No. 26, the Company replies:"Throughout our history, customer growth tends to be very strongly correlated to the local economics. For example, during times of significant sales growth (the Branson, Missouri extreme growth in the 1990s) Empire's customer growth reached its highest levels. During the recent economic downturn which coincided with low sales growth in Empire's service territory, Empire's customer growth recorded its lowest levels. Due to the strong correlation (as illustrated by the above examples among others), Empire believes customer growth tends to be a reliable economic driver in the forecast."

> *The forecasts of the driver variables for the use per unit shall be specified. The utility shall document how the forecast of use per unit has 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.*

In preparing its load forecast, Empire has not considered any economic or demographic drivers other than customer growth. The effects of changes in the price of electricity, price of competitive energy sources, or personal income have not been explored. The most straightforward driver to have considered is the price of electricity. Historical data is readily available and future prices could easily be calculated from the average system rates produced for each of Empire's 17 Plans (see Table F-1 in Vol. V). Not incorporating the effects of changes in the price of electricity into its forecast is a significant omission.[6]

What is the basis for Empire's assumption related to future customer growth? It appears that Empire has assumed the average customer growth rate observed between 1996 and 2009 for forecasting purposes. The only supporting documentation found in Volume II is a vague statement[7] and a histogram showing customer growth rates over various time intervals. (Vol. II, pp. 37-38) Although customer growth has slowed dramatically in recent years (i.e., 0.7% in 2008 and 0.2% in 2009), Empire's assumes that customer growth will soon return to rates of increase that it has seen in the past.[8] Empire offers no support for this supposition.

The basis for the base case forecast is important because 13 of the 17 integrated resource plans Empire examined assume the base case load forecast, and two other scenarios are only slight variants associated with the loss of a wholesale customer. If future load growth is closer to 1.0% per year (i.e., the historic growth rate) rather than the ** [redacted] ** growth rate assumed in Empire's base case forecast, the load level in 2029 would be lower by at least 300 MW.

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[6] Although Empire does not deny that its customers are sensitive to changes in the price of electricity, it seems to conclude that it would be too time consuming to incorporate price elasticity into its analysis. In its response to MDNR Data Request No. 13, the Company replies: "If the load forecast was adjusted based on the future price of electricity in a particular plan, this could alter the load forecast, which would lead to the need to re-do the integration phase (because the load forecast changed) which could change the resource plan, which would change the future price of electricity, which would change the load forecast, which would lead to the need to re-do the integration phase which could lead to a very exhaustive iterating process for each of the many plans."

[7] "The customer counts used in the regression analysis were based on customer growth percentages during 1996-2009. Compound annual growth rates were calculated for three-, five- and ten-year periods. A histogram was created with historical growth percentages to organize values into bins (see Figure 4-1). A high and low customer growth percentage was calculated using the mean and standard deviation from the historical period." See Vol. II, pp. 37-38.

[8] At an Empire presentation on its load forecast held on October 20, 2010, the Company's load forecaster Aaron Doll indicated that he believed that customer growth will be slower than assumed in the IRP. He estimated that the level of the load would be about 20 MW lower if he were to redo the forecast today.

The statistical support for Empire's class level sales forecasts is also deficient. For example, consider the regression analysis results for the residential class provided in Figure 2-4 on p. 18. Although the results point to a high R^2 value, no statistical results are provided for estimation problems associated with serial or autocorrelation.[9] Further, no discussion (or data) is provided related to estimation problems associated with multicollinearity.[10] It is not clear what statistical tests Empire did perform.[11]

Does the Company's residential sales forecast make sense? Between 2000 and 2009 residential sales increased at an annual rate of 1.3%. Empire's forecast calls for a much faster rate of growth: **[redacted]** per annum, 2009-2029. In its response to MDNR Data Request No. 11, the Company states: "Our long term growth rate is trended off of our historical growth rates and thus long term growth in the IRP base forecast is not expected to vary much from the historical growth." Using Empire's residential equation and its weather data, we calculate that residential sales, on a weather-normalized basis, grew by 1.7% per year, 2000-2009. This is a significantly slower rate of growth than what the Company projects for the future.

Whereas residential kWh usage per customer actually declined between 2000 and 2009, falling from 13,467 to 13,218 kWh, Empire is projecting usage to increase dramatically in the future. That is, residential kWh usage per customer is estimated to advance to **[redacted]** kWh in 2019 and **[redacted]** kWh in 2029. It unclear why residential usage per customer will increase by such a large amount in the future and Empire offers little support for its projection.

[9] Serial or autocorrelation is a problem associated with regression analysis using time series data. Serial or autocorrelation violates the ordinary least squares assumption that the error terms are uncorrelated. While the presence of autocorrelation does not bias the coefficient estimates, the t-values associated with the coefficients will be overstated, because the standard errors tend to be underestimated. In response to MDNR Data Request No. 21, Empire did provide the Durbin-Watson statistic for its residential equation, but no information for other tests (such as the Ljung-Box or Breusch-Godfrey tests).

[10] Multicollinearity is a statistical problem in which two or more independent (or, explanatory) variables in a multiple regression model are highly correlated. A multiple regression model with correlated predictors may not provide valid results about any individual explanatory variables, or about which of the selected variables are redundant with others. However, even extreme multicollinearity does not result in biased estimators.

[11] For example, in response to MDNR Data Request No. 7, the Company notes that "No tests were performed to identify possible problems with serial or auto correlation for peak demand."

In its response to MDNR Data Request No. 15, the Company replies: "Our long term growth rate is trended off of our historical growth rates and thus long term growth in the IRP base forecast is not expected to vary much from the historical growth." The Empire forecast calls for usage per customer to increase at ** [redacted] ** per year, 2009-2029. By contrast, the actual growth rate between 2000 and 2009 was -0.2% per annum. On a weather-normalized basis (using Empire's residential equation and its weather data), we calculate that residential usage per customer grew by 0.2% per year, 2000-2009. This is a significantly slower rate of growth than what the Company is projecting in its IRP. A 0.2% rate of increase in usage per customer would result in a residential summer peak load in 2029 that would be approximately 125 MW lower than Empire's forecast.

Figure 1 (Highly Confidential in its entirety) places Empire's usage per customer forecast within a historical context. As part of this forecast, Empire is projecting a substantial increase in residential usage. However, the Company has not provided adequate support for this estimation, nor has it taken into account the effects of changes in the price of electricity, price of competitive energy sources, or personal income. It has not attempted to quantify the effects of national appliance efficiency standards or improvements in lighting efficiency mandated in the Energy Independence and Security Act of 2007, which will begin taking effect in 2012 (see the response to MDNR Data Request No. 12).[12] In short, Empire has failed to comply with requirement of 22.030(5)(B)(1)(A).

[12] Although Empire has not taken the affect of the Energy Independence and Security Act of 2007 into account in preparing its load forecast, it has in its demand-side analysis: "Because of this legislation, the Residential High Efficiency Lighting Program will be eliminated in 2018." (Volume IV, p. 49)

Figure 1
Highly Confidential in its entirety

Empire's methodology for developing its commercial sales forecast is equally unclear and without sufficient support. On p. 51 of Volume II it is stated,

> *Commercial class sales without subclasses were forecast using a linear regression in Microsoft Excel employing monthly binaries, actual HDD and CDD, and a leap year binary. A forecast of Commercial sales with customers as an independent variable was created and a forecast of Commercial UPC was also created during this stage of the forecast process. The UPC forecast was chosen for its correlation coefficient, P Values and other statistical measures. The number of customers was then applied to the Commercial UPC to calculate a Commercial sales total. The number of Commercial customers was determined by using an allocation of historical Commercial customers as a percentage of total customers.*

However, within Volume II, the equation used by Empire to prepare its forecast of commercial sales with customers as an independent variable is not provided.[13] Based upon a review of supplemental work papers provided to the MDNR, it is clear that Empire's commercial equation that uses customers as an independent variable has received no greater scrutiny than its residential equation. That is, no statistical results are shown related to estimation problems associated with serial or autocorrelation.[14] No discussion (or data) related to estimation problems associated with multicollinearity is provided.

The Company's has based its commercial customer forecast on "… an allocation of historical Commercial customers as a percentage of total customers" rather than on an analysis of actual growth in the number of its commercial customers. Empire offers no support or rationale for such a forecast. Generally, the resulting commercial customer forecast appears to be somewhat high. Empire is projecting commercial customer growth of about **[redacted]** per annum, 2009-2029. By contrast, the number of commercial customers increased by 0.9% per year, 2000-2009.

With regard to industrial sales, Empire projects that sales will grow by **[redacted]** per annum between 2009 and 2029. The comparable historical growth rate between 2000 and 2009 was -0.2% per year. What is the basis for Empire's forecast? On p. 63 of Volume II it is stated,

> *Electricity usage for the large volume customers is determined in consultation with Empire's Manager of Industrial and Commercial Energy Sales based on Empire's knowledge of the customers and their expected change in operation in the future.*

No analytical support for Empire's industrial forecast is provided.

Overall, GDS believes that Empire's base case forecast is overly optimistic in its expectation of future load growth. The Company's support for its assumptions and statistical models is lacking. In addition, the basis for Empire's development of its high and low load growth scenarios is unclear and inadequate. All that is said on p. 27 of Volume II is,

> *The development of the high and low load forecasts began by changing the Residential class forecast based on different levels of customer growth and different levels of use per customer. Then, market share analysis was used to modify the other Revenue Classes accordingly.*

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[13] The regression equation used by Empire was provided in a supplemental spreadsheet as part of its load forecasting work papers.

[14] In response to MDNR Data Request No. 22, Empire did provide the Durbin-Watson statistic for its commercial equation, but no information for other tests (such as the Ljung-Box or Breusch-Godfrey tests).

The text indicates that key assumption is residential customer growth. But what did Empire assume? The Company does not provide any further discussion of its assumptions in Volume II. However, in a supplemental spreadsheet supplied with its load forecasting work papers, the high/low values used by Empire were provided. In its low growth case, Empire assumed **[redacted]** customers in 2029 vs. **[redacted]** in its base case. In its high growth case, Empire assumed **[redacted]** customers in 2029. The annual growth rate for the high case is **[redacted]** per annum, 2009-2029. The growth rate for the low case is **[redacted]**, while that for the base case is **[redacted]**. Surprisingly, there is essentially no difference between the three cases with regard to customer growth.[15]

Therefore, growth in kWh use per customer must be driving the high and load low forecasts. What did Empire assume and what is its rationale for its assumptions? Again, this is not addressed in Volume II. Empire's calculations were provided in a supplemental spreadsheet supplied with its load forecasting work papers. In its low growth case, Empire assumed **[redacted] ** kWh per residential customer in 2029 vs. **[redacted]** in its base case. In its high growth case, Empire assumed **[redacted]** kWh per residential customer in 2029. The corresponding annual growth rates for the 20-year period are **[redacted]**, **[redacted]** and **[redacted]** respectively. No rationale for the different growth rates was provided. Empire simply assumed that that growth would be 50% greater (than the base case) in the high case and 50% less in the low case.

Empire's low growth scenario, to which it assigns a **[redacted]** probability, projects a peak load of **[redacted]** MW in 2029; the compound annual growth rate relative to 2009 is **[redacted]**. By comparison, Empire's actual peak load grew by only 1.0% per annum, 2000-2009 and declined between 2005 and 2009. Thus, Empire's low growth forecast calls for faster load growth over the 20-year planning horizon than it experienced during the past decade. Is this a reasonable assessment? The Company provides little evidence to support this estimation.

Empire's high growth forecast, to which it assigns a **[redacted]** probability, projects a peak load of **[redacted]** MW in 2029; the compound annual growth rate relative to 2009 is **[redacted]**. Again, Empire provides limited support for its assumptions.

[15] In response to MDNR Data Request No. 83(a), Empire remarks that: "Yes, the high-low residential customer band is as wide as we intended."

Of the three scenarios presented, Empire's low growth scenario provides the closest correlation with the actual load growth it has experienced in the past decade. Even then, Empire's low growth forecast calls for more rapid load growth than it has seen between 2000 and 2009. GDS concludes that Empire's proposed low case is the most likely of the three it has presented and that the Company's base and high load growth scenarios should be assigned very low probabilities of occurrence.

That is, it is appropriate to either specify new probabilities for Empire's load growth scenarios or define some more realistic growth load scenarios. The latter option is preferable. Possible scenarios, which should reflect stakeholder input, could be developed around Empire's proposed low growth scenario (i.e., ** [redacted] **), which could become the new base case with a 50% probability of occurrence. A new low load growth case could be defined to equal Empire's historic load growth (i.e., 1.0%), with a probability of 25%. A new high growth scenario could be associated with Empire's proposed base case forecast (i.e., ** [redacted] **), with a probability of 25%. The load growth assumptions used should be developed with stakeholder input. It is difficult to propose alternatives that do not depend upon judgment, because no independent forecast was developed for Empire and the Company's own prognosis is deficient.

Deficiencies in Empire's Load Analysis and Forecasting (re 4 CSR 240-22.030)

- Paragraph 4 CSR 240-22.030(5)(B)(2)(A) – Empire's filing is deficient as the utility has not considered any economic or demographic drivers other than customer growth in preparing its load forecast. It has not has taken into account changes in the price of electricity, price of competitive energy sources, or personal income.

- Paragraph 4 CSR 240-22.030(6) – Empire's filing is deficient in that the utility has not considered any economic or demographic drivers other than customer growth in preparing its load forecast.

- Paragraph 4 CSR 240-22.030(7) – Empire's filing is deficient in that the support for its high and low load growth scenarios is unclear and inadequate. In addition, the basis for the high and low case load forecasts appears to be biased toward stronger growth than can be supported by Empire's analysis.

- Paragraph 4 CSR 240-22.030(8)(C) – The utility has not provided a summary of the sensitivity analysis required by section (6) of this rule that outlines how changes in the driver variables affect the forecast.

- Paragraph 4 CSR 240-22.030(8)(H) – Empire's filing is deficient in that the utility's base case forecast is overly optimistic in its expectation of future load growth. The utility's support for its assumptions and statistical models is insufficient.

Proposed Remedies to the Deficiencies in Empire's Load Analysis and Forecasting

- Paragraph 4 CSR 240-22.030(5)(B)(2)(A) – This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

- Paragraph 4 CSR 240-22.030(6) – This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

- Paragraph 4 CSR 240-22.030(7) – Revised filing. Empire should rerun its resource plans and risk analysis with different load growth assumptions. Possible scenarios (which should reflect stakeholder input): base case = Empire's proposed low growth scenario (i.e., **[redacted]**); low case = Empire's historic load growth (i.e., 1.0%); high case = Empire's proposed base case forecast (i.e., **[redacted]**). The load growth assumptions used should be developed with stakeholder input.

- Paragraph 4 CSR 240-22.030(8)(C) – This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

- Paragraph 4 CSR 240-22.030(8)(H) – Revised filing followed by stakeholder process. Empire should rerun its resource plans with a revised base case load forecast. Possible scenario (which should reflect stakeholder input): base case = Empire's proposed low growth scenario (i.e., **[redacted]**). The load growth assumption used should be developed with stakeholder input.

Volume III: Supply-Side Resource Analysis

4 CSR 240-22.040 requires that utilities review alternative supply-side resources and determine cost estimates for each type of resource in order to incorporate these resources in the integrated planning process. There are no major deficiencies with Empire's analysis of alternative supply-side resources. However, some areas of concern exist with respect to Empire's supply-side resource analysis.

- **Empire's treatment of biomass and solar generation options is very limited. The utility has provided no evidence that it has considered the accuracy of previous fuel price forecasts prepared by Ventyx as a criterion for selecting that firm as a provider of fuel price forecasts. Empire has not provided sufficient documentation related to how each fuel price forecast was prepared, nor has it clearly identified the critical uncertain factors that drive the price forecast and the range of forecasts it has offered.**

Analysis of Supply-Side Resource Analysis Deficiencies

Empire considered a number of conventional resources as options including: supercritical coal (ownership and power purchase agreement (PPA)), combustion turbine, combined cycle, nuclear (power purchase agreement only), distributed generation, and integrated gasification combined cycle.

To take advantage of economies of scale, the nuclear and the supercritical coal options were modeled as an ownership or PPA share of larger units built in the region. Generation resources using carbon capture and sequestration were not assumed to be commercially viable within the planning horizon for the IRP; these resources were not options considered in the optimization modeling.[16]

As noted by Empire on pp. 38-39 of Volume III, a renewable portfolio standard (RPS) was approved by Missouri voters in 2008. The RPS (Proposition C), which is currently undergoing rulemaking at the MPSC, mandates that a percentage of an electric utility's sales are to be provided by renewable energy resources. The RPS increases from 2% in 2011 to 15% in 2021. Further, the standard also includes a solar energy set-aside requirement of 0.3% by 2021; however, terms and conditions of the Missouri RPS include an opt-out provision for the solar

[16] Cost parameters were developed for supercritical coal, combined cycle and integrated gasification combined cycle with carbon capture and sequestration. These values are presented in Volume III.

requirement that Empire was able to meet. Notably, as of January 2009, Empire had a renewable energy resource capacity equal to approximately 15% of its fossil-fired generating capacity.

A number of potential renewable resources were considered as possible supply-side resources including: wind, landfill gas, biomass and solar thermal. Although Empire provided a reasonable analysis of wind and landfill gas options, its examination of biomass and solar generation was significantly limited. Empire's review of biomass options seems limited to an examination of a single 2003 study that considered using a mixture of poultry manure with wood waste as a generation source.[17] Although Empire has not thoroughly examined the extent of biomass generation options, it does appear that the performance parameters (capital cost per kW, heat rate, etc.) that the Company has assumed in its optimization analysis are reasonable.[18] Empire only considered small scale (i.e., 5 MW) biomass generating units.

The Company's analysis of solar generation options is deficient. In Table 5-10, Empire provides solar performance parameters for a 100 MW centralized (utility-scale) solar thermal installation, without citing any specific source for its estimates.[19] Empire cites the capital cost for a 100 MW solar thermal installation as $5,070 per kW. However, in its response to MDNR Data Request No. 3, Empire states: "Utility scale photovoltaics were not evaluated as a supply-side resource." It is unclear why this evaluation was not conducted. Reductions in the cost of future solar generation technologies are likely. One recent analysis cites a current capital cost for utility scale photovoltaic generation (in Maine) at $4,000 per kW; further, the study projects that the cost will fall to $2,500 per kW in 2020.[20]

In addition to the performance parameters for generating resources, Empire notes on p. S-2 of Volume III that

> *Two of the most significant assumptions underlying this IRP are the natural gas price assumptions and the costs for various forms of air emissions…. Four levels of carbon regulation, including a no carbon regulation case, were evaluated. Empire has assumed that if carbon regulation were implemented, it would be in the form of a cap and trade system.*

[17] Mississippi Band of Choctaw Indians, Feasibility study of siting a renewable energy, biomass-based installation on tribal lands, http://apps1.eere.energy.gov/tribalenergy/pdfs/mississippi_band_choctaw_tep_nov03.pdf
[18] Compared with Table 8.2 Cost and Performance Characteristics of New Central Station Electricity Generating Technologies in Energy Information Administration (EIA), Annual Energy Outlook 2010, December 2009.
[19] Empire's source may be JD Energy. Solar Power Electric Generation, January 2010.
[20] GridSolar, LLC, Presentation to the Natural Resources Council of Maine, January 21, 2010, http://www.gridsolarme.com/News.html

Are these price assumptions realistic? Empire's assumptions were prepared by its consultant, Ventyx. The natural gas price forecast used for the IRP analysis is based on the Ventyx Fall 2009 Power Market Advisory Service Electricity & Fuel Price Outlook. Table S-1 and Figure S-1 in Volume III provide a forecast for natural gas prices assuming four levels of carbon regulation.[21] Ventyx's projected gas prices are relatively insensitive to changes in carbon costs. In the No CO_2 Case, nominal gas prices increase at annual compound growth rate of ** [redacted] ** between 2010 and 2029. In the Base CO_2 Case, the prices increase at ** [redacted] ** per annum. In the Low CO_2 Case, the prices increase at ** [redacted] **. In the High CO_2 Case, the prices increase at ** [redacted] ** per year. What is the basis for Ventyx's forecast? While little explanation is provided in Volume III, the projected rate of increase in the Base CO_2 Case appears to be reasonable.[22] In the Annual Energy Outlook 2010 prepared by the U.S. Energy Information Administration (EIA), it projected the nominal price of natural gas at the Henry Hub will rise from $4.64 per MMBtu in 2010 to $11.48 per MMBtu in 2029 for an annual compound growth rate of 4.88%.[23]

On p. 28 of Volume III it is stated that

> *Four levels of CO_2 regulation were examined including a case in which no CO_2 regulation was enacted. Table 3-9 shows the projected CO_2 costs ($/ton) in a cap and trade system (referenced as a carbon tax in this IRP), assumed to be applicable no earlier than 2015.*

[21] Although the numbers in the Table S-1 and Figure S-1 are the same, the referenced units of measure in Table S-1 are $/MMBtu and those in Figure S-1 are $/MWh. Which is it? According to the Energy Information Administration, the natural gas price at the Henry Hub averaged $3.76 per MMBtu in trading on November 9, 2010. Converting that price to $/MWh results in $12.83 per MWh. The 2010 gas price shown in Table S-1 is ** [redacted] ** per MMBtu; thus, the stated units for Figure S-1 (i.e., $/MWh) must be mislabeled.

[22] Ventyx assumed that if carbon regulation were implemented, it would be in the form of a cap and trade system and that any carbon tax would not start earlier than 2015.

[23] EIA, Annual Energy Outlook 2010, December 2009. See Table 13. Natural Gas Supply, Disposition, and Prices.

However, no explanation is provided in Volume III as to how Ventyx developed its projected CO_2 costs.[24] In its Base CO_2 Scenario, Ventyx projects that CO_2 costs, in nominal dollars, will rise from ** [redacted] ** per ton in 2015 to ** [redacted] ** per ton in 2029. In the Low CO_2 Case, the 2029 cost is ** [redacted] ** and in the High CO_2 Scenario the cost is ** [redacted] ** per ton. Clearly, this is a major externality associated with marginal electricity generation. Are these cost estimates reasonable?

In a 2009 study prepared for a group of New England electric utilities, gas utilities and efficiency program administrators, Avoided Energy Supply Costs in New England: 2009 Report, an estimate of $80/ton is cited as the long-term marginal abatement cost for CO_2. The AESC report notes

> *In this 2009 AESC report, we find that CO_2 has the most significant externality. We also conclude that the long-run marginal abatement cost of CO_2 is a practical and conservative measure of the full cost of carbon. In updating our recommendation from the 2007 AESC report, we review current literature on emissions reductions necessary to avoid the most dangerous impacts of climate change, as well as analyses of technologies available to achieve those emission reductions. We recommend that the Study Group uses a marginal abatement cost value which is*

[24] In a separately provided document, Empire District Integrated Resource Plan, prepared by Ventyx, it is stated on pp. 13-14 that

> *To develop the probabilities for the CO2 tax cases, Ventyx included CO2 legislation from the Waxman-Markey bill in it's forecast to develop a zero, low, medium and high case. For this IRP, it is assumed that a cap-and-trade program will be implemented across all sectors, including transportation, agriculture and electric beginning in 2015. For the medium case the following limits were used.*
>
> *17% reduction from 2005 levels by 2020*
> *42% reduction from 2005 levels by 2030*
> *83% reduction from 2005 levels by 2050.*
>
> *Also for the medium case, retirement of units and retrofits for carbon capture and sequestration beginning in 2018 were utilized to hit these levels. The uses of international offsets were also used to develop the CO2 prices.*
>
> *A low case was developed from the medium case, however it considered 40% lower cost of reductions for all sectors except power with the following limits. Retirements and retrofits were also used to hit these limits.*
>
> *10% reduction from 2005 levels in 2020*
> *20% reduction from 2005 levels in 2030*
> *40% reduction from 2005 levels in 2050*
>
> *Last, the high case was developed from the medium case also which considered the current CO2 legislation limits. For this case however, the limits were imposed on the power sector only, so international offsets and other lower cost options were not available. Additionally, the cost of CO2 reductions were 40% higher in the power sector. In this case, retirements and retrofits were also used to meet CO2 limits, however as the price of CO2 increased, the cost to retrofit coal units were justified and gas consumption was reduced. Equal probabilities were assigned to the CO2 cases by Empire.*

based on the cost of controlling emissions. (This is an alternative to setting value based on monetized estimates of damages.)

For AESC 2009 we recommend using a long-run marginal abatement cost (2009$) of $80 per short ton of CO_2. This estimate is one-third higher than the value of $60 (2007$) per short ton recommended in AESC 2007. In 2009 approximately 5% of that $80/ton is internalized in the market price of electricity, through RGGI, and 95% is an externality. By 2024, we estimate that approximately 40% of that amount will be internalized.[25]

By the metric employed in the 2009 AESC study, Ventyx's carbon cost estimates cited in its Base CO_2 Scenario appear to provide a reasonable assessment for planning purposes. However, documentation of what was assumed is lacking in Volume III. Based upon a separately provided document, Empire District Integrated Resource Plan, Ventyx's methodological approach for preparing its high and low emission cost estimates appear to be reasonable.

Deficiencies in Empire's Supply-Side Resource Analysis (re 4 CSR 240-22.040)

- Paragraph 4 CSR 240-22.040(1) – Utility scale photovoltaic (PV) options were not considered in the utility's supply-side resource analysis. Empire's treatment of biomass options is very limited. A more thorough analysis of both PV and biomass generation should have been performed. While the Company has considered some distributed generation options, it does not appear to have analyzed customer-based combined heat and power (CHP) options smaller than 5 MW.

- Paragraph 4 CSR 240-22.040(8)(A)(2) – Empire has provided no evidence that it has considered the accuracy of previous fuel price forecasts prepared by Ventyx as a criterion for selecting that firm as a provider of fuel price forecasts. While the utility relied on Ventyx for most fuel prices, it also relied on EIA for coal. Thus, Empire also needs to consider EIA assumptions and examine its use (or non-use) of the EIA alternative cases.

- Paragraph 4 CSR 240-22.040(8)(A)(3) – Empire has not provided sufficient documentation related to how each fuel price forecast was prepared, nor has it clearly

[25] Synapse Energy Economics, Inc., Avoided Energy Supply Costs in New England: 2009 Report, August 21, 2009, pp. 6-73 and 6-74. Available at http://www.synapse-energy.com/Downloads/SynapseReport.2009-10.AESC.AESC-Study-2009.09-020.pdf.

identified the critical uncertain factors that drive the price forecasts (from Ventyx and the EIA) and the range of forecasts it has offered.[26]

Recommendations Related to Deficiencies in Empire's Supply-Side Resource Analysis

- Paragraph 4 CSR 240-22.040(1) – This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

- Paragraph 4 CSR 240-22.040(8)(A)(2) – This is an issue of concern that should be addressed in a stakeholder process with focus on interim use of these forecast sources as well as its use in next filing..

  Paragraph 4 CSR 240-22.040(8)(A)(3) – This is an issue of concern that should be addressed in a stakeholder process with focus on interim use of these forecast sources as well as its use in next filing..

[26] Although Volume III does not provide the necessary documentation, Empire has provided information on how the fuel price forecasts were prepared in other supplemental documents and in its October 21, 2010 PowerPoint presentation to stakeholders.

Volume IV: Demand-Side Resource Analysis

In 4 CSR 240-22.010(2) it is clearly stated that the policy objective of the electric utility resource planning process is as follows:

> *The fundamental objective of the resource planning process at electric utilities shall be to provide the public with energy services that are safe, reliable and efficient, at just and reasonable rates, in a manner that serves the public interest. This objective requires that the utility shall—*
>
> > *(A) Consider and analyze demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process;*

In our analysis of the Empire IRP filing, we do not find that the utility has considered demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process. In addition, there are a number of deficiencies in Empire's filing with regard to other requirements of Missouri Rule 4 CSR 240-22.050. Empire's demand-side resource analysis is deficient in many regards.

- **In particular, Empire's DSM portfolio was budget constrained to be no greater than 1% of Empire's 2009 electric revenues. Further, Empire's analysis fails the equivalence requirement with respect to scalability.**

- **Further, Empire's demand-side resource analysis is inadequate: the basis for its conservation potential estimates is lacking; the utility has not performed a standalone Probable Environmental Benefits Test to screen end-use measures; Empire has not estimated the technical potential of each end-use measure; and the required marketing and evaluation plans are lacking.**

Although GDS believes that there are a number of deficiencies with respect to Empire's DSM filing, it is notable that Empire did engage the Applied Energy Group (AEG) to perform a conservation potential study for the utility. While not complete, the potential study is an important first step in identifying cost-effective demand-side resources to be included in its integrated resource plan.

GDS's review of the Empire's demand-side resource analysis contained in its Integrated Resource Plan included an assessment of the energy efficiency potential and program impact estimates. We have attempted to determine whether Empire's program design, participation,

budgets and impacts are appropriate and consistent with current best-practices. GDS has also reviewed Empire's DSM potential study and Empire's IRP for compliance with the Missouri Rule 4 CSR 240-22.050 related to DSM reporting requirements.

Analysis of Demand-Side Resource Analysis Deficiencies

Demand-Side Resource Potential Study

4 CSR 240-22.050(5) requires that:

> *The utility shall conduct market research studies, customer surveys, pilot demand-side programs, test marketing programs and other activities as necessary to estimate the technical potential of end-use measures and to develop the information necessary to design and implement cost-effective demand-side programs. These research activities shall be designed to provide a solid foundation of information 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.*

In its report The Empire District Electric Company Demand-Side Resource Potential Study 2011-2013 (provided as Appendix D to Volume IV of Empire's IRP filing), AEG has provided estimates for the potential amount of savings that could be obtained from energy efficiency measures within the Empire service territory: i.e., the technical, economic, and maximum achievable potential.[27] As defined by AEG on p. ES-2,

> *Technical potential assumes total and continuous conversion to the most efficient technologies, regardless of cost. It provides the broadest and highest definition of DSM potential since it estimates savings that would result if all installed equipment and processes were replaced by the best available equipment and processes in all markets.*
>
> *For the assessment of economic potential, estimates are based on modified savings for new construction, equipment replacement, and retrofit EEMs using the maximum savings only where measures and technologies are cost-effective. The assessment of maximum achievable potential is based on the same savings estimates used for economic potential, with modifications residing in assumptions of market penetration on Empire's programmatic successes, best practice studies, regulatory input and feedback from trade allies. Whereas economic potential estimates assume 100 % market penetration, the achievable potential estimates rely on these realistic penetration rates achieved from actual utility energy-efficiency programs. Achievable potential is further refined to reflect other considerations, such as budgets or market barriers. (The refined estimate of achievable potential is often referred to as realistic achievable potential.)*

[27] The AEG study, in turn, was partially based upon a market research study conducted for the utility: EMPIRE ELECTRIC ENERGY MANAGEMENT SURVEY 2008, which was provided in Appendix C to Volume IV.

In Tables ES-1 and ES-2 of that study, AEG provided energy savings estimates. Because some of reported values were incorrect, we are updating those tables based upon Empire's responses to MDNR Data Request No. 89. The baseline sales level is based on Empire sales by class of service for the 12-month period, December 2008 to November 2009.

Table 1. Potential Estimates (kWh) - Corrected Table ES.1			
	Technical	**Economic**	**Achievable**
Residential	915,965,277	551,882,020	45,190,194
Commercial	488,836,606	328,349,329	24,626,200
Industrial	118,775,076	86,420,187	6,481,514
Total	1,523,576,959	966,651,536	76,297,908
Table 2. Potential Estimates (Percent of baseline) - Corrected Table ES.2			
	Technical	**Economic**	**Achievable**
Residential	49%	29%	2%
Commercial	27%	18%	1%
Industrial	18%	13%	1%
Total	35%	22%	2%

It should be noted that the potential estimates shown above in Tables 1 and 2 represent the conservation potential associated with a particular CO_2 cost assumption and avoided cost scenario. That is, Empire's supply-side consultant, Ventyx, developed four resource plans extending out to 2029. Avoided costs were calculated for the alternative carbon mitigation scenarios. The avoided costs associated with the four cases increase from Scenario 1 (no value associated with carbon savings) to Scenario 4 (high value associated with carbon offsets), with Scenario 3 representing Empire's most likely carbon mitigation assumption used to develop Empire's preferred Resource Plan 4. More DSM programs are cost effective and initiated as avoided costs increase. Thus, if there were less carbon regulation than assumed in Empire's base case, the economic and achievable potential would be lower than indicated in Tables 1 and 2. In Scenario 4, where CO_2 costs result in higher avoided costs, the economic and achievable potential would be more than twice the amounts shown in Tables 1 and 2.

Comparing the achievable savings in Table 1 with the amount of the conservation savings reported in Empire's resource plan scenarios (see Tables 4 and 5 below and Volume IV Appendix A of D – 20 year program impacts), it appears that that savings in Table 1 are not those associated with Scenario 3, but rather Scenario 2 (low value associated with carbon offsets).

Technical Potential

Based on a comparison with other potential studies reported in the National Action Plan for Energy Efficiency (NAPEE)[28] AEG's estimates for the technical potential as reported in Table ES-2 appear to be reasonable. However, Empire has not provided any worksheets prepared by AEG or how its assessment was developed. The technical potential study is deficient in this regard.

Economic Potential

AEG estimates that the economic potential for efficiency savings within the residential sector is approximately 29% of baseline sales. While this value falls within a reasonable range, it is significantly lower than AEG's estimate for technical potential. Typically, the economic potential is close to, but somewhat lower than the technical potential.[29] However, the economic potential is not typically 20 percentage points lower than the technical potential. In

[28] National Action Plan for Energy Efficiency (2007). Guide for Conducting Energy Efficiency Potential Studies. Prepared by Philip Mosenthal and Jeffrey Loiter, Optimal Energy, Inc. <www.epa.gov/eeactionplan>

[29] In studies cited for California and New York within NAPEE, the economic potential is about 70% of the technical potential. AEG's estimate for Empire is 60% of the technical potential.

general, this indicates that a number of efficiency measures (that are cost effective in other jurisdictions) were not found to be cost effective within the Empire service territory. This result may be related to a lower avoided cost of energy in Empire's service area relative to other jurisdictions. Regardless, AEG does not discuss this matter, except to say on p. 35:

> *The economic potential starts with the same list of potential efficiency measures as the technical potential, but includes only those efficiency measures that are found to be cost-effective as determined using the Societal Test , which compares the total costs and benefits to society – including the utility and its customers.*

However, using the societal test to screen DSM measures is not what is intended in 4 CSR 240-22.050(3):

> *The utility shall evaluate the cost effectiveness of each end-use measure identified pursuant to section (1) using the probable environmental benefits test.*

While the economic potential estimates developed for Empire's commercial and industrial sectors (i.e., 18% and 13% of baseline sales, respectively) are comparable to studies completed elsewhere, most of AEG's assumptions are unstated. It is unclear what measures were eliminated from consideration. On p. 35, AEG continues:

> *Measures that failed the Societal Cost-effectiveness Test in most markets or building types (for Commercial measures) were removed from the analysis. For example, some measures were not cost effective in the "no future carbon cost case" (scenario 1) but were cost effective in the higher carbon cost cases (scenario 3 or scenario 4).*

In total, across all classes of service, AEG estimates Empire's economic potential for efficiency savings is about 22% of its baseline sales (for the 12-month period ending 11/09). AEG estimates the cost-effective economic potential for efficiency savings is close to one trillion kWh.

Achievable Potential

According to NAPEE, "**Maximum achievable potential** describes the economic potential that could be achieved over a given time period under the most aggressive program scenario. **Achievable potential** refers to energy saved as a result of specific program funding levels and incentives. These savings are above and beyond those that would occur naturally in the absence of any market intervention."[30] However, Empire is often ambiguous on what was

[30] NAPEE, p. 6-17.

assumed and on what is the difference between maximum achievable potential and achievable potential.

On p. 31 of the potential study, AEG defines achievable potential as follows:

> *Achievable potential (budget-constrained potential), or the efficiency savings feasible using cost-effective efficiency measures within specific budget targets.*

However, in response to MNDR Data Request No. 35, Empire remarks that "Table ES.1 in the Demand-Side Resource Potential Study reflects the maximum achievable potential." In response to MDNR Data Request No. 88, it is stated "The estimates of maximum achievable potential presented in the AEG study … is not a budget constrained estimate." However, in response to MDNR Data Request No. 94, it is stated:

> *AEG developed the participation goals for the programs in Scenarios 1 through 4 on the budgets established for each scenario.*
>
> *AEG began with a budget assumption for Scenario 4 of 1% of sales revenues.*

Given the target budget that Empire specified for AEG, how much of the economic potential does AEG believe that the Company can secure over the next 20 years? Not much. AEG estimates that the total achievable potential is only 2% of baseline sales. Otherwise put, AEG's estimate of the achievable potential is only 8% of the cost-effective economic potential.

AEG's estimates are low compared to other potential studies completed in the United States, including the Midwest. According to the NAPEE report, the maximum achievable potential ranges from as low as 5% (Massachusetts) to as high as 35% (NY,NJ & PA).[31] For the Midwest, a GDS potential study for a Kentucky utility reported a maximum achievable potential of 12%.[32] The methodology used to develop Empire's achievable potential is representative of what is typically used to generate a budget-constrained program potential. In response to MDNR Data Request No. 42, the Company explains that its DSM portfolio, and AEG's estimate of the achievable potential, is budget constrained:

> *We developed our portfolio with budgets reflecting reasonable and justifiable incentive levels that are consistent with industry practice. Based on these parameters, we developed the participation goals. Had we designed programs without any consideration for cost and simply "gave away" the efficiency measures (paid full cost), we could have increased the savings. The*

[31] National Action Plan for Energy Efficiency (2007). *Guide for Conducting Energy Efficiency Potential Studies*. Prepared by Philip Mosenthal and Jeffrey Loiter, Optimal Energy, Inc. <www.epa.gov/eeactionplan>. Page 2-1.
[32] GDS Associates, Inc., The Maximum Achievable Cost Effective Potential for Electric Energy Efficiency In the Service Territory of the Big Rivers Electric Corporation, November 2005.

cost for this would have been significant as well as a burden for ratepayers. But even if we did this, many measures would still require significant investment by participants and that is the primary constraint on participation and higher savings goals.

Further, in response to MDNR Data Request No. 55, the Company states that

Empire requested that the budget be limited to 1% of 2009 revenue. This level was determined based upon the discussions being held at that time relating to the rulemaking on the renewable energy guidelines.

AEG's low achievable potential estimates appear to reflect the historically low DSM program performance of Empire compared to other utilities in the US. Empire ranks very low compared to other electric utilities on the percent of annual kWh sales saved from energy efficiency programs. Empire is one of the lowest ranking utilities by that metric in the United States.

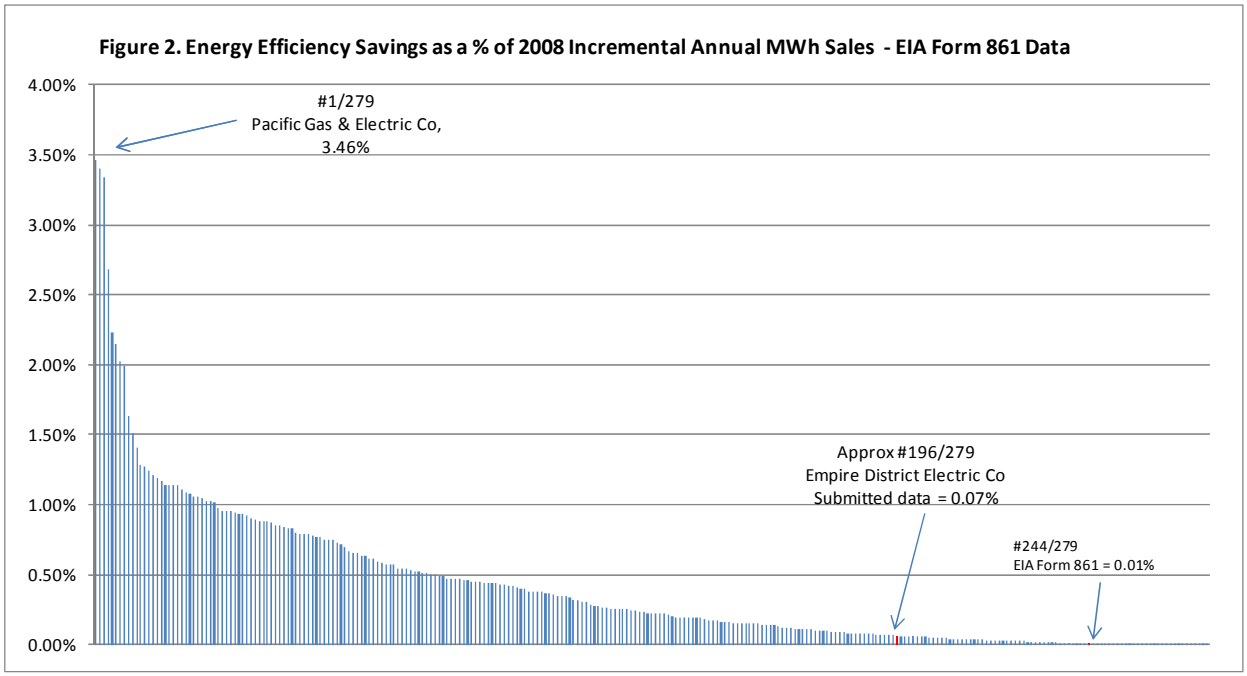
- Based on data provided by the Company in response to MDNR Data Request No. 30, Empire's DSM programs in Missouri saved about 3.2 million kWh in 2008, and its retail sales in that year were close to 4,772 million kWh. That is, Empire's energy efficiency savings represents approximately 0.07% of its retail sales. In 2009, the Company's energy efficiency savings totaled about 2.7 million kWh.

- According to EIA Form 861 data for 2008, in terms of the metric of savings as a fraction of sales, Empire's 0.07% would place it at 196 out of 279 utilities reporting.[33] Table 3 shows the relationship between kWh saved and annual sales for the top 20 utilities in the US and for Empire.

[33] The Form EIA-861 Database is an electric utility data file that includes such information as peak load, generation, electric purchases, sales, revenues, customer counts and demand-side management programs, green pricing and net metering programs, and distributed generation capacity. The data source is the survey Form EIA-861, "Annual Electric Power Industry Report." Data for all years are final. The database can be accessed at http://www.eia.doe.gov/cneaf/electricity/page/eia861.html. Based upon the data that is in the EIA database, the 2008 ratio energy savings to sales is 0.01% and Empire's ranking is 244.

Table 3. Energy Efficiency Savings as a % of 2008 Annual MWh Sales - Top 20 Performers from EIA Form 861 Data				
Utility #	**Utility Name**	**EE savings as a % of annual MWh sales**	**Rank**	**State**
14328	Pacific Gas & Electric Co	3.46%	1	CA
2182	City of Breckenridge	3.41%	2	MN
7294	City of Glendale	3.34%	3	CA
7303	Glidden Rural Electric Coop	2.69%	4	IA
19497	United Illuminating Co	2.23%	5	CT
2548	City of Burlington-Electric	2.14%	6	VT
17609	Southern California Edison Co	2.02%	7	CA
4176	Connecticut Light & Power Co	1.99%	8	CT
1367	Bayfield Electric Coop, Inc	1.63%	9	WI
309	City of Algona	1.51%	10	IA
13407	Nevada Power Co	1.41%	11	NV
15356	Price Electric Coop Inc	1.28%	12	WI
329	Allamakee-Clayton El Coop, Inc	1.27%	13	IA
15500	Puget Sound Energy Inc	1.24%	14	WA
17166	Sierra Pacific Power Co	1.21%	15	NV
18383	Taylor Electric Coop	1.20%	16	WI
19062	City of Traer	1.17%	17	IA
14468	People's Cooperative Services	1.14%	18	MN
9922	Jump River Electric Coop Inc	1.14%	19	WI
8298	Hawkeye Tri-County El Coop Inc	1.14%	20	IA
5860	**Empire District Electric Co**	**0.01%**	**244**	**MO**

Figure 2 shows how Empire compares with other utilities in the US.



Given the target DSM budget that Empire specified, the Company's IRP filing does not depart from its past level of performance. Based on the data provided by Empire, the annual amount of energy efficiency savings that it expects to obtain in the future ranges between **[redacted]** and **[redacted]** of its annual kWh sales (before reduction for DSM). In the utility's preferred resource plan (Plan 4), Empire would implement conservation programs that would save about **[redacted]** of its annual kWh sales.

The amount of DSM found in Empire's resource plans was determined in a roundabout manner. First, Empire's supply-side consultant, Ventyx, developed four resource supply scenarios associated with different degrees of carbon regulation. Avoided costs were calculated for these alternative carbon mitigation scenarios. As detailed in Empire's response to MDNR Data Request No. 77, the avoided costs for these scenarios were provided to AEG. In turn, AEG developed four DSM portfolios to be used as "inputs" into Ventyx's optimization model. AEG's DSM portfolios effectively served as constraints within the optimization model rather than true scalable inputs. Counter to the requirements of 240-22.010(2)(A), Empire has not prepared an analysis of demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives. AEG's participation goals for the programs in Scenarios 1 through 4 were based on the budgets established for each scenario. Empire's DSM portfolio for Scenario 4 was budget constrained to be no greater than 1% of its 2009 electric revenues. Further, Empire's analysis fails the equivalence requirement with respect to scalability. The amount of DSM capacity selected in Empire's resource planning process was limited to what AEG estimated based upon fixed investment levels. The analysis did not allow for the expansion of demand-side resources beyond Empire's constrained DSM budget, where they are cost effective.

Table 4 (Highly Confidential in its entirety) shows the cumulative amount of energy efficiency savings for 2029 (adjusted for measure lifetimes) that Empire would incorporate into its integrated resource plan based on these alternative futures.[34] The avoided costs associated with the four cases increase from Scenario 1 to Scenario 4, with Scenario 3 representing Empire's most likely carbon mitigation assumption. As is shown in Table 4, more DSM savings are obtained as avoided costs increase. The average annual DSM program costs associated with the scenarios increases from **[redacted]** million in Scenario 1 to **[redacted]** million in Scenario 2, **[redacted]** million in Scenario 3 and **[redacted]** million in Scenario 4.

[34] Scenario 1, in which avoided costs do not include a future carbon cost, is associated with Empire's Plan 9. Scenario 2, in which avoided costs assume a low carbon cost, is associated with Empire's Plan 10. Scenario 3 is Empire's base case, where avoided costs assume a medium carbon cost, is associated with Plans 1-2, 4-8, and 13-17. Scenario 4, in which avoided costs assume a high carbon cost, is associated with Plans 11 and 12. Empire's Plan 3 included no DSM programs.

Table 4

Highly Confidential in its entirety

[redacted]				
[redacted]				
[redacted]				
[redacted]				
[redacted]				
[redacted]				
[redacted]				
[redacted]				
[redacted]				
[redacted]				

Figure 3 (Highly Confidential in its entirety) places the cumulative amount of energy savings achieved in 2029 within the context of the technical and economic potential that AEG has estimated for Empire. To say that least, a substantial amount of energy efficiency savings potential is left unaddressed in Empire's resource plans.

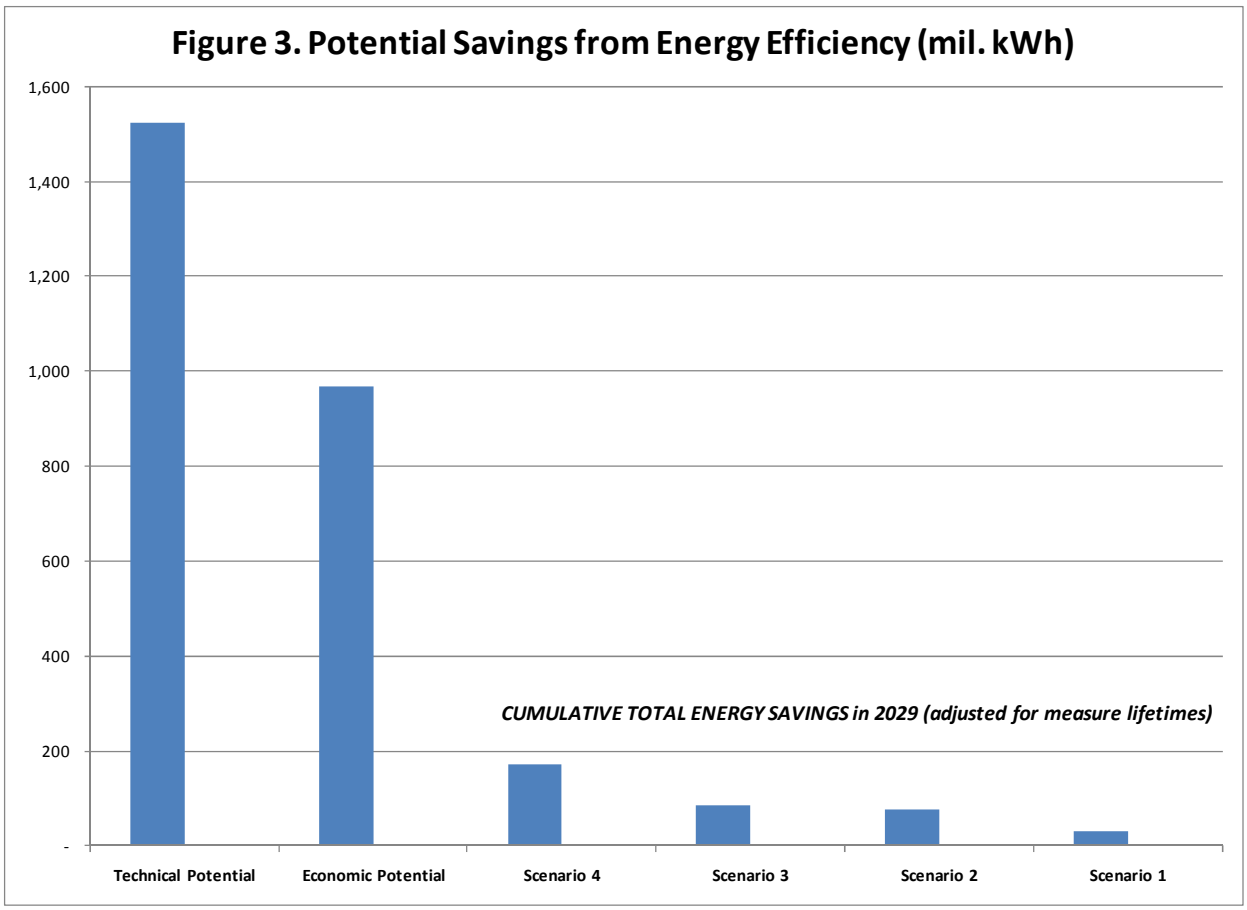


Figure 3. Potential Savings from Energy Efficiency (mil. kWh)
1,600
1,400
1,200
1,000
800
600
400
200
-
CUMULATIVE TOTAL ENERGY SAVINGS in 2029 (adjusted for measure lifetimes)
Technical Potential
Economic Potential
Scenario 4
Scenario 3
Scenario 2
Scenario 1

Table 5 (Highly Confidential in its entirety) provides a detailed summary for the cumulative amount of the kWh savings that Empire indicates is achievable by 2029. Noticeably absent from the four DSM portfolios is any savings from a residential lighting program even though about 15% of residential sales are associated with lighting.[35] It should be noted that Empire's portfolio does not include any program directed at consumer electronics or plug loads. Further, the Company has placed a significant emphasis is placed on load control measures that have minimal impact on kWh usage.

Table 5

** Highly Confidential in its entirety**

[redacted]

[35] See Figure 5, p. 24, of The Empire District Electric Company Demand-Side Resource Potential Study 2011-2013 (provided as Appendix D to Volume IV of Empire's IRP filing).

The annualized amount of energy savings as a percentage of sales, **[redacted]**, associated with Empire's base case (Scenario 3, which was used to develop Plan 4) is no larger than the minimal level that Company has achieved in the past (e.g., in 2009). Why isn't Empire's performance improving? In response to MNDR Data Request No. 42, AEG remarks that this has to do with the unique characteristics of Empire's service area:

> *The characteristics of Empire's service territory present challenges that will result in lower than industry averages, assuming average cost per kWh saved. There is no large city in or near the service area; the Company serves a high percentage of lower income customers; its service area is largely rural and customers are spread out over a large geographic region. Empire's experience in implementing its current portfolio highlights the magnitude of these challenges. In addition the results of the residential and commercial baseline studies that were conducted over the past year further support this conclusion.*

Based on the savings as a percentage of sales metric, Empire ranked no higher than 196 out of 275 reporting utilities in 2008. However, considering that some of the best performing utilities are rural electric cooperatives, Empire should not consider its small town or rural geography a disadvantage in creating high impact, successful programs with increasing penetrations over the timeframe of the IRP.

It is also worth repeating that the DSM budget was constrained to be no higher than 1% of Empire's 2009 electric revenues. With regard to the percentage of revenue spent on energy efficiency, garnered from the 2008 EIA Form 861 data, Empire ranks 215th out of 284 reporting utilities (see Figure 4). In 2008, Empire spent only 0.10% of revenues on energy efficiency programs. In contrast, the top 20 utilities by this metric spend over 2% of revenues on energy efficiency programs (see Table 6). According to the same 2008 data, North Central Missouri Electric Cooperative ranked 7th among utilities, spending a reported 2.82% of revenues on conservation programs.

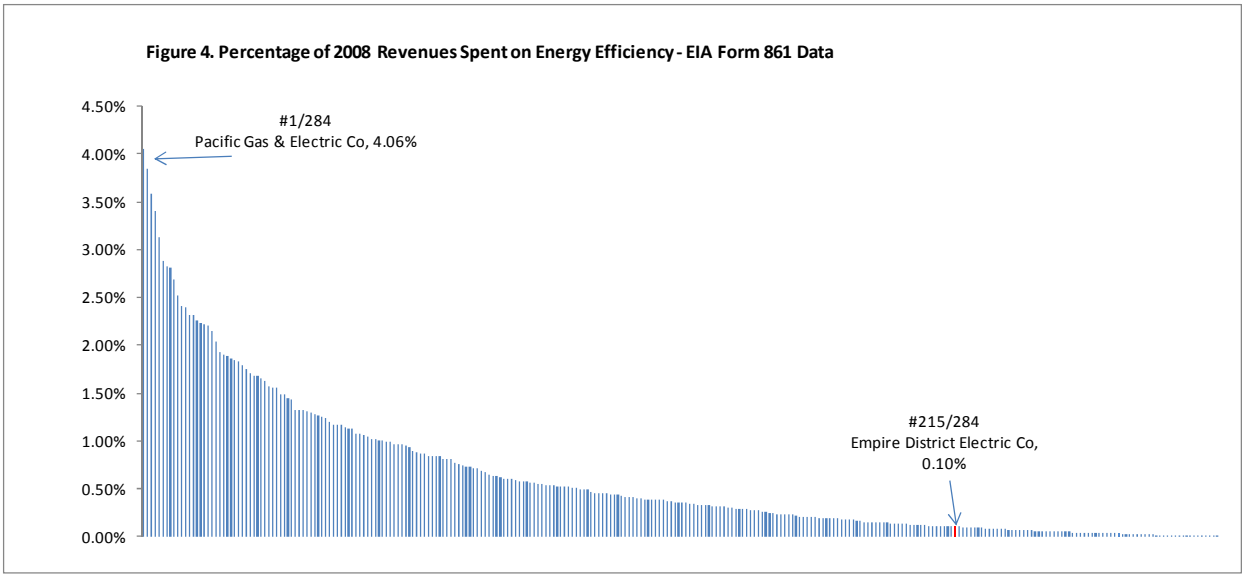


Table 6. Percentage of 2008 Revenues Spent on Energy Efficiency - Top 20 Performers from EIA Form 861 Data

Utility #	Utility Name	% of annual revenues spent on Energy Efficiency	Rank	State
14328	Pacific Gas & Electric Co	4.06%	1	CA
16555	Salem Electric	3.84%	2	OR
16609	San Diego Gas & Electric Co	3.59%	3	CA
907	City of Ashland	3.40%	4	OR
2548	City of Burlington-Electric	3.12%	5	VT
5930	Village of Fairport	2.88%	6	NY
13690	North Central MO Elec Coop Inc	2.82%	7	MO
13149	City of Needles	2.81%	8	CA
20214	Waverly Municipal Elec Utility	2.69%	9	IA
15477	Public Service Elec & Gas Co	2.52%	10	NJ
17609	Southern California Edison Co	2.41%	11	CA
15500	Puget Sound Energy Inc	2.40%	12	WA
4176	Connecticut Light & Power Co	2.32%	13	CT
3644	PUD No 1 of Clallam County	2.31%	14	WA
40437	Emerald People's Utility Dist	2.27%	15	OR
15296	New York Power Authority	2.23%	16	NY
16868	Seattle City of	2.22%	17	WA
11804	Massachusetts Electric Co	2.20%	18	MA
44372	Oncor Electric Delivery Company, LLC	2.15%	19	TX
1050	City of Azusa	2.04%	20	CA
5860	**Empire District Electric Co**	**0.10%**	**215**	**MO**

Participation

For the all proposed programs in each scenario, Empire's projected participation numbers are based upon numerous factors. On p. 43 of Volume IV, it is stated

> *Establishing a participation goal for each program requires a balancing of numerous factors, including the pool of eligible participants, the available budget, and past program performance. Each program budget is developed in a way that balances best practices, including the share of technology costs paid directly by participants as compared to the incentive subsidy.*

This statement indicates a top-down emphasis for developing the level of participation and subsequently, the estimated program achievable potential. When yearly participation is constant, this means that market penetration actually declines or at the very least remains constant. Most successful DSM programs manage to increase penetration rates of end-use measures.

Empire has constrained program penetration to impact and spending levels comparable to the low levels accomplished in the past. Empire did not allow its IRP models to consider more energy efficiency when it was cost effective and passed the TRC test. The Company's approach has limited customer participation to rates achieved in the past even though there is a significant amount of energy efficiency potential available for the models to select if a true bottom-up methodology was used in the study (see Figure 3).

Empire has provided extremely limited measure-level detail on unit cost assumptions that would allow GDS to determine the relative size of the incentives paid by the utility and whether the incentives fall within an appropriate "best-practice" range to maximize market penetration and/or market transformation. Further, the Company does not appear to have explored the utilization of social networks (e.g., churches, food banks, etc.) to increase participation and deliver efficiency measures.

Empire's Demand-Side Resource Analysis

Identification of End-Use Measures. The IRP rule (4 CSR 240-22.050(1)) requires the development of a menu of energy efficiency and energy management measure that provide a broad coverage of—

- **22.050(1)(A) All major customer classes**

Appendix A of the Empire IRP includes analyzed measures from all major customer classes: residential, commercial and industrial. Section 2.12 on page 30 of Volume 4 reports that a C&I

Peak Load Reduction program is currently in effect for agreed interruptions of greater than 50kW.

- **22.050(1)(B) All significant decision-makers**

Empire has not clearly defined whether residential tenants and commercial lessees are eligible to participate in its DSM programs.

- **22.050(1)(C) All major end uses**

According to Appendix A of IRP Volume 4 (DSM), all major end-uses were included in the analysis.

- ✓ For the residential sector, this includes: HVAC, water heating, lighting, appliances, weatherization, and insulation.
- ✓ For the commercial sector, this includes: lighting, HVAC, water heating, refrigeration, ventilation, cooking, appliances, compressed air and commissioning.
- ✓ For the industrial sector, this includes: lighting, HVAC, weatherization, CHP, motors and drives, boilers, ventilation, process heat, process cooling and refrigeration.

- **22.050(1)(D) Renewable energy sources and energy technologies**

Empire did consider residential solar photovoltaic and wind renewable energy programs in its technical potential analysis. But, based upon the societal screening test used, the measures were not included in the candidate demand-side resources considered in the IRP. However, Empire's analysis is deficient in that these measures were not considered in the commercial and industrial sector analysis.

Calculation of Avoided Costs. The IRP rule (4 CSR 240-22.050(2)) requires that: the utility develop estimates of the cost savings that can be obtained by substituting demand-side resources for existing and new supply-side resources. These avoided cost estimates shall be used for cost-effectiveness screening and ranking of end-use measures and demand-side programs.

- **22.050(2)(A) Supply Resource Cost Estimates**

The rule states that the utility shall use the cost estimates developed to calculate two estimates of avoided cost: avoided utility costs and avoided utility costs plus avoided probable environmental costs. 22.050(2)(A)(1) requires that the choice of new generation options used to calculate avoided costs be limited to those which will meet the need for capacity under the base-case load forecast at approximately the lowest present value of utility revenue requirements over the planning horizon.

On p. 73 of Volume IV Empire provides its interpretation of 22.050(2)(A)

> *DSM programs to be considered in the IRP analysis are to be screened … using avoided costs developed specifically for this purpose. Screening of DSM programs was performed by Applied Energy Group (AEG) using avoided costs developed by Ventyx. Those DSM programs that passed the screening were made available for consideration in the Capacity Expansion Module of Ventyx. Four levels of energy avoided costs were determined using four levels of pollution mitigation: Scenario 1 – no CO_2 tax is implemented over the planning horizon, Scenario 2 – low CO_2 tax, Scenario 3 – base CO_2 tax, and Scenario 4 – high CO_2 tax. Higher avoided costs result from the imposition of higher levels of pollution mitigation. For all cases, regulation of CO_2 starts in 2015.*

Empire developed the required avoided cost detail for four alternative carbon mitigation scenarios, which is commendable.[36] As the Company recognizes on p. 74,

> *As avoided costs increase, there are additional benefits to be gained through energy conservation and peak load reduction. Increased benefits are represented by higher benefit cost results. Higher retail rates result in higher bill savings for those customers who become motivated to conserve and participate in DSM programs.*

- **22.050(2)(C) Calculation of Avoided Capacity and Running Costs**

As 22.050(2)(C) specifies, avoided costs are to be calculated as the difference in costs associated with a specified decrement in load large enough to delay the on-line date of the new capacity additions by at least one year. In its calculation of avoided costs, Empire selected a decrement size of 10 MW, which is appropriate for DSM analysis. Avoided capacity and energy costs were developed for each of the four carbon mitigation scenarios.[37] In turn, AEG used the calculated avoided cost data in its assessment of DSM programs. Thus, AEG's analysis of DSM measures did incorporate the cost savings obtained by substituting demand-side resources for supply resources: avoided utility costs and avoided environmental costs.

[36] In response to MDNR Data Request No. 64, Empire describes the process used to develop the avoided cost estimates:

> *The avoided costs were developed in portfolio runs with the Midas model … using market prices developed for each CO2 Scenario from the Power and Fuel model. For the Empire portfolio, Ventyx started with Empire's 2007 Resource Plan. Updates were made for the load, fuel and emission prices to match the 2010 IRP assumptions.*

[37] Empire notes on p. 75 that "** [redacted] ** However, since adding DSM capacity would allow Empire to make sales of energy into the market, a nonzero capacity market was considered in developing the avoided capacity and energy costs for use in the DSM screening."

Cost-Effectiveness Screening of End-Use Measures. The IRP rule (**4 CSR 240-22.050(3)**) requires that the utility evaluate the cost effectiveness of each end-use measure using the probable environmental benefits test.

However, AEG did not screen DSM measures using the probable environmental benefits test (counter to the specific requirement of 22.050(3)). AEG did evaluate measures based upon five cost effectiveness tests: total resource cost test, ratepayer impact test, utility cost test, societal benefit test, and participant test. The societal test, rather than the total resource cost test, appears to have been used as a primary screening tool; as is stated on p. 41 of AEG's report:

> *Measures that failed the Societal Cost-effectiveness Test in most markets or building types (for Commercial measures) were removed from the analysis. For example, some measures were not cost effective in the "no future carbon cost case" (scenario 1) but were cost effective in the higher carbon cost cases (scenario 3 or scenario 4).*

Further, in the Potential Study (Appendix D to Volume IV, p. ES-10), AEG remarks:

> *For Empire, the TRC also includes various estimates of avoided costs associated with carbon emissions. In some instances because of the addition of these environmental costs TRC may also be referred to as the Societal Cost Test.*

However, there are differences between the total resource cost test and the societal test.[38] In AEG's own benefit/cost model, it calculates avoided environmental damage costs for inclusion in the societal benefit test (which are not included in the TRC test). AEG has assumed an environmental externalities cost of **$[redacted]** per kWh, which escalates at **[redacted]** per annum over the planning horizon. This is in addition to the probable environmental costs embedded in the four avoided cost scenarios.

- **22.050(3)(A) Develop estimates of the end-use measure demand reduction for each demand period and energy savings per installation for each avoided cost period on a normal weather basis.**

Empire has provided the estimated energy savings and demand reductions in the files labeled "MDNR 37 HC Scenario [#].xls" in each measure tab in Rows 100-150 for kWh savings and Rows 161-185 for kW reduction. No issues or errors with this reporting requirement were identified.

[38] In response to MDNR Data Request No. 69, Empire states "There are no measures that passed the TRC test that have not been included in a program."

- **22.050(3)(B) Benefits per installation of each end use measure in each avoided cost period shall be calculated as the demand reduction multiplied by the levelized avoided demand cost plus the energy savings multiplied by the levelized avoided energy cost.**

Empire has taken the end use measures that have passed the benefit-cost tests and grouped them into relevant groupings by similar load shapes. Although the detailed end-use measure level benefits and costs are not provided, this methodology that was used to run the Ventyx model is unlikely to have a discernable effect on the potential estimates compared to the significant effect of budget-constrained participation levels.

- **22.050(3)(G) For each end-use measure that passes the probable environmental benefits test, the utility also shall perform the utility benefits test for informational purposes.**

The Utility Cost Test was performed for each measure in the "MDNR 37 HC Scenario [#].xls" files. However, the Probable Environmental Benefits Test was not used to screen end-use measures counter to the requirement of 22.050(3).

Technical Potential of Each End-Use Measure. The IRP rule (**4 CSR 240-22.050(4)**) requires that the utility estimate the technical potential of each end-use measure that passes the screening test.

In the Company's response to MDNR Data Request 39, Empire provided estimates for the technical potential for energy savings for a number of end use categories (heating, cooling, lighting, etc.) relative to its baseline sales, for the 12-month period ending 11/09. However, Empire's filing is deficient in that the Company has not estimated the technical potential of each end-use measure that passes the probable environmental benefits screening test. Further, it should be noted that the estimates submitted in response to MDNR Data Request 39 were provided without the supporting documentation, calculations or assumptions.

Potential Demand-Side Programs. The IRP rule (4 CSR 240-22.050(6)) requires that the utility develop a set of potential demand-side programs designed to deliver an appropriate selection of end-use measures to each market segment. One efficiency measure that is noticeably absent from Empire's portfolio after 2017 is residential lighting, even though lighting accounts for about 15% of residential sales. Empire has provided no explanation of why it has not included a residential lighting program after 2017.

- **22.050(6)(B) Analyze the interactions between end-use measures (for example, more efficient lighting reduces the savings related to efficiency gains in cooling equipment because efficient lighting reduces intrinsic heat gain)**

Empire has not provided details of any analysis of interactive effects conducted within the technical potential study. Section 3.2.3 on page 39 of Volume 4 provides a brief description of how interactive effects work, but GDS has not been able to review the technical potential calculations that should include interactive effects.

- **22.050(6)(D) Design a marketing plan and delivery process to present the menu of end-use measures to the members of each market segment and to persuade decision-makers to implement as many of these measures as may be appropriate to their situation.**

The general delivery plan in the IRP, commencing at page 42 of Volume 4, is not comprehensive and does not provide the degree of detail that would be necessary for an actionable program implementation.

Cost-Effectiveness Screening of Demand-Side Programs. The IRP rule (4 CSR 240-22.050(7)) requires that the utility evaluate the cost-effectiveness of each potential demand-side program using the total resource cost test. The utility cost test shall also be performed for purposes of comparison.

Adequate descriptions of all the DSM programs screened are included in Volume 4 of the IRP document commencing on page 47. No issues or errors with this reporting requirement have been identified. AEG did evaluate programs based upon five cost effectiveness tests: total resource cost test, ratepayer impact test, utility cost test, societal benefit test, and participant test. The societal test, rather than the total resource cost test, seems to have been used as a primary screening tool. However, Empire notes that all measures that passed the total resource cost test have been included in a program.

The total nominal value and net present value of benefits and costs are presented for each measure in Rows 47 and 48 of each tab of the file labeled "MDNR 37 HC Scenario [#].xls". The benefit-cost ratios are properly calculated using the Net Present Value. No issues or errors with this reporting requirement have been identified.

Unfortunately, as mentioned above, Empire has not considered demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process. That is, Empire has constrained its DSM budget to be limited to no greater than 1% of 2009 revenue.

- **22.050(7)(A) The utility shall estimate the incremental and cumulative number of program participants and end-use measure installations due to the program and the incremental and cumulative demand reduction and energy savings due to the program in each avoided cost period in each year of the planning horizon.**

Empire has provided a tabulation of the incremental and cumulative participant counts for each end-use measure in the file labeled "V4 Appendix A of D – 20 year program impacts – HC.xls". Although this reporting requirement has been met, the participant quantities appear to be severely budget restrained despite the claim that this is a "bottom-up" analysis. A true bottom-up analysis should be developed without budget constraints and without artificial levels for program participation.

Evaluation of Demand-Side Programs. The IRP rule (**4 CSR 240-22.050(9)**) requires that the utility develop evaluation plans for all demand-side programs that are included in the preferred resource plan selected.

The evaluation plans described at the end of each program summary in Volume IV of the IRP filing, commencing at page 47, are not adequate for the purpose of conducting process or impact evaluation plans of the demand-side programs associated with its preferred resource plan. However, the Company has supplied copies of evaluations for some of its current programs, many of which will be continued in the future.

Deficiencies in Empire's Demand-Side Resource Analysis (re 4 CSR 240-22.050)

- Paragraph 4 CSR 240-22.010(2)(A) – Empire did not analyze demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process. Empire's DSM portfolio was budget constrained to be no greater than 1% of Empire's 2009 electric revenues. Further, Empire's analysis failed the equivalence requirement with respect to scalability.

- Paragraph 4 CSR 240-22.050(1)(B) – Empire has not clearly defined whether residential tenants and commercial lessees are eligible to participate in its DSM programs.

- Paragraph 4 CSR 240-22.050(1)(D) – Although Empire did consider residential solar photovoltaic and wind renewable energy programs in its technical potential analysis, the

Company's analysis is deficient in that the same measures were not considered in the commercial and industrial sector analysis.

- Paragraph 4 CSR 240-22.050(3)(G) – Empire's filing is deficient in that it has not performed a standalone Probable Environmental Benefits Test to screen end-use measures.

- Paragraph 4 CSR 240-22.050(4) – Empire has not estimated the technical potential of each end-use measure that passes the probable environmental benefits screening test. Further, it should be noted that the estimates submitted in response to MDNR Data Request 39 were provided without the supporting calculations or assumptions.

- Paragraph 4 CSR 240-22.050(5) – Empire has not provided any worksheets or other documentation that show the assumptions that AEG made or how it developed its assessment of the technical, economic and achievable potential for efficiency improvements. Further, the achievable potential in the AEG study was constrained by a budget constraint. The potential study is deficient in that is did not address the amount of maximum achievable cost-effective potential that could be obtained.

- Paragraph 4 CSR 240-22.050(6) – Empire's portfolio does not include any program directed at consumer electronics or plug loads. Empire's filing is deficient in that its DSM portfolio after 2017 does not include a residential lighting program, even thought lighting accounts for about 15% of residential sales. Significant emphasis is placed on load control measures that have minimal impact on kWh usage.

- Paragraph 4 CSR 240-22.050(6)(B) – Empire has not provided details of any analysis of interactive effects conducted within the technical potential study.

- Paragraph 4 CSR 240-22.050(6)(D) – Empire's filing is deficient in that the general delivery plan in the IRP is not comprehensive and does not provide the information required for a detailed marketing plan.

- Paragraph 4 CSR 240-22.050(7)(A) – Empire's filing is deficient in that, although this reporting requirement has been met, the participant quantities appear to be severely budget restrained despite the claim that this is a "bottom-up" analysis.

- Paragraph 4 CSR 240-22.050(9) – Empire's filing is deficient in that the evaluation plans described are not adequate for the purpose of conducting process or impact evaluation plans of the demand-side programs associated with its preferred resource plan.

Proposed Remedies to the Deficiencies in Empire's Demand-Side Resource Analysis

- Paragraph 4 CSR 240-22.010(2)(A) – Revised filing. Empire should be required to estimate program potential with budget constraints that reflect current best-practice, with DSM spending greater than one percent of incremental annual sales.

- Paragraph 4 CSR 240-22.050(1)(B) – This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

- Paragraph 4 CSR 240-22.050(1)(D) – This is an issue of concern that should be addressed in a stakeholder process with commitment to studies for next resource filing.

- Paragraph 4 CSR 240-22.050(3)(G) – Supplemental filing. Empire should provide the results of a standalone probable environmental benefits test for all end-use measures.

- Paragraph 4 CSR 240-22.050(4) – Supplemental filing. Empire should provide the results of a standalone probable environmental benefits test for all end-use measures and also provide all measure assumptions used to develop the technical potential assessment.

- Paragraph 4 CSR 240-22.050(5) – Supplemental filing. Empire should be required to provide the assumptions that AEG made and describe how it developed its assessment of the technical, economic or maximum achievable potential.

- Paragraph 4 CSR 240-22.050(6) – Revised filing or stakeholder process. Empire should explain why no residential lighting program is included after 2017. It should justify its omission of measures directed at consumer electronics and plug loads and explain its preference for load control measures.

- Paragraph 4 CSR 240-22.050(6)(B) – Revised filing or stakeholder process. Empire should provide an analysis of interactive effects along with the measure assumptions used to develop the technical potential estimates.

- Paragraph 4 CSR 240-22.050(6)(D) – Supplemental filings and stakeholder process or collaborative. Empire should complete and submit comprehensive program marketing plans for the DSM programs it plans to implement in the future.

- Paragraph 4 CSR 240-22.050(7)(A) – Revised filing. Empire should conduct a true bottom-up achievable potential analysis without budgetary constraints, using an updated load forecast.

- Paragraph 4 CSR 240-22.050(9) – Supplemental filings and stakeholder process or collaborative. Empire should complete and submit comprehensive evaluation plans for the DSM programs it plans to implement in the future.

○

Volume V: Integrated Resource Analysis, Risk Analysis and Strategy Selection

Deficiencies related to the Policy Objectives of the Electric Utility Resource Planning Process (re 4 CSR 240-22.010)

In 240-22.010(2) it is clearly stated that the policy objective of the electric utility resource planning process is as follows:

> *The fundamental objective of the resource planning process at electric utilities shall be to provide the public with energy services that are safe, reliable and efficient, at just and reasonable rates, in a manner that serves the public interest. This objective requires that the utility shall—*
>
> > *(A) Consider and analyze demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process;*
> >
> > *(B) Use minimization of the present worth of long-run utility costs as the primary selection criterion in choosing the preferred resource plan; and*
> >
> > *(C) Explicitly identify and, where possible, quantitatively analyze any other considerations which are critical to meeting the fundamental objective of the resource planning process, but which may constrain or limit the minimization of the present worth of expected utility costs. The utility shall document the process and rationale used by decision makers to assess the tradeoffs and determine the appropriate balance between minimization of expected utility costs and these other considerations in selecting the preferred resource plan and developing contingency options. These considerations shall include, but are not necessarily limited to, mitigation of—*
> >
> > > *1. Risks associated with critical uncertain factors that will affect the actual costs associated with alternative resource plans;*
> > >
> > > *2. Risks associated with new or more stringent environmental laws or regulations that may be imposed at some point within the planning horizon; and*
> > >
> > > *3. Rate increases associated with alternative resource plans.*

Related to 240-22.010(2), the primary deficiencies in Empire's Integrated Resource Analysis are:

(1) The Company has not analyzed demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process,

- That is, the DSM portfolio evaluated in the integrated resource analysis was budget constrained – to be no greater than 1% of Empire's 2009 electric revenues (see the response to MDNR Data Request No. 55).

- Empire's analysis failed the equivalence requirement with respect to scalability.

(2) It has not adequately considered the risks associated with all critical uncertain factors that could affect the costs associated with alternative resource plans,

- In the Company's response to MDNR Data Request No. 78, it states:

> *Empire needed to make choices about the primary types of uncertainty to analyze in this IRP after consideration of Empire's situation, industry best practices, and the key factors that impact Empire's operation. The choices needed to be narrowed (in many cases uncertainties are grouped together) in order to make the modeling process reasonable…. So while a myriad of uncertainties and potential conditions exist, it is imperative to focus in on what is deemed the most important at the time the analysis is conducted.*

- Not all critical uncertain factors were addressed in the IRP. It its response to MDNR Data Request No. 78, Empire continues:

> *Essentially EERS and Smart grid were added to the list of uncertain factors to consider, but they were not chosen as critical uncertain factors for the decision tree representation based on the need to limit the size of the tree and focus on the most pressing factors that are present at the time the analysis was conducted. In the future, it is possible other uncertain factors will need to be considered either as part of the decision tree or handled as an assumption in an alternate plan.*

(3) Empire has not considered all of the risks associated with new or more stringent environmental laws or regulations that may be imposed at some point within the planning horizon,

- The Company has not addressed the possible affect of SB 376 (Missouri Energy Efficiency Investment Act). Although there are uncertainties inherent in the provisions of the draft rule and how the commission will interpret the load reduction targets and translate this into load reduction targets, Empire should have considered the consequences and requirements of possible rules.

- The Company has not considered the possible affect of future state or national energy efficiency performance standards on its resource plans. Nationally, Rep. Markey (MA) and Sen. Schumer (NY) have both introduced versions of the "Save American Energy Act" related to EERS. In enacted, these bills would create a national EERS that will work to reduce electricity usage by 15% and natural gas usage by 10% by 2020.

- In advance of possible national legislation, 19 states have adopted legislation that will reduce electricity usage through more stringent building codes, appliance efficiency standards, incentives for combined heat and power, and increased demand-side management.

(4) Empire has not addressed the impact of future rate increases on the demand for electricity.

- Although Empire does not deny that its customers are sensitive to changes in the price of electricity, it seems to conclude that it would be too time consuming to incorporate price elasticity into its analysis. See Empire's response to MDNR Data Request No. 13.

Deficiencies in Empire's Integrated Resource Analysis (re 4 CSR 240-22.060)

- Paragraph 4 CSR 240-22.060(3) – Empire's filing is deficient in that the utility did not analyze demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process. Further, the Company's DSM portfolio was budget constrained to be no greater than 1% of Empire's 2009 electric revenues. Empire's base case forecast is overly optimistic in its expectation of future load growth. The utility's support for its assumptions and statistical models is lacking. Additionally, the basis for Empire's development of its high and low load growth scenarios is unclear and inadequate.

- Paragraph 4 CSR 240-22.060(4)(C) – We are concerned that that the utility has not attempted to address the impact of future rate increases on the demand for electricity.

- Paragraph 4 CSR 240-22.060(4)(D) – Empire's filing is deficient in that Empire did not analyze demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process. Empire's DSM portfolio was budget constrained to be no greater than 1% of Empire's 2009 electric revenues. Further, Empire's analysis failed the equivalence requirement with respect to scalability.

Deficiencies in Empire's Risk Analysis and Strategy Selection (re 4 CSR 240-22.070)

- Paragraph 4 CSR 240-22.070(2) – Empire's filing is deficient in that not all uncertain factors that are potentially critical were addressed in the IRP. Critical uncertain factors missing include customer growth, smart grid development, and price of electricity.

- Paragraph 4 CSR 240-22.070(2)(A) – Empire's filing is deficient in that the utility's base case forecast is overly optimistic in its expectation of future load growth. Empire's support for its assumptions and statistical models is lacking. Additionally, the basis for utility's development of its high and low load growth scenarios is unclear and inadequate.

- Paragraph 4 CSR 240-22.070(2)(C) – The utility's filing is deficient in that Empire has not addressed the possible affect of SB 376 (Missouri Energy Efficiency Investment Act) on its resource plan. Also the affect of future state or federal energy efficiency resource standards (EERS) has not been considered.

- Paragraph 4 CSR 240-22.070(2)(K) – Empire's filing is deficient in that the utility did not analyze demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process. Empire's DSM portfolio was budget constrained to be no greater than 1% of Empire's 2009 electric revenues.

- Paragraph 4 CSR 240-22.070(2)(L) – We are concerned that that It is not clear that Empire has performed any sensitivity analysis related to utility marketing and delivery costs for demand-side programs.

Proposed Remedies to the Deficiencies in Empire's Integrated Resource Analysis, Risk Analysis and Strategy Selection

- Paragraphs 4 CSR 240-22.010(2)(A), 4 CSR 240-22.060(3), 4 CSR 240-22.060(4)(D) and 4 CSR 240-22.070(2)(K) – Revised filing. The utility should be required to estimate program potential with budget constraints that reflect current best-practice, with DSM spending greater than one percent of incremental annual sales. Empire should be required to rerun its analysis in such a manner that demand-side efficiency and energy management measures are evaluated on an equivalent basis with supply-side alternatives in the resource planning process.

- Paragraphs 4 CSR 240-22.010(2)(C)(1) and 4 CSR 240-22.070(2) – This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

- Paragraphs 4 CSR 240-22.010(2)(C)(2) and 4 CSR 240-22.070(2)(C) – This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

- Paragraphs 4 CSR 240-22.010(2)(C)(3) and 4 CSR 240-22.060(4)(C) – This is an issue of concern that should be addressed in a stakeholder process prior to the next utility resource filing.

- Paragraph 4 CSR 240-22.070(2)(A) – Revised filing. Empire should rerun its resource plans and risk analysis with different load growth assumptions. Possible scenarios (which should reflect stakeholder input): base case = Empire's proposed low growth scenario (i.e., **[redacted]**); low case = Empire's historic load growth (i.e., 1.0%); high case = Empire's proposed base case forecast (i.e., **[redacted]**). The load growth assumptions used should be developed with stakeholder input.

- Paragraph 4 CSR 240-22.070(2)(L) – This is an issue of concern that should be addressed in the next utility resource filing.

Summary of Findings

In summary, the major deficiencies that GDS has found with regard to Empire's IRP filing are as follows:

(1) Empire's failure to analyze demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives in the resource planning process. The utility's DSM portfolio was budget constrained to be no greater than 1% of Empire's 2009 electric revenues. Empire should be required to estimate DSM program potential with budget constraints that reflect current best-practice.

(2) Empire's base case forecast is overly optimistic in its expectation of future load growth. The utility's support for its assumptions and statistical models is lacking. Additionally, the basis for Empire's development of its high and low load growth scenarios is unclear and inadequate.

(3) Empire's demand-side resource analysis is inadequate: the basis for its conservation potential estimates is lacking; the utility has not used the probable environmental benefits test to screen end-use measures; Empire has not estimated the technical potential of each end-use measure; the required marketing and evaluation plans are lacking.

(4) Given the above deficiencies, Empire should rerun its alternative resource plans and risk analysis with a revised load forecast and a DSM portfolio that is not budget constrained.