Synapse
Energy Economics, Inc.

Review of AmerenUE February 2008 Integrated Resource Plan

Public Version

June 18, 2008

AUTHORS

Rick Hornby, Jeff Loiter, Phil Mosenthal, Tom Franks, Bob Fagan, Dr. David White

PREPARED FOR

Missouri Department of Natural Resources Energy Center

22 Pearl Street
Cambridge, MA 02139

www.synapse-energy.com
617.661.3248

Table of Contents

1. Executive Summary

A. Introduction

The Missouri Department of Natural Resources Energy Center (MDNR-EC) retained Synapse Energy Economics (Synapse), and its sub-contractor Optimal Energy Incorporated (Optimal), to assist in its review of the Integrated Resource Plan (IRP) filed by AmerenUE in February 2008. The Missouri Public Service Commission Electric Utility Resource Planning rules promulgated in 1993 in Missouri's Code of State Regulations (CSR) as 4 CSR 240-22.010 – 22.080 (IRP rule) provide the framework for the review.

This report summarizes the key results of the review prepared by the Synapse and Optimal project team. The report identifies deficiencies in compliance with the IRP rule and proposes remedies for those deficiencies.

B. Overview of AmerenUE IRP

The IRP is summarized in a sixteen page report titled *2008 Integrated Resource Plan Report.* Supporting detail is presented in six separate sections that correspond to sections of the IRP Rule. Those six sections are:

- 22.010 Policy Objectives;
- 22.030 Load Analysis and Forecasting. Three volumes plus a four-volume Appendix A and Appendices B and C;
- 22.040 Supply Side Resource Analysis. Three volumes plus Appendices A through R;
- 22.050 Demand-Side Resource Analysis. One volume plus Appendices A through J;
- 22.060 Integrated Resource Analysis. One volume plus Appendices A2 through Q2; and
- 22.070 Risk Analysis and Strategy Selection. One volume plus Appendices A through C.

AmerenUE describes its “preferred plan” or strategy in Section 4 CSR 240-22.070 starting at page 57. The preferred plan has the following components:

- Energy efficiency. A portfolio to offset at least 25% of energy and demand growth by 2016 and achieve a minimum reduction of 540 MW by 2025;
- Expansion of Renewable Generation. AmerenUE proposes to meet 10 percent of its annual retail load from new renewable resources by 2020;
- Increase efficiency of Existing Generating Units;
- Identify Existing Generating Units that will need to be retired; and
- Preserve the option of adding a new nuclear unit, in the order of 1200 MW to 1600 MW, to come on-line by 2018 or 2020. AmerenUE states in 4 CSR 240-

22.070.9 at page 101 that "…to remain on schedule to obtain a Nuclear PTC, a decision to proceed with the project needs to be made in late 2010 or early 2011" . This statement is referenced in 4 CSR240-22.070(10)B) on page 103, making it a component of AmerenUE's Resource Acquisition Strategy.

C. Major Deficiencies

Our review identifies four major problems with the AmerenUE IRP and its preferred strategy:

- the IRP under-estimates the potential for reductions in electricity requirements through energy efficiency;
- certain of the DSM programs that AmerenUE proposes to begin offering in 2008 have design flaws;
- the IRP over-estimates the cost of generation from wind capacity; and
- the IRP under-estimates the uncertainty associated with the future capital cost of new nuclear capacity.

The balance of the report is organized as follows:

- Section 2 provides a list of proposed remedies;
- Section 3 presents a discussion of deficiencies in, and proposed remedies for, the analysis of demand-side resources;
- Section 4 presents a discussion of deficiencies in, and proposed remedies for, the demand-side management programs that AmerenUE proposes to implement starting in 2008;
- Section 5 presents a discussion of deficiencies in, and proposed remedies for, the analysis of wind resources; and
- Section 6 presents a discussion of deficiencies in, and proposed remedies for, risk analysis and strategy selection.

2. List of Proposed Remedies

This Section lists proposed remedies according to the provisions of the rule for which deficiencies were identified. It also identifies, where applicable, provisions of the rule that were modified by provisions of the Stipulation and Agreement settling Case No. EO-2006-0240 or provisions of waivers granted by the Commission at the utility's request. The deficiencies themselves are identified in Sections 3 through 6.

A. Proposed Remedies for 4 CSR 240-22.050

i. Achievable Potential, 4 CSR 240-22.050(4)

AmerenUE should identify and evaluate the achievable potential from a portfolio of demand-side resources that represents a very aggressive approach to encouraging program participation. This portfolio should be consistent with the levels of participation and reductions actually being achieved by leading utilities in other states. Most studies identify achievable potential in the range of 20-30% of forecast load with maximum average annual savings ranging from 1 percent to 2 percent per year. While it may not be feasible for AmerenUE to immediately ramp up to these levels of achievement, the purpose of an IRP is consider all cost-effective resources to determine the least cost, long term resource supply, while recognizing the timing necessary to acquire it.

AmerenUE should file this evaluation with the Commission no later than February 2010. (Under its preferred plan AmerenUE is preserving the option of having 1200 MW to 1600 MW of nuclear capacity come on-line by 2018 or 2020, for which it will have to make a decision whether to proceed in late 2010 or early 2011[1]. We are proposing this filing date to ensure that all parties, including AmerenUE, understand the impact that reductions under an aggressive portfolio may have on the timing and magnitude of the Company's next capacity addition before it makes any major commitments to that capacity addition.)

During the preparation of its next IRP AmerenUE should identify and evaluate the achievable potential from a portfolio of demand-side resources that represents a very aggressive approach to encouraging program participation. This portfolio should be consistent with the most recent data on actual participation and reductions reported by leading utilities in other states as of the time it prepares the 2011 IRP.

ii. Technologies and Measures Omitted from the Analyses

4 CSR 240-22.050 (1)(D) – "Renewable energy sources and energy technologies that substitute for electricity at the point of use."

[1] 4 CSR 240-22.070.9, page 101

AmerenUE should include technologies that do not generate electricity in its screening of energy sources and energy technologies that substitute for electricity at the point of use.

4 CSR 240-22.050(6) (B) – "Analyze the interactions between end-use measures…."

AmerenUE should include a more comprehensive range of measures and technologies in its screening analyses and model all potentially cost-effective efficiency resources at maximum achievable levels to determine their potential resource contributions.

iii. Calculation of Levelized Cost of Saved Energy (4 CSR 240-22.050(3)(C))

AmerenUE should calculate the levelized cost of saved energy in nominal dollars by dividing the net present value (NPV) of the DSM program costs, calculated using a reasonable nominal discount rate, by the net present "value" of the physical energy savings, calculated using the real discount rate corresponding to the nominal discount rate. The calculations should account for the persistence of physical energy savings over the life of the DSM measures.

iv. Unduly Low Assumptions for Penetration of Measures and Programs (4 CSR 240-22.050(7)(A)1.

AmerenUE should develop penetration curves in a manner that addresses the particular market conditions for the efficiency measure and that accounts for program delivery strategies and measure bundling, rather than the formulaic payback-based approach used currently. Furthermore, AmerenUE should include consideration of non-electric customer benefits in their projection of market penetration.

v. Inappropriate Treatment of Costs and Benefits

AmerenUE should develop net-to-gross (NTG) ratios specific to classes of measures and programs based on industry experience. It should exclude NTG ratios from measure-level cost-effectiveness screening. AmerenUE should include the benefits (or costs) associated with incurred O&M savings (or increases). These should include all readily quantifiable O&M costs, including changes in fossil fuel and water use, maintenance and replacement costs. The O&M costs that are included should be documented in such a way that they may be readily identified.

B. Proposed Remedies for 4 CSR 240-22.050 (6) and 4 CSR 240-22.070(9)

i. Sub-Optimal Technologies

AmerenUE should not promote technologies that represent baseline practice or are suboptimal, including but not limited to:

- LED exit signs, except in retrofit situations.
- Electroluminescent exit signs.
- Previous generation T8 fluorescent lighting; support should be offered only for current generation, i.e."Super-T8".

AmerenUE should incorporate findings from their market research and analysis (Filing - 4 CSR 240-22.070 Appendix B, Section 6.1.1.) as soon as possible in their program implementation, as opposed to waiting for the next mandated program design cycle.

ii. Market Fragmentation and Program Design

AmerenUE should review the design and implementation of its DSM programs such that a participating customer sees a single point of contact. AmerenUE should consider combining the Home Performance and existing HVAC programs as well as the Commercial and Industrial (C&I) prescriptive, custom, and retro-commissioning programs.

AmerenUE should review the design and implementation of its residential DSM programs to address the following weaknesses:

- programs targeted at all-electric customers should better address the primary area of savings potential – namely space heating.
- upstream “buydowns” rather than coupons for the Residential Lighting & Appliance Program, despite their contention that the “scale is insufficient to generate significant manufacturer or major retailer participation.” Upstream buydowns work in Vermont, where the total population is only half of that in AmerenUE’s Missouri territory. Furthermore, such a program could be conducted in conjunction with similar programs in AmerenUE’s other service territories in Illinois.

AmerenUE should review the design and implementation of its C&I DSM programs to address the following weaknesses:

- The C&I Custom program should pay a per kWh incentive for efficiency programs. This incentive should be structured carefully to minimize free-ridership and “cream-skimming”, i.e., projects the customer would have done in any case or that are already very inexpensive from the customer’s perspective.
- AmerenUE should implement a commercial and industrial (C&I) new construction program as soon as possible, and should not limit participation to projects enrolled in the U.S. Green Building Council’s Leadership in Energy and Environmental Design (“LEED”) program. Limitation to LEED projects will likely lead to very high free-ridership and ignore the majority of C&I new construction opportunities.
- AmerenUE should consider delaying the start of the retro-commissioning program, and/or consider some modifications to the approach.

AmerenUE should review the design and implementation of its DSM programs to address the following weaknesses:

- It's unclear which measures are retrofit and which are "replace-on-fail" (aka lost-opportunity). AmerenUE should make the distinction clear in its program design.
- AmerenUE's resource focus can be optimized. More resources should be initially focused on those efficiency savings from already planned investments in the market ("lost opportunities"), and less on time-discretionary early retirement strategies ("retrofit").

C. Proposed Remedies for Wind Resources (4 CSR 240-22.040)

During the interim period before it prepares its next IRP AmerenUE should periodically reassess the cost-effectiveness of acquiring additional wind generation from the bids received in response to its 2007 wind RFP. The levelized cost of that wind generation may be cost-effective based upon the PTC and higher capacity factors reflected in those bids. If additional wind generation is cost-effective Ameren could increase the "tranche 1" procurement.

During the preparation of its next IRP, AmerenUE should

- demonstrate that its assumptions regarding capacity factors are consistent with the most recent data on capacity factors for the best commercially available wind sites.
- demonstrate that its assumptions regarding the timing of transmission capacity upgrades, and the allocation of the costs associated with those upgrades, are based upon the most recent system planning studies and currently effective transmission cost allocation principles.
- present scenarios for acquiring wind resource that identify the region being considered using a number of multi county areas, with a characterization of the wind resource available for each. To make a meaningful comparison of the regions under consideration, the information presented should include estimates for various heights of turbines (e.g. hub heights of 80 meters, 100 meters, 120 meters) of wind power density, transmission upgrades required and cost per MWh under both a PPA and an ownership arrangement.

D. Proposed Remedies for Risk Analysis and Strategy Selection (4 CSR 240-22.070)

i. Identification of Uncertain Factors (4 CSR 240-22.070 (2))

AmerenUE should, in the preparation of its next IRP, obtain input on all uncertain factors, including load transformation, from several AmerenUE staff as well as a range of external sources. It should also provide full documentation supporting the values and associated probabilities for each critical uncertain factor used in the evaluation of candidate plans. In addition, AmerenUE should consider including capacity costs as an uncertain factor in its deterministic analysis of candidate portfolios.

AmerenUE should prepare an updated evaluation of candidate portfolios including capacity costs as an uncertain factor in its deterministic analysis in order to inform their decision as to whether to proceed with a new nuclear project. Since AmerenUE states that this decision needs to be made in late 2010 or early 2011, it should submit this updated evaluation as a supplemental filing with the Commission no later than February 2010.

ii. Plans for Research on Renewables (4 CSR 240-22.070(9)(C))

Before its IRP is determined to be in compliance AmerenUE should provide a full description of its plan for research on biomass.

iii. Monitoring Critical Uncertain Factors (4 CSR 240-22.070 (10)(E)

Before its IRP is determined to be in compliance AmerenUE should provide a full description of the process and methods that it will use to monitor and report on each critical uncertain factor. At a minimum, this description should identify what will be monitored, by whom, to whom the reports will be submitted and the corresponding schedules. Because there are significant unresolved issues related to the DSM and renewable components of the preferred plan, it would be appropriate to include periodic updates on DSM and renewable resources, especially wind and biomass, as part of this monitoring and reporting.

3. Analysis of Demand-Side Resources

A. Overview

The IRP guidelines call for an integrated analysis of the costs and benefits of different energy resources on an equal footing, to determine a least cost long-term plan for meeting Missouri's electricity needs. This is meant to include demand-side resources such as energy efficiency, demand response and distributed generation. Based upon the analyses presented in its IRP AmerenUE is proposing a portfolio of energy efficiency programs that will offset at least 25% of energy and demand growth by 2016 and achieve a minimum reduction of 540 MW by 2025.

The achievable potential for energy efficiency is the amount of energy/demand reduction one might expect based on consumer adoption of cost-effective energy efficiency measures in response to utility-sponsored energy efficiency programs. This measure explicitly attempts to reflect consumer behavior in response to awareness, costs and incentives, and is estimated as the amount of energy/demand reduction over-and-above that expected to be realized by consumers acting in their self-interest (so-called "naturally-occurring" energy efficiency).

The AmerenUE estimate of achievable potential for energy efficiency, at roughly one quarter of the efficiency resources currently being captured and known to be achievable in other jurisdictions, including states which have already achieved large reductions in energy use, can not be considered **aggressive**. This deficiency is discussed relative to 4 CSR 240-22.050(4).

AmerenUE has under-estimated the achievable potential that exists in Missouri due to a number of flaws in its assumptions and analyses. These include:

- A lack of comprehensiveness in its analysis, including the omission of some demand side technologies;
- Estimates of program and measure penetration that are unreasonably low; and
- Cost-effectiveness screening that does not fully and properly account for all the costs and benefits of efficiency measures.

These deficiencies are discussed primarily relative to 4 CSR 240-22.050(7), with cross-references to other sections of the rule where appropriate.

B. Achievable Potential, 4 CSR 240-22.050(4)

In the Stipulation and Agreement settling Case No. EO-2006-0240, AmerenUE agreed to model an "**aggressive** portfolio of demand-side resources" in at least some of the alternative resource plans included in its February 2008 IRP filing (**emphasis added**). In addition, AmerenUE's waiver to Section 4 CSR 240-22.050(4) of the IRP rule (DSM waiver) states "…An estimate of achievable potential should be prepared for multiple portfolios of programs, where at least one portfolio represents a **very aggressive** approach to encouraging program participation" (**emphasis added).**

Deficiency

The AmerenUE IRP does not include a portfolio that represents a very aggressive approach to encouraging program participation. AmerenUE has under-estimated the magnitude of possible reductions in annual energy requirements that it could achieve through energy efficiency measures. AmerenUE's programs are far from "aggressive" and do not reflect full "achievable potential." At the policy level, the Company has set its reductions goal inordinately low while at the methodological level, its assumptions result in a significant underestimate of "achievable potential."

The energy efficiency portfolio in AmerenUE's preferred plan is designed to offset at least 25% of energy and demand growth by 2016. That proposed level of reduction, which is equivalent to only ***% of forecast electric load in 2016, represents incremental reductions of about ***% of annual sales each year from 2008 through 2016[2]. Those incremental reductions are substantially less than the incremental reductions utilities in many other jurisdictions have been achieving for the past several years, which have been approximately 1% of annual sales each year or more. A number of states are increasing, or planning to increase, those incremental reductions to 2% of annual sales per year or more. These states include Illinois, New York, Massachusetts, California, Connecticut and Rhode Island. Vermont is already capturing savings at approximately 2% per year. New York has set a goal of 15 percent reduction by 2015, essentially 2% per year. In Illinois, where AmerenUE also has operations, state law will require over 10% cumulative savings by 2017 (Public Act 095-0481), and a ramp up to 2% per year incremental savings. Therefore, AmerenUE's target of less than ***% per year incremental savings for the next decade can hardly be considered aggressive.

AmerenUE's forecast of savings is substantially lower than what we believe is achievable in Missouri. The cumulative potential by 2017 is ***% of total load. A meta-study conducted by ACEEE, which can be found in AmerenUE's workpapers, found a median achievable potential of 24% (an average of 1.2% per year) for electric efficiency studies (Nadel et al, 2004)

The DSM programs submitted by AmerenUE, as designed, will not capture all of the cost-effective potential savings. The rule specifically requires consideration and analysis of "demand-side efficiency and energy management measures on an equivalent basis with supply-side alternatives." This framework sets the theoretical maximum cost of DSM at the lowest cost of alternative supply-side resources. Any cost per kWh up to that cost is justified, yet AmerenUE sets a threshold in its planning process well below that level.

Contributing to this underestimate is a number of the assumptions that AmerenUE used in its analyses. These include:

- **Arbitrarily leveling of penetration after the first years**. AmerenUE projections show an arbitrary leveling of penetration after first years. There seems to be a

[2] All percentage reductions are calculated using confidential data from *"AmerenUE_Programs_Summary.xls,"* provided in response to MDNR Request #10.

disconnect between 2013 change in growth rate and change in slope of S-curve (and savings), around 2018. AmerenUE notes "… the percentage participation differs from the calculations after a certain point, due to AmerenUE's budgetary and programmatic constraints. For the Aggressive Portfolio, the annual growth rate is set at 2.3% after the 2012 demand target is reached, in order to achieve the 2025 demand target." (Response to Data Request No. 48). Not only does AmerenUE's analysis set the target low, their analysis is hobbled to meet that target and fails to capture a significant portion of the achievable cost-effective savings

- **Arbitrarily constraining the incentive cost**. AmerenUE is arbitrarily limiting incentives to 75% of measure incremental costs. While this may be an appropriate program design strategy, the IRP should be considering all the efficiency resources that are achievable to determine the need for other supply resources as part of its IRP. Clearly, AmerenUE could pay 100% of costs, as a number of other programs do (particularly for retrofit, hard to reach markets like small commercial and low income, but also for many lost opportunity prescriptive measures). This should be the bar for assessing the available energy resources in the IRP. Truly aggressive programs could pay 100% incentives as long as that was cost-effective. This is also more appropriate for purposes of an IRP, where the objective is to evaluate the maximum achievable efficiency against supply-side options. Note that we do not necessarily recommend AmerenUE pay these levels of incentives for actual program delivery. Programs can be designed to capture very high penetration rates at lower incentives, particularly when bundling other services such as financing, technical assistance, and aggressive marketing. For example, Efficiency Vermont typically pays about 50% of incremental cost for lost opportunity measures and 25% of installed cost for early retirement measures, yet is capturing savings of approximately 2% per year of load. However, because AmerenUE is assuming that measure penetrations are a function of measure payback, it is essential that they consider the maximum achievable potential assuming 100% incentives in its IRP.

AmerenUE argues in its DSM Implementation Plan (filing 22.070 Appendix B – Pg 24) that "best practices" are relative to the amount of time a utility has been delivering energy efficiency.

> "Experience shows that the recipe for program success is one part good design and two parts good execution. Neither of these ingredients is entirely portable – a best practice program or program process inevitably contains locational or sponsor idiosyncrasies that have contributed to its success. One characteristic common to many programs labeled as best practice is that they have been sponsored by entities with years or decades of program experience. What appears today as best practice is often the product of an evolution in program planning, implementation and evaluation within experienced organizations. While a new entrant into the energy efficiency marketplace will certainly be able to extract value from this

> experience, it is the ability of the entrant to effectively execute under its unique circumstances that will determine program success.
>
> This point leads to a final general observation; what is a best practice for a utility that has been designing and managing programs for two decades will be different in some cases from what should be viewed as best for a utility such as AmerenUE that is just entering the field. The energy efficiency portfolios managed by utilities with long experience tend to be characterized by narrower market segmentation, more complex delivery structures, and a larger number of programs."

It appears that AmerenUE is under-estimating the amount of value they will be able to extract from the industry's experience.

There is no question that expectations of outcomes should be rationally linked to existing and projected program delivery capacity. However, this "ramp-up" factor is no excuse for redefining "best practices" at arbitrarily low levels based solely on the company's inexperience. DSM is a mature industry with a vast body of knowledge and large number of practitioners. AmerenUE will be contracting with experienced professionals and will be seeking to maximize their return on investment. These contractors also deliver these other "best practices" programs. This is no reason to lower the bar.

Remedy

AmerenUE should identify and evaluate the achievable potential from a portfolio of demand-side resources that represents a very aggressive approach to encouraging program participation. This portfolio should be consistent with the levels of participation and reductions actually being achieved by leading utilities in other states. Most studies identify achievable potential in the range of 20-30% of forecast load with maximum average annual savings ranging from 1 percent to 2 percent per year. While it may not be feasible for AmerenUE to immediately ramp up to these levels of achievement, the purpose of an IRP is consider all cost-effective resources to determine the least cost, long term resource supply, while recognizing the timing necessary to acquire it.

AmerenUE should file this evaluation in a supplemental filing with the Commission no later than February 2010. (Under its preferred plan AmerenUE is preserving the option of having 1200 MW to 1600 MW of nuclear capacity come on-line by 2018 or 2020, for which it will have to make a decision whether to proceed in late 2010 or early 2011[3]. We are proposing this filing date to ensure that all parties, including AmerenUE, understand the impact that reductions under an aggressive portfolio may have on the timing and magnitude of the Company's next capacity addition before it makes any major commitments to that capacity addition.)

[3] 4 CSR 240-22.070.9, page 101

During the preparation of its next IRP AmerenUE should identify and evaluate the achievable potential from a portfolio of demand-side resources that represents a very aggressive approach to encouraging program participation. This portfolio should be consistent with the most recent data on actual participation and reductions reported by leading utilities in other states as of the time it prepares the 2011 IRP.

C. Assumptions and Analyses Based Upon Best Practices, 4 CSR 240-22.050 (7)

AmerenUE has under-estimated the achievable potential that exists in Missouri due to a number of flaws in its assumptions and analyses. Many of these flaws reflect a lack of comprehensiveness, for example measures that were omitted from analyses, as well as assumptions that do not reflect best practices. Thus, the deficiencies and remedies discussed in this section relate to 4 CSR 240-22.050(4) as well as to 4 CSR 240-22.050(7) A.1 which states "Initial estimates of demand-side program load impacts should be based on the best available information from in-house research, vendors, consultants, industry research groups, national laboratories, or other credible sources."

In addition, the parties to the Stipulation in Case No. EO-2006-0240, at Point 18 5) a) i), agreed to "Identification of 'best practices' programs and inputs." The deficiencies identified in this section represent clear failures to meet those requirements. Finally, some deficiencies are also failures to meet other sections of the rule. Those other sections are noted in the discussion.

i. Technologies and Measures Omitted from the Analyses

a. Substitutes at Point of End Use

4 CSR 240-22.050 (1)(D) – "Renewable energy sources and energy technologies that substitute for electricity at the point of use."

Deficiency - While the PSC IRP rule requires that "technologies [are to be considered] that substitute for electricity at the point of use," AmerenUE chose to study Distributed Generation (DG) technologies, which it defines as "generators located and operated on AmerenUE customer property to serve customer electric load (a.k.a. self-generation)." These are clearly not the same thing. For example, solar domestic hot water systems and daylighting designs substitute for electricity, rather than generating electricity.

Remedy

AmerenUE should include technologies that do not generate electricity in its screening of energy sources and energy technologies that substitute for electricity at the point of use.

b. Bundled Measures

4 CSR 240-22.050(6) (B) – "Analyze the interactions between end-use measures…."

Deficiency

The AmerenUE screening process limited its consideration of interactive effects to the measure level. (See discussion in Company's "Demand-Side Resource Analysis") It did not consider bundled measures that would optimize overall systems and ignoring the significant benefits achievable through better design and custom opportunities. As a result, while the measure list appears large, it is not comprehensive and does not efficiently capture the available opportunities. Two examples of this systematic deficiency follow:

- Performance lighting programs for C&I customers are routinely capturing reductions of 40% better than building code through better design, fixtures and controls. By only including specific one-for-one lighting replacements, AmerenUE is missing a big part of the lighting potential, particularly from better design practices. For early retirement of older systems, capture of 60% savings or better is feasible.
- AmerenUE's approach to retro-commissioning ("RCx") only includes a few very specific improvements. The current best practices find that many RCx opportunities are customized, site-specific items that are not included in AmerenUE's analysis, such as simply correcting inappropriate settings and scheduling. Massachusetts has done a pilot RCx project where they typically find about 10% savings in total building electric use from no-cost/low-cost measures.

Remedy

AmerenUE should include a more comprehensive range of measures and technologies in its screening analyses and model all potentially cost-effective efficiency resources at maximum achievable levels to determine their potential resource contributions.

c. Omitted Measures and technologies

4 CSR 240-22.050(7)(A) A.1 – "Initial estimates of demand-side program load impacts shall be based on the best available information from in-house research, vendors, consultants, industry research groups, national laboratories, or other credible sources." and Stipulation, Case No. EO-2006-0240 Point 18 5)a)i) – "Identification of 'best practices' programs and inputs."

Deficiency

AmerenUE excluded a number of measures and technologies from its screening.

Specific “best practices” measures. AmerenUE did not include efficient pool pumps and timers and fuel switching for clothes drying, space heating and water heating.

Emerging Technologies. AmerenUE ignores emerging technologies, and continues to assume the same technologies will be promoted for a full 20 years. Given the long planning horizon, this is inappropriate, as technologies will clearly advance. The most glaring omission in this category is solid-state or (“LED”) lighting. AmerenUE does not assume any improvements in the maximum efficiency of new appliances and equipment that will become commercially available over time. For example, the current Federal Standard for residential central AC units is 13 SEER. AmerenUE screens residential 14 SEER AC units, the lowest level of commercially available “efficient” units that exceed that Federal standard. AmerenUE does not screen residential AC units with higher levels of efficiency nor do they consider ductless mini-split AC units that are likely to capture increasing shares of the market as they have in other countries.

Improved design and custom opportunities. AmerenUE’s screening is limited to the measure level. In many cases the greatest saving can be achieved at the lowest cost per kWh through improved design and custom opportunities, which appear to be absent from their screening. AmerenUE’s submission includes reports on programs, such as the LEED™ Incentive Grant Program, that demonstrate their awareness of this issue. The absence of screening for these programs, and other design and custom programs that are best practices, is a glaring deficiency.

Targeted measures. In some cases AmerenUE inappropriately excludes an entire class of measures from consideration due to faulty assumptions. For example, AmerenUE excludes early retirement of inefficient residential central AC because it claims preliminary analysis showed that this measure is not cost-effective. Our review of AmerenUE’s preliminary analysis confirms that this measure is not cost-effective under the set of assumptions used by AmerenUE. However, this measure would be cost-effective for a sub-set of target installations, specifically for existing equipment that is very inefficient, e.g., less than 8 SEER. Screening should be performed to determine the efficiency at which early retirement is cost-effective, to allow for the design of a program to target units below this level.

Remedy

AmerenUE should include a more comprehensive range of measures and technologies in its screening analyses and model all potentially cost-effective efficiency resources at maximum achievable levels to determine their potential resource contributions.

ii. Error in Calculation of Levelized Cost of Saved Energy

4 CSR 240-22.050(3)(C) requires “Annualized costs per installation for each end-use measure…” expressed as levelized costs over the life of the measure.

Deficiency

AmerenUE appears to have erred in its calculation of the levelized cost of saved energy under its DSM programs.

AmerenUE calculates the levelized cost of saved energy under its DSM programs in its DSM workpaper files "AmerenUE_Moderate Portfolio_11.07.07.xls" and "AmerenUE_Aggressive Portfolio_01.22.08.xls".

In Response to MDNR Data Request 10, AmerenUE states "The levelized cost is calculated by multiplying the sum of each program's annual costs (incentive and non-incentive costs) over the 20 year time horizon by the capital recovery factor (CRF), and dividing by cumulative savings. The capital recovery factor equation is: Discount rate / (1 - (1 + discount rate) ^ - time horizon)." AmerenUE refers to a description of this method in a California Energy Commission Staff Paper.

Our review of the AmerenUE calculation of levelized cost indicates that it has not applied the methodology in the California paper correctly.

- AmerenUE applies the discount rate to the sum of the stream of DSM program costs. This means that the levelized cost does not depend on the timing of the spending, which is clearly incorrect. Shifting spending later or earlier in the program should change the levelized cost, as later spending will be more heavily discounted. This is particularly true for Ameren because later years spending has a much higher cost per annual kWh, driven, it appears, by the 2.5% inflation applied to these costs.

- The AmerenUE calculation divides the DSM program costs incurred in years 2007 through 2027 with the cumulative reduction in energy over that time frame. This calculation excludes the energy savings that will occur after 2027 as a result of the DSM program expenditures from 2007 through 2027 spending. That is, program spending between 2007 and 2027 results in measures being installed that continue to save energy over their lifetime, usually between 7 and 15 years depending on the measure. The AmerenUE analysis ignores the energy savings that will occur beyond 2027 as a result of DSM expenditures prior to 2027.

- The formula uses a nominal discount rate of 9%. Given the use of 2.5% inflation, this translates to a 6.3% real discount rate which is high. A lower nominal discount rate would produce a lower levelized cost of saved energy. More importantly, it appears that the calculations apply this nominal discount rate to both the costs and the physical energy savings. It is more appropriate to apply the nominal discount rate to the costs, while applying the real discount rate to the physical energy savings.

Remedy

AmerenUE should calculate the levelized cost of saved energy in nominal dollars for each program year. It can prepare this calculation using the methodology from the California paper and the application of appropriate discount rates. For each program year "n" AmerenUE should first express the DSM program expenditures in that year as a levelized annual cost using the estimated life (time horizon or years) over which the measures installed in year n will produce annual energy savings. It should then calculate the levelized cost per unit of saved energy for program year n by dividing the levelized annual cost for program year n by the annual energy savings from the measures installed in year n. After AmerenUE has calculated the levelized cost of saved energy in nominal dollars for each program year, it can then calculate a total

average cost of saved energy for all program years, using annual energy savings by program year as a weighting factor.

iii. Unduly Low Assumptions for Penetration of Measures and Programs

4 CSR 240-22.050(7)(A) A.1 – "Initial estimates of demand-side program load impacts shall be based on the best available information from in-house research, vendors, consultants, industry research groups, national laboratories, or other credible sources." and Stipulation, Case No. EO-2006-0240 Point 18 5)a)i) – "Identification of 'best practices' programs and inputs."

Deficiencies

AmerenUE's estimates of market penetration are deficient because they do not reflect best practices. They are arbitrarily constrained, inappropriately based on customer pay-back periods; and inappropriately disaggregate penetration rates for bundled measures.

a. Market Penetration Arbitrarily Constrained

AmerenUE's screening sets many inputs as constant over the planning horizon, contrary to widespread program experience and industry best practice. Industry experience has shown that many of the inputs will vary over time including but not limited to market penetration, Net to Gross (NTG) ratios, codes and standards, energy costs, and administrative costs.

MDNR-EC is aware of the AmerenUE consultant's position, presented in a memo of October 17, 2007, that uncertainty mitigates against a more aggressive portfolio. Across the nation, and indeed across the global, utilities and policy makers are adopting substantially more aggressive goals based in part on the very uncertainties that AmerenUE uses to justify what it characterizes as an aggressive program but is in reality only a modest program.

The consultant states in the memo's closing that," If one is interested in what more efficiency would do to the integrated plan, it would be more efficient simply to arbitrarily increase the savings we project by some amount than to construct another long-term scenario." This approach might produce an acceptable outcome and go a long way toward addressing the concerns in screening and provide AmerenUE and the stakeholders with important information for the IRP process.

The AmerenUE analysis is arbitrarily constrained by the assumptions used to define an aggressive program noted above. Due to these assumptions, after 20 years most of its program penetrations reach a maximum level of only around 25-30%. In many cases, AmerenUE's penetrations do not even reach the levels of "base case penetrations" from independent forecasts by the 20th year. AmerenUE's treatment of premium efficiency motors is illustrative of this failing. Current market studies indicate that this equipment has at least a 20% market share. The AmerenUE program plans to start well below that, at just 1-8% and only reach between 3 and 28% in the twentieth year. The experience of other programs indicates that AmerenUE could effectively transform this market within ten years, reaching penetrations in the 60-70% range, and then either benefit from

significant post-program market effects in the second decade or raise the bar and promote even higher efficiency motors. These low penetration rates that do not even reach current base case penetrations for many years would likely result in a very high level of free riders and very little savings.

b. Market Penetration Inappropriately Based on Customer Pay-Back Periods

Assuming that penetration rates are simply a function of the customer payback from savings on electricity overlooks numerous factors customers consider when deciding what to install, electric savings being only one of them. For some measures, such as efficient clothes washers, the non-electric savings in fossil fuel and/or water are more significant than the electric savings. Other attributes including non-energy benefits, such as convenience, quality, performance, ease of installation, from the customer perspective may overwhelm the simple consideration of payback. Successful programs have reached penetration rates in the 70-80% ranged based on these factors.

The fallacy of AmerenUE's focus on electricity cost payback is highlighted by the fact that some measures with extremely fast paybacks, such as retro-commissioning, have extremely low penetration rates due to high transaction costs and other barriers. Furthermore, because AmerenUE is not including non-electric benefits in its modeling, it is not even accurately estimating the real customer payback period. Furthermore, because AmerenUE is not including non-electric benefits in its modeling, it is not even accurately estimating the real customer payback period. This problem is compounded if AmerenUE fails to include O&M benefits and costs. And finally, one could design programs that overcome 100% of all financial barriers, thereby making payback zero and rendering AmerenUE's mathematical model meaningless.

c. Estimates Inappropriately Disaggregate Penetration Rates For Bundled Measures

Comprehensive programs suffer from a methodological problem inherent in AmerenUE's analysis of penetration rates. At the root of this is the practice of setting different penetration curves for measures that are delivered as a package. For example, the HVAC diagnostic program assumes some people would choose to correct refrigerant charge, while others would only address airflow. A similar methodological problem exists in the analysis of the retro-commissioning program, where AmerenUE breaks out individual RCx measures each with slightly different paybacks and it has different penetration curves for each measure and building type. In reality these programs would likely be delivered as "turn-key" programs where a customer would do all measures once it chose to participate.

Remedy

AmerenUE should develop penetration curves in a manner that addresses the particular market conditions for the efficiency measure and that accounts for program delivery strategies and measure bundling, rather than the formulaic payback-based approach

used currently. Furthermore, AmerenUE should include consideration of non-electric customer benefits in their projection of market penetration.

iv. Inappropriate Treatment of Costs and Benefits

4 CSR 240-22.050(7)(A)1. – "Initial estimates of demand-side program load impacts shall be based on the best available information from in-house research, vendors, consultants, industry research groups, national laboratories, or other credible sources." and Stipulation, Case No. EO-2006-0240 Point 18 5)a)i) – "Identification of 'best practices' programs and inputs."

Deficiencies

The analysis presented by AmerenUE contains flawed assumptions on costs and benefits in these particular areas:

- Net-to-Gross Ratios
- Savings in Operation and Maintenance Costs

a. Net-to-Gross Ratios

The use of default "net-to-gross" ratios does not reflect actual base case and penetration scenarios and is inappropriately applied at the measure level, reducing apparent cost-effectiveness of some measures.

AmerenUE is using default "net-to-gross" ratios for each program based on California practice. Net-to-gross ratios are a short-hand way of reducing the estimate of claimed savings to account for the aggregate impact of "installation rate[4]", "free-rider[5]" and "spill-over[6]" effects. For example, if a program has 1,000 MWh of gross savings based upon the participants who claimed an incentive and a net-to-gross ratio of 0.8, the program only claims a net saving of 800 MWh. These NTG ratios do not properly represent the likely NTG ratios for AmerenUE's programs. Rather, for each program and measure AmerenUE should be analyzing the base case penetration and the penetration with the program and determine the net savings. For many measures AmerenUE's penetrations are assumed to be very low, which would likely lead to very high free-riders, and thus very low NTG ratios. Also, it is not clear whether the NTG ratios are factored into the measure-level cost-effectiveness screening but it appears they are. This is inappropriate because it would assume lower savings from measures than actually occurs and unreasonably omit some measures as non-cost-effective.

[4] Participant buys efficiency product and gets a rebate, but doesn't put in service

[5] Participant gets incentive but was going to buy the efficiency product even without the incentive

[6] Participant buys efficient product, but doesn't collect the incentive

Remedy

AmerenUE should develop NTG ratios specific to classes of measures and programs based on industry experience. It should exclude NTG ratios from measure-level cost-effectiveness screening.

b. Incremental Annual Operation and Maintenance (O&M) Costs

Section 4 CSR 240-22.050 (3) requires AmerenUE to evaluate the cost-effectiveness of each end-use measure. That Section specifies the calculation of benefits of each measure in terms of avoided demand costs and avoided energy costs. It then specifies the costs to be included in the calculation of annualized costs for each end-use measure. Among those costs are the "…incremental annual operation and maintenance costs (regardless of who pays these costs) levelized over the life of the measure".

AmerenUE states in its filing that its measure screening complied with the requirement in 4 CSR 22.505(3)(C)2 to include annual operation and maintenance costs in its calculations. However, the documentation in AmerenUE's work papers does not support their statement. The incremental annual operation and maintenance costs do not appear in the supporting spreadsheets. For example, while they include a column in the DSM Model for "PV of O&M [operation and maintenance] costs", all these values are zero. This is important because energy efficiency measures can result in lower annual O&M costs, i.e., negative incremental O&M costs. These savings in annual O&M costs can be very significant for some measures; in some cases they may mean the difference between a measure being determined to be cost-effective rather than not cost-effective. For example, AmerenUE completely ignores the savings from avoided purchase of incandescent bulbs when adopting compact fluorescent lamps. This is a very large benefit. If those savings were recognized the customer payback would be much lower. Given AmerenUE's payback-based penetration approach, this would result in much higher penetrations for this measure.

Omission of these incremental costs is a deficiency under 4 CSR 240-22.050 (3)(C) 2 – "Annualized costs per installation for each end-use measure shall be calculated as the sum of the following components:….2. Incremental annual operation and maintenance costs (regardless of who pays these costs) levelized over the life of the measure using the utility discount rate."

Remedy

AmerenUE should include the incremental annual O&M costs associated with measures in its calculations, with the recognition that the incremental impact may be savings in those costs. These impacts should include all readily quantifiable incremental changes in annual O&M costs, including changes in fossil fuel and water use, maintenance and replacement costs. The O&M costs that are included should be documented in such a way that they may be readily identified…

4. Design of Demand-Side Management Programs, 4 CSR 240-22.050(6) and 4 CSR 240-22.070(9)

A. Overview

The AmerenUE programs should be the starting point of an integrated plan to capture the full achievable potential under an aggressive portfolio, assuming one had been identified in the IRP. The early years will necessarily be less aggressive than future years to allow for capability and infrastructure development. However, this should be done in relation to a long term plan of ramping up to capture all cost-effective efficiency.

The DSM programs AmerenUE is proposing to implement under its current 3-year plan starting in 2008 represent a significant increase in efficiency efforts, and will likely provide substantial efficiency resources cost-effectively. However, our review indicates that those programs could be improved through a number of modifications. The major weakness in the programs that AmerenUE is proposing include, but are not limited to:

- Promotion of suboptimal technologies rather than more cost-effective alternatives.
- Slow ramp up, ultimately targeting far less efficiency than could be achieved over the long term.

This section discusses the major deficiencies in the DSM programs that AmerenUE proposes to implement starting in 2008. These deficiencies relate to the requirements under sections 4 CSR 240-22.050(6) and 4 CSR 240-22. 070(9) and the Stipulation in Case No. EO-2006-0240

B. Recommendations for DSM Program Design and Implementation

Provision 18 of the Stipulation in Case No. EO-2006-0240 states "AmerenUE will perform a cost/benefit analysis of potential DSM programs, including engaging a consultant to assist in this evaluation, to work on program design and to create an implementation plan." Among the specific tasks identified in that section is a commitment to identify best practices programs and inputs (Task 5 a i).

4 CSR 240-22.050(6) specifies "The utility shall develop a set of potential demand-side programs that are designed to deliver an appropriate selection of end-use measures to each market segment."

4 CSR 240-22. 070(9) specifies that "The utility shall develop an implementation plan that specifies the major tasks and schedules necessary to implement the preferred resource plan over the implementation period. The implementation plan shall contain: (B) A schedule and description of ongoing and planned demand-side programs, program evaluations and research activities."

i. Sub-Optimal Technologies

Deficiency

AmerenUE's analysis assumes promotion of measures that are or will be sub-optimal, baseline, or code requirements for the full 20 year program life. Examples of these measures include:

- Standard T8 technology, which is widely considered to be baseline practice for all new installations. Despite this, AmerenUE projects to continue promoting this 20 year old, inefficient technology for the full 20 years, ultimately reaching penetrations in the single digits.
- Compact fluorescent lamps (CFL) for a full 20 years, at relatively low penetration levels, despite Federal 2007 EPACT standards that will require either CFLs, or a yet to be designed efficient alternative, as soon as 2012.
- Premium efficiency motors that will likely be a federal mandate within ten years.

Remedy

AmerenUE should not promote technologies that represent baseline practice or are suboptimal, including but not limited to:

- LED exit signs, except in retrofit situations.
- Electroluminescent exit signs.
- Previous generation T8 fluorescent lighting; support should be offered only for current generation, i.e."Super-T8"

AmerenUE should incorporate findings from their market research and analysis (Filing - 4 CSR 240-22.070 Appendix B, Section 6.1.1.) as soon as possible in their program implementation, as opposed to waiting for the next mandated program design cycle.

ii. Market Fragmentation and Program Design

a. Comprehensive Approach

Deficiency

The programs described in AmerenUE's filing fragment the markets for efficiency. Best practices in several jurisdictions are moving away from a program "silo" approach.

The goal should be to achieve all cost-effective energy savings at a customer location once that customer has enrolled in a program. Programs could be designed and delivered such that the customer sees a single point of contact. This will reduce barriers to participation, increase penetration of related measures, and increase administrative

efficiency. For example, the Home Performance and existing HVAC programs could be combined as could the C&I prescriptive, custom, and retro-commissioning programs.

Remedy

AmerenUE should review the design and implementation of its DSM programs such that a participating customer sees a single point of contact. AmerenUE should consider combining the Home Performance and existing HVAC programs as well as the C&I prescriptive, custom, and retro-commissioning programs.

b. Residential DSM Programs

Deficiency

The residential DSM programs in AmerenUE's DSM Implementation Plan have several sub-optimal design features.

Remedy

AmerenUE should review the design and implementation of its residential DSM programs to address the following weaknesses:

- programs targeted at all-electric customers should better address the primary area of savings potential – namely space heating.
- upstream "buydowns" rather than coupons for the Residential Lighting & Appliance Program, despite their contention that the "scale is insufficient to generate significant manufacturer or major retailer participation." Upstream buydowns work in Vermont, where the total population is only half of that in AmerenUE's Missouri territory. Furthermore, such a program could be conducted in conjunction with similar programs in AmerenUE's other service territories in Illinois.

c. Commercial and Industrial (C & I) Programs

Deficiency

The C&I DSM programs in AmerenUE's DSM Implementation Plan have several sub-optimal design features.

Remedy

AmerenUE should review the design and implementation of its C&I DSM programs to address the following weaknesses:

- The C&I Custom program should pay a per kWh incentive for efficiency programs. This incentive should be structured carefully to minimize free-

ridership and “cream-skimming”, i.e., projects the customer would have done in any case or that are already very inexpensive from the customer’s perspective.

- AmerenUE should implement a commercial and industrial (C&I) new construction program as soon as possible, and should not limit participation to projects enrolled in the U.S. Green Building Council’s Leadership in Energy and Environmental Design (“LEED”) program. Limitation to LEED projects will likely lead to very high freeridership and ignore the majority of C&I new construction opportunities.
- AmerenUE should consider delaying the start of the retro-commissioning program, and/or consider some modifications to the approach.

d. Cross-Program Design Features

Deficiency

The DSM programs in AmerenUE’s DSM Implementation Plan have several sub-optimal design features.

Remedy

AmerenUE should review the design and implementation of its DSM programs to address the following weaknesses:

- It’s unclear which measures are retrofit and which are “replace-on-fail” (aka lost-opportunity). AmerenUE should make the distinction clear in its program design.
- AmerenUE’s resource focus can be optimized. More resources should be initially focused on those efficiency savings from already planned investments in the market (“lost opportunities”), and less on time-discretionary early retirement strategies (“retrofit”).

5. Analysis of Wind Resources (4 CSR 240-22.040)

Deficiency

AmerenUE's supply side resource analysis over-estimates the cost of generation from new wind turbine capacity.

Rule 4 CSR 240-22.040 (1) states in part:

The analysis of supply side resources shall begin with the identification of a variety of potential supply-side resource options which the utility can reasonably expect to develop and implement solely through its own resources or for which it will be a major participant… The utility shall collect generic cost and performance information for each of these potential resource options…

AmerenUE initiated a wind RFP process in 2007, as noted on page 88 of the Risk Analysis and Strategy Selection section. It provided summary information on the bids received in response to that process in a confidential response to MDNR Data Request 21. The cost and performance information for new wind capacity that AmerenUE presents in 4 CSR 240-22.040, starting at page 35, are inconsistent with the cost and performance information submitted by bidders in response to the wind RFP. As a result, the IRP supply side resource analysis over-estimates the cost of generation from new wind turbine capacity.

AmerenUE evaluates the economics of three quantities of wind resources, which it refers to as “tranches”, which it assumes will be available at three different points in time. Tranche 1 is 300 MW available currently and tranche 2 is 300 MW available by 2014. Tranches 1 and 2 are available in Missouri, Illinois and or Iowa, i.e. within the Mid-West ISO (MISO). Tranche 3 wind is 1200 MW available by 2018 from resources both inside and outside of MISO.

The responses in the 2007 wind RFP offered lower prices per MWH when the energy is purchased under a PPA than when provided under a Build Transfer Agreement which results in ownership of the generation assets by Ameren. The IRP ignores these savings and only examines the projected cost under Ameren ownership.

a. Capital Costs

AmerenUE assumptions for the capital costs of wind, excluding costs of transmission upgrades, are $1,900/kw for tranche 1 and $2,100/kW for tranche 2 and tranche 3. These capital costs are high relative to the bids submitted in response to the wind RFP, particularly for tranches 2 and 3. As explanation for the higher tranche 2 and 3 costs, AmerenUE claims higher costs associated with higher towers. However, in those assumptions AmerenUE does not appear to factor in scale economy effects from the use of larger turbines or the economies associated with larger wind farms. (Responses to MDNR Data Requests 27 and 30).

b. Capacity Factors

AmerenUE assumes net capacity factors of wind of 33% for tranche 1, 35% for tranche 2 and 39% for tranche 3. The results of the RFP indicate that higher net capacity factors can be achieved with higher towers or premium sites. For example the average capacity factor from all the wind farms that responded to the wind RFP is **%. The range of net capacity factors of the bidders in the wind RFP range from *** % to ***%. (Confidential response to MDNR Data Request 21).

c. Production Tax Credit

Many of the responses to the wind RFP offered fixed price terms under Purchased Power Agreements (PPA) in a range much lower than the $108/MWh levelized cost estimated by AmerenUE. A large portion of the difference between the fixed prices offered by the bidders and the AmerenUE estimate appears to be due to the effect of the Production Tax Credit (PTC). The AmerenUE estimate of levelized cost from wind capacity assumes no PTC. The financing arrangements presented in the wind proposals, along with fundamental economies of scale and wind farm capacity factors, appear to produce considerably lower costs than the AmerenUE estimate of levelized costs (Confidential response to MDNR Data Request 21).

d. Transmission Upgrade Costs

AmerenUE places the entire amount of assumed transmission upgrade costs on the wind resources in tranches 2 and 3. This assumption ignores the fact that transmission upgrade costs would most likely be allocated among many projects, not just to wind projects. The AmerenUE assumption artificially inflates the wind resource cost. For example, tranche 3 wind is burdened with from $21 to $42 per MWh of costs associated with building transmission. This allocation of 100% of the transmission upgrade costs ignores the significant beneficial effects such transmission would bring to the AmerenUE system (response to MDNR Data Request 27). Transmission is a shared resource, and it benefits all users of the grid, both load and generation. The wind developments would not be the sole beneficiary of the network transmission indicated to be required for new wind. Some, or even much, of this transmission is arguably better allocated across all load to allow for all generation resources to be delivered. And, some part of this cost is likely to be shared by other MISO systems, just as Ameren will share in transmission costs imposed on other systems.

The results of the RFP process indicate that much more than 600 MW of commercially viable wind is available in MISO (in MO, IL, IA), thus refuting the notion that as you go into tranche 3 you have to incur wheeling charges. It is also possible that actual transmission upgrades required could be much less than is set out in these documents, because of the availability of “good sites” (as per the results of the RFP) closer to the Ameren service area. In essence, the results of the RFP suggest that since much more wind is available closer to Ameren service territories, the overall transmission costs may be lower than they have estimated (even if it were to all be allocated to the wind resource, which it shouldn’t be). Also, there is no significant transmission needs analysis in the IRP that would provide a more careful look at actual needs. For example, under the recent FERC provisions for offering “conditional firm” transmission service, a

transmission system would not necessarily have to be planned/built to support the installed capacity of all wind under the most severe system loading circumstances.

A more realistic approach to assignment or allocation of transmission upgrade costs is required in the IRP in order to properly "burden" any new capacity that would contribute to the need for, or benefit from, an upgrade. A reasonable allocation would be closer to zero than to 100 percent. It also appears that AmerenUE has not allocated transmission upgrade costs to other types of new capacity.

Ameren's discussion of the potential for wind energy development does not address wind resources as a site dependent resource. Even a quick examination of a wind resource map will show a wide variation in the resource between different regions in the multi-state region served by Ameren. Instead of tranches of unspecified location, the IRP needs to present wind resource data for specific locations.

Discussion of a site in terms of its Capacity Factor may lead to an under-estimate of the wind resource at that location. Capacity factor is meaningful only relative to a certain combination of turbine, rotor and wind conditions. For example at the same site, using the same turbine the capacity factor can vary based on the diameter of the rotor. Similarly capacity factor will vary if the same rotor is used with a different turbine. A more useful general comparison is to specify the average annual wind power density (watts per square meter of rotor area) present at a specified distance above ground level.

e. Magnitude of Wind Resource

AmerenUE under estimates the quantity of commercially-available wind resource. AmerenUE has determined that 1,800 MW of wind is a "reasonable judgment for developable wind resource that could be sited and commercially supported" and hence representative of an "All Wind" case. The basis for this determination is unclear. The responses to the wind RFP indicate that over*** MW of wind was commercially available from sites in Missouri and Illinois alone, and that over *** MW could eventually be available from those sites (Confidential Response to MDNR Data Request 21). The magnitudes identified are stated without specifying the locations being considered, and the criteria used. As the magnitudes cited understate the wind resource in the multi-state area, it is apparent that the unstated assumptions have confined the analysis.

f. In-Service Dates

AmerenUE provides little support for its assumed in-service dates for new wind capacity in tranches 2 and 3, i.e., 2014 and 2018. No clear assessment is given of the capacity of the existing transmission system to support a given increment of wind; and no examination is made of possible "optimal" paths of expansion given the wind resource locations. These in-service dates appear to be based upon the most conservative estimate of when new transmission might be built (Response to MDNR Data Request 28).

Remedies

During the interim period before it prepares its next IRP AmerenUE should periodically reassess the cost-effectiveness of acquiring additional wind generation from the bids received in response to its 2007 wind RFP. The levelized cost of that wind generation may be cost-effective based upon the PTC and higher capacity factors reflected in those bids. If additional wind generation is cost-effective Ameren could increase the "tranche 1" procurement.

During the preparation of its next IRP, AmerenUE should:

- demonstrate that its assumptions regarding capacity factors are consistent with the most recent data on capacity factors for the best commercially available wind sites.
- demonstrate that its assumptions regarding the timing of transmission capacity upgrades, and the allocation of the costs associated with those upgrades, are based upon the most recent system planning studies and currently effective transmission cost allocation principles.
- present scenarios for acquiring wind resource that identify the region being considered using a number of multi county areas, with a characterization of the wind resource available for each. To make a meaningful comparison of the regions under consideration, the information presented should include estimates for various heights of turbines (e.g. hub heights of 80 meters, 100 meters, 120 meters) of wind power density, transmission upgrades required and cost per MWh under both a PPA and an ownership arrangement.

6. Risk Analysis and Strategy Selection (4 CSR 240-22.070)

A. Overview

In Section 4 CSR 240-22.060 AmerenUE created 110 Alternative Resource Plans or candidate portfolios for initial evaluation. The Alternative Resource Plans consisted of different combinations of DSM, conventional resources, renewable resources, and upgrades of existing plants. In Section 4 CSR 240-22.070 AmerenUE "winnowed" the 110 candidate portfolios down to 18 candidate portfolios, and then winnowed those 18 down to a single preferred strategy. Its selection process entailed three main steps.

In step one AmerenUE developed a set of scenarios, and a corresponding probability tree, in order to evaluate each candidate plan under a range of possible futures with different combinations and values of critical uncertain factors.

- AmerenUE identified three critical uncertain factors to use in its joint sensitivity or "deterministic" analysis in step two. The three critical uncertain factors are carbon policy, natural gas prices and future load. For its analysis AmerenUE created nine different scenarios or "worlds" that reflect different combinations of projected future values and probabilities for each of those three uncertain factors.
- AmerenUE identified an additional four "independent" critical uncertain factors to use in its independent sensitivity or "probabilistic" analysis in step three. The four independent critical uncertain factors are capital costs, interest rates, off-system sales and production tax credit. For each of these it estimated future values and associated probabilities.

In step two, the deterministic analysis, AmerenUE calculated the present value revenue requirements (PVRR) of each of the 110 candidate plans under each of the nine scenarios. AmerenUE used those PVRR results to select the two "best" plans under each scenario, for a total of 18 top candidate plans for further risk analysis in step three. From the results for each scenario AmerenUE selected the two plans with the lowest PVRR.

In step three, the probabilistic analysis, AmerenUE calculated the PVRR of each of the 18 top candidate plans for each of 324 possible end-states from the probability tree. Then, for each possible end-state, AmerenUE calculated the difference between the PVRR of the "best" plan in that end state, with best defined as the lowest PVRR, and the PVRRs of the other 17 plans in that specific end state. The IRP presents the resulting expected PVRR differences of each plan in Table 2, page 49 of Section 4 CSR 240-22.070. AmerenUE selected as its preferred strategy the plan with the lowest expected PVRR difference. The name of the preferred strategy is "NUC1660-Agg-LowNoWind" which refers to 1600 MW of new nuclear, "aggressive" DSM (according to AmerenUE0 and low/no wind.

B. Deficiencies

i. Identification of Uncertain Factors (4 CSR 240-22.070 (2))

Rule 4 CSR 240-22.070 (2) states in part "Before developing a detailed decision-tree representation of each resource plan, the utility shall conduct a preliminary sensitivity analysis to identify the uncertain factors that are critical to the performance of the resource plan. This analysis shall assess at least the following uncertain factors…" The rule then lists twelve specific factors.

a. Documentation of the Values and Probabilities for Uncertain Factors

Deficiency

The documentation of the values and probabilities of the uncertain factors is inadequate in several respects.

- The "subjective assessment" of load transformation by CRA, one of the consultants to AmerenUE, presented in CSR 240-22.030 (7) is based upon input from only one AmerenUE staff person. Consideration of more than one opinion typically produces a wider range of values and substantially improves the validity of results based on expert assessments.
- The range of values for each factor assumed for modeling purposes tends to exclude values that may have a low probability, e.g. 5 percent, but an extremely high value (e.g. 100% higher than value at the 50th percentile). Consideration of extreme outcomes is a major objective of risk assessment. Risk measurement techniques such as Value at Risk (VAR) should be used to address risk of extreme outcomes. For a detailed discussion of the application of VAR in utility resource planning see "Energy Portfolio Management: Tools and Practices for Regulators" prepared by Synapse Energy Economics for The National Association of Regulatory Utility Commissioners (October 2006).
- The probability distributions assumed for the uncertain factors do not appear to be based upon analyses of the historical values of each factor, including analyses of correlations between these factors. Without such a basis, the factors are an expression of personal perception and with no data to back them up have very limited credibility.

Remedy

AmerenUE should, in the preparation of its next IRP, obtain input on all uncertain factors, including load transformation, from several AmerenUE staff as well as a range of external sources. It should also provide full documentation supporting the values and associated probabilities for each critical uncertain factor used in the evaluation of candidate plans.

b. Consideration of Uncertainty in the Future Capital Costs of New Nuclear Capacity

The AmerenUE waiver request related to risk analysis and strategy selection (attachment D, page 4), states that AmerenUE "…cannot know *a priori* what types of uncertain events will have the most effect on the variation of integrated projections.." and "the sensitivity of the scenario outputs will be explored for a number of different uncertain factors that can affect integrated energy systems."

The 18 top candidate plans that AmerenUE chose for further detailed risk analysis in step three reflect the three critical uncertain factors (i.e., carbon policy, natural gas prices future load) that AmerenUE used in its deterministic analysis in step two. The 18 candidate plans chosen based upon those three uncertain factors are not particularly diverse. For example 11 of the 18 plans include nuclear capacity and only 2 include gas-fired capacity. Had AmerenUE included capital costs of new capacity as a fourth uncertain factor in this step, the 18 top candidate plans chosen in step two would likely have reflected a more diverse mix of capacity resources. This difference in outcome is due to the impact of variations in capacity costs on the performance of candidate plans that include new coal and/or nuclear capacity. Those more diverse candidate plans would have performed differently in the probabilistic analysis and, as a result, AmerenUE may have chosen a different preferred plan.

The future values for capital costs of new coal and nuclear capacity, and the probabilities of those future values, make capital costs a critical uncertain factor that should be considered earlier in the evaluation process. In recent years the projected costs of new coal plants have increased dramatically and has led to the cancellations of a number of proposed plants. The future cost of new nuclear plants is even more uncertain. Based on historic experience in the US, and recent experience with new nuclear plants in Europe, the future capital costs of new nuclear plants are likely to be significantly greater than the initial cost estimates.

Deficiency

AmerenUE appears to have underestimated the range of future capital costs of new nuclear capacity in its evaluation of its candidate portfolios.

The AmerenUE IRP does provide a discussion of factors that could influence future capital costs of new nuclear plants[7]. The company cites that discussion as demonstration of compliance with Stipulation & Agreement provision #17 which reads in part "…the firm providing the estimate [of capital costs] shall be required to identify the critical uncertain factors that may cause the capital cost estimates to change significantly and to provide a range of estimates and an associated subjective probability distribution that reflects this uncertainty."

[7] 4 CSR 240-22.040 (8)(B) at page 250.

The discussion in the IRP may enable AmerenUE to claim that it is in formal compliance with the Stipulation. However, the distribution of possible future capital costs used in the IRP, i.e. probabilities and corresponding capital costs, is quite optimistic based on historic experience with new nuclear plants in the United States as well as with recent experience with new nuclear plants in Europe.

Remedy

In its next IRP AmerenUE should consider including capacity costs as an uncertain factor in its deterministic analysis of candidate portfolios.

In addition, AmerenUE should prepare an updated evaluation of candidate portfolios including capacity costs as an uncertain factor in its deterministic analysis in order to inform their decision as to whether to proceed with a new nuclear project. Since AmerenUE states that this decision needs to be made in late 2010 or early 2011, it should submit this updated evaluation as a supplemental filing by February 2010.

ii. Plans for Research on Renewables (4 CSR 240-22.070(9) (C))

Rule 4 CSR 240-22.070 (9) states in part "The utility shall develop an implementation plan that specifies the major tasks and schedules necessary to implement the preferred resource plan over the implementation period. The implementation plan shall contain…. (C) A schedule and description of all supply-side resource acquisition and construction activities..."

Deficiency

The IRP presents very little discussion of AmerenUE's plans for research on biomass although biomass is an essential component of the renewable component of their preferred plan.

Remedy

Before its IRP is determined to be in compliance AmerenUE should provide a full description of its plan for research on biomass.

iii. Monitoring Critical Uncertain Factors (4 CSR 240-22.070 (10) (E)

Rule 4 CSR 240-22.070 (10) (E) requires "A process for monitoring the critical uncertain factors on a continuous basis and reporting significant changes in a timely fashion to those managers or officers who have the authority to direct the implementation of contingency options when the specified limits for uncertain factors are exceeded."

Deficiency

The IRP discussion of the process for monitoring critical uncertain factors is deficient. The discussion does not present any details on the process or describe that methods that AmerenUE will use to monitor and report on trends in the capital costs of new nuclear and coal capacity, carbon policy or any of the other critical uncertain factors.

As stated in the waiver on risk and strategy selection it is important for the utility to monitor "what activities AmerenUE needs to engage in to preserve its options to shift to any of the other resource plans that the analysis finds to have a significant chance of later emerging as a preferred plan."

Remedy

Before its IRP is determined to be in compliance AmerenUE should provide a full description of the process and methods that it will use to monitor and report on each critical uncertain factor. At a minimum, this description should identify what will be monitored, by whom, to whom the reports will be submitted and the corresponding schedules. Because there are significant unresolved issues related to the DSM and renewable components of the preferred plan, it would be appropriate to include periodic updates on DSM and renewable resources, especially wind and biomass, as part of this monitoring and reporting.