7. Demand-Side Resources

Highlights

- *Ameren Missouri has conducted a DSM Market Potential Study with primary data from its service territory to assess the potential for energy and demand savings*
- *A total of 425 demand side measures have been evaluated*
- *Ameren Missouri plans to spend nearly $60 million over 3 years on energy efficiency programs to obtain nearly 253 GWh of energy savings and over 54 MW of peak demand savings.*
- *Business Custom Program incentive levels increased by over 50% from prior implementation plan levels.*
- *The budget for the Residential HVAC program has increased more than 25% from the Cycle 1 budget to position it as one of the premier program offerings.*
- *The innovative Multi-family Income Qualified program will continue and may be expanded depending on how Ameren Missouri and stakeholders determine how best to serve hard-to-reach customer segments.*

Ameren Missouri has undertaken significant steps to improve and expand its consideration and evaluation of demand side resources. Chief among these is the development of a DSM Market Potential Study, which relies on primary market research within Ameren Missouri's franchise service territory. Using the results of this study, Ameren Missouri has developed a range of potential DSM portfolios for evaluation in the integration and risk portions of the IRP analysis.

7.1 Implementation Plan Summary

7.1.1 Introduction

The implementation plan covers a three year period beginning on January 1, 2012 and extending through December 31, 2014. The following table summarizes the estimated energy and demand savings and costs estimated for this period.

Table 7. 1: Estimated Incremental Savings and Costs for the Implementation Period - LOW RISK Portfolio

	2012	2013	2014
Estimated energy savings (MWh)	100,378	80,393	73,064
Estimated demand reduction (MW)	18	17	19
Estimated costs (Program costs in millions)*	$ 20.50	$ 18.76	$ 20.17

* Note: The Company may choose to equalize expenditures for each year after finalizing implementation plans with its implementation contractors.

As stated above, this document focuses primarily on the years 2012 through 2014, which is the second 3-year implementation cycle ("Cycle 2") of Ameren Missouri's ongoing DSM programming. Analysis was also performed for all other years in the Integrated Resource Planning (IRP) horizon (2010-2030). Several demand side management (DSM) portfolios were analyzed and considered during this process. The list of all DSM portfolios considered has been enumerated below in ascending order of impact and budget. More detail has been provided on the development of the various portfolios in Section 7.8.

- **Low Risk Portfolio (Low Risk)**: reduces Cycle 1 levels of program spending and savings to a level commensurate with the Company's growing concerns with the current DSM regulatory framework, especially lost revenues. This portfolio only slightly escalates these levels over time.

- **Capacity Calibrated Portfolio (CCP)**: tuned to meet only annual capacity needs during the planning horizon.

- **Realistic Achievable Potential Portfolio (RAP):** version of the RAP identified in Ameren Missouri's foundational DSM Market Potential Study found in Appendix B, updated with the latest information and assumptions from the IRP process.

- **Maximum Achievable Potential Portfolio (MAP):** version of the MAP identified in Ameren Missouri's foundational DSM Market Potential Study, updated with the latest information and assumptions from the IRP process.

- **1% Per Year Portfolio (1PPY):** very aggressive portfolio designed to achieve 1% incremental energy savings every year after 2015. Designed to be equivalent to MAP.

- **2% Per Year Portfolio (2PPY):** extremely aggressive portfolio designed to achieve 2% incremental energy savings every year after 2020.[1]

7.1.2 Portfolio Programs

The Low Risk portfolio represents a robust set of energy efficiency measures that have been aggregated into programs. The programs were designed to incorporate considerations of new building construction, thermal integrity, equipment and appliance

[1] ER-2010-0036 – Stipulation and Agreement #12a;
EO-2007-0409 – Commission Order for 4 CSR 240-22.050(4)

efficiency, and utilization levels of energy-using capital stock.[2] The table below represents a high level summary of the proposed programs.

Table 7. 2: Low Risk Portfolio Programs[3]

Residential - Lighting	Incentives are provided to the manufacturing and retail partners to increase sales of qualified lighting whereby the end-user receives a discount on the price of ENERGY STAR qualified or other high efficiency lighting products.
Residential - HVAC	HVAC diagnostics/tune-up, retrofit, and replacement upgrades for air conditioners, heat pumps, and cooling systems, achieving electric energy savings.
Residential - Appliance Recycling	An incentive is provided to a customer for removing an inefficient refrigerator or freezer whereby a turnkey appliance recycling company verifies customer eligibility, schedules pick-up appointments, picks up appliances, recycles and disposes units, and performs incentive processing.
Residential – Low Income	Delivers energy savings to low income qualified customers through direct install measures and incentives for energy efficient appliances.
Business – Standard Incentive	Incents customers to purchase energy efficient measures with predetermined savings values and fixed incentive levels.
Business – Custom Incentive	Applies to energy efficient measures that do not fall into the Standard Incentive program. These projects are often complex and unique, requiring separate incentive applications and calculations of estimated energy savings.
Business - Retro-Commissioning	This program has a special focus on complex control systems and provides options and incentives for businesses to improve operations and maintenance practices for buildings, systems, and processes, achieving electric energy savings.
Business - New Construction	Provides incentives to overcome cost barriers to incorporating energy efficient building design and construction to achieve electric energy savings.
Business Multi-family	Focusing on common area lighting improvements and whole building HVAC system upgrades/replacement, multi-family buildings will be able to leverage incentives to improve energy performance. This program may be integrated into the Business Standard Incentive program.
Residential Demand Response – Direct Load Control	The purpose of the program is to reduce customer load and increase system reliability through command and control applications.
C&I Demand Response – Direct Load Control	The program seeks to reduce customer demand through installation of command and control switches on commercial customers systems.

[2] 4 CSR 240-22.050(1)(B)
[3] 4 CSR 240-22.050(11)(G)

7.1.3 Portfolio Overview

The Low Risk portfolio is the set of Energy Efficiency Programs included in its preferred plan. This is a portfolio that:

- **Is cost-effective** at the measure, program, and portfolio level. The overall portfolio benefit-cost ratio using the Total Resource Cost test is **1.81** (included Demand Response).
- **Aligns with best practice**. The program designs selected for this portfolio have been based on a review of program experience across the country as reflected in various studies of best practice by the American Council for an Energy Efficient Economy, the Consortium for Energy Efficiency, the National Action Plan for Energy Efficiency, and the U.S. Environmental Protection Agency.
- **Is flexible and mitigates risk**. By selecting this portfolio, Ameren Missouri is committing to its overarching elements: namely the energy savings goals and the budgets to achieve them. Specific program designs are still conceptual. Incentive levels are still broadly and formulaically developed. The details of program implementation have only been broadly sketched in the program templates found in Chapter 7 - Appendix A. Detailed program design and implementation planning typically occur after the Commission reviews the Company's IRP planning process. Once the review process is complete, the Company works with implementation contractors (or subcontractors) to develop more detailed plans that include specific incentive levels, participation levels, and implementation plans. This will allow the Company to bring a third party implementation contractor's expertise (or in-house management expertise) into the process before the program design is complete. The Low Risk portfolio plan is based on a formal assessment of the risks associated with each program and is designed to manage those risks, but exact adherence to this plan is neither intended nor probable. A key element of the risk management strategy is the flexibility to shift resources within the portfolio – to modify portfolio composition and risk as the market responds to our programs.
- **Is scalable** and enables the Company to ramp programs up or down as needed. It is not possible, at this stage in the process, to predict precisely how the market will accept each program. Therefore, having programs within the portfolio that can be quickly scaled up or down is essential to enable a rapid response to changing plan targets and market realities.
- **Represents a diverse cross-section of opportunities** for customers of all rate classes to participate in the programs.
- To the extent possible, **coordinates with other existing efforts**. The programs are working to coordinate with the natural gas energy efficiency programs offered by Ameren Missouri. The Company is also working with Laclede Gas to improve

coordination between natural gas/electric energy efficiency programs that address opportunities to improve the heat gain/loss characteristics of buildings.

7.1.4 Key Changes for Cycle 2

The Cycle 2 portfolio includes many enhancements, improvements, and evolutions relative to the Cycle 1 portfolio. The key changes for Cycle 2 are:

- Incorporated information gleaned from implementation experience in Cycle 1.[4]
- Primary market research from the DSM Potential study was used to inform program design and identify achievable energy savings potential. This granularity was absent in the previous 2008 IRP filing.[5]
- New modeling software, DSMore, was used to calculate cost-effectiveness for each measure, program, and portfolio.
- Decreasing program efforts surrounding CFL sales to reflect the expected impacts of Energy Independence and Security Act 2007 ("EISA").
- Re-evaluation of motors/drives within the Business Programs. In order to garner savings from this hard-to-reach market segment, increased marketing and incentive dollars have been allocated to help transform the commercial and industrial motors/drives market.
- Decreased reliance on the prime contractor implementation model for the Residential portfolio. This contractor model, however, appears to be working well in the business portfolio, so it has remained as the primary implementation model.
- Increased administrative costs to comply with the expected filing requirements of Missouri Senate Bill 376 otherwise known as the Missouri Energy Efficiency Investment Act ("MEEIA"). As discussed later in this document, significant allocation of company resources will be required.

The following table summarizes annual incremental portfolio energy savings, demand savings, and program costs for the 3-year implementation planning period.

[4] EO-2007-0409 – Stipulation and Agreement #27; EO-2007-0409 – Stipulation and Agreement #29
[5] EO-2007-0409 – Stipulation and Agreement #27; 4 CSR 240-22.050(07)(A)1;
EO-2007-0409 – Commission Order for 4 CSR 240-22.050(07)(A)1

Table 7. 3: Ameren Missouri Portfolio Summary for Cycle 2 (2012-2014)

LOW RISK	Incremental GWh			Incremental MW			Budget (millions of $)		
	2012	2013	2014	2012	2013	2014	2012	2013	2014
Lighting	44.3	30.5	17.1	1.3	0.9	0.5	$3.78	$2.70	$1.53
HVAC	9.2	10.8	14	4.4	5.1	6.5	$3.11	$3.74	$4.95
Appliance Recycling	7.0	3.9	3.4	1.0	0.6	0.5	$1.65	$0.95	$0.89
Low Income	3.3	2.8	2.2	0.2	0.2	0.2	$2.78	$2.96	$3.12
EE Residential Total	**63.9**	**48.1**	**36.8**	**6.9**	**6.8**	**7.7**	**$11.32**	**$10.34**	**$10.49**
Standard	9.8	11.5	13.7	3.9	4.6	5.5	$2.90	$3.35	$3.94
Custom	23.6	17.7	19.2	6.3	4.8	5.3	$5.57	$4.26	$4.75
RCx	1.0	0.8	0.8	0.2	0.2	0.2	$0.11	$0.09	$0.08
New Construction	1.2	1.4	1.7	0.4	0.5	0.6	$0.43	$0.54	$0.71
Multifamily Common	0.9	0.9	0.9	0.2	0.2	0.2	$0.17	$0.19	$0.21
EE Business Total	**36.5**	**32.3**	**36.3**	**10.9**	**10.2**	**11.7**	**$9.18**	**$8.42**	**$9.69**
EE PORTFOLIO TOTAL	**100.4**	**80.4**	**73.1**	**17.8**	**17.0**	**19.4**	**$20.50**	**$18.76**	**$20.17**
	Total System Energy (GWh)			**Total System Peak (MW)**			**Total Revenue Requirements (million $)**		
	2012	2013	2014	2012	2013	2014	2012	2013	2014
Ameren Missouri Baseline Forecasts	41,035	41,291	41,601	8,318	8,380	8,425	$3,034	$3,251	$3,474
DSM as %	0.24%	0.19%	0.18%	0.22%	0.20%	0.23%	0.68%	0.58%	0.58%

The graphs on the following pages summarize portfolio cumulative energy savings, cumulative peak demand savings, and annual program costs for the planning horizon.

It should be noted that 2010 and 2011 reflect plans from the previous 3-year implementation plan (Cycle 1) that are already in motion. Also, no demand response ("DR") programs are part of the upcoming implementation plan (Cycle 2), but are planned to begin in 2016. A more detailed description of the energy savings and demand reduction calculations for each program can be found in the Electronic Work Papers "BatchTool_(desired program name).xlsx".

Figure 7. 1: Ameren Missouri EE Annual Budget

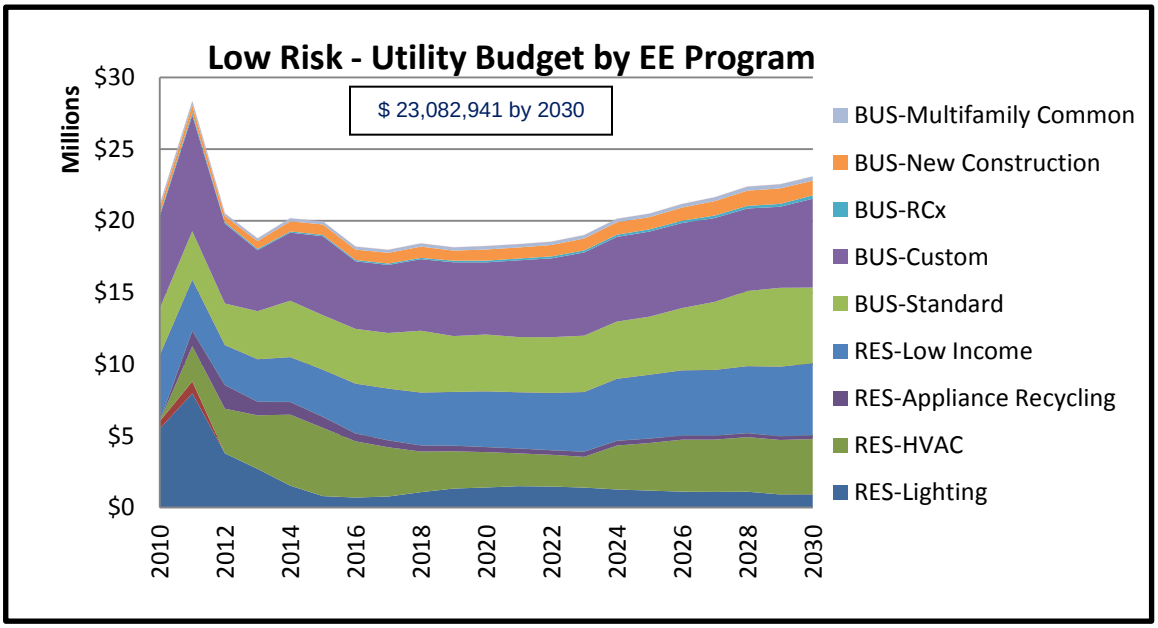


Figure 7. 2: Ameren Missouri EE Cumulative Energy Impacts

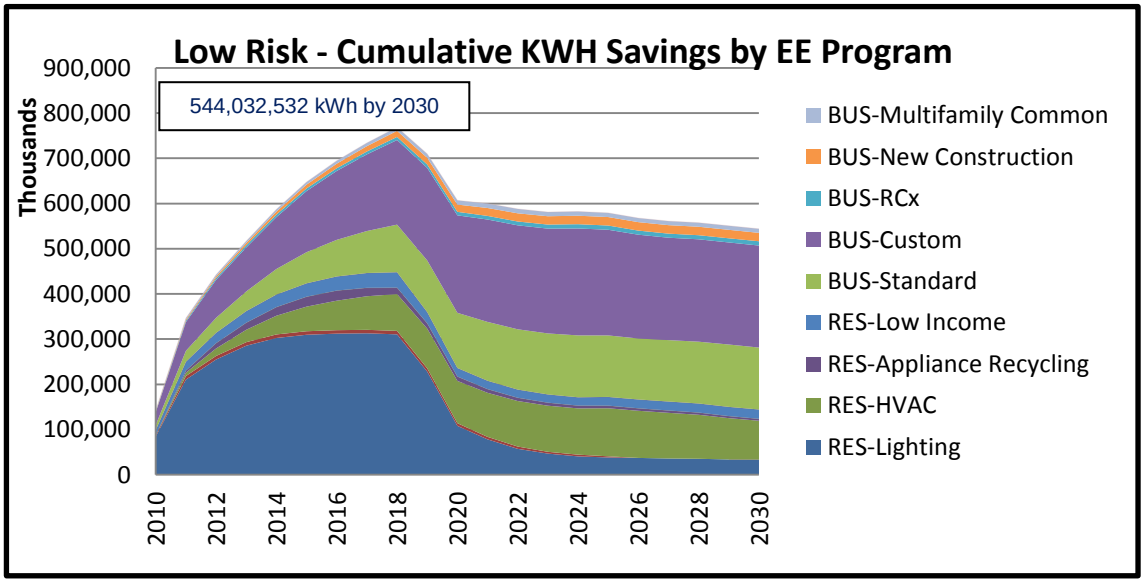


Figure 7. 3: Ameren Missouri EE Cumulative Peak Demand Impacts

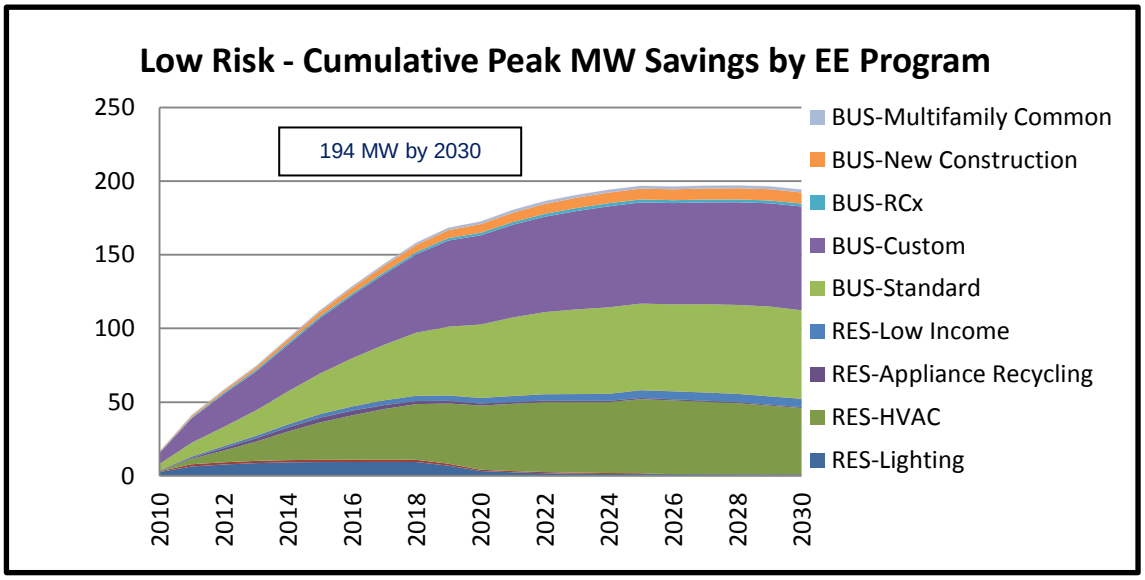


Figure 7. 4: Ameren Missouri DR Annual Budget

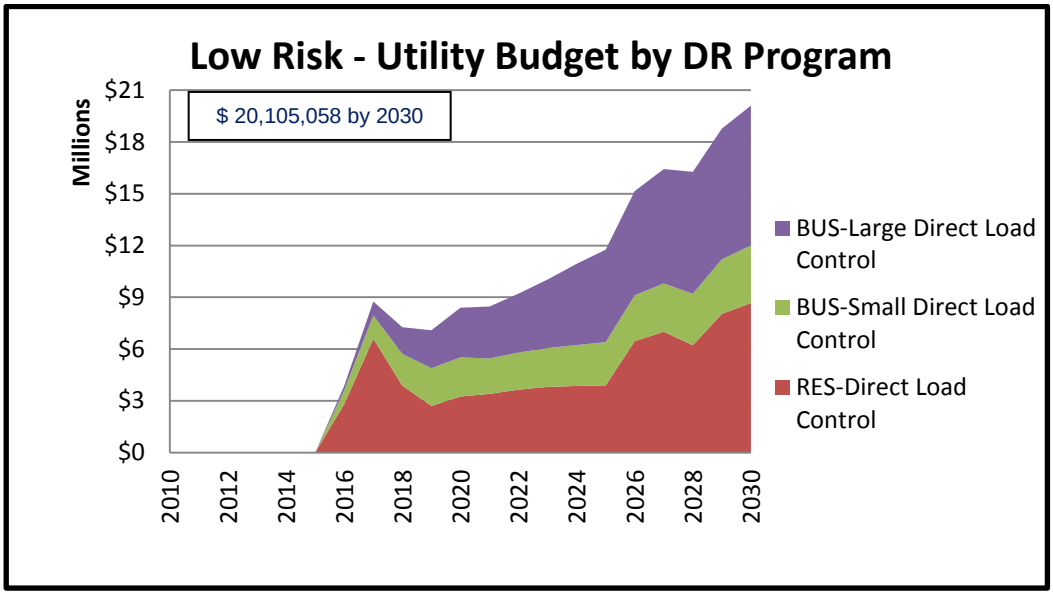


Figure 7. 5: Ameren Missouri DR Cumulative Peak Demand Impacts

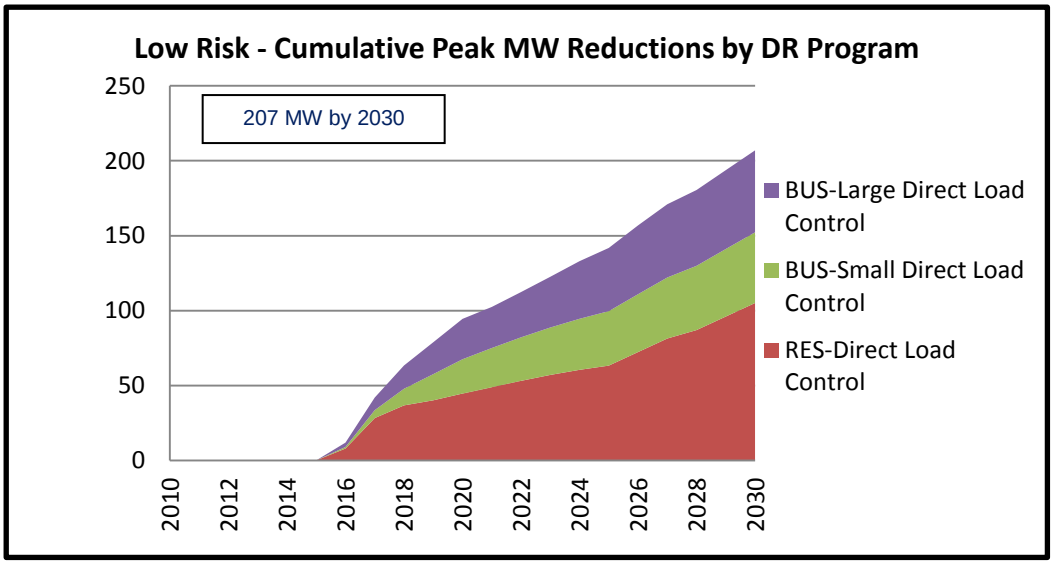


Figure 7. 6: Ameren Missouri Combined EE & DR Annual Budget

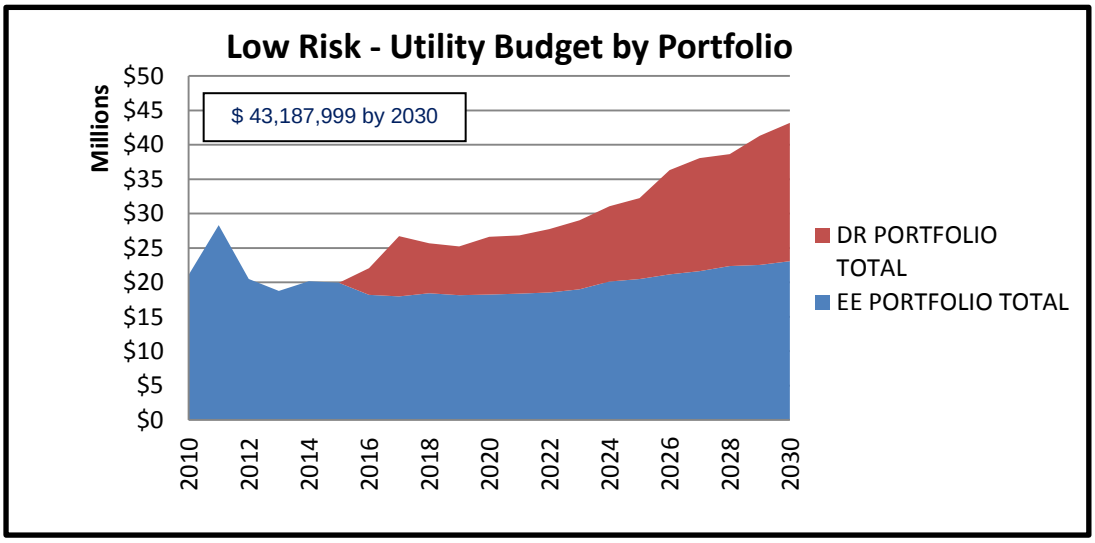


Figure 7. 7: Ameren Missouri Combined EE & DR Cumulative Energy Impacts

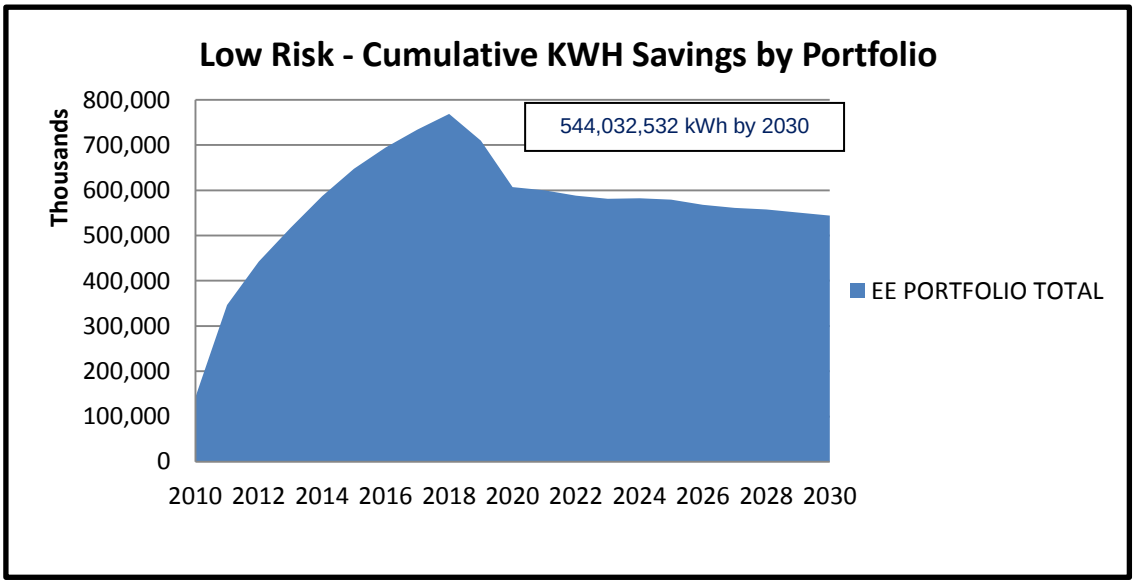


Figure 7. 8: Ameren Missouri Combined EE & DR Cumulative Peak Demand Impacts

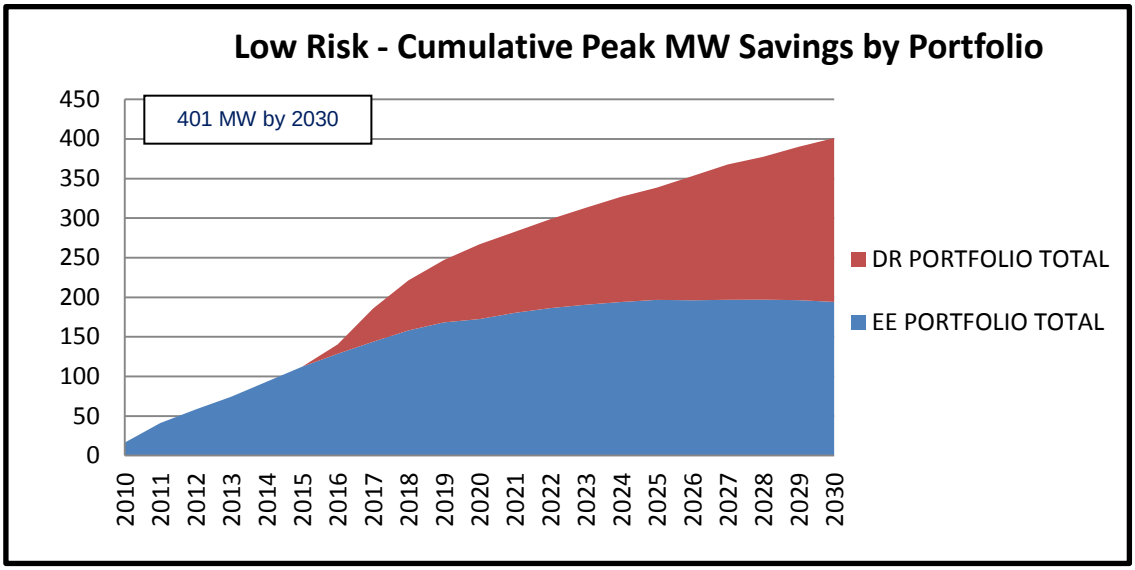


Table 7. 4 shows the cost-effectiveness tests for the portfolio of programs for the planning horizon. Please see Section 7.2.3 for definitions and further detail.

Table 7. 4: Cost Effectiveness Tests[6]

LOW RISK Portfolio				
	TRC	UCT	PCT	RIM
ENERGY EFFICIENCY				
RES-Lighting	1.99	4.66	3.29	0.70
RES-HVAC	1.42	3.19	1.85	0.83
RES-Appliance Recycling	1.31	1.31	-	0.51
RES-Low Income	0.65	0.65	2.25	0.39
RES-TOTAL	**1.43**	**2.47**	**2.53**	**0.68**
BUS-Standard	2.10	3.34	2.93	0.94
BUS-Custom	2.06	3.55	3.19	0.83
BUS-RCx	2.55	5.23	4.85	0.64
BUS-New Construction	1.70	2.39	2.95	0.83
BUS-Multifamily Common	1.66	3.39	2.48	0.77
BUS-TOTAL	**2.05**	**3.41**	**3.10**	**0.86**
PORTFOLIO TOTAL	**1.75**	**2.96**	**2.80**	**0.78**
DEMAND RESPONSE				
RES-Direct Load Control	2.59	N/A because same as TRC	N/A because can't determine cost of businesses to shut down operations	N/A because costs are less than savings so the only impact is lost revenues
RES-TOTAL	**2.59**			
BUS-Small Direct Load Control	2.69			
BUS-Large Direct Load Control	1.48			
BUS-TOTAL	**1.94**			
PORTFOLIO TOTAL	**2.23**			
EE AND DR PORTFOLIO TOTAL	**1.81**			

The levelized cost in average nominal dollars for the LOW RISK portfolio over the planning horizon is shown below in Table 7. 5 Please see Electronic Work Papers ("Portfolio LOWRISK_Levelized_costs_rollup_2010-12-02.xlsx") for a more detailed description of how the levelized costs were calculated.[7]

[6] 4 CSR 240-22.050(7)(D), 4 CSR 240-22.050(11)(I)
[7] EO-2007-0409 – Stipulation and Agreement #21

Table 7. 5: Levelized Costs

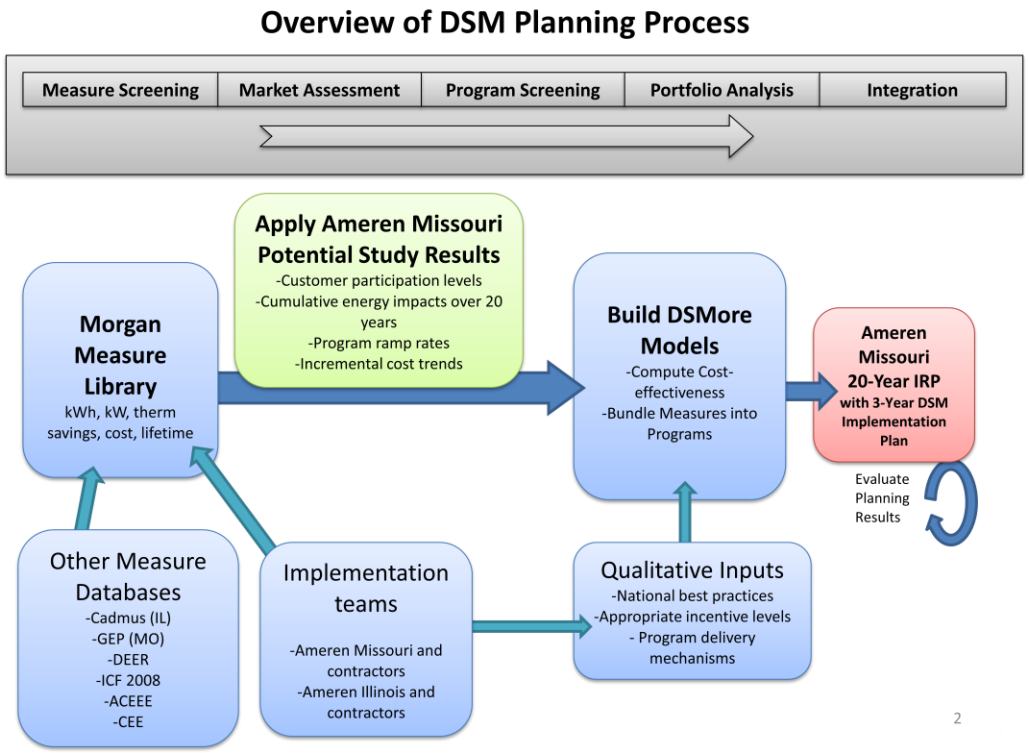
LOW RISK		
All Years: 2010-2030	Nominal Levelized UTILITY Cost / kWh	Nominal Levelized TRC Cost / kWh
RES-Lighting	$ 0.014	$ 0.044
RES-HVAC	$ 0.053	$ 0.144
RES-Appliance Recycling	$ 0.056	$ 0.056
RES-Low Income	$ 0.170	$ 0.170
RES-TOTAL	$ 0.040	$ 0.080
BUS-Standard	$ 0.041	$ 0.076
BUS-Custom	$ 0.036	$ 0.071
BUS-RCx	$ 0.022	$ 0.056
BUS-New Construction	$ 0.058	$ 0.092
BUS-Multifamily Common	$ 0.034	$ 0.084
BUS-TOTAL	$ 0.038	$ 0.073
EE PORTFOLIO TOTAL	**$ 0.039**	**$ 0.076**

7.2 The Planning Process

Ameren Missouri's portfolio for Cycle 2 contains a substantial list of improvements to the planning process from methods previously employed for Cycle 1. A primary improvement is the knowledge gained from the actual program implementation and evaluation experience of Cycle 1. Another primary improvement is the incorporation of a substantial DSM market potential study with primary market research data for Ameren Missouri customers.[8] Development of the plan also reflects: (1) the acquisition of the DSMore™ model – the leading cost effectiveness tool for energy efficiency and demand response programs; (2) the acquisition of multiple measure level databases; (3) a robust economic screening process including approximately 500 electric energy efficiency measures; and (4) a review of utility program design best practices. The flow of the overall planning process has been illustrated in Figure 7. 9 and is described in more detail in Section 7.2.5.

[8] 4 CSR 240-22.050(5)

Figure 7. 9: Overview of DSM Planning Process*



** Acronyms used in this diagram are as follows: Global Energy Partners (GEP), Database for Energy Efficient Resources (DEER), American Council for an Energy-Efficient Economy (ACEEE), Consortium for Energy Efficiency (CEE), Demand Side management (DSM).*

7.2.1 DSM Market Potential Study

As a foundational step in the DSM planning process, Ameren Missouri selected Global Energy Partners (GEP) through a competitive bidding process to conduct a rigorous DSM market potential study. The study employed extensive primary market research on Ameren Missouri customers in order to estimate potential energy efficiency and demand response savings and costs.[9] A summary of the DSM market potential study is included in Appendix B and the entire study is attached in the Electronic Work Papers ("Studies" folder).[10]

One of the primary reasons to conduct the potential study was to have a factual basis on which to gauge the reasonableness or aggressiveness of DSM efforts. Key objectives for this study were to:

[9] 4 CSR 240-22.050(5)
[10] 4 CSR 240-22.050(11)(E)

1. Assess and understand technical, economic, achievable and naturally occurring potential for all customer segments in the Ameren Missouri service area from 2009 to 2030.
2. Analyze energy savings at various levels of cost.
3. Conduct primary market research to collect electricity end-use data, customer demographics and psychographics.[11]
4. Understand how customers in the Ameren Missouri service territory make decisions related to their electricity use and energy efficiency investments.[12]
5. Develop several scenarios for assessing DSM potential.
6. Clearly communicate the DSM Potential in an objective way that is useful for Ameren Missouri senior management, Ameren Missouri stakeholders and Ameren Missouri DSM and IRP staff.

Conducted throughout 2009, the study included significant communication and coordination between Ameren Missouri, the contractor, and stakeholders. This has been outlined in detail in Section 7.2.1.1.

7.2.1.1 Stakeholder Interactions During DSM Potential Study

A number of Stakeholder workshops were held regarding the development of the Ameren Missouri Demand Side Market Potential Study, which was used as a key input in the development of the Ameren Missouri DSM Portfolios that are analyzed within the IRP.[13]

February 4, 2009: An Introductory Stakeholder Workshop was held that identified the study team members, the study objectives, and tasks to be performed in the study. Stakeholder comments and suggestions were requested and a list of action items was developed and addressed in the following weeks.

April 7, 2009: As part of the action items follow-up to the February 4, 2009 meeting, the Measure list inputs were developed and distributed for Stakeholder comment. Stakeholder comments were prepared and received by Ameren Missouri.

May 20, 2009: Stakeholder comments on the Measure list inputs were prepared and received by Ameren Missouri, and were incorporated into the final version of the Measure list, as “EE Measures and DR Options_Ameren Missouri_2009-05-20.xls”.

June 23, 2009: A Stakeholder Workshop was held to provide a DSM Market Potential Study Status Update. During the meeting the measure list that would be screened was identified, along with the adjustments to the list as provided by the Stakeholders.

[11] EO-2007-0409 – Stipulation and Agreement #23
[12] 4 CSR 240-22.050(1)(B)
[13] EO-2007-0409 – Stipulation and Agreement #24

October 29, 2009: The next Stakeholder workshop included an update for the Ameren Missouri DSM Market Potential Study related to the Market Research results and the status of the remaining work for the study. The workshop also covered a number of subjects related to current EE program activities as well as the results of a recently completed Ameren Missouri Distributed Generation Market Penetration Assessment. Stakeholder comments and suggestions were accepted during the workshop.

January 28, 2010: The Final Report for the Ameren Missouri DSM Market Potential Study (a four volume report showing all steps of the study as well as the results and interpretation of the study results) was distributed to the Stakeholder group.

February 4, 2010: The Final Report for the Ameren Missouri Market Potential Study was discussed during a Stakeholder Workshop. The workshop provided an overview of the Study, along with the results of the study. As with the previous workshops, Stakeholder comments and suggestions were accepted during the workshop.

Following this meeting there have been a number of "Post-Study" interactions between the Stakeholders and Ameren Missouri:

February 11, 2010: The Missouri Department of Natural Resources (MDNR) submitted a number of questions related to the content of the study, via email. The subject of these questions was:

- Terminology
- Survey samples
- Data and inputs
- Energy potential benefits and supply curves
- Energy savings baselines
- Economic potential in the commercial sector

March 3, 2010: Ameren Missouri provided responses to the questions that were presented by the MDNR on February 11, 2010.

March 11, 2010: Ameren Missouri hosted a WebEx based discussion between the study contractors and the Stakeholders covering the responses provided on March 3, 2010.

March 18, 2010: Ameren Missouri hosted a follow-up teleconference to the March 11, 2010 WebEx, with David Lineweber, who led the market research work for the contractor team that prepared the study, and Mr. Adam Bickford, of the Missouri Department of Natural Resources (MDNR), to specifically address sample design.

April 1, 2010: Ameren Missouri issued a follow-up memo to Stakeholders via email that was thought to address all known comments and concerns that had been expressed by the Stakeholder group to date regarding the Ameren Missouri DSM Market Potential Study.

July 14, 2010: Mr. Adam Bickford (MDNR) sent memos to Ameren Missouri via email identifying additional concerns with the Ameren Missouri Market Potential Study memo and the market research methodologies used in the study.

July 15, 2010: Mr. Adam Bickford (MDNR) presented his concerns from the memos at the Ameren Missouri Regulatory Stakeholder Quarterly DSM meeting

August 11, 2010: Ameren Missouri distributed memos addressing Mr. Adam Bickford's concerns that were presented on July 15, 2010.

Ameren Missouri believes that its potential study is represents the state-of-the art of DSM Potential studies The study depicts achievable potential in the Company's service territory based on primary market research data.

7.2.1.2 Definition of Potentials

Below are key definitions of DSM potentials that were assessed in the Study:

- **Technical potential** is a theoretical construct that assumes customers will adopt all feasible measures, regardless of cost or customer preferences.[14]

- **Economic potential** is a theoretical construct that assumes customers will adopt all cost-effective measures, regardless of customer preferences and market barriers.

- **Maximum achievable potential (MAP)** takes into account expected program participation, based on customer preferences resulting from ideal implementation conditions. MAP establishes a maximum target for the EE and DR savings that a utility can hope to achieve through its EE and DR programs and involves incentives that represent a substantial portion of the incremental cost combined with high administrative and marketing costs. It is commonly-accepted in the industry that MAP is considered the hypothetical upper-boundary of achievable savings potential simply because it presumes conditions that are ideal and not typically observed in real-world experience.

- **Realistic achievable potential (RAP)** represents what the industry considers to be realistic estimates of EE and DR potential based on realistic parameters associated with DR and EE program implementation (i.e., industry-standard incentive levels, customer acceptance barriers, etc.). RAP corresponds to best practices that are typically attainable since the estimates are tied to known program experience from around the country.

[14] 4 CSR 240-22.050(04)

7.2.1.3 Key Findings

The study enlightened Ameren Missouri about its customer base and the potential for energy savings and peak demand reductions that are possible through energy-efficiency ("EE") and demand response ("DR") programs. The key highlights are as follows:

- There is more opportunity for program savings than was estimated using secondary data. Achievable potential is higher than what was included in the Ameren Missouri 2008 IRP.
- Concurrent with higher opportunities, budgets to harvest those opportunities reach an annual spend range of $100 million to $200 million by 2015. This range corresponds to roughly 2% and 5% of projected Ameren Missouri revenues, a spending level which exceeds nearly all electric utilities in the nation.
- A comprehensive view of measures yielded considerable economic potential. The study considered hundreds of measures and there are very significant savings opportunities.
- Ameren Missouri customers are different than others in the nation. They typically express less interest in DSM investments at this time.

Using a bottom-up, end-use approach, Global Energy Partners assembled models of equipment stock and energy usage throughout the time horizon that were based on the primary market research data of the Ameren Missouri service territory.[15] They then applied EE and DR measures and programs to the model at levels defined by the extensive attitudinal research in order to estimate the potential energy saving effects. Each set of results has been briefly summarized below, and full detail is available in the 4 volume report which is publicly available on Ameren's website.

Energy Efficiency Potential

- Realistic achievable potential in 2030 represents a reduction of 7.3% of the total forecasted baseline usage for that year. This represents 25% of technical potential and 44% of economic potential.
- Maximum achievable potential in 2030 represents a reduction of 11.0% of the total forecasted sales in 2030. This represents more than a third of technical potential and nearly two-thirds of economic potential.

In addition to energy savings, energy efficiency programs also create savings in coincident peak demand. The savings are substantial because many of the EE savings result from measures related to air conditioning across all sectors, C&I

[15] 4 CSR 240-22.050(05)

lighting, and motors, all of which have high usage during peak periods. These EE peak demand savings have been combined with DR peak demand savings in the following discussion.

Demand Response Potential

- Realistic DR achievable potential in 2030 represents a reduction of 10.0% of the total forecasted peak demand for 2030.
- Maximum DR achievable potential in 2030 represents a reduction of 12.3% of the total forecasted peak demand for 2030.

Combined Peak Demand Savings

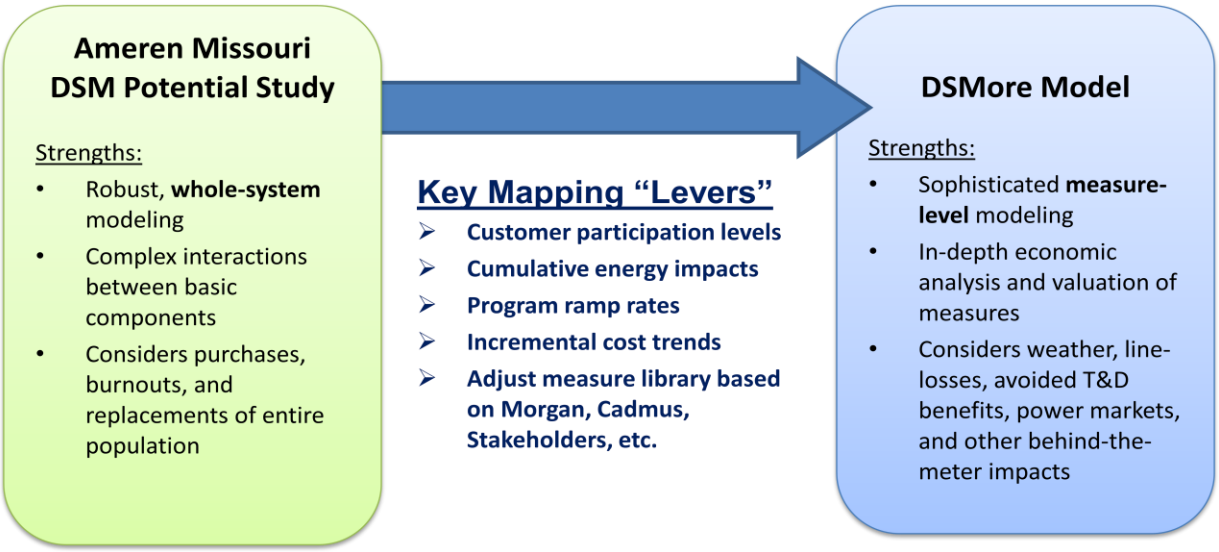
Throughout the forecast period, peak demand savings from EE programs for RAP and MAP are about the same as the savings from DR programs. However, in contrast to DR programs, the peak-demand savings from EE programs are permanent and non-dispatchable. Together, these peak demand savings are quite substantial:

- Realistic achievable potential of EE and DR in 2030 represents a reduction of 19.2% of the total forecasted peak demand for 2030.
- Maximum achievable potential of EE and DR in 2030 represents a reduction of 26.1% of the total forecasted peak demand for 2030.

7.2.1.4 Mapping of Potential Study to Planning Assumptions

Several outputs of the Ameren Missouri DSM Market Potential Study required translation or mapping in order to become appropriate inputs for the Ameren Missouri IRP team. Ameren Missouri acquired “DSMore” modeling software (discussed in detail in Section 7.2.5.1) in order to have a more sophisticated cost-effectiveness analysis at the measure level. It was necessary to map the various components of the GEP study to this updated analysis framework. This has been illustrated in the figure below.

Figure 7. 10: Mapping Potential Study to DSMore



The GEP measure database and Ameren Missouri's updated measure database each included hundreds of measures. To reconcile these databases, several adjustments were made to measure data including specifying values on a "per installation" basis instead of a "per square foot" basis, and matching measures that had disparate naming conventions or baseline assumptions. We also verified that savings, costs (exclusive of utility marketing, program delivery, and lost revenues), and lifetimes matched up after the reconciliation.[16]

GEP then provided Ameren Missouri with the participation levels, program ramp rates, and incremental cost trends over the planning horizon such that the overall energy impacts were approximately equal to the Realistic Achievable Potential (RAP) and Maximum Achievable Potential (MAP) from the Ameren Missouri's DSM Market Potential Study.[17] With these values, Ameren Missouri was then ready to begin the actual portfolio analysis required for the IRP.

7.2.2 Effects of Missouri Energy Efficiency Investment Act

In 2010, the Missouri Public Service Commission submitted new rules to the Secretary of State to implement the Missouri Energy Efficiency Investment Act (MEEIA). Provisions of MEEIA affected the DSM planning process in multiple ways. First, the rules allowed certain commercial and industrial customers to opt out of energy efficiency programs and any associated surcharges on their bills. The rules also call for a number of administrative, filing, and tracking exercises that will substantively increase the costs associated with DSM.

[16] 4 CSR 240-22.050(03)(D)
[17] 4 CSR 240-22.050(07)(A)

Business Customer Opt Out

MEEIA would allow eligible large business customers to opt out of utility energy efficiency programs. Customers with single facilities exceeding 5.0 MW of peak demand could opt out immediately, and those with accounts that can aggregate to a peak demand over 2.5 MW can do so given that they demonstrate an achievement of savings at least equal to those expected by utility-provided programs.

Ameren Missouri estimates in its planning that 20% of the available DSM potential from C&I customers will opt out. The Low Risk portfolio is sized such that it can operate unaffected by this loss of potential. In more aggressive portfolios, however, Ameren Missouri has correspondingly reduced its business program potential estimates by 20% from those in the DSM Market Potential Study.

The 20% opt out estimate is the base case assumption used in the integration analysis. However, there were also a high case (35%) and a low case (5%) developed for the risk analysis. Because this law is new and there is no experience to base expectations on, there is a great deal of uncertainty around which customers will act on the opt out provision. The estimates were developed by trying to ascertain the highest and lowest levels that would be possible given the law's provisions. The base case was assumed to be the midpoint between those more extreme scenarios.

The low case was based off of an analysis of the load that has already notified Ameren Missouri of its intention to opt out of energy efficiency programs. Nine customers have already provided such notification. One of those, customers, Noranda Aluminum, is large enough to be handled separately in such analysis. The aggregated annual load for the remaining eight customers was compared to an estimate of the annual total Commercial and Industrial ("C&I") class loads to determine that 5% of the C&I class had already opted out. This makes a logical lower bound for the total load that will ultimately opt out.

The upper bound for opt out potential was developed by doing detailed analysis from the Ameren Missouri billing system to identify potential customers that would qualify for the opt out provision. First, customers that met the 5 MW threshold per their 2009 billing demand were identified to immediately qualify for opt-out. That list was adjusted for the fact that two customers on it had already closed or announced their intention to close their operations. Once again, the Noranda load was also removed from the list, as it is large enough to be treated separately. The annual MWh consumption for the remaining 5 MW customers for the year 2009 was aggregated as one group of opt out eligible load.

Next, individual accounts greater than 2.5 MW were identified and a similar aggregation of the associated annual consumption was calculated. This group would have to meet some more stringent rules to opt out of energy efficiency programs. However, because

those rules are not yet developed or known, it was conservatively assumed for the high case that all of them may be able to ultimately opt out.

Finally, several companies that were believed to be candidates to aggregate multiple accounts to the 2.5 MW level were identified. Because billing demand was not available for all of these accounts, an energy threshold was determined to represent a proxy for meeting the demand cut off. Customers that had energy consumption greater than 15.3 GWh were assumed to have a demand greater than 2.5 MW. This implies a 70% load factor, which is likely conservative for the types of customers under consideration. Customers included in these queries were ones that Ameren Missouri forecasting personnel were familiar with and in no way were meant to be an exhaustive list of all customers that could possibly opt out. Customers identified included hotel chains, retail chains, restaurant chains, and grocery chains.

Aggregating the three groups of customers that could potentially opt out, Ameren Missouri identified approximately 7 million MWh of annual usage as being potentially subject to the opt out provision. Estimated annual retail consumption of the C&I classes on a total basis (excluding Noranda) was approximately 19.5 million MWh (note that this estimate was prepared before the full load forecast was completed for the IRP and may not tie precisely to the base case forecast). Therefore, the percent of load eligible to opt out in the high case was determined to be approximately 35% (note the result was rounded down from 36% for simplicity). As mentioned above, because there is so little information about the likely behavior of eligible customers, the base case simply used the midpoint between the extreme scenarios as an estimate of the impact of this provision.

Table 7. 6: Maximum Opt-Out Potential

Customer Category	2009 MWh
>5 MW Individual (ex-Noranda)	4,202,589
>2.5 MW Individual	2,121,112
>2.5 Aggregate	703,316
Total	**7,027,017**

Table 7. 7: Opt-Out Scenarios

	High Case (All Eligible)	Base Case (Midpoint)	Low Case (Already Notified)
Total C&I Load Estimate (ex-Noranda)	19,479,367	19,479,367	19,479,367
Opt out MWh	7,027,017	3,952,103	877,190
Opt out %	**36%**	**20%**	**5%**

New Administrative Requirements

There are four new or revised rules from MEEIA that will affect future DSM efforts.

- 4 CSR 240-3.163 covering Electric Utility Demand-Side Investment Mechanisms. The second is
- 4 CSR 240-3.164 covering Electric Utility Demand-Side Programs Filing and Submission Requirements.
- 4 CSR 240-20.093 Demand-Side Programs Investment Mechanism.
- 4 CSR 24-20.094 Demand-Side Programs.

While these rules have not been approved at the time of its analysis, Ameren Missouri attempted to incorporate the potential impacts of new DSM rule requirements into its DSM modeling, program design, and implementation planning work as described below.

4 CSR 240-3.163 Electric Utility Demand-Side Investment Mechanisms

This rule set forth the information that an electric utility must provide when it seeks to establish, continue, modify, or discontinue a Demand-Side Programs Investment Mechanism (DSIM). This rule also sets forth the requirements for submission of information related to DSIM rate adjustment filings and for submission of annual reports as required for electric utilities that have a DSIM. Ameren Missouri attempted to consider incremental program administration costs required by the rule in the following areas:

- New annual reporting requirements
- Development and implementation of new models to estimate the impact of the DSIM on customers and utility earnings

- Development of models and systems to estimate of impacts of the DSIM on rates and customer bills for the 3-year implementation period
- Development of technical reference manuals – perhaps statewide

4 CSR 240-3.164 Electric Utility Demand-Side Programs Filing and Submission Requirements

This rule sets forth the information that an electric utility must provide when it seeks approval, modification, or discontinuance of demand-side programs. Ameren Missouri attempted to consider incremental program development, implementation and administrative costs required by the rule in the following area:

- Continually maintaining a current DSM market potential study based on primary data

4 CSR 240-20.093 Demand-Side Programs Investment Mechanism

This rule allows the establishment and operation of Demand-Side Programs Investment Mechanisms (DSIM), which allow periodic rate adjustments related to recovery of costs and utility incentives for investments in demand-side programs. Ameren Missouri attempted to consider incremental program administration costs required by the rule in the following areas:

- Development of accounting systems to track DSM related costs for compliance with the rule
- Development of systems to disclose DSIM costs on customers' bills
- The continuance of DSM tariff filings in addition to DSIM reporting requirements

4 CSR 24-20.094 Demand-Side Programs

This rule sets forth the definitions, requirements and procedures for filing and processing applications for approval, modification, and discontinuance of electric utility demand-side programs. This rule also sets forth requirements and procedures related to customer opt-out, tax credits, monitoring customer incentives and collaborative guidelines for demand-side programs. Ameren Missouri attempted to consider incremental program administration costs required by the rule in the following areas:

- Resources to address how to either achieve or not achieve annual demand-side savings targets or guidelines specified in the new rule that exceed maximum achievable potential identified in DSM potential studies

- Resources to address additional filing requirements when there is a variance of 20% or more in the approved DSM program annual budget
- Resources to address rule requirements for customers that choose to opt out of electric utility DSM programs
- Resources to determine eligibility to participate in DSM programs based on the customers' receiving a state tax credit
- Resources to administer statewide DSM advisory collaborative.

To account for these potential rule impacts, Ameren Missouri inserted a 1% (1% of total program costs) placeholder in the administrative costs for each program due to the uncertainty surrounding the specifics of the law and ambiguity around the final rulemaking during the inception of this plan. This planning assumption is thought to be a conservative estimate and yet is none-the-less a sizeable expense totaling more than $1.5 million dollars over the three years.

7.2.3 Cost-Effectiveness Defined

Ameren Missouri calculated the cost effectiveness of its DSM measures, programs, and portfolios using the total resource cost ("TRC") test, the utility cost test ("UCT"), the participant cost test ("PCT"), and the ratepayer impact measure ("RIM") test.[18] In each year of the planning horizon, the benefits of each demand-side program are calculated as the cumulative energy impact multiplied by all applicable avoided costs, and then summed into net present values for the timeframe considered.[19] The definitions of the tests, drawing upon the California Standard Practice protocol for DSM economic assessment, are outlined below:

> **The Total Resource Cost (TRC**) test measures benefits and costs from the perspective of the utility and society as a whole. The benefits are the net present value of the energy and capacity saved by the measures. The costs are the net present value of all costs to implement those measures. These costs include program administrative costs and full incremental costs (both utility and participant contributions), but no incentive payments to customers. The full incremental costs include single upfront costs and operational & maintenance costs where applicable.[20] Programs passing the TRC test (that is, having a B/C ratio greater than 1.0) result in a decrease in the total cost of energy services to all electric ratepayers.

[18] 4 CSR 240-22.050(3)(G), 4 CSR 240-22.050(7)(C), 4 CSR 240-22.050(7)(D)
[19] 4 CSR 240-22.050(7)(B), details for cost effectiveness screen are available in the Electronic Work Papers ("Measure Screen Data 11-18-2010.xlsx").
[20] 4 CSR 240-22.050(3)(C)

The Utility Cost Test (UCT) measures the costs and benefits from the perspective of the utility administering the program. As such, this test is characterized as the revenue requirement test. Benefits are the net present value of the avoided energy and capacity costs resulting from the implementation of the measures. Costs are the administrative, marketing and evaluation costs resulting from program implementation along with the costs of incentives. Programs passing the Utility Cost test result in overall net benefits to the utility, thus making the program worthwhile from a utility cost accounting perspective.

The Participant Cost Test (PCT) measures the benefits and costs from the perspective of program participants, or customers, as a whole. Benefits are the net present value savings that customers receive on their electric bills as a result of the implementation of the energy efficiency and demand response measures. Costs are the customer's up-front net capital costs to install the measures. If the customer receives some form of a rebate incentive, then those costs are considered as a credit to the customer and are subtracted from the customer's total capital costs.

The Ratepayer Impact Measure (RIM) test measures the difference between the change in total revenues paid to a utility and the change in total costs to a utility resulting from the energy efficiency and demand response programs. If a change in the revenues is larger or smaller than the change in total costs (revenue requirements), then the rate levels may have to change as a result of the program.

7.2.4 Avoided Costs

Table 7. 8 shows the avoided costs used for the valuation of Ameren Missouri's DSM efforts in the IRP analysis. A brief description of each component can be found below. [21]

Table 7. 8: Avoided Costs

Year	Energy ($/MWh)	Capacity ($/kW-Year)	Distribution ($/kW-Year)	Transmission ($/kW-Year)
2010	$38	**HC**	$19	$9
2011	$40	**HC**	$20	$9
2012	$43	**HC**	$20	$9
2013	$45	**HC**	$21	$10
2014	$48	**HC**	$22	$10
2015	$50	**HC**	$22	$10
2016	$54	**HC**	$23	$11
2017	$58	**HC**	$24	$11
2018	$61	**HC**	$24	$11
2019	$65	**HC**	$25	$11
2020	$69	**HC**	$26	$12
2021	$73	**HC**	$27	$12
2022	$77	**HC**	$27	$13
2023	$81	**HC**	$28	$13
2024	$85	**HC**	$29	$13
2025	$89	**HC**	$30	$14
2026	$92	**HC**	$31	$14
2027	$96	**HC**	$32	$15
2028	$99	**HC**	$33	$15
2029	$102	**HC**	$34	$15
2030	$105	**HC**	$35	$16

Avoided Energy Costs

Because DSM measures produce savings for multiple years beyond the date of their installation, cost-effectiveness calculations require multiple years of economic forecasting. To estimate the avoided costs of electricity the Ameren Missouri Plan relied on energy market forecasts provided by CRA International's MRN-NEEM model projections.[22,23]

CRA International performed an analysis for 10 distinct scenarios based on possible combinations of three critical factors: Carbon Policy, Natural Gas Prices, and Load Growth. Each of the 10 scenarios had an associated market price for electricity. The

[21] 4 CSR 240-22.050(11)(D), 4 CSR 240-22.050(03)(B)
[22] 4 CSR 240-22.050(02)
[23] 4 CSR 240-22.050(11)(D)

probability weighted average of the 10 scenarios was the data stream used for the relevant avoided energy costs in the Ameren Missouri DSM program analysis. Each avoided cost was levelized over the 20 year planning horizon.[24] Chapter 2 contains further detail on the development of electricity market price projections.

Avoided Capacity Costs

Highly Confidential

[24] 4 CSR 240-22.050(03)(B)1

Avoided Transmission and Distribution Costs

Avoided transmission and distribution (T&D) costs come from integrated system effects and are difficult to quantify, as opposed to energy and capacity costs where there are markets with specific prices. As part of integration modeling Ameren Missouri attributed the MW impacts of DSM programs with a corresponding reduction in capital expenditures associated with T&D expansion.

Avoided Distribution Cost

Ameren Missouri has estimated the marginal cost of system capacity by reviewing a variety of bulk substation and distribution substation projects to determine a generic marginal cost of distribution capacity expansion. Typical costs for distribution circuit construction and line transformers were included, as were allowances for service drops and sub-transmission line construction. The overall generic marginal cost of system capacity was valued at approximately $400/kW.

In order to understand the relationship between the generic marginal cost of system capacity to load growth an analysis has been conducted to determine how much capacity has been or will be added to the system. However, the evaluation of the portion of distribution system build-out required to serve load growth is complicated by the fact that projects serve a variety of purposes; capacity upgrades to serve incremental system load, capacity upgrades to serve relocated system load, and refurbishment or replacement of equipment to avoid imminent failure.

The total expenditures on capacity projects for 2005 through 2014 are $1.34 billion ($134 million annually). Of that total $411 million is for new business, $392 million is for distribution line work and $537 million is for bulk and distribution substations. The generic marginal cost of distribution capacity indicates how much total system capacity has been added but does not indicate the purpose of the capacity. However if we consider the amount of load growth we estimate from 2005 through 2014 it indicates approximately 10% of the expenditures are attributable to load growth.

Not all system expansion costs can be deferred through the efforts of demand-side resources. Distribution line work and substation projects may be reduced or delayed but new business expenditures will be unaffected. This indicates approximately $9.6 million annual expenditures could be affected by demand-side resources. However, of the projects that are postponed or cancelled, some of the expenditures allocated to the new projects will need to be spent to refurbish or replace the associated existing equipment. It is assumed that 40% of the potential savings will be expended in this

manner and only 60% of the potential savings will actually be realized. After appropriate adjustments the estimated avoidable annual expenditures is $5.8 million. Using a levelized fixed charge rate of 12.42% and an average annual growth of 38.4 MW, the avoided distribution cost is estimated to be $18.60 kW-year in 2009 dollars.[26] The annual stream is a 3% escalation from that starting point and is available in
.

Avoided Transmission Cost

Avoided electric transmission costs began with a similar generic marginal cost of system transmission capacity, and have been estimated by applying the following factors:

- Usage growth-related factor - This factor captures the effect that some of the transmission projects may not be deferrable by DSM because they have not been driven by usage growth but rather by customers relocating to different areas. In these cases, there is local growth but not system wide growth.
- Location-specific Factor/Deferrable Factor - This factor accounts for the fact that Ameren analyzes the system as an aggregate and cannot tell whether load pockets will be deferred by DSM programs. Since DSM programs are not being designed to avoid or offset specific transmission projects, there is no certainty as to which projects will actually be deferred.
- Condition/Reliability Replacement Factor - This factor approximates the effect that load growth projects cause transmission asset turnover, so if Ameren Missouri does not upgrade or replace a substation because of DSM, then Ameren Missouri will need to spend money on additional maintenance or reliability projects that would have been avoided had new equipment been installed to meet load growth. For example, choosing 70% for this factor says that for every $1 saved from DSM, $0.30 is needed to support the equipment that would have been replaced with new equipment.

The explicit avoided cost values developed from the above transmission and distribution considerations are available in Table 7. 8.

Avoided Ancillary Service Cost

The ancillary services market in the Midwest ISO went live on January 6, 2009 as MISO Day 3. The ancillary service market is characterized by three services: regulation reserve, spinning reserve, and supplemental reserve.

[26] 4 CSR 240-22.050(3)(B)

- Regulation Reserve is unloaded and loaded capacity utilized by the Midwest ISO balancing authority to manage the area control error as necessary to comply with applicable reliability standards.

- Spinning Reserve is synchronized unloaded capacity set aside to be available to immediately offset abnormal supply deficiencies.

- Supplemental Reserve is unloaded capacity set aside to be available to offset abnormal supply deficiencies.

Since the Midwest ISO ancillary services market is relatively immature and the total ancillary services 2010 year-to-date through October cost is only 16 cents per megawatt hour, no estimate of avoided ancillary services has been included in Ameren Missouri's analysis at this time.

7.2.5 Overview of the EE Analysis

7.2.5.1 DSMore Model

Demand Side Management Option Risk Evaluator (DSMore^{TM}) is a powerful financial analysis tool designed to evaluate the costs, benefits, and risks of demand side management (DSM) programs and services. This tool, built by Integral Analytics, is the leading DSM cost-effectiveness model and is used in more than 27 states for DSM program planning. The power of DSMore lies in its ability to process millions of calculations resulting in thousands of cost effectiveness results that vary with weather and/or market prices.

DSMore provides all of the familiar cost effectiveness test results, including Utility Cost Test, Total Resource Cost Test, Ratepayer Impact Measure Test, and Societal Test. Moreover, these test results are provided for various weather conditions, including "normal" weather, and under a number of wholesale market conditions. DSM measures typically perform better during higher priced wholesale markets and more extreme weather. In fact, given that these two environmental forces tend to occur at the same time, the added boost in value that accrues to DSM avoided cost has a natural upward movement in value. By viewing numerous test results, the upward movement in DSM cost effectiveness becomes apparent.

Customization of the DSMore model by Integral Analytics and Ameren Missouri for measure analysis and program development included the addition of the following data specific to the Ameren Missouri service territory:

- Historic weather data

- Hourly market price data[27]
- Historic rate level hourly energy usage (8760 load shapes)
- Rate information for the for the following classes
    - 1M RES Residential
    - 2M SGS Small General Service
    - 3M LGS Large General Service
    - 4M SPS Small Primary Service
    - 11M LPS Large Primary Service
- Annual avoided electric energy cost projections (summed over all avoided cost periods)[28]
- Annual avoided capacity costs
- Avoided T&D costs
- Line loss factors applicable to the electric rates to perform calculations at transmission level
- Discount Rate
- Inflation Rate
- Hourly end-use load shapes (twenty year projections of 8760 load shapes) that represent the major end-usages of the customer population[29]
    - All of the analyzed measures were assigned an end-use load shape
- Hourly system load shape (twenty year projection of 8760 hourly load shape with no energy efficiency programs present)

It should be noted that the DSMore model's energy inputs and outputs discussed in this report are at the MISO transmission level, and thus include the line loss factors necessary to aggregate and report impacts at that level.

7.2.5.2 Measure Level Screening

Ameren Missouri used multiple sources of data for the analysis of energy efficiency measures. The primary source of data was the Morgan Measure Library. Morgan Marketing Partners ("MMP") works with many DSMore users to develop utility specific databases of energy efficiency technologies and building simulations to use in program planning. Key features of the Morgan Measure Library include:

Two databases of residential and business measure level cost and savings data (weather sensitive and non-weather sensitive) that have been customized for the Ameren Missouri service territory. A full list of measures considered in the development of a menu of energy efficiency and energy management measures can be found in the

[27] 4 CSR 240-22.050(2)(B)
[28] 4 CSR 240-22.050(03)(B); 4 CSR 240-22.050(03)(B)2
[29] EO-2007-0409 – Stipulation and Agreement #30; EO-2007-0409 – Stipulation and Agreement #27

first column the spreadsheet labeled "Measure Screen Data 11-18-2010.xlsx"[30] found in the Electronic Work Papers.[31] [32] The column labeled "End Use Effected" categorizes each measure into end-uses such as lighting, refrigeration, heating, cooling, water heating, and motors.[33] The annual energy savings and coincident peak demand impacts per customer are located in the ninth and tenth columns respectively. The annual savings values were used for cost-effectiveness screening and the resulting TRC ratios for each measure in each customer class are shown in the last 5 columns of the spreadsheet. [34] The incremental costs per measure are also shown in the spreadsheet.[35]

This database contains not only stand-alone efficiency measures, but also several bundled measure combinations. [36] For example, many of the HVAC systems were viewed on a holistic basis incorporating several measures including an efficient air conditioner, refrigerant charge correction, fan motors, duct sealing, etc. The Business programs' motors components incorporated a whole motor system integrating a system audit, motor incentives, and recommendations on process upgrades.

The following special considerations were accounted for in the Weather Sensitive measures:

- The weather basis used for analysis of weather sensitive measures consists of National Oceanic and Atmospheric Association ("NOAA") historic hourly weather data (precipitation, temperature, dew point, winds, visibility, cloud cover, pressure) recorded in St. Louis, MO.
- A set of residential, commercial and industrial prototypical building models were developed using the DOE-2.2 building energy simulation program (more than 2900 were developed) for each of the market segments defined within the Morgan Measure Library.[37] The prototypes are based on the models used in the California Database for Energy Efficiency Resources (DEER) study, with appropriate modifications to adapt these models to local design practices and climate.[38]
- MMP provided a tool for blending the results of the discrete analyses and costing data to simplify further cost effectiveness analyses within the measure screen.

[30] EO-2007-0409 – Stipulation and Agreement #20.
[31] 4 CSR 240-22.050(01)(A), 4 CSR 240-22.050(11)(A)
[32] 4 CSR 240-22.050(01)(D)
[33] 4 CSR 240-22.050(01)(C), 4 CSR 240-22.050(01)(D)
[34] 4 CSR 240-22.050(03)(A), 4 CSR 240-22.050(11)(C)
[35] 4 CSR 240-22.050(11)(B)
[36] EO-2007-0409 – Stipulation and Agreement #26
[37] 4 CSR 240-22.050(06)(A), 4 CSR 240-22.050(11)(F)
[38] 4 CSR 240-22.050(05)

The third column of the table in "Measure Screen Data 11-18-2010.xlsx" labeled "Weath. Senstv." is populated with WS to denote a weather sensitive measure.[39]

- Approximately 65 residential measures were analyzed for the possible combinations of the following residential building types, sizes, vintages, and applicable HVAC technologies – resulting in a total of approximately 2975 DOE 2.2 analyses.[40]
- Approximately 160 commercial and industrial measures were analyzed for the possible combinations of the following commercial building types and applicable HVAC technologies – resulting in a total of more than 750 DOE 2.2 analyses.

Table 7. 9: Residential Weather-Sensitive Modeling Variables

3 vintages of single and multi-family building types	7 HVAC technologies within single and multi-family homes	2 sizes of multi-family residential buildings	3 vintages of manufactured home types	6 HVAC technologies within manufactured homes
Old, poorly insulated (1950s)	Central AC with gas furnace	2-4 unit buildings	Old (Pre 1978)	Central AC with electric furnace
Existing, average insulation (1950-2004)	Central air source heat pump	5+ unit buildings	Existing, average (1978-1994)	Central AC with gas furnace
New (2004+)	Central dual fuel heat pump		Newer (1995-2005)	Central air source heat pump
	Electric furnace no AC			Central dual fuel heat pump
	Gas furnace no AC			Electric furnace no AC
	PTAC			Gas furnace no AC
	PTHP			

[39] 4 CSR 240-22.050(03)(A)
[40] EO-2007-0409 – Stipulation and Agreement #26

Table 7. 10: Commercial & Industrial Weather-Sensitive Modeling Variables

13 Commercial and Industrial Building Types	9 HVAC technologies within select C&I Building Types
Assembly	Constant Volume ("CV") reheat economizer with Air Cooled Chiller
Big Box Retail	CV reheat economizer ("econ") with Gas Engine Chiller
Fast Food Restaurant	CV reheat econ with Water Cooled Chiller
Full Service Restaurant	CV reheat no econ with Air Cooled Chiller
Grocery	CV reheat no econ with Gas Engine Chiller
Hospital	CV reheat no econ with Water Cooled Chiller
Hotel	Variable Air Volume ("VAV") reheat econ with Air Cooled Chiller
Large Office	VAV reheat econ with Gas Engine Chiller
Light Industrial	VAV reheat econ with Water Cooled Chiller Assembly
Primary School	
Small Office	
Small Retail	
Warehouse	

The Non-Weather Sensitive Database from MMP consisted of measure level data for 200 commercial and 74 residential measures.[41] The third column of the table in "Measure Screen Data 11-18-2010.xlsx" labeled "Weath. Senstv." is populated with "NWS" to denote a non-weather sensitive measure. [42]

Ameren Missouri reviewed the detailed data and analyses contained within the entire Morgan Measure Library to assess its accuracy and completeness. The non-weather sensitive database was then refined using results from the Ameren Missouri DSM market potential study (described above and in the Electronic Work Papers "Studies Folder"), as well as other recognized energy efficiency databases. Ultimately this resulted in a final non-weather-sensitive database consisting of 236 commercial and 107 residential measures.[43]

[41] 4 CSR 240-22.050(01)(A)
[42] 4 CSR 240-22.050(03)(A)
[43] 4 CSR 240-22.050(05), 4 CSR 240-22.050(11)(E)

The weather sensitive and non-weather-sensitive databases were combined and duplicate measures and nonsensical measures were removed using a qualitative screen. The final master measure database after all these steps consisted of 425 measures for analysis. This database contains a plethora of best-practice measures that are compliant with existing code, account for future code changes (as in residential and business lighting), are technologically advanced (solar thermal, LED lighting), and offer consumers multiple efficient options.[44] Furthermore, various categories of measures previously understudied were incorporated into the analysis including emerging technologies, bundled measures, and targeted measures.[45]

Interactive Effects

Interactive effects were assessed by Ameren Missouri's contractors for both the Ameren Missouri DSM Potential Study and the DOE-2.2 modeling that was performed by MMP for measures within the Morgan Measure Library. Capturing the interactive effects of all applicable measures required examining many instances where multiple measures affect a single end use both positively and negatively. To avoid overestimation of total savings, the assessment of cumulative impacts accounts for the interaction among the various end uses.[46]

Within the DOE-2.2 models, this was accomplished by establishing a base level model that incorporated many non-related measures and identifying the savings achieved by stacking the incremental measure within an additional modeling run, with a comparison of the base and modified runs to arrive at the implemented measure impact on energy consumption.[47]

Checking Measure Level Results

Ameren Missouri went to great lengths to check the reasonableness of the Morgan Measure Library. Ameren Missouri performed a review of data provided by other data sources and contrasted that information with the data contained within the Morgan Measure Library to validate, or adjust if necessary, the measure database. The other measure databases that were used to validate the Morgan measure database contents were:

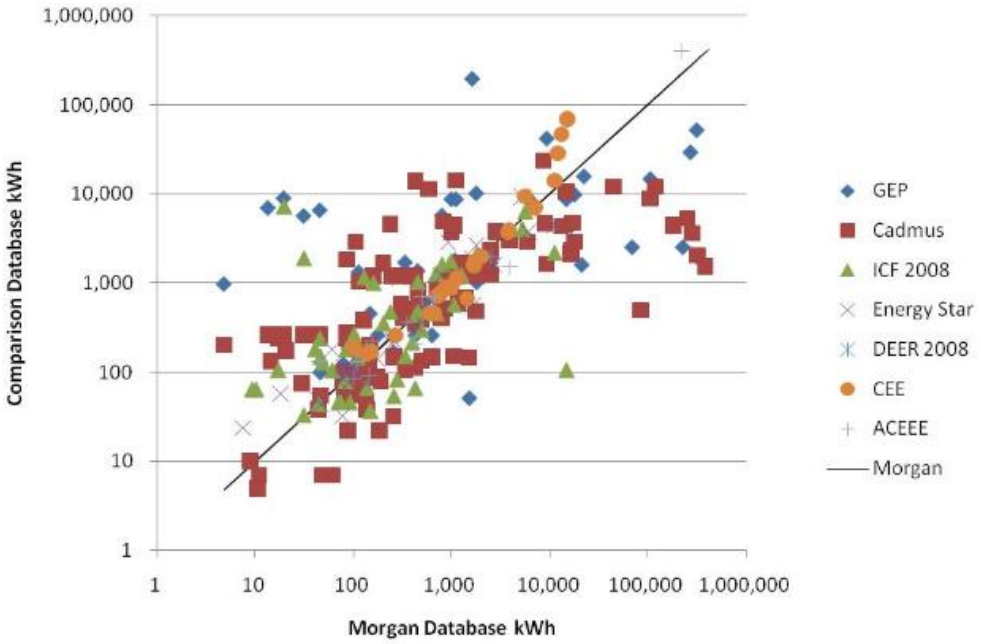
- Global Energy Partners measure database for DSM potential studies
- The Cadmus Group's measure database for DSM potential studies
- DEER 2008
- ICF 2008 data from Ameren Missouri's 2008 IRP Plan
- ENERGY STAR

[44] EO-2007-0409 – Stipulation and Agreement #24
[45] EO-2007-0409 – Stipulation and Agreement #28
[46] EO-2007-0409 – Stipulation and Agreement #26
[47] 4 CSR 240-22.050(06)(B)

- American Council For An Energy Efficient Economy ("ACEEE")
- Consortium For Energy Efficiency ("CEE")[48]

The following graph illustrates just one of the validation processes that Ameren Missouri performed. This example shows a comparison of the incremental kWh savings value associated with the same energy efficiency measures from the various databases: Outliers, when present, were subsequently investigated, and corrective actions were implemented when necessary. As can be seen, the measure savings of the various sources trend as expected: along a diagonal line with a slope of one. This indicates that the sources feeding the measure database tend to converge.

Figure 7. 11: Measure kWh Scatter Plot



With the master measure database assembled, Ameren Missouri then conducted a measure level screen for each measure in all rate classes (1M-Res, 2M-SGS, 3M-LGS, 4M-SPS, and 11M-LPS).[49] This resulted in a total of more than 4000 measure level screening analyses being performed in DSMore to assess the cost-effectiveness using the TRC test.

To be inclusive of marginally cost-effective measures and provide greater diversity in the Ameren Missouri program mix, the measure level TRC criterion was set at 0.90. That is, individual measures tested without program costs were required to have a TRC

[48] EO-2007-0409 – Stipulation and Agreement #27
[49] 4 CSR 240-22.050(01)(A)

benefit-to-cost ratio greater than 0.90 in order to pass the measure screen. Table 7.11 illustrates the number of passing measures. Table 7.12 subsequently lists the passing measure categories that have been included in the planning horizon. (These categories may include an aggregation of more specific measures.)

The worksheet "Measure Screen Data 11-18-2010.xlsx" found in the Electronic Work Papers shows the results for each measure's TRC result for each applicable customer rate. All measures passing the screening test have been highlighted in green.[50]

Table 7.11: Number of Measures Screened

	Measures Screened	Measures Passed	Percent of Measures Passed
Residential	152	80	53%
Business	273	171	63%
Total	**425**	**251**	**59%**

Table 7.12: Measure Categories Passing the TRC

Residential Measure Categories	Business Measure Categories
Air Source Heat Pump	Air Source Heat Pump
Basement Wall Insulation	Anti Sweat Heater Controls
Ceiling Fan	Barrel Wraps Inj Mold and Extruders
Central Air Conditioner	Central Air Conditioner
CFL bulbs – specialty	Ceramic metal halide lighting
CFL bulbs – standard	CFL bulbs – specialty
CFL fixture	CFL bulbs – standard
Crawlspace Wall Insulation	CFL fixture
Dehumidifier recycling	CHW reset
Dual Fuel Heat Pump	Commercial clothes washer
Duct Insulation	Commercial freezer – ENERGYSTAR
Duct Sealing	Commercial ice machine – ENERGYSTAR
ECM blower	Commercial refrigerator – ENERGYSTAR
Efficient faucet aerator	Compressed Air Optimization - Leak Audit, New Compressors, Improved Controls
Efficient pool pump	Cooking Equipment
Efficient showerhead	Cool roof
Electric Water Heater EF 0.93+	Daylight Sensor controls

[50] 4 CSR 240-22.050(03)(E); 4 CSR 240-22.050(11)(C)

Freezer recycling	Delamping
Geothermal heat pump	Demand Controlled Ventilation
Geothermal HP Desuperheater	ECM case motor
Gravity film heat exchanger (GFX)	Efficient Chiller
Heat Pump Clothes Dryer	Efficient Condenser
Heat Pump Water Heaters	Efficient faucet aerator
High Intensity Discharge Lamps (HID) - Exterior	Efficient motor
HVAC Maintenance and Tune-up	Efficient pool pump
Infiltration reduction	Efficient pump
LED lights	Efficient Refrigeration Condenser
Lighting Timeclock	Efficient showerhead
Metal Halide Outdoor Lighting	Energy Management System
Multiple Drawer Refrigerators	Engineered Nozzles Compressed Air
Occupancy Sensor	Exterior lighting control
Outdoor Lighting - Photovoltaics	Floating Head Pressure Control
Packaged Terminal Air Conditioner (“PTAC”)	Geothermal heat pump
Packaged Terminal Heat Pump (“PTHP”)	Guest Room Energy Management
Pipe Wrap	Head Pressure Control
Programmable / Set-back Thermostat	Heat Pump Water Heaters
Radiant Barrier	High bay T5 fluorescent lights
RCA improvement	High Intensity Discharge Lamps (HID) - Exterior
Refrigerator recycling	High performance T8 fluorescent lights
Room AC recycling	Infrared Heater
Smart power strip	LED Case lighting
Solar hot water heater	LED lights
Wall Insulation	Lighting Controls
Water heater blanket	Occupancy Sensor
Water heater thermostat setback	Optimizing Process Cooling
Window Air Conditioner	Optimizing Process Heating
	Pre rinse spray valve
	Programmable / Set-back Thermostat
	Pulse start metal halide lighting
	Radiant Barrier
	Refrigerant charging correction
	Refrigeration strip curtains
	Retrocommissioning, Lighting
	Smart power strip
	Timeclocks
	Tractor Heater Timers
	Vending Equipment Controller

	VFD air compressor
	VFD fan
	VFD motor
	VFD pump
	Wall Insulation
	Water loop heat pump
	Window replacement

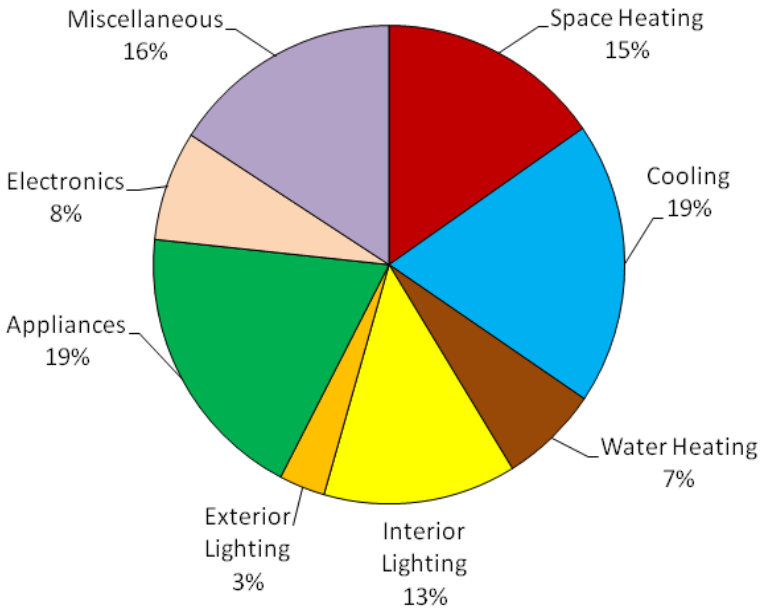
7.2.5.3 Bundling Measures into Programs

An energy efficiency measure is a device, appliance, or practice which, when implemented for a home, business, or manufacturing process, results in a reduction in the amount of energy used per unit of useful service. For program design purposes, all measures passing the screening analysis were considered and incorporated into at least one program, and in many cases, multiple programs.[51] In general, related measures were grouped together for bundling into programs. Each program was comprised of a cross-cutting set of measures capable of cost-effectively addressing the characteristics of each market segment.[52]

Program participation estimates for each measure in each year of the implementation plan were based on participation rate assumptions and measure allocations derived from the DSM potential study and mapping exercise outlined above in Section 7.2.1.4. The primary market research obtained from the 2009 Ameren Missouri DSM potential study was used to clarify and define the program components to achieve those savings.[53] As an example, the following pie chart from the potential study describes how energy is used at the end-use level by Ameren Missouri Residential customers:

[51] 4 CSR 240-22.050(3)(F)
[52] 4 CSR 240-22.050(06)(C)
[53] 4 CSR 240-22.050(05)

Figure 7. 12: Base Year Residential Electric Consumption by End Use



Once participation levels were identified and incorporated, program design work could begin. Ameren Missouri incorporated multiple components in the program design phase including primary market data from the Potential Study and also input from its implementation team. An example of how information from the Potential Study was used in the program design process, consider residential space heating – both electric and gas. The market share and equipment saturation of electric space heating in the Ameren Missouri market is relatively low, but because of the high energy intensity of this end use, the electric energy consumed in space heating (15%) is nearly equivalent to the electric energy used for cooling (19%), where the Ameren Missouri market share and equipment saturation is almost 100%. This speaks to the need for exploration of a program focused around improving electric space heating efficiency through various measures including furnace fan upgrades.

Input from the Ameren Missouri DSM implementation team was also a significant factor in the program design process. The implementation team has gained significant experience from participation in the energy efficiency market at both the residential and business levels. They have firsthand field experience and identified the necessary program elements required to move the market. Estimation of incentive levels, program administration and marketing costs, and portfolio level costs were based primarily on the Ameren Missouri implementation team's experience during Cycle 1.

The combination of all energy efficiency programs, both business and residential, comprises the energy efficiency portfolio. This report and its appendices primarily

represent one particular portfolio, although there were several other portfolios developed for various alternative resource plans. The full array of portfolios developed is discussed in Section 7.8.[54]

7.2.5.4 Program Cost-Effectiveness Screening

Once measures had been assembled into programs, each program was analyzed using the aforementioned cost-effectiveness metrics, primarily the TRC test.[55] The program screening process added program-level and portfolio-level costs to the bundled measures to estimate the level of their total delivered cost. The method in which these costs were developed has been described below. All programs that were included in the residential and business portfolios were designed to have a TRC ratio greater than 1.0, with the exception of the Low Income program. This is because typical Low Income programs target a hard-to-reach market and it is common practice for the utility to offer fully installed measures in this program with little or no cost to the customer.[56]

Accompanying the TRC calculations are several other cost-effectiveness tests. For each program, TRC, RIM, and UCT tests also were calculated.[57] The cost-effectiveness results were more accurate than the 2008 IRP filing by utilizing more granular hourly data and the newly acquired modeling tool DSMore.[58] These results, along with participation estimates, program costs, utility costs and energy and demand reduction estimates (load impacts) are in the electronic appendices for each given portfolio (i.e. Low Risk, RAP, etc.) within each program BatchTool ('Portfolio Screens' folder and then select desired portfolio and program).[59]

Calculation of Incentive Costs

Incremental costs which include upfront costs and operational & maintenance costs are listed in the "Measure Screen Data 11-18-2010.xlsx".[60] Incentive costs were calculated by summing the average, per-measure incentive levels that were developed according to the following methodology.

1. First, a simple payback analysis was performed on each measure to arrive at the initial target incentive level. This determined the incentive amount required to supplement the customer's electric bill savings such that the incremental cost of the measure would be paid back in 2 years.
2. Second, upper and lower constraints were applied for each program based on an appropriate percent of incremental cost. These constraints were established

[54] 4 CSR 240-22.050(07)(F)
[55] 4 CSR 240-22.050(07)
[56] 4 CSR 240-22.050(07)(E)
[57] 4 CSR 240-22.050(07)(C)
[58] EO-2007-0409 – Stipulation and Agreement #30
[59] 4 CSR 240-22.050(07)(A), 4 CSR 240-22.050(11)(H)
[60] 4 CSR 240-22.050(03)(C)1-3

based on results from the Ameren Missouri Energy Efficiency implementation teams, the Ameren Missouri potential study efforts, and information from the last 3- year plan. These incentive thresholds are shown in the table below:

Table 7. 13: Incentive Thresholds by Program (% of Incremental Cost)

ENERGY EFFICIENCY PROGRAM	Max Limit (%)	Min Limit (%)
RES-Lighting	30%	20%
RES-HVAC	30%	20%
RES-Appliance Recycling	N/A	N/A
RES-Low Income	100%	100%
BUS-Standard	30%	20%
BUS-Custom	Based on $/ first year-kWh saved	
BUS-RCx	35%	20%
BUS-New Construction	40%	20%
BUS-Multifamily Common	30%	20%

3. Finally, the resulting incentive level was reviewed and, in some cases, manually adjusted based on information from actual field experience, other utilities' program experience, the EM&V contractor teams, and market conditions.

An example of a manually adjusted incentive is the ground source heat pump ("GSHP"). Steps 1 and 2 above for the Energy Efficient Products Program would have set the incentive level between 20% - 30% of incremental cost. A comparison of the broader market and other utility incentive levels, however, caused Ameren Missouri to reduce its GSHP incentive in PY4 to $800, or approximately 10% of the incremental measure cost. This more accurately reflects market conditions.

Another exception to the above methodology is when an assessment of market needs dictates that full measure cost or direct installation of measures must occur. This is the case in programs such as Low Income.

Specific incentive levels are available in the program templates and appropriate program BatchTools.

Calculation of Administrative Costs

Portfolio Administrative Costs were calculated on a per-measure basis. These administrative costs were determined as a percentage of incentive costs and applied with a logarithmic decline over the duration of the program. This logarithmic decline is

assumes that administrative costs should decline over time due to lessons-learned, increased operational efficiencies, and economies of scale.

Portfolio Level Cost Estimates

There are 4 Portfolio Level Costs applied on a per-program basis: Portfolio Administrative Costs, EM&V Costs, Educational Costs, and Marketing Costs. Each cost was calculated by applying the following percentages to the Total Program Costs:

Table 7. 14: Portfolio Level Costs*

Portfolio Admin Costs	6.0%
EM&V Costs	5.0%
Educational Costs	2.5%
Marketing Costs	2.5%

**Total Program Costs include the Program Administrative Costs (previously mentioned), Incentive Costs (previously mentioned), Implementation Costs, and any Miscellaneous Costs.*

Portfolio administrative costs include a 1.0% of total program costs increase comply with new rules from MEEIA, as described in Section 7.2.2 above.

7.2.5.5 Net-To-Gross ("NTG") Assumptions

Program cost-effectiveness is based on program net savings – savings that are attributable directly to a program after netting out non-program effects. Net savings are accounted for in the calculation by multiplying gross program savings by what is known as the net-to-gross ratio. The net-to-gross ("NTG") ratio is the ratio of the verified net savings for a program to the verified gross savings. Ameren Missouri sought to encompass the following three factors in the NTG ratio, which the industry commonly recognizes as the primary drivers in the difference between net and gross savings:

(1) Free Ridership – defined as the portion of customers who would have implemented an efficiency measure even in the absence of a program incenting it.

(2) Free Drivership, or Spillover – defined as the portion of customers who adopt a measure that has been promoted by a program after having been influenced by the program, but without taking the program incentive.

(3) Realization Rate – defined as the rate by which actual energy savings reflect estimated energy savings. Various factors affecting this metric include the installation rate of a group of measures, portion of those measures that are actually correctly installed, and actual hours of operation and actual measure quantity and type can impact this rate

Although all effects should ultimately be accounted for in the calculation of net savings, evaluations have often ignored the spillover effect. The effect of applying the NTG ratio, therefore, is to reduce program savings and cost-effectiveness.

For Cycle 2 program planning purposes, Ameren Missouri based individual program NTG assumptions on Cycle 1 EM&V results, Ameren Illinois EM&V results, and previous planning work where applicable. Table 7. 15 shows the NTG assumptions for the Ameren Missouri portfolio of proposed Cycle 2 programs:

Table 7. 15: NTG Planning Assumptions

Program	Net to Gross Factor	Notes
RES-Lighting	0.80	Deemed reasonable by EM&V.
RES-HVAC	0.80	Not yet evaluated. Considered best practice.
RES-Appliance Recycling	0.54	Based on EM&V calculated data in Ameren Illinois program.
RES-Low Income	1.00	Subsidized incentives allow targeting of segment who would not otherwise act on EE.
BUS-Standard	0.80	Deemed reasonable by EM&V.
BUS-Custom	0.80	Deemed reasonable by EM&V.
BUS-RCx	0.80	Deemed reasonable by EM&V.
BUS-New Construction	0.80	Deemed reasonable by EM&V.
BUS-Multifamily Common	0.80	Deemed reasonable by EM&V.

7.2.5.6 Hourly Load Shapes

Creating Unitized Measure Level End-Use Load Shapes

As mentioned in Section 7.2.5.6, a set of hourly forecast end-use shapes were developed to represent all of the shapes of the measures that were being analyzed. These load shape forecasts were calendar aligned to be consistent with the hourly load forecast that was also mentioned in Section 7.2.5.6. These hourly shapes consisted of 8760 hours of load values for a 365 day year, and 8784 hours of load values for a 366 day year within the load forecast.[61]

To provide for scaling of the shapes to represent the savings that were projected by the modeling within DSMore, each year of each end-use shape was unitized on an annual energy basis,

[61] 4 CSR 240-22.050(8)

The process described in the remaining parts below is repeated for each of the energy efficiency potentials that were analyzed.

The annual energy savings projections (at the meter) for each class of end-use within a program were calculated. These annual energy values were multiplied by each hourly energy value within the corresponding unitized end-use load shape to create a correctly scaled hourly end-use load shape forecast. Each of the scaled end-use load shapes within a single program is then summed on an hourly basis to arrive at an hourly end-use forecast of the program impact at the meter.

The sum of each residential and business program meter level hourly load forecast is calculated on an hourly basis to arrive at the respective Meter Level Energy Efficiency Portfolio Load Shape.

Each hour of the Energy Efficiency Portfolio Load Shapes is adjusted by the appropriate line loss factors to arrive at the Integration Level Energy Efficiency Portfolio load shapes. These two shapes are then summed on an hourly basis to arrive at the Hourly Integration Level Energy Efficiency Portfolio Load Shape which is subsequently used in Ameren Missouri's resource plan model, MIDAS.

7.2.6 Demand Response

While demand response ("DR") and energy efficiency ("EE") are interrelated, they fundamentally differ as options to supply-side generation. DR is designed to change on-site demand for energy in intervals from minutes to hours and associated timing of electric demand/energy use (i.e. lowering during peak periods) by transmitting changes in prices, load control signals or other incentives to end-users to reflect existing production and delivery costs. EE is designed to reduce electricity consumption during all hours of the year, attempting to permanently reduce the demand for energy in intervals ranging from seasons to years and concentrates on end-use energy solutions. The number of electric end-use EE technologies exceeds 400. The number increases to well over 1,000 when considering various permutations of each EE end use technology. Although there are a limited number of demand response specific end-use technologies for small commercial and residential customers such as switches to cycle central air conditioners, water heaters, and pool pumps, most business demand response programs involve short-term load curtailment plans that include the operation of a energy load management system, specific process shutdowns and, in some cases, complete facility shutdowns such that entire shifts of workers are furloughed. Consequently, demand response for business customers, especially large business customers, does not focus on demand response measures as much as it is on facility operations such as shift reductions or shutdowns. [62]

[62] 4 CSR 240-22.050(01)(A)

DR programs can be classified as Dispatchable and Non-Dispatchable. Increased predictability of customer participation and load response, especially for voluntary programs, is vital to understand the influence of DR on reliability.

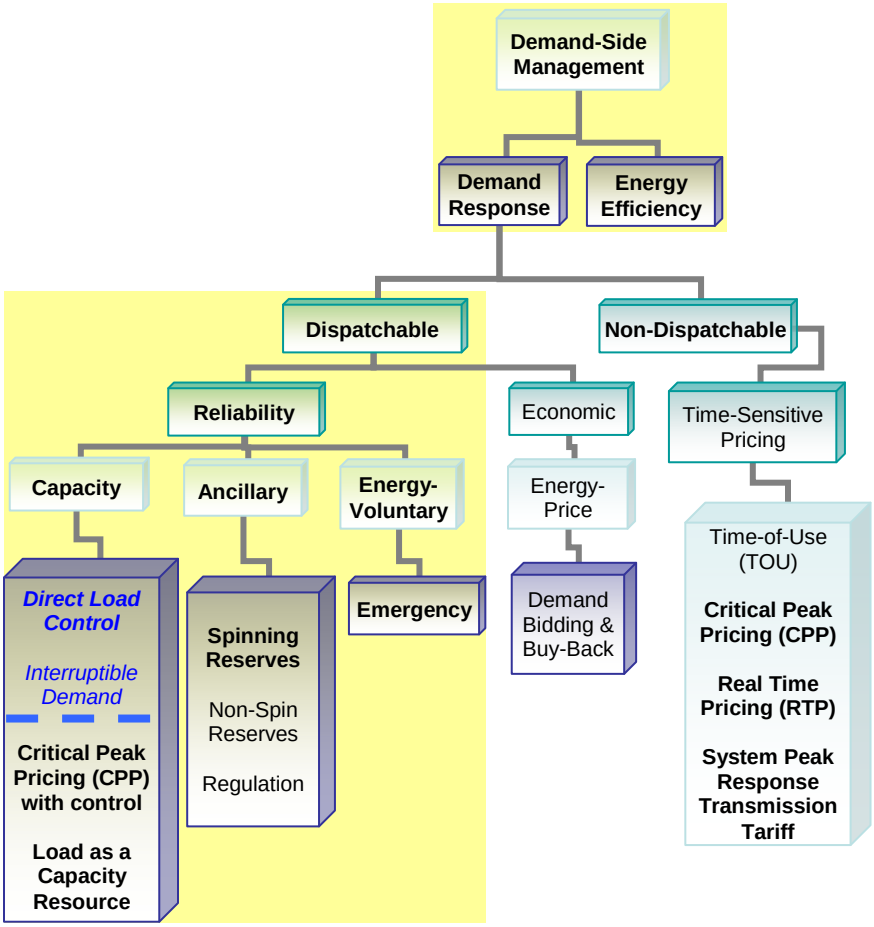
Dispatchable Demand Response ("DDR") includes an inducement or incentive for customer participation and peak load reductions. Ameren Missouri has a history of deploying DDR resources. Up until the late 1990s Ameren Missouri enrolled between 80 to 120 MW of large industrial customer load on an interruptible rate. From 1993 to 1998 Ameren Missouri conducted a residential DDR pilot program called "No Sweat" to cycle residential air conditioners using a switch placed on the outside unit. Starting in 2004 and continuing through 2005 Ameren Missouri conducted a residential time-of-use pilot featuring a critical peak pricing rate and a critical peak pricing rate accompanied with smart thermostat technology.

Non-Dispatchable Demand Response ("NDDR") link prices in retail and wholesale markets. Retail customers receive a price signal reflecting the costs of production and delivery and view these higher prices as a signal to deploy resources more efficiently. This characteristic has the potential to reduce or shape electricity use and overall costs. Although not as extensive as its history with dispatchable demand response, Ameren Missouri has some experience with NDDR. For example, Ameren Missouri has had a tariff in place since 1999 for large commercial and industrial customers called Rider L that calls for customers to voluntarily reduce loads during times of system stress in return for receiving a payment based on the market price of energy. In Ameren Missouri's residential time-of-use pilot in 2004 and 2005 various time-of-use rates were also offered to customers in order to determine the load impacts associated with time-of-use pricing. Finally, in the summer of 2009, Ameren Missouri conducted a limited pilot with employees only to determine the impact of market prices and smart home technology, i.e., real-time pricing and consumption information, smart thermostats, web-based communications, on peak demand and energy consumption.[63]

The following diagram illustrates the type of DR programs that are typically considered dispatchable or non-dispatchable:

[63] 4 CSR 240-22.050(05)

Figure 7. 13: Demand Side Management Structure



7.2.6.1 DDR Residential and Small Commercial

For the residential and small commercial classes, standard technologies for direct load control are typically either switches placed on cycle-able units (water heaters, AC systems) and on during an event or a programmable, controllable thermostat that arrives at a similar result. A variation of direct load control using a programmable, controllable thermostat is for the utility to send a price signal to customers when an event is called allowing the customer, rather than the utility, to curtail demand.

Residential demand response programs using switches to cycle air conditioners have been in existence for over twenty years. There are several prominent national contractors who offer turnkey solutions for switch programs. Turnkey services include customer recruitment, enrollment, appointment scheduling (if necessary), device installation, data management, quality control and project management.

A programmable, controllable thermostat is capable of precise temperature control with four time and temperature settings per day. The thermostat has the capacity to handle

weekday, Saturday and Sunday schedules. From a control perspective, the thermostat can accommodate simple cycling strategies, cycling strategies with pre-defined limits, ramped temperature control and randomization.[64]

On August 14, 2009 Ameren Missouri issued a request for information ("RFI") to solicit demand response program proposals for consideration as part of the 2011 Ameren Missouri IRP/DSM planning process. The intent of this request was to solicit innovative demand response program ideas that could be considered alongside other program ideas in the Company's demand-side analysis process. This RFI and can be found in the Electronic Work Papers "Ameren DR_RFI-8-14-2009.pdf".[65]

Ameren Missouri received the following indicative pricing proposal to implement either a residential air conditioning switch program or a programmable, controllable thermostat program.

Table 7. 16: Estimated Residential DLC Costs

Description	Estimated Price	Frequency
Field Office Set-up	$20,000 - $25,000	One-time
IT Set-up	$50,000 - $80,000	One-time
Customer Care Center Set-up	$2,500 - $5,000	One-time
Program Mangement Fee	$25,000 - $30,000	Monthly
Customer Care Center Fee	$5,000 -$10,000	Monthly
Switch Installation - First Device	$75 - 95	Each
Switch Installation - Additional Devices	$40 - $55	Each
Thermostat Installation - First Device	$125 - $135	Each
Thermostat Installation - Additional Devices	$80 - $100	Each
Service Call	$80	Per Hour
Customer Recruitment	$50 - 70	Each

Ameren Missouri used these indicative cost estimates in the calculation of its residential direct load control demand response options. The Company, however, increased the installed thermostat cost estimate to $300 to reflect experience gained during field installation of programmable, controllable thermostats in its 2004-2005 residential time-of-use pilot program.

In terms of the estimate of the peak demand reduction per customer attributable to either the switch or thermostat technology, Ameren Missouri assumed 1.0 kW. The

[64] 4 CSR 240-22.050(08)
[65] EO-2007-0409 – Commission Order for 4 CSR 240-22.050(6)

Company has empirical data from prior pilot studies that show a range of potential demand impacts for residential air conditioning cycling programs. Ameren Missouri's "No Sweat" pilot completed in 1998 showed an average 1 kW per switch reduction in peak demand. The residential time-of-use pilot completed in 2005 showed an average 1.24 kW per thermostat reduction in peak demand when combined with a critical peak pricing rate. In order to achieve peak demand reductions in the 1.0 kW range the assumption is that the program will target customers with high summer usage.

7.2.6.2 DDR Large Business

Large business customers generally have personnel and systems specifically assigned to address energy management. Hence, the demand response model for business class customers is typically one where a third party aggregator works on behalf of the electric utility to aggregate multiple customer loads to deliver a guaranteed amount of peak load reduction to the utility. The utility is typically blind to the demand response technologies or techniques deployed by each business customer. However, the third party aggregator is contractually committed to the utility to deliver a guaranteed amount of peak demand reduction when called upon by the utility. Therefore, the utility considers this load to be dispatchable or reliability-based demand response.

As part of the same RFI issued on August 14, 2009 to solicit demand response program proposals for consideration as part of the 2011 Ameren Missouri IRP/DSM planning process, Ameren Missouri received multiple bids from third party aggregators whose business is tailored to garner demand response capabilities from the commercial, institutional and industrial sectors. The bids outlined customized, comprehensive load management programs that offered firm, dispatchable capacity. The bids were agnostic of any specific type of demand response technology. The bids have the following parameters that were used in the Ameren Missouri cost effectiveness analysis of business reliability-based demand response options:

- Program length: 5 to 10 years
- Capacity price: $67 to $74/kw-yr
- Energy price: $100-$300/MWH
- Dispatch: 60 firm hours and 15 dispatch events per year

The generic business reliability-based demand response program addresses the commercial, institutional and industrial markets. The program is targets customers with average peak demands greater than 50 kW.

7.2.6.3 Non-Dispatchable Demand Response ("NDDR") Technologies

As described above, NDDR refers to pricing programs. Pricing programs offer customers the opportunity to save money on their energy bills by shifting usage away

from high load hours. In contrast, reliability based or direct load control program offers customers a fixed payment in return for utility control of specific end-uses.

The load reduction impact attributable to pricing programs is a function of utility infrastructure, customer based technology including information and feedback systems and utility rate structure. As noted in the Ameren Missouri DSM Potential Study Volume 4: Program Analysis page 4-2, full scale deployment of price response programs is dependent upon the installation of AMI technology. The reason for this is that AMI technology has the two-way communication necessary to send pricing signals and retrieve interval data for customers participating in dynamic pricing programs on a very large scale. For purposes of the 2011 IRP planning process, the planning team assumed that the existing Automatic Meter Reading ("AMR") technology would begin to be converted to AMI technology beginning in 2015 when the existing AMR system would be approximately 20 years old. Deployment of a meter replacement system is dependent on numerous factors, however, and both the commencement and completion of such an endeavor could vary considerably depending on major drivers such as budgets, customer demand, operational needs, regulatory environment, and technology availability. Ameren Missouri continues to explore a wide range of options for system upgrades, including but not limited to AMI. Please see Chapter 6 for a further discussion.

7.2.6.4 NDDR Residential and Small Commercial

There are a variety of forms that residential dynamic pricing programs could take. Possibilities include critical peak pricing ("CPP"), peak time rebate ("PTR"), and real-time pricing ("RTP"). A PTR program is a credit only program. Since there are no financial penalties to the customer associated with a PTR rate, PTR programs would likely achieve a higher level of customer acceptance compared to CPP or RTP program structures.

In order to achieve maximum potential load reduction impact as well as maximum customer satisfaction, Ameren Missouri modeled an opt-out PTR program to represent price responsive programs for the residential and small business classes.

A discussion of price responsive DR for the mass markets requires a discussion of customer meter technologies. Hourly market prices and real-time consumption are very useful data to customers when making decisions on how to alter energy consumption during high price periods. Ameren Missouri currently has a 1995 vintage one-way AMR metering system in place. The system was designed primarily for monthly volumetric meter reads of electricity usage at customers' homes. However, the system has the capability to record 15-minute interval meter data. The system, as presently configured, is not capable of two-way communication with the customers. However, the meter

manufacturer has recently developed add-on meter technology that can send customers real time consumption information.

By 2015, the Ameren Missouri AMR technology will have been in place for approximately 20 years – basically the effective useful life of the equipment. The Company will address business cases and decisions regarding the next generation meter technology as the AMR system reaches the end of its useful life. Advanced Metering Infrastructure technology is the state-of-the art two-way metering technology that at the present time would appear to be the most likely candidate to replace the AMR system. Ameren Missouri's ability to achieve maximum load impacts from mass market price responsive DR programs requires both smart rates, at least in the form of an opt-out PTR rate, and smart technologies – possibly an AMI system.

The possible implementation of an opt-out price response demand response program would constitute a significant change in Ameren Missouri's relationship with all of its residential customers.

A PTR option uses price signals in the form of customer credits to encourage customers to reduce their usage during critical time periods on specific event days. Credits, or rebates, reflect the reduction in usage below a customer specific baseline. The Company would call event days on relatively short notice for a limited number of days during the year and the timing of such events would not be not consistently predictable. However, there would be trigger criteria available so that customers could anticipate the potential for events based on the weather or other factors. Events may occur during times of system contingencies or when the Company faces high costs in procuring wholesale power. Notification of an event can either be a day in advance or on the day of the event.

For participation in this option, customers must have advanced meters such as, at a minimum, the AMR system currently in place with Ameren Missouri's residential customers. The AMR system will support a dynamic rate to some extent. However, for the current AMR system to support a default dynamic rate with very high participation rates, significant changes to both the system itself and the processes of data collection, storage, and validation would be necessary. To that end, and for purposes of the 2011 DSM Implementation Plan filing, Ameren Missouri assumed an AMI implementation and deployment beginning in 2015 to better facilitate the adoption of large scale dynamic pricing for Ameren Missouri. Enabling technologies such as residential PCTs allow automatic responses to events for both the AMR and AMI system. Therefore, the PTR program will offer both a technology enabled and non-enabled option.

7.2.6.5 NDDR Large Business

Ameren Missouri considered the same types of price response programs, i.e., CPP, PTR and RTP for the business classes as for the residential and small commercial classes. Ameren Missouri has a current demand response tariff for large customers called Rider L, commonly referred to as the "Peak Power Rebate" program. This is a form of PTR sometimes referred to as a "Demand Bidding" program. There is an energy component to Rider L based on the market price for energy. There is a capacity component that was initially based upon the avoided cost of a new combustion turbine generator and then subsequently re-set at a capacity value aligned with the current market cost of capacity.

Following similar logic to that used to model PTR dynamic pricing for an indicative residential price response program, Ameren Missouri also modeled PTR to be indicative of the business price response program. Modeling PTR enables Ameren Missouri to build upon the decade of experience it has working with business customers on the Rider L program.

Rider L currently works as follows:

- Customers must be able to reduce a minimum of 200 kW at a single premise during a price response event. Additionally, individual customers may commit to a maximum reduction of 10,000 kW.
- Events may be called during times of system contingencies or when faced with high prices in procuring wholesale power. A single event will last a minimum of 4 hours and the total number of event hours will not exceed 60 hours per year.
- Customers will be notified of an event either the day before or the day of the event. Customers who wish to participate must confirm their intent and nominate their anticipated load reduction with Ameren Missouri within a specified time limit following the notification.
- Participants are paid an hourly credit equal to the least of the estimated reduction, or the enrolled reduction, or the actual hourly reduction, times the hourly credit. The hourly credit is based on the day-of or day-ahead risks adjusted MISO market energy prices, plus a risk adjusted capacity price of $0.20 /kWh. Participants are paid credits on a monthly basis netting positive and negative events against each other.

Event days are dispatched on relatively short notice for a limited number of days during the year. Usually their timing is unknown. However, trigger criteria are well-established so that customers can expect events based on the weather or other factors. Events can be called during times of system contingencies or when faced

with high prices in procuring wholesale power. Notification of an event can either be a day in advance or on the day of the event.

For participation in this option, customers must have advanced meters, such as the AMR system currently in place with Ameren Missouri's customers. While the AMR system will support a dynamic rate to some extent, significant changes would be needed to both the system itself and the data collection, storage, and validation processes for the current AMR system to support a default dynamic rate with very high participation rates, hence the evaluation of AMI and other substitute technology options.

A full evaluation was completed on Rider L and can be found in the Electronic Work papers ("PPR Evaluation Report Final.doc").[66] The cost-effectiveness of Rider L was calculated, at the program level, to be 1.81. The Company will continue to monitor progress within the demand response markets and coordinate with Stakeholders as potential possibilities arise.

7.2.6.6 Cost-Effectiveness Analysis Results

Ameren Missouri modeled direct load control and price responsive demand response programs for cost-effectiveness in terms of the total resource cost ("TRC") test. A total of 5 types of demand response programs were modeled. The 5 program types include:

1. RES direct load control ("DLC")
2. RES peak time rebate ("PTR")
3. Small Business direct load control ("DLC")
4. Large Business direct load control ("DLC")
5. Business peak time rebate ("PTR")

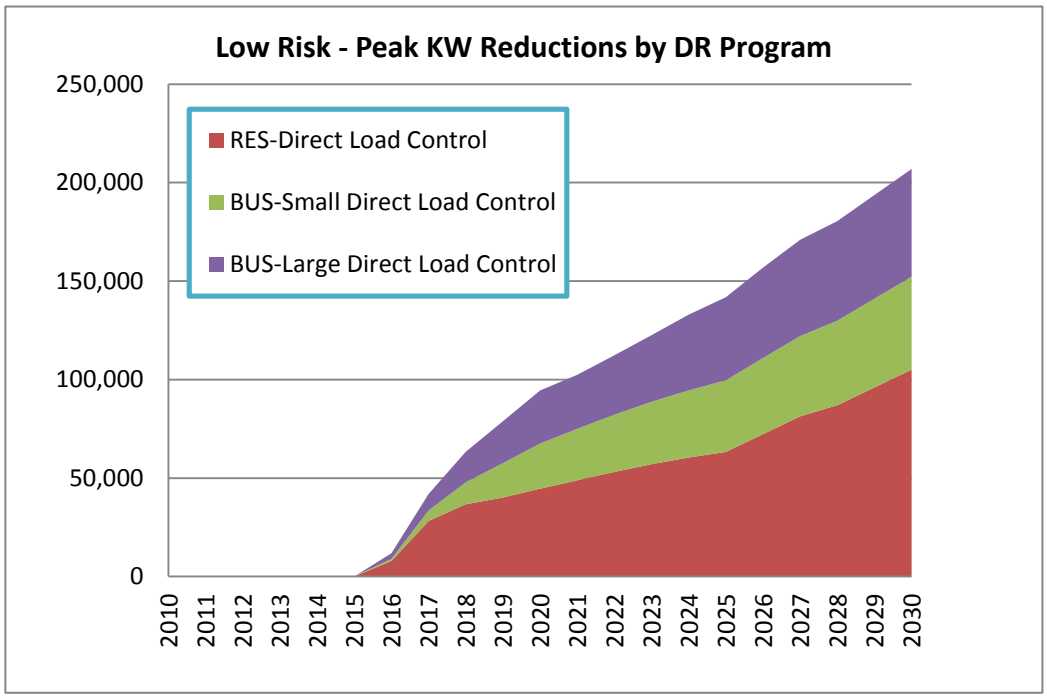
Table 7. 17: Low Risk Demand Response Portfolio Results[67]

Program Type	Benefits	Costs	TRC	2030 MW Reduction
RES DLC	$71,351,281	$27,526,717	2.59	105.057
Small Bus DLC	$34,391,288	$12,802,093	2.69	47.197
Large Bus DLC	$31,221,644	$21,030,267	1.48	54.712
Total	$136,964,213	$61,359,077	2.23	206.965

Figure 7. 14 shows the timing and magnitude of demand response load reductions by program type for the Low Risk portfolio.

[66] EO-2009-0437 – Stipulation and Agreement #12; EO-2009-0437 – Stipulation and Agreement #13; 4 CSR 240-22.050(11)(J)
[67] 4 CSR 240-22.050(07)(B)

Figure 7. 14: Low Risk Demand Response Potential



7.2.7 Rate Design

The Company considered alternative rate designs in the development of its demand response programs. The following matrix illustrates the demand response technologies and rate designs considered:

Table 7. 18: Demand Response Program Matrix

Demand Response Program	Residential [1M]	Small C&I [2M]	Medium C&I [3M]	Large C&I [4M, 11M]
Direct Load Control				
Residential Direct Load Control	X			
Small C&I Direct Load Control		X		
Dynamic Pricing Programs				
Residential Dynamic Pricing	X			
C&I Dynamic Pricing		X	X	X
Other C&I Programs				
Demand Bidding			X	X
Curtailable				X
DR Aggregator Contracts		X	X	X

The residential dynamic pricing program is designed to target all residential customers within the Ameren Missouri service territory. Dynamic pricing requires interval meter data for billing purposes. Ameren Missouri is able to utilize its existing Automated Meter Reading (AMR) system to provide the data necessary to support the rate during initial program years, and is assumed to install AMI meters beginning in 2015 to facilitate additional participants.

Rather than use a generic "dynamic pricing program" for this analysis, Ameren Missouri's DSM Potential Study contractor, Global Energy Partners ("GEP"), screened the various possibilities, critical peak pricing ("CPP"), peak time rebate ("PTR"), and real-time pricing ("RTP"), for the program that provided the best overall customer acceptance and peak impacts. Because a PTR program is a credit only program, customer acceptance rates in an opt-in, or voluntary, scenario tend to be higher than other penalty and credit programs such as CPP. Southern California Edison estimated a maximum take rate of 20% on a voluntary CPP program using the Momentum Market Intelligence tool created for the California State-Wide Pricing Pilot.[68] Considering that this take rate was estimated using market research performed in California on customers that are experienced with DR programs, a translation of this take rate to Ameren Missouri would necessarily be lower, perhaps in the 10 – 15% maximum range. PTR, due to its "no loser" nature, would likely be able to achieve the 20% participation on a voluntary basis; or much higher participation rates, in the 50-75% range on an opt-out or default basis. Both the FERC National assessment of demand response and the two California utilities offering dynamic pricing on a default basis have estimated an upper bound for customer participation rates at 75%. Additionally, it has been demonstrated in industry pilots that the impacts that can be obtained through PTR and CPP programs are equivalent, meaning that the program with the higher participation rate will generate higher impacts for Ameren Missouri.[69] We therefore chose to model an opt-out PTR program for the residential class, recommending it because of both increased customer satisfaction and increased total potential impacts. This is an important point, as actual implementation of such a DR program would constitute a sweeping change in Ameren Missouri's relationship with all of its residential customers.

A PTR option uses price signals in the form of customer credits to encourage customers to reduce their usage during critical time periods on specific event days. Credits, or rebates, are calculated based on reduction in usage below a customer specific baseline. Event days are dispatched on relatively short notice for a limited

[68] Southern California Edison SmartConnect Business Case Filing with the CPUC, July 2007, available at: http://www3.sce.com/sscc/law/dis/dbattach1e.nsf/0/DA51DA091ECD4DAA88257329007E0AB3/$FILE/A.07-07-XXX+SCE+AMI+Phase+III+SCE-4.pdf

[69] Faruqui, Ahmad and Sanem Sergigi, "BGE's Smart Energy Pricing Pilot – Summer 2008 Impact Evaluation," Filed by BGE with the Maryland Public Service Commission, April, 2009.

number of days during the year. Usually their timing is unknown. However, trigger criteria are well-established so that customers can expect events based on the weather or other factors. Events can be called during times of system contingencies or when faced with high costs in procuring wholesale power. Notification of an event can either be a day in advance or on the day of the event.

For participation in this option, customers must have advanced meters, such as the AMR system currently in place with Ameren Missouri's residential customers. While the AMR system will support a dynamic rate to some extent, significant changes would be needed to both the system itself and the data collection, storage, and validation processes for the current AMR system to support a default dynamic rate with very high participation rates. To that end, we assume an AMI implementation and deployment beginning in 2015 to better facilitate the adoption of dynamic pricing for Ameren Missouri. Enabling technologies such as residential programmable controllable thermostats ("PCTs") allow automatic responses to events for both the AMR and AMI system; therefore, the PTR program will offer both a technology enabled and non-enabled option. The same program logic applies to the Ameren Missouri proposed C&I dynamic pricing programs.

7.2.8 Distributed Generation

In order to analyze a complete set of demand side energy options, Ameren Missouri chose to evaluate the potential opportunities for distributed generation technologies[70]. A market penetration study was commissioned to analyze various distributed generation ("DG") technologies and also to identify the market potential for those technologies in Ameren Missouri's service territory. While DG technologies, by nature, supply electricity to the customer (or grid), they are often small units which are used to offset customer load rather than selling electricity on the open market. For this reason, these technologies were analyzed alongside other demand side technologies. The report of the DG market penetration assessment is included in Electronic Work Papers "2009 AmerenUE DG Penetration Study.pdf" in the "Studies" folder.[71]

7.2.8.1 Market Penetration Study

Ameren Missouri sent out Request for Proposals in April of 2009 to eight different consulting firms and the Company received three bids. To properly evaluate the bids, a Delphi approach was utilized. Experts from various departments within Ameren collaborated and developed a quantitative scoring matrix for the bidders. The major categories of the scoring matrix have been listed below.

[70] 4 CSR 240-22.050(01)(D)
[71] 4 CSR 240-22.050(11)(E)

- Technical Approach
  - 1. Proposed Research and data gathering methods
  - 2. Analysis design, implementation, and administration strategy
  - 3. Best practice, innovation, & likelihood for success in proposed technical approach
  - 4. Time to implement/deliver programs
- Organizational and Management Capability
  - 1.Demonstrated competence and experience
  - 2. Management structure & references
- Cost
  - 1. Material Costs
  - 2. Labor Costs
  - 3. Ameren Missouri's perception of bidders ability to achieve goals within budget

Navigant Consulting Inc. ("NCI") was chosen to conduct the market penetration study. The study was comprised of three main sections, technology assessment, market penetration calculation, and a review of other utility best practices relating to DG.

7.2.8.2 Technology Assessment

A robust list of DG technologies was analyzed for the study. First, an assessment of each technology was used to identify potential DG technologies. NCI recommended a list of 7 different technology categories including Combined Heat and Power ("CHP"), Solar Photovoltaics ("PV"), Small Wind, Fuel Cells, Small Gas or Bio-fuel Generators, Energy Storage, and Small Hydro.[72] Within each of these categories were specific technologies whose economic, technical, and operational characteristics were outlined.

The technology screening process was two-fold. First, a qualitative screen was used to eliminate any technologies that were deemed inappropriate for Ameren Missouri's service territory or too immature for mass market adoption and utility sponsorship. NCI collaborated with the Ameren staff to identify key criteria for analyzing the technologies including geographical constraints, consumer psychographics, market maturity, regulatory environment, siting and permitting requirements, and technology maturity. Each technology, within each criterion, was then analyzed on three different time-frame scenarios: near term, mid-term (2015 – 2020), and long term (2020 – 2030). Each technology was then given a 1 to 5 rating based on favorability of the technology in each criterion (5 being favorable). The results are seen in Table 7. 19.

[72] 4 CSR 240-22.050(1)(D)

Table 7. 19: DG Technology Qualitative Screen

Qualitative Screening Criteria																				
Technology	Criteria																			
	Market Maturity			Technology Maturity			Fuel/Geog. Applicability			Siting and Permitting Requirements			Customer Willingness To Adopt			Policy Issues			Total Score		
	N	M	L	N	M	L	N	M	L	N	M	L	N	M	L	N	M	L	N	M	L
PV	4	5	5	3	4	5	3	3	3	3	4	4	5	5	5	5	5	5	3.9	4.3	4.7
CHP – Fuel Cell	4	4	5	3	4	5	5	5	5	3	3	4	3	4	5	5	5	5	3.8	4.3	5.0
CHP – Recip	4	5	5	5	5	5	3	3	3	3	3	3	3	4	4	4	1	1	3.7	3.6	3.5
CHP - Microturbine	4	5	5	3	5	5	5	5	5	3	3	4	3	4	4	4	3	3	3.6	4.3	4.3
Small Non-Renewable Generator - Recip	5	5	5	5	5	5	3	3	3	3	3	3	3	3	3	3	1	1	3.6	3.4	3.3
Small Non-Renewable Generator - Microturbine	4	5	5	3	5	5	5	5	5	3	3	4	3	3	3	4	3	3	3.6	4.1	4.0
Small Biofuel Generator – Recip	1	3	5	5	5	5	1	2	3	1	2	3	1	2	3	4	4	5	2.4	3.1	4.1
Small Biofuel Generator - Microturbine	1	2	4	3	5	5	1	2	3	1	2	3	1	2	3	4	4	5	1.9	3.0	4.0
Electrical Energy Storage – Rechargeable	5	5	5	5	5	5	1	1	1	3	4	5	5	5	5	3	4	5	3.7	4.0	4.4
Electrical Energy Storage – Other (e.g. flywheels)	1	2	3	1	2	3	1	1	1	1	2	3	1	2	3	3	3	4	1.3	2.0	2.9
Electrical Energy Storage – Emerging Technologies (e.g. flow batteries)	1	3	4	1	2	3	1	1	1	1	2	3	1	2	3	3	3	4	1.3	2.1	3.0
Small Wind	3	3	3	3	3	3	1	1	1	1	1	2	5	5	5	5	5	5	3.3	3.4	3.6
Small Hydro	1	1	1	1	2	3	3	3	3	1	1	1	1	1	3	5	5	5	2.0	2.2	3.1
Fuel Cell – Phosphoric Acid	4	4	5	5	5	5	5	5	5	3	3	4	3	4	5	4	5	5	4.1	4.5	5.0
Fuel Cell – Molten Carbonate	4	4	5	3	4	5	5	5	5	3	3	4	3	4	5	4	5	5	3.6	4.3	5.0
Fuel Cell – Emerging Technologies (e.g. PEM, SOFC)	1	2	3	1	2	4	5	5	5	3	3	4	3	4	5	4	5	5	3.0	3.7	4.6
Weighting	5%	10%	10%	22.5%	22.5%	22.5%	20%	20%	15%	10%	5%	5%	27.5%	27.5%	27.5%	15%	15%	20%			

Source: NCI, August 2009. Based upon NCI's extensive work with DG technologies and markets for investors, governments, energy companies, and manufacturers.

Key

5 = Favorable
3 = Average
1 = Unfavorable

N = Near Term
M = Mid Term
L = Long Term

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NAVIGANT CONSULTING

This qualitative screen filtered out the bottom 20% including emerging energy storage (flow batteries) and small hydro due to permitting difficulties and technology immaturity.

The remaining measures were then subjected to a quantitative screen, the Total Resource Cost Test ("TRC"). Each technology was analyzed to account for any applicable tax credits and any utility rebates (Missouri RES $2/watt installed solar). Additionally, two sensitivity analyses were conducted on varying avoided transmission and distribution costs ($5/kW and $25/kW). The results in Table 7. 20 indicate a majority of the technologies do not pass the desired TRC threshold of 1.0 in the next 10 years, however, in the outer years of the study, a small amount of technologies reach cost-effectiveness. Photovoltaics receive high levels of subsidization from the Federal government currently, and for this study, those tax credits were assumed to last until 2030 as a means to evaluate the technologies under the most favorable conditions. CHP can reach cost-effective levels by utilizing wasted heat generated from steam operations in power generation by the end-user. Small wind, although limited in its applications, can realize TRC scores greater than 1.0 in the later years as the installed costs ($/kW) drop by an average of 52% over the planning horizon.

Table 7. 20: DG Technology TRC Results

Technology	$5/kW T&D			$25/kW T&D		
	2010	2020	2030	2010	2020	2030
CHP Fuel Cell	0.25	0.5	0.42	0.25	0.51	0.75
CHP Microturbine	0.39	0.65	0.91	0.39	0.66	0.94
CHP Recip	0.47	0.77	1.13	0.48	0.79	1.16
Batteries	0.27	0.6	0.66	0.34	0.76	0.88
Fuel Cell (PEM, SOFC)	N/A	N/A	0.53	N/A	N/A	0.55
MC Fuel Cell	0.4	0.6	0.68	0.41	0.62	0.71
PA Fuel Cell	0.38	0.57	0.62	0.39	0.59	0.64
PV Residential	0.58	0.99	1.15	0.63	1.11	1.33
PV Commercial	0.56	0.96	1.11	0.6	1.07	1.28
Small Bio Microturbine	N/A	0.37	0.58	N/A	0.39	0.61
Small Bio Recip	N/A	N/A	N/A	N/A	N/A	N/A
Small Non-Renewable Micro	N/A	0.43	0.61	N/A	0.45	0.64
Small Non-Renewable Recip	N/A	0.47	0.7	N/A	0.49	0.74
Small Wind	0.54	0.93	1.09	0.55	0.96	1.14

Using the results of both the qualitative and quantitative screens, Ameren Missouri and NCI chose the most favorable technologies and analyzed their market penetration potential. These technologies included: Commercial Photovoltaics, Residential Photovoltaics, CHP Reciprocating Engines, CHP Microturbines, Fuel Cells (Phosphoric Acid), and Rechargeable Batteries. Ameren Missouri felt it was important to analyze some form of energy storage. Many of the technologies are renewable or intermittent resources, indicating inconsistent operating characteristics and potential lack of availability during critical time periods (such as system peak). Storage allows the energy generated by the intermittent DG technology to be available and used when the customer, or system, needs it most.

7.2.8.3 Market Penetration Approach

Once the technology assessment was complete, the team analyzed the market potential for each of the technologies that passed. To accurately identify the potential market penetration for each technology, a 5 step methodology was used.

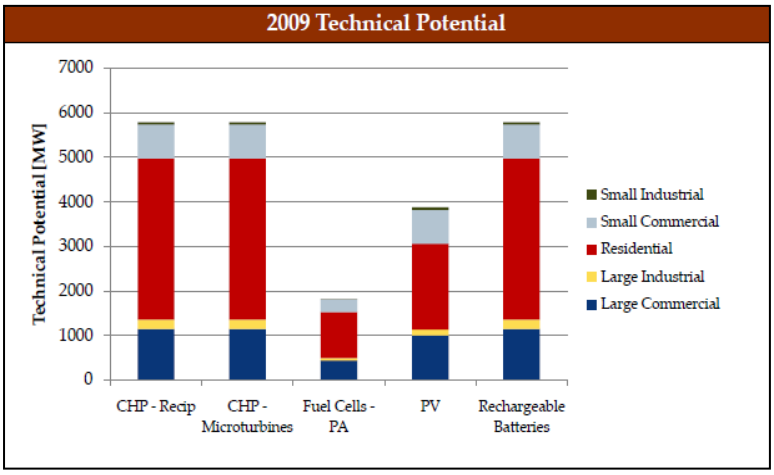
1. **Assess a Technology's Technical Potential** – technical potential was defined as the physical installation limit of a technology without taking economics into account.
2. **Calculate First Year Simple Payback Period for Each Year of Analysis** – From NCI's experience with projecting penetration rates for technologies, a simple payback period was deemed the best indicator of uptake.

3. **Project Ultimate Adoption Using Payback Acceptance Curves** – these curves estimate the percentage of a market that will ultimately adopt a technology without factoring how long this adoption will take.
4. **Project Actual Market Penetration Using Market Penetration Curves** – the market penetration curves factor in market and technology characteristics to project how long adoption will take.
5. **Project Market Penetration Under Different Scenarios** – three different scenarios were analyzed including baseline, Grid.com, and technology revolution scenarios.

Technical Potential

Each DG technology's technical potential was a function of its characteristics and system size. Technologies were separated into four different categories. *Load Following* technologies are those DG systems that can follow load (CHP in this case). CHP was sized to meet average load profiles of various customers, representing the different commercial rate classes, during summer peak months. The appropriate system size was then multiplied by number of applicable customers in the Ameren Missouri service territory. *Base Load* technologies do not follow load and for this study, fuel cells occupied this category. To size fuel cells, NCI reviewed average load profiles of applicable customers and sized the system to meet their average base load. This system size was then multiplied by number of customers to reach technical potential. *Fuel Following* technologies include PV. Ameren Missouri provided estimates of existing building characteristics within its service territory for both commercial and residential customers. NCI then used in-house data to estimate percentage of roof space capable of housing PV systems multiplied by number of customers to calculate the physical installation of limit of PV could physically be installed. Finally, batteries were a subset of *Load Following* technology and were analyzed in conjunction with Ameren Missouri's Time-of-use rates. Results are in the graphic below.

Figure 7. 15: DG Technical Potential



Calculate First Year Simple Payback

The next step was to calculate each technology's first year simple payback. The equation in its simplest form is (Net Initial Costs)/(Net Annual Savings), where:

$$\frac{Net\ Initial\ Costs}{Net\ Annual\ Savings}$$

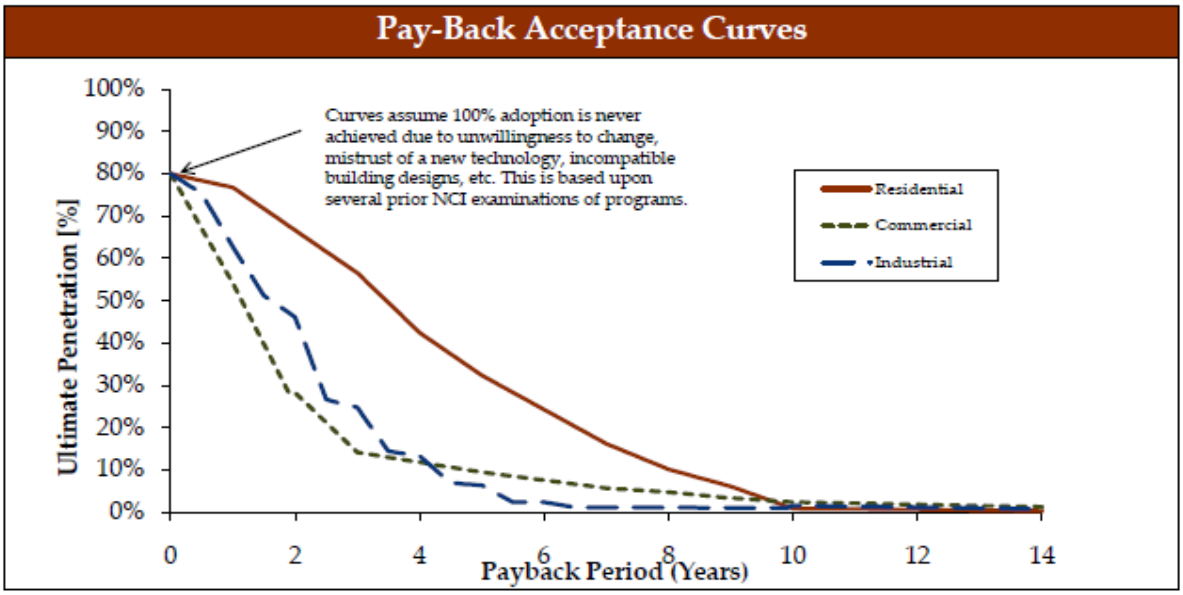
- Net Initial Costs = Installed Cost – Federal Incentives – Capacity based incentives*(1-Tax Rate).
- Net Annual Savings = Annual Energy Bill Savings + (Performance Based Incentives – O&M Costs – Fuel Costs)*(1-Tax Rate).

8760 load shapes and Ameren Missouri rate structures were used for the estimation of annual bill savings in NCI's proprietary energy modeling software. PV was analyzed under two different rate structures, standard and time-of-use while batteries were calculated only using TOU rates. For thermal savings associated with CHP, NCI reviewed EIA's Residential Consumption Survey (2005) and for commercial customers utilized the Commercial Building Energy Consumption Survey (CBECS) to estimate thermal heating needs. CHP was assumed to meet a majority of the heating needs of each customer class.

Payback Acceptance Curves

To estimate adoption rates, regardless of timing, NCI used in-house data informed by previous work with Federal agencies and other utilities to develop payback acceptance curves using assumed payback levels. The chart below summarizes NCI's findings and demonstrates a unique characteristic in that even when payback periods are immediate, full market adoption will not occur due to consumer unwillingness to change and incompatibility with existing building energy systems.

Figure 7. 16: Payback Acceptance Curves



Source: NCI based upon work for various utilities, federal government organizations, and state/local organizations. The curves were developed from customer surveys, mining of historical program data, and industry interviews.

Market Penetration Curves

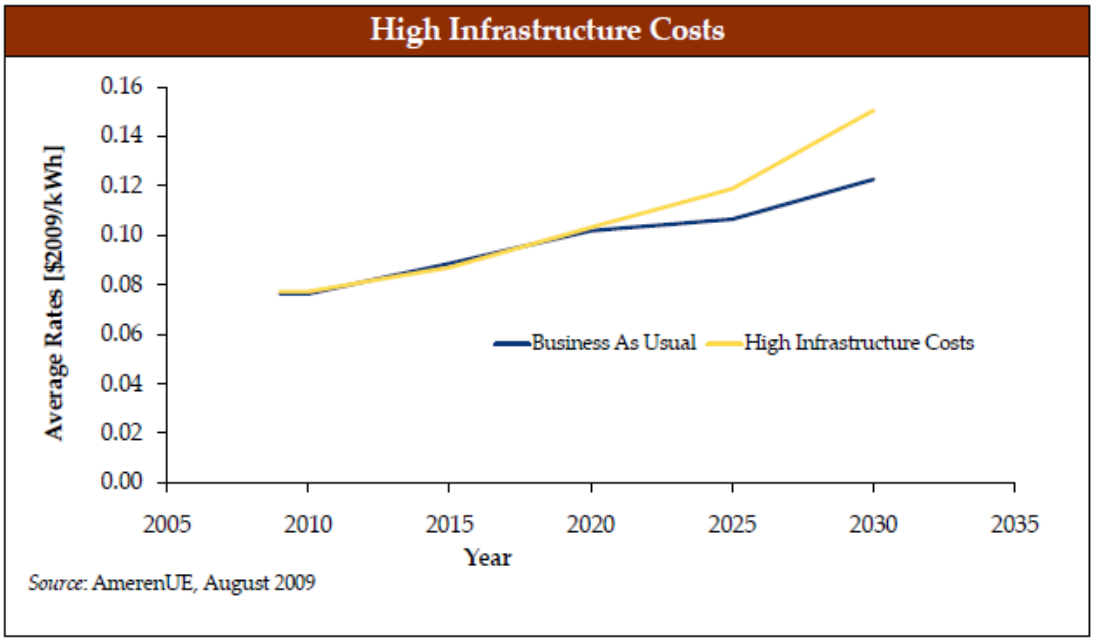
Market penetration curves (S-curves) were used to project installed kW capacity of DG in Ameren Missouri's service territory. A key metric when using S-curves is the year of introduction, and for this study, NCI assumed the first year of introduction occurred when the simple-pay-back was less than 25 years (this is the highest payback period that witnessed ANY adoption). Another critical assumption is that Ameren Missouri did not offer DG incentive or rebate programs (at the time the study was conducted).

Projecting Market Penetration in Different Scenarios

There were three different scenarios analyzed for this study. Ameren Missouri provided two scenarios based on various scenarios presented in the corporate point of view document.

- Business As Usual
- High Infrastructure – Ameren Missouri develops large amounts of new infrastructure and rates increase relative to BAU scenario.
- Technology Revolution – DG technology costs fall faster than BAU scenario.

Figure 7. 17: Ameren Missouri Scenarios



Ameren Missouri further relied on NCI's expertise to develop a third scenario based off accelerated technology innovation causing substantial reductions in up-front customer costs. This scenario has been outlined in Table 7. 21.

Table 7. 21: Technology Revolution Scenario

	Business As Usual [$2009/kW]			Technology Revolution [$2009/kW]		
Technology	2009	2020	2030	2009	2020	2030
CHP - Microturbine	3,400	2,800	2,300	3,400	2,400	1,800
CHP – Recip	2,500	1,800	1,300	2,500	1,500	1,000
Fuel Cells - PA	4,500	3,000	2,100	4,500	2,300	1,300
PV [Com.&Ind./Res.]	7,300/8,100	5,100/5,700	3,700/4,100	7,300/8,100	3,700/4,300	2,000/2,500
Rechargeable Batteries	2,200	1,700	1,300	2,200	1,400	900

The table below summarizes each technology's market penetration throughout the planning horizon and under each scenario. CHP has the most promising future due to the relative mature nature of the technology and the added benefit of recouping waste heat. Due to the relatively low capacity factors, long payback periods, and insufficient rebates, PV witnesses little market penetration in the planning horizon. Fuel cells, while a promising technology, have difficulty penetrating the Ameren Missouri market due to the exorbitant up-front capital requirements and lack of availability in the residential markets. Table 7. 22 represents the market penetration in 10 year increments for each of the technologies over the time horizon of the study.

Table 7. 22: Market Penetration (MWh)

Technology	2010	2020	2030
CHP Microturbine			
BAU	816	110,304	4,451,305
High Infrastructure	766	102,761	6,531,089
Tech Revolution	866	141,265	6,629,786
CHP Reciprocating Engine			
BAU	-	171,121	11,142,749
High Infrastructure	-	185,767	13,041,603
Tech Revolution	-	208,984	13,177,549
Phosphoric Acid Fuel Cell			
BAU	-	-	-
High Infrastructure	-	-	219,101
Tech Revolution	-	-	-
PV Residential			
BAU	-	-	62
High Infrastructure	-	-	324
Tech Revolution	-	-	104,330
PV Commercial			
BAU	-	-	4,545
High Infrastructure	-	-	6,585
Tech Revolution	-	1,007	203,606
Batteries			
BAU	-	31	55,391
High Infrastructure	-	1	98,738
Tech Revolution	-	477	608,182

7.2.8.4 Current DG Activities

Using the results of the potential study, Ameren Missouri is evaluating various DG options and developing strategies to connect with customers. Ameren Missouri has dedicated a core group of specialists throughout the corporation to focus on multiple aspects of a distributed generation strategy. Analyzing the various technologies, identifying communication strategies, and determining necessary incentive dollars to move the market are all within the scope of this group. While objectively evaluating all relevant DG technologies is important, PV provides the best opportunities in the current operating environment and has therefore received a majority of the resources thus far.

The Missouri RES outlines various compliance standards that electric utilities operating in Missouri must adhere to. One of these requirements outlines a specific percentage of power procured by the utility must come from renewable resources. "Such portfolio requirement shall provide that electricity from renewable energy resources shall constitute the following portions of each electric utility's sales:

1. No less than two percent for calendar years 2011 – 2013
2. No less than five percent for calendar years 2014- 2017
3. No less than ten percent for calendar years 2018-2020
4. No less than fifteen percent in each calendar year beginning 2021

Furthermore, the law states, "At least two percent of each portfolio requirement shall be derived from solar energy," with "…each kilowatt-hour of eligible energy generated in Missouri shall count as 1.25 kilowatt-hours for purposes of compliance."

To comply with these requirements, Ameren has taken a unique approach to procure the necessary solar carve-out while simultaneously providing more incentives for customers to install solar PV. Customers, both commercial and residential, can buy-down the initial cost of a PV system leveraging multiple funding sources including Federal Tax Credits (30% of system cost), RES payment (Ameren Missouri pays $2 per installed watt up to 25 kW), and the most recent addition of the Standard Offer, which pays customers $100 for the system's Solar Renewable Energy Credits ("S-REC").

These S-REC payments can occur in two ways. For systems less than 10 kW, the company will calculate the SRECs generated over 10 years of operation and purchase the corresponding solar energy credits from the customer in lump sum up-front. Alternatively, the customer can receive annual payments for energy produced by the system, (systems greater than 10 kW but less than 100 kW) for the first five years of operation. These systems will require metering technology to measure the system's output.

Accompanying the standard offer for S-RECs, the company has installed a solar system with an estimated nameplate capacity of 100 kW at the Corporate Headquarters in St. Louis, Missouri. The solar arrays are comprised of three different solar technologies including monocrystalline, polycrystalline, and thin-film. Furthermore, there are multiple PV systems located towards the entrance of the parking lot.

This system will have several unique aspects including a metering system capable of producing real-time generation measurements that customers, employees, and government officials can view online. The system will also provide an opportunity to educate customers on the construction process, different PV technology options, and discuss the performance of the different technologies.

The market penetration study provided a platform for future program potential. The Company's standard offer will encourage customers to consider installing solar technologies and also provide an opportunity to comply with the required renewable solar requirements. The solar installation at the Corporate Headquarters allows Ameren to monitor and evaluate the performance of multiple PV technologies and relay their findings in real-time. Using all of these activities, Ameren Missouri will position itself to better educate its customers and also be prepared for future shifts in generation markets.

7.3 Implementation

7.3.1 Implementation Model

In 2008, Ameren Missouri chose to utilize a prime contractor model to delivering energy efficiency programs. Since the Cycle 1 plan called for Ameren Missouri to spend roughly $25 million on energy efficiency programs, it was necessary to hire an experienced Prime Contractor to attempt to achieve the aggressive load reduction goals. The Prime Contractor's main responsibilities include managing sub-contractors, business development, advertising, and performance tracking. To further leverage economies, Ameren Missouri chose to hire one contractor to implement both the Residential and Business portfolios, each with separate statements of work and contracts. This would allow for several benefits including streamlined statement of work development, shared personnel and capital equipment resources, and consolidation of communication channels between implementer and the Company.

Midway through Cycle 1, Ameren Missouri switched to a hybrid approach in implementing the energy efficiency portfolio. A prime contractor model has been effective for the commercial and industrial market segments. Targeted marketing and experience with other utility programs has allowed the prime contractor to drive customer participation and build a substantial trade-ally network. The prime contractor's experience with other utility service territories allows for knowledge sharing and implementation techniques that would likely not be available if Ameren Missouri were to implement the program in-house. Many of the projects in the commercial and industrial market require engineering expertise and specialized skill-sets to garner large energy savings, indicating a strong need for past experience and competency in these areas by the implementation staff, all of which the contractor provides.

The residential portfolio, however, has achieved greater and more pervasive energy savings using a sub-contractor approach. Ameren Missouri employees manage the individual programs, hiring sub-contractors with expertise in the given area to interact with customers to meet the energy savings targets. Unlike many business projects, most of the residential energy savings are fairly straight-forward and do not require

extensive engineering capabilities. Examples of these types of programs include appliance recycling and lighting programs.

Further information surrounding delivery mechanisms for specific programs can be found in Chapter 7 - Appendix A: Program Templates.[73] While many of the suggested implementation, marketing, and evaluation methodologies represent probable strategies the Company will use, each program is subject to change.[74] Discussions with implementation teams, evaluation contractors, review of evaluation reports and further analysis of the market at the time of final program design will inform the final program details.[75]

7.3.2 Program Ally Network

The program ally network consists of contractors, retailers, and other program partners that are involved in the implementation of energy efficiency projects. Ameren Missouri has created a robust network of program allies for both the residential portfolio as well as the commercial and industrial portfolio. Providing incentives and marketing through trade allies is an efficient way to promote the energy efficiency programs. Since these contractors tend to interact with customers frequently and at the point of purchase, they are an ideal segment to deliver incentives to the customer base. In order to produce effective trade allies, a significant emphasis must be given to developing a relationship with these contractors through outreach, training and educating.

7.3.2.1 Business Portfolio

As of October 1, 2010, Ameren Missouri had 215 program allies enrolled in the commercial and industrial business programs. These allies represent a wide range of competencies including but not limited to large manufacturers, installation contractors, engineering consultants, and the smaller retail outlets. The growth of this important segment has been steady since beginning in early 2009. Trade-shows, seminars, and electronic mailers have been effective tools to recruit and educate program allies. After the allies have been sufficiently trained and educated on the business programs, co-branding and other marketing opportunities are available to the contractor. As the efficiency programs mature, so will the program ally network. In this planning cycle, more education and training will be necessary and new emphasis on a systematic method of measuring trade ally performance will provide the necessary incentives to motivate program trade allies and continue the growth of the network and the productivity of its members.

[73] 4 CSR 240-22.070(09)(B)
[74] 4 CSR 240-22.050(06)(D)
[75] 4 CSR 240-22.050(07)(A)2

7.3.2.2 Residential Portfolio

The residential energy efficiency portfolio leverages a diverse program ally network. There are over 200 lighting stores enrolled in the Lighting & Appliance program and over 170 stores carrying qualified appliances. Stores ranging from rural retail outlets to large big box retailers are part of this trade ally classification. The HVAC program enlisted over 100 technicians and 44 contractors in the first 3 months since inception. Residential HVAC trade allies have been recruited and trained by a contractor specializing in HVAC tune-up work. For this planning cycle, it will be important to grow the HVAC contractor network and continue to leverage their marketing and outreach capabilities. The Multi-family Income Qualified program enlists a contractor to recruit local subcontractors to install efficient upgrades. Incentivizing the contractor network allows for immediate rebates for the customer, a component that has been effective in driving customer participation.

7.3.3 Outreach, Marketing and Communications

Outreach, marketing and communications will continue to be an important mechanism for ensuring customers and program allies are aware of, and participate in, portfolio programs.

The marketing efforts for the residential portfolio are administered internally, but each vendor offers marketing services as well. Residential Campaign activities include:

- The Ameren Missouri Energy Efficiency website, which provides an overview of programs offerings, energy savings tips, energy savings toolkit, list of authorized CFL recycling locations, online CFL store, program forms, rebate applications, list of certified contractors, and more.
- Utilization of field representatives from Applied Proactive Technologies (APT) to train retailer/dealer, ensure retailer/dealer participation, and maintain detailed records.
- Training and in-store displays are provided for appliances sold by ally retailers/dealers.
- Utilization of Proctor Engineering Group to lead the HVAC program with a large trade ally network to conduct assessments in each county of the service territory.
- Utilization of Honeywell with local subcontractors to improve units qualified for the Multifamily Income Qualified program.
- Social CFL distribution.
- Television, radio, print, direct mail, and magazine advertisements.
- News story press releases resulting in newspaper and television news stories.
- Brochures and literature.
- Conference and special event exhibits.
- Outreach, education seminars, and speaking events.

Program ally recommendations and word-of-mouth are surprisingly very successful aids to promoting program offerings. The marketing efforts for the business portfolio are mainly internal, but external assistance has been utilized for sub-branding.
Business Campaign activities include:

- The Ameren Missouri Energy Efficiency website, which provides an overview of programs offerings, energy savings tips and tools, list of trade allies, program forms, incentive applications, schedule of trainings, calendar of events, view of historical usage, and more.
- The *Powerful Solutions* eNewsletter which provides news, program updates, and informative articles and tools for businesses owners, managers and employees.
- The *Powerful Solutions* "Ask an Expert" service serves as an avenue to ask Ameren researchers, development experts and engineers industry-related questions.
- The *Powerful Solutions* eLibrary gives access to archived eNewsletters and "Ask An Expert" questions and responses.
- *Powerful Solutions* also provides tools for businesses such as workplace posters, lighting calculator, carbon footprint calculator and more.
- Direct mail and designed post card advertisements.
- Outreach, education seminars, speaking events, and trade shows.
- Target advertisements are occasionally utilized to reach certain customers or increase awareness of specific programs.
- The Trade Ally eNewsletter and the Trade Ally banquet endorse healthy communication.

7.3.3.1 DSM Implementation - First Three Year Cycle

Ameren Missouri has maintained an ongoing dialog with the Stakeholders through the implementation of the first 3 year cycle of the DSM plan. The Stakeholders are asked to participate in a number of forums to exchange data related to the current status of the implementation plan, as well as any new ideas and suggestions that could improve the implementation process.

The forums used for these exchanges consists of quarterly status meetings, tariff applications, adjustments to tariffs due to significant changes in DSM program content or delivery, and meetings (in person or via WebEx) where exchanges related to changes in government involvement have an impact on the ability of the implementation team to achieve DSM goals.

7.3.3.2 DSM Implementation – Second Three Year Cycle

As mentioned above, the Stakeholders have been involved throughout the current implementation process, and Ameren Missouri anticipates this manner of involvement

will persist throughout the entire DSM implementation process (second, third, etc. three year cycles).

7.3.4 Filing, Workforce Development, and Implementation Schedule

There are a number of timing issues that exist within the entire process of developing and implementing a successful DSM portfolio. Many tasks must be initiated with assumptions about the ultimate outcome of parallel tasks. This is evident in the timing associated with filing, resolving issues, and the IRP, short term implementation plans, tariffs, and rate cases. The Gantt chart below presents a representation of the tasks that are to be completed with the completion of the IRP process and the implementation of DSM plan. A more detailed description of the issues that exist follows Figure 7. 18.

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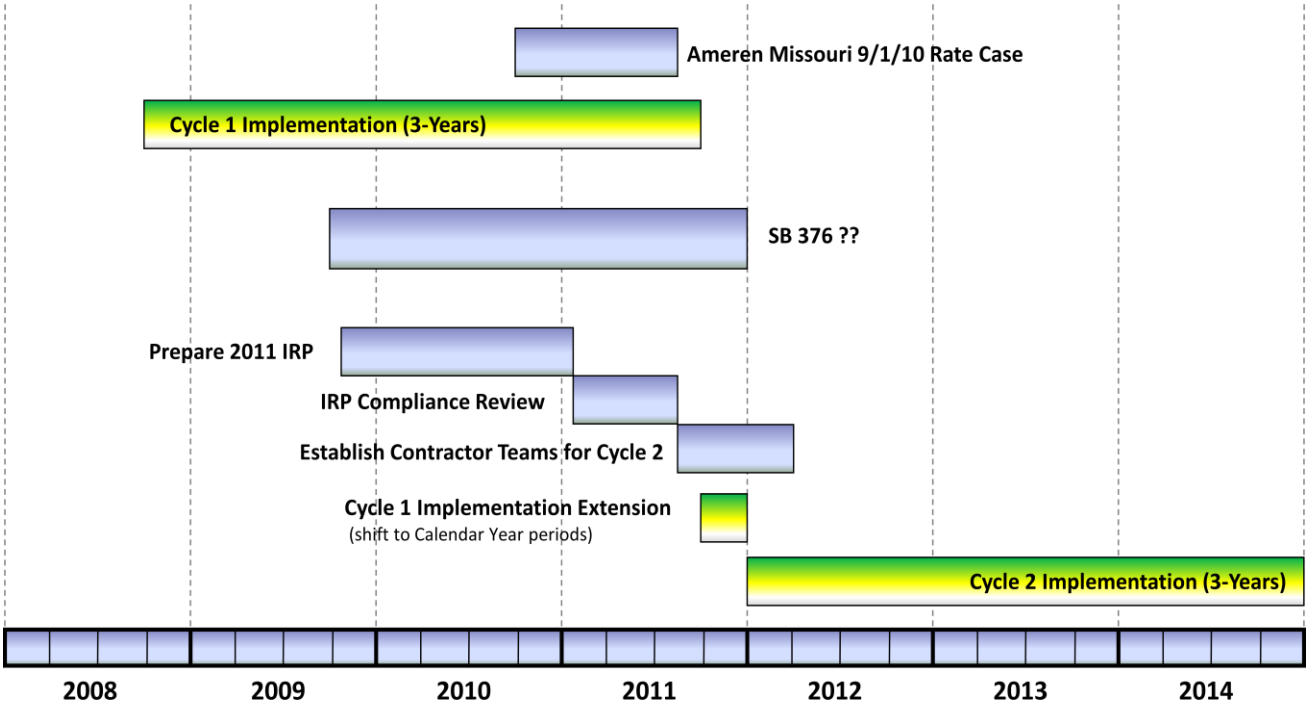
Figure 7. 18: DSM Filing, Workforce Development, and Implementation Schedule



7.3.4.1 Aligning Program Years with Calendar Years

One of the challenges facing the Ameren Missouri Implementation team relates to the difference in the definition of a program year and a calendar year. With the first three year cycle DSM implementation, the program year has been based on a year that begins on the first day of October and ends on the last day of September in the following year. However, the Ameren Missouri's budgeting process has historically been established for a calendar year. This has created an inefficient budgeting and reporting process for which a solution is available.

To that end, Ameren Missouri intends to realign the program year to synch with the calendar year for the second three year cycle of the DSM implementation. Although this change will resolve budgeting issues, there may be new issues that require resolution. Among those issues, there is the need for continuity between the end of the first three year cycle for DSM implementation and the start of the second three year cycle for DSM implementation.

To address the discontinuity that exists between the end of the current program year schedule and the start of the next three year DSM implementation plan, Ameren Missouri intends to seek approval for an extension of the first three year cycle. If the extension is not approved, there will be a discontinuity in the DSM implementation process.

The discontinuity will cause a number of problems, as outlined below:

- Shut down of existing programs
- Termination of contracts with existing contractors
- Customer confusion related to the cessation of the DSM implementation
- A potential for an extended period of discontinuity with the need to re-establish contracts following the final approval of a new DSM plan, or DSIM.
- An inability to meet planned DSM goals due to an extended discontinuity between the first and second three year DSM implementation cycles

7.3.4.2 Missouri Energy Efficiency Investment Act

There is still a high level of uncertainty surrounding how to appropriately file for DSM program approval under MEEIA due to the lack of official rules and guidelines. This uncertainty could cause potential delays and inefficiencies in filing and also potentially alter the approach needed to maintain continuity between the current DSM Implementation Plan and the second DSM Implementation. This will have the potential to cause difficulties, and delays, associated with:

- Existing negotiated contracts and those that are being developed
- Updates to the DSM program approval filing to reflect changes in the rules
- Updates to the DSM program approval filing to reflect changes in the amount of achievable savings
- Potential updates to the DSM plan as filed in the IRP, with subsequent approval
- Additional Stakeholder meetings related to the updated DSM plan, IRP, DSM program approval, and cost recovery.
- Meeting the projected DSM goals due to delays in implementation

Establishing Contractor Teams for Cycle 2

The second three year DSM Implementation cycle is anticipated to begin on January 1, 2012. To start this cycle of the DSM Implementation, a number of tasks need to be completed.

- The updated rules that are being developed for implementing MEEIA need to be finalized
- The Ameren Missouri request of program approval
- A contractor team needs to be selected, which consists of the following tasks (anticipated to take 6 – 7 months)
  - Prepare and Issue RFP – 6 weeks (Sept 15, 2011)
  - Receive bids from contractors on the work for the second three year cycle of the Ameren Missouri DSM Implementation plan, hold Question and Answer sessions, complete the review and assessment process for all of the bids on the work,– 6 weeks (Nov 1, 2011)
  - Select the contractor team that will implement the second three year cycle of the Ameren Missouri DSM Implementation plan, prepare Statement of Work document(s) for the contractor team(s), iron out contract details (will involve receiving approval of the Corporate Project Oversight Committee and the Strategic Sourcing groups), establish teams, and ramp up – 3 to 4 months (March 1, 2012)
- File and receive approval of Tariffs that describe the DSM Implementation process, teams, measures, and other details associated with the implementation process (typical turn around after tariff is filed is 30 days).

As is evident with the outlined tasks that have been identified above, the completion date of this process is later than the starting date of the second Ameren Missouri three year DSM Implementation cycle. To maintain continuity between the current DSM implementation cycle (Cycle1) and the next DSM implementation cycle (Cycle 2), a plan must be followed that will bridge the uncertainty gaps. The most logical approach would be to take the path of minimal risk, and make subsequent adjustments to the plan following the completion of the approval process.

For example, the process of implementing Cycle 2 will require starting implementation prior to having knowledge of the outcome of the tasks associated with gaining approval to implement. Ameren Missouri will need to proceed with the assumption that the PSC will grant approval that is equal, at a minimum, to the current level of DSM implementation that is underway for Cycle 1. This is because a significant amount of lead time is required for contractor selection, transition, and communication with the market to keep program momentum building.

Ameren Missouri will need to proceed with caution when establishing contracts with the contractors (renewing contractor agreements or establishing new contractor agreements) for Cycle 2, due to the uncertainties that exist. The Company will need to have performance adjustment clauses within the implementation contracts. These clauses will address the potential changes in DSM delivery goals that may occur as a result of the approval, or denial, of requested regulatory treatment and the approval process associated with the rules that will be in place that meet the requirements of MEEIA. The incorporation of these clauses will likely be a deterrent to contractor participation, requiring an increase in administrative fees to mitigate contractor risk associated with establishing, or maintaining a workforce involved with the delivery of DSM programs within the Ameren Missouri service territory and its evolving regulatory context.

Some of the costs associated with the contractor risk mitigation could potentially be reduced if Ameren Missouri were to file, and receive, expedited approval for continuing the Cycle 1 DSM program through the uncertain transition timeframe when all of these issues are being resolved.

Failure to follow a schedule, such as that outlined above, will result in discontinuities in the Cycle 2 DSM implementation, an inability to meet goals as stated in the IRP, and potential refilling of plans to reflect the lower levels of delivery that will be anticipated to be achieved.

7.4 Evaluation Measurement and Verification ("EM&V")

7.4.1 The EM&V Model

Ameren Missouri will continue to improve its current strategy for process and impact evaluations.[76] Evaluation Measurement & Verification ("EM&V") demonstrates the value of energy efficiency programs by providing an assessment of the programs' methods and performance in efforts to better understand programs and identify ways for improvement. Ameren Missouri will continue to utilize an independent third party contractor model to provide an objective assessment of the energy efficiency portfolio performance.

7.4.1.1 Existing EM&V Model

Separate evaluators are currently under contract for the Residential and Business portfolios. The Cadmus Group, Inc. evaluates Residential activities while ADM Associates, Inc. evaluates the Business portfolio. The consultants provide an annual

[76] 4 CSR 240-22.050(09)

independent review of the net program impacts and, to the extent practical, advise the adjustment of measures and implementation processes as a result of the evaluations.

The evaluators submit process and impact evaluations six months after the completion of each program year, and will provide a final report nine months after the completion of the third and final program year, summarizing the 3 year implementation period. In addition, the evaluators are to submit monthly progress reports and participate in weekly conference calls with Ameren Missouri management. These scheduled updates allow the Ameren Missouri staff to continuously monitor and manage EM&V activities and assist the Implementation Team in identifying areas that could potentially affect program performance. [77]

A major objective of evaluation is to quantify the savings attributable to an energy efficiency program as opposed to other factors such as weather or behavioral shifts within markets. Evaluators compare savings to baseline estimates to determine the effects of individual measures and entire programs. Impact evaluations estimate these quantitative effects of the programs. A second type of evaluation known as process evaluation analyzes program design and implementation strategies through program documentation review, interviews with key stakeholders, and customer surveys.

Impact Evaluations

One of the most important aspects of evaluation is the measurement of savings achieved, or impact evaluation results. Ameren Missouri has developed, in coordination with the evaluation contractor, the necessary methods to estimate load impacts of the EE programs offered by the Company. [78] An integral part of this calculation methodology is the net-to-gross ("NTG") ratio which is a factor that represents the net program load impact divided by the gross program load impact. This factor is applied to gross program savings to determine the program's net impact. The NTG ratio is important in determining actual energy savings attributable to a particular program, as distinct from energy efficiency occurring naturally without the program's existence. The NTG ratio accounts for how spillover, free-ridership and market transformation influence the impacts of an energy efficiency program. Spillover reflects benefits attributable to an energy program, but without requiring program incentives and not directly credited to the program. Participant spillover is attributable to program participants that implement measures that were not incentivized by the program. Non-participant spillover is associated with actions influenced by an energy program, but not linked with direct program participation.

Free riders are program participants who would have taken the initiative to engage in energy efficiency behavior or implement an energy efficiency measure, regardless of

[77] 4 CSR 240-22.050(11)(J)
[78] 4 CSR 240-22.050(09)(A)

whether an energy efficiency program promoted or encouraged that action. The planning assumptions used for this plan were designed to capture the effects of NTG factors in the base model. A commonly used average NTG ratio is 0.80. The planning assumptions are available in Table 7. 15.

ADM was able to measure impacts for two business programs in program year 1.[79] Through billing analysis, project engineering review, and on-site data collection ADM Associates, Inc. was able to gather sufficient data to estimate gross savings, realization rates, and ultimately net annual kWh savings to measure the performance of the Standard Incentive and Custom Incentive programs for the Business Portfolio.[80] The results from PY 1 are found in Table 7. 23.

Table 7. 23: Business Program PY 1 Impacts

Program Component	Expected kWh Savings	Realized Gross kWh Savings	Gross Realization Rate	Realized Net kWh Savings	Net to Gross Ratio
Custom Incentive	6,910,418	6,760,033	98%	5,017,778	74%
Standard Incentive	9,444,264	10,777,210	114%	10,466,366	97%
Total	16,354,682	17,537,243	107%	15,484,144	88%

Cadmus was unable to determine spillover, free ridership, or other NTG factors due to limited PY 1 impacts for the Lighting & Appliance program. The evaluation of this program used an NTG value of 0.8 based on the 2008 Integrated Resource Plan. Cadmus believes the assumed NTG value is reasonable based on experience with other upstream lighting programs. The results from PY 1 are found in Table 7. 24. Due to significant program changes and multiple program launch delays, program implementers felt that original energy savings goals were unattainable for the Multifamily and Multifamily Income Qualified programs. Neither program generated sufficient participation for Cadmus to merit conducting a full impact evaluation.

Table 7. 24: Residential Program PY 1 Impacts

Program Component	Realized Gross MWh Savings	Realized Net MWh Savings	Net to Gross Ratio
Residential Lighting	8,058.0	6,446.4	80%
Residential Appliance	20.5	16.4	80%

[79] 4 CSR 240-22.050(09)(B)
[80] 4 CSR 240-22.050(09)(B)1A-B, 4 CSR 240-22.050(09)(B)2

Process Evaluations

Ameren Missouri has collaborated with its evaluators to identify appropriate process evaluation goals, procedures, and practices.[81] These evaluations focus more on program design and delivery, market segments, and other societal factors that affect the program's performance.[82]

Cadmus Group, Inc. used program implementor/contractor interviews, retailer surveys and review of program materials to inform the process evaluation. Stakeholder and retailer interviews provided details on program design, staffing levels, training, implementation, marketing to retailers, retailer satisfaction, marketing to consumers, products, payments and invoicing, communications, tracking and market feedback. Program data reviews provided further information on program design and implementation processes.

Similarly, ADM Associates, Inc. conducted process evaluations for the Business Portfolio of programs. Four key criteria were used including:

- In depth interviews with Prime Contractor and relevant Ameren Missouri management staff.
- In depth interviews with program allies.
- Analysis of participant survey that included questions about how the participant learned about the program, how the process operated, decision-making criteria, and overall program satisfaction.
- Document review and analysis of program database focusing on participation data.

The last filed EMV reports and plans are located in the Electronic Work Papers and summarized in the table below.[83]

[81] 4 CSR 240-22.050(09)(A)
[82] 4 CSR 240-22.050(09)(A)1-5
[83] 4 CSR 240-22.050(11)(J)

Table 7. 25: EM& Reports and Locations

Report	Folder Location in Electronic Work Papers	File Name
Ameren Missouri BES Evaluation	Evaluation Reports	Ameren_Missouri BES Evaluation.doc
Ameren Missouri Lighting & Appliance Evaluation	Evaluation Reports	Ameren_Missouri Lighting Appliance PY1 Evaluation.doc
Ameren Missouri Retro-Commissioning Evaluation Plan	Evaluation Reports	Evaluation Plan for AUE RCx Program-Draft #3.doc
Ameren Missouri MF and MFIQ Process Evaluation	Evaluation Reports	Ameren_Missouri MF and MFIQ PY1 Process Evaluation.doc
Ameren Missouri Peak Power Rebate Evaluation	Evaluation Reports	PPR Evaluation Report Final.doc

Unique EM&V Approach

Traditionally, EM&V of energy efficiency programs has been performed after the conclusion of program implementation periods. In 2008, Ameren Missouri became one of the first program administrators to simultaneously hire EM&V and implementation contractors for two new portfolios of programs. The utility took this step because it believes it is beneficial to have everyone on the same page from beginning to end, allowing all parties to understand evaluation protocols at the outset. Ameren Missouri views this new approach as a way to optimize evaluation opportunities since it allowed program implementers to adjust design and delivery based on real-time information from the evaluators. Hindsight revealed that the EM&V consultants were hired somewhat prematurely. The design phase took longer than expected and the timing of the hiring could have been delayed. This, however, should not be a considerable issue for the Cycle 2 as programs are not expected to change drastically.

Overall, however, Ameren Missouri is pleased with the EM&V consultants selected via competitive bid during the initiation of Cycle 1. The evaluators have proven to be capable of delivering contractual obligations within budget and scope. For Cycle 2, however, another competitive bidding process will take place to ensure the Company adheres to its supplier diversity commitments and that the most qualified evaluation contractor is hired. Ameren Missouri allocated 5% of portfolio resources to EM&V.

EM&V is important to Ameren Missouri because it involves processes to aid in obtaining quality results through lessons learned. The documentation process also serves as a useful tool to record results, determine benefits, and provide guidance for future planning of DSM programs. Independent process evaluation permits suggestions for program improvement while impact evaluation helps to accurately account for energy

impacts. EM&V applies to program administration and implementation so all employees including utility staff and program contractors are held accountable.

Evaluation Contractors also aid implementation efforts in several other fashions. Evaluators provide valuable training for Ameren Missouri staff, implementers, and regulatory stakeholders on NTG calculation methodologies, deemed savings approaches, and sharing experiences with other utility service territories. Evaluators contribute meaningfully to operational efforts, having done so in the past for program design roundtable discussions, design of customer forms and materials, data tracking system setup, and program delivery modifications.

Data Collection

Thus far, Ameren Missouri has been engaged with the EM&V contractors to develop and implement the necessary protocols, methodologies, and technology to gather the appropriate data necessary to facilitate effective evaluation.[84] As programs mature and the market begins to transform, it is important for Ameren Missouri to continue to have open lines of communication with both the evaluation teams and the implementation teams. It is foreseeable that a centralized data tracking system could be utilized to track program metrics. Having a centralized system would allow economies of scale for collecting both residential and business energy efficiency program data, facilitate a consistent reporting platform, and allow for more transparency between evaluators, implementation, and the utility staff. This data tracking system would also aid in addressing the filing requirements outlined in MEEIA.

7.4.2 Internal Verification and Quality Control

The evaluation contractor has responsibility for installation verification and estimation of energy savings for purposes of independent evaluation. Besides coordinating independent EM&V, Ameren Missouri requires implementation contractors to develop and implement internal Quality Assurance and Quality Control ("QA/QC"), inspection, and due diligence procedures. These procedures will vary by program and are necessary to assure customer eligibility, completion of installations, and the reasonableness and accuracy of savings upon which incentives have been based. An example of this is the QA/QC completed in the HVAC program. Using diagnostic equipment (such as CheckMe!), the contractor can verify proper installation. If errors are found through completing this process, appropriate actions can be taken to correct the installation errors.

7.4.3 EM&V Considerations

One concern that Ameren Missouri must address in the beginning of Cycle 2 is the potential of having two EM&V contractors, for the same set of programs, simultaneously.

[84] 4 CSR 240-22.050(09)(C)

There may be an overlap of the current EM&V contractor completing the final report after the completion of Cycle 1 with the bidding EM&V contractors being solicited to conduct evaluations for Cycle 2. As mentioned previously, the final report summarizing all activities within the first 3-year implementation plan is due nine months after the expiration of program year 3. This overlap will likely occur because Ameren Missouri intends to solicit multiple EM&V contractors for competitive bids for work beginning in January 2012. If a new EM&V contractor wins the bidding process, Ameren Missouri will have to manage the completion of the Cycle 1 EM&V report while also focusing on developing the new contractor and orienting them into the Cycle 2 portfolio framework. New contracts, new meetings with the implementation teams and a host of other activities will be necessary for the new evaluation contractor. While these considerations may seem burdensome, it is important to allow a competitive bidding process in order to provide the most cost-effective evaluation possible.

Another consideration involves the adoption of new provisions in MEEIA, where the Commission Staff may acquire the services of an independent third party auditor to monitor the EM&V activities of the electric utilities and their evaluation contractors on a statewide level. This added intricacy will have several impacts on EM&V practices including, but not limited to:

- Increased scope for EM&V contractor,
- Potential budget constraints to comply with reporting requirements to auditor,
- New communication channels adding to the complexities of procedures and reporting, and
- Increased administrative responsibilities for the Ameren Missouri management team.

Ameren Missouri will continue to work with the evaluation contractors and make the necessary plans to incorporate the auditors into the planning/evaluation process. It would be beneficial to all parties if this independent auditor could participate early in the process, similar to the EM&V contractors beginning their work at the inception of the implementation of Cycle 1 programs.

7.5 Portfolio Framework

The essence of the Ameren Missouri proposed DSM portfolios is balance—a mix of investments corresponding to different objectives and with different risk profiles that help ensure goals are met even if individual investments under-perform. The set of demand-side programs that Ameren Missouri proposes should be viewed in similar terms. The mix of programs is structured to satisfy a variety of public policy and Company objectives, while ensuring that even if some programs under-perform, the portfolio as a whole will fulfill its role in the Company's overall resource strategy.

Ameren Missouri designed multiple portfolios to attempt to address risk factors around the regulatory framework within which it will be implementing its DSM portfolio during the 2012-2014 implementation period. The magnitude of the regulatory framework risk is significant at the time of the Ameren Missouri 2011 IRP filing as proposed rules addressing the Missouri Energy Efficiency Investment Act have not been finalized.

This section describes the demand side program planning philosophy that has guided selection of the programs proposed. The design of the portfolio framework includes two basic steps: the definition of DSM planning objectives and establishment of a perspective on program and portfolio risk. Planning objectives are set to reflect policy and regulatory standards, as well as program performance and customer service criteria. The energy efficiency and demand response policy objectives are incorporated into the greater IRP policy objectives and can be found in the Executive Summary of this filing.

Key portfolio design objectives are outlined in the following sections. Invariably, the extent to which the Company can satisfy some important objectives is not quantitatively measureable. In addition, we should expect that it will not be possible to simultaneously maximize/satisfy all objectives.

7.5.1 Planning Objectives

Ameren Missouri's portfolios have generally been designed to achieve the following objectives:

- Include All Programs that Screen as Cost-Effective
  - Unless there is evidence not to
- Provide Coverage of Hard-to-Reach Sectors
- Include Educational/Informational Elements to Promote Changes in Long-term Customer Behavior
  - C&I motors
  - RES behavior – possible pilot projects
- Promote Emerging Technologies and Innovative Concepts
- Strengthen Customer Satisfaction
- Balance Energy Efficiency and Demand Response Elements
- Minimize Rate Impacts
  - Analyze and assess ratepayer impact measure ("RIM") tests
  - Strive to include program delivery mechanisms that minimize free ridership
- Promote Portfolio Flexibility
- Employ Best Practice Portfolio and Program Design Whenever Possible
- Use Potential Study As Basis For Annual kWh Savings For Realistic Achievable Potential ("RAP") and Maximum Achievable Potential ("MAP") scenarios

The Low Risk portfolio, however, has a limited set of objectives commensurate with the limits of the current regulatory framework. The Low Risk portfolio objectives are:

- Continue programs from Cycle 1
- Promote Portfolio Flexibility
- Provide Coverage of hard to reach sectors (mainly Low Income)
- Continue to focus on Programs that enhance customer satisfaction
- Limit lost revenues and exposure to potential disallowance of costs accrued in regulatory assets

7.5.2 Portfolio Diversity and Flexibility

Ameren Missouri considered diverse portfolios of cost-effective measures and programs. However, to mitigate regulatory uncertainty risks, Ameren Missouri also considered a diverse but downsized set of program options. Each portfolio screened was designed to address different risks, objectives, and operating environments to provide a robust outlook of various possibilities for energy efficiency and demand response in the planning horizon. It is important for Ameren Missouri to maintain the flexibility within each portfolio in order to alter program delivery mechanisms, incentive levels, measure participation and other program metrics to reflect the ever-changing consumer marketplace. Some key areas of where portfolio flexibility was utilized in the planning process are listed below.

Increased Incentives

Ameren Missouri is including higher incentives for a portion of the Business market segments in the Cycle 2 as compared to the existing Business Program incentive offerings. The Business portfolio has achieved savings to meet Cycle 1 goals but expects it will need higher incentives to keep moving the market to higher levels of savings. The Business Custom program, for instance, was modeled with incentive amounts ($/kWh basis) over 50% higher than current offerings for both lighting and normal, custom energy efficiency improvements.

Consumer Education

Customer education adds costs to the portfolio but is vital to overcome market barriers and promote customer adoption over the long term. Ameren Missouri will have several programs requiring increased consumer education efforts in Cycle 2 including Appliance Recycling, Business Custom (motors component specifically), and the HVAC tune-up. These programs typically require a significant educational component to drive customer participation and increase market adoption. While each program offers significant energy savings, customers are not always aware of how best to integrate each program's offerings into their current situation.

7.6 Key Issues

This section summarizes various issues that the Ameren Missouri team has identified as having an important role in developing the broad range of portfolios considered in the development of this IRP Implementation Plan.

7.6.1 Motors

New efficient motor standards codified in the Energy Independence and Security Act of 2007 (EISA) are slated to take effect Dec. 19, 2010. A broad range of motors built after that date will have to conform to nominal full-load efficiencies that define premium-efficient motors, commonly marketed as “NEMA Premium.”

7.6.1.1 EISA’s Impact

The Energy Independence and Security Act of 2007 (EISA) requires general-purpose “Subtype I” motors in the 1-hp to 200-hp category — and manufactured alone or as a component of another piece of equipment — be built to minimum nominal full-load efficiency standards as defined in NEMA MG-1 (2006) Table 12-12. Those standards generally define the premium-efficient motor — those that may carry the NEMA Premium designation. That category came into being with passage of the Energy Policy Act of 2005, which required motors procured for federal uses to meet those higher efficiency ratings.

EISA effectively expands those federal procurement guidelines to include many motors used in commercial and industrial applications. It succeeds efficiency standards that were mandated for such motors in the Energy Policy Act of 1992 (EPAct ’92). The new EISA standards are several percentage points higher than efficiency ratings that define those so-called EPAct motors, and which are spelled out in NEMA MG-1 (2006) Table 12-11.

EISA also raises the efficiency bar for various other types of motors. Some that had been exempted from EPAct ’92 standards, which were one to four percentage points

higher than efficiency ratings for standard-efficiency motors, will now have to meet EPAct '92 efficiency guidelines. Such motors, called Subtype II, incorporate Subtype 1 design elements but have non-standard configurations.

EISA also brings NEMA Design B motors sized between 200 hp and 500 hp under the EPAct '92 efficiency prescriptions, as well as fire-pump motors. For manufacturers, the new EISA efficiency standards virtually replace the standard efficiency motor — ones that predate motors called for in the Energy Policy Act of 1992. From December 19, 2010 on, premium-efficient motors are the rule for many common motor classifications and applications. The new standard doesn't mandate that commercial users of covered motors replace less efficient motors — or even that they replace premium motors. But it does mean that attrition will come into play; future replacements will almost certainly be made with more efficient models, as the sun sets on standard motors.

7.6.1.2 The Economic Analysis of Motors

With premium-efficient motors carrying a price tag of up to 30% more than either EPAct or standard efficiency motors, some users could have more incentive to consider the advantages of maintaining and repairing old, less efficient motors as the need arises. But at the same time, the new higher efficiency motors do offer a quicker payback period, helping offset the higher up-front cost. Ultimately, though, a user's decision to repair or replace motors will turn on budget considerations. For some users whose business may be struggling in a sluggish economy and are looking for ways to trim costs in the short term, repairing existing motors might emerge as the expedient choice. Some may conclude that repairing the motor with best practices so it retains its efficiency and works as soundly as before translates to a meaningful 20% savings over replacement.

On the other hand, users more focused on the short term may opt to snap up cheaper, though less efficient, motors while supplies last. While most manufacturers are moving swiftly to shift production of EISA-covered motors to premium efficiency, those ultimately marked for replacement could legally roll off assembly lines through late 2010.

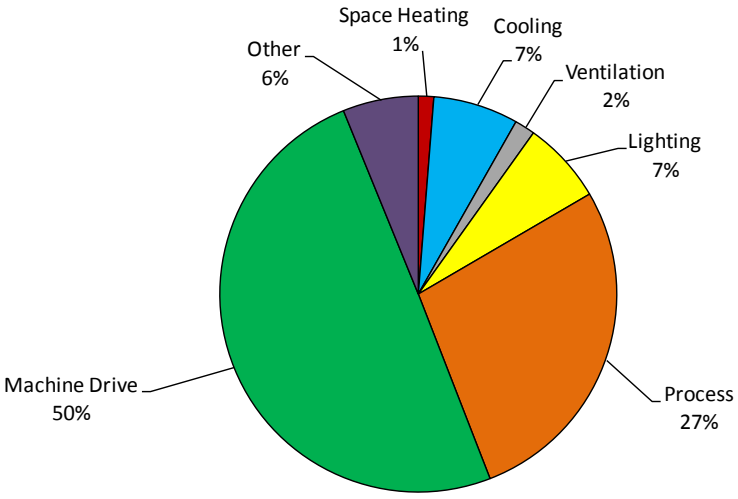
7.6.1.3 New Federal Motor Incentives May Emerge

Congress has debated a Federal "crush for credit" legislation that would provide up to $700 million of monetary incentives to accelerate the shift to premium-efficient motors. This legislation continues to be discussed in Congress. A renewed push took shape in June 2010, with the introduction of Senate Bill 3436. It would offer buyers rebates of $25 per horsepower for purchases of NEMA Premium motors. Plus, companies that permanently dispose of replaced, less efficient motors would get $5 per horsepower.

7.6.1.4 Motor/Drives Opportunity

The 2010 Ameren Missouri DSM Potential study showed that motors and drives account for approximately 50% of electric energy used by industrial customers. See chart below:

Figure 7. 19: 2008 Industrial Electricity Usage by End use



The excerpt from the study in regards to potential load reductions attributable to increased motor/drive energy efficiencies is:

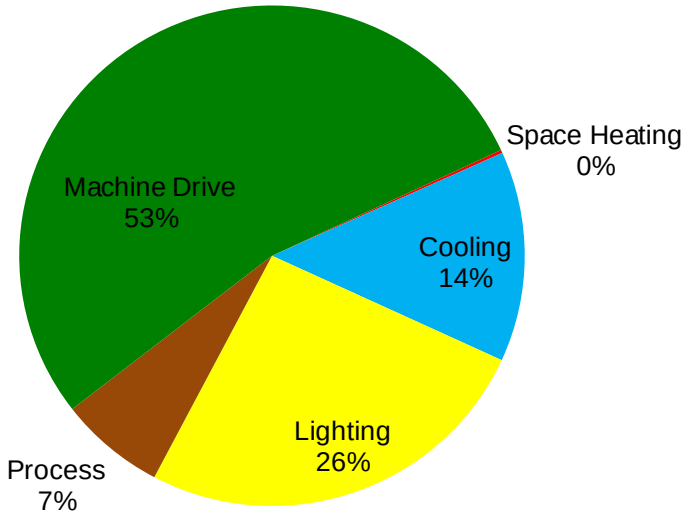
7.6.1.5 Industrial EE Measure Potential

In 2030, economic potential in the industrial sector is 986 GWh or 8.5% of baseline industrial usage in 2030. The breakdown by end use for selected years is presented in Table 7. 26, which shows that machine drives – motors and air compressors account for more than half the potential savings. However, the absolute savings from motors is relatively small for two reasons. First, there are significant savings already embodied in the baseline forecast as a result of the NEMA standards that have been in place for many years and which will begin to require installation of premium-grade motors be installed in December 2010. Second, industrial customers are savvy and have been able to successfully postpone motor replacement by rewinding existing motors. In addition to motors, there are significant savings opportunities in cooling, lighting and, to a lesser degree, electric processes.

Table 7. 26: Industrial Economic Potential by End Use

	2009	2015	2020	2030
Space Heating	1	1	2	2
Cooling	26	63	75	134
Ventilation	-	-	-	-
Lighting	117	252	251	255
Process	25	65	67	67
Machine Drive	114	416	509	528
Total	**284**	**797**	**904**	**986**

Figure 7. 20: End-use Breakdown of Industrial Economic Potential in 2030



7.6.1.6 Motor Program Design Challenges

Fundamental barriers to achieving the 528 GWH potential from the motors market include: first cost vs. life cycle costing, energy efficiency taking secondary status to operations and production, lack of corporate direction, and the massive scale of the potential market. At its core, the motors/drives program is a market transformation program designed to create pull through marketing for NEMA Premium motors. It is behavior-based to create long-term persistence. It is technology-based to create short-term opportunities for the retrofitting of existing inefficient motors through innovative marketing programs

Considerable groundwork (awareness building, marketing, leveraging market actors, partnering with motor dealers / distributors / manufacturers, and educating end users) will be necessary before this approach generates meaningful energy savings from the motors market. A detailed list of the exact type of activities of a comprehensive motors program includes the following:

- Research and develop motor dealer lists.
- Develop an understanding of the C&I sector.
- Develop Rebate materials, including marketing pieces to develop awareness, education and training.
- Investigate a startup marketing plan to develop program awareness; Ameren Missouri Website pages devoted to motors and drives energy saving opportunities; perhaps a dedicated Web site; direct mail to facility managers culled from Ameren Missouri account information as available.
- Develop relationships and program awareness with local distributors and manufacturer reps, energy organizations, and DOE.
- Investigate Trade shows, industry meetings (ASE, EASA, BOMA, etc.) and develop speaking / presentation opportunities.
- Visit and educate all motor dealers in territory. Train staff on program benefits, rebate application procedures, and identify the dealers most able and interested in becoming more value added to their customers.
- Pursue Motor Management / Program Training opportunities with dealers and other venues where end users can be offered free training. Develop training modules.

7.6.2 Low Income Programs

Planning for the evolution of Ameren Missouri's low income program was a vital part of the Cycle 2 strategy. Traditionally, low income energy efficiency programs have been created to provide energy saving assistance at low or no cost to qualified low income customers who would be otherwise be unlikely to participate in DSM programs. The strategy should address critical needs of customers such as: limited capital budgets, limited education, language barriers, and receptiveness to the programming.

During the Cycle 1 implementation, the American Recovery and Reinvestment Act of 2009 (ARRA) provided the low income housing market with unprecedented amounts of weatherization and energy retrofit funds. As a result, Ameren Missouri sought and found a niche in the multi-family market where the federal stimulus dollars were not overwhelming the potential effect of Ameren Missouri funding. As the ARRA funds are set to diminish and fade out, part of the Cycle 2 strategy will be to continue to focus on the multi-family market in the early years but re-evaluate moving back into the single-

family housing market in the later years of Cycle 2 to continue the work begun by the ARRA funded actions.

The low income program development team designed the following list of core concepts to use as a basis for the program:

- Offer all measures at no cost to the participants.
- Work with associations such as Housing and Urban Development (HUD), Public Housing, Weatherization Assistance Programs (WAP) and Low Income Home Energy Assistance Program (LIHEAP) to identify eligible participants.
- Enforce education as a major component.
- Include program offerings to renters and customers residing in mobile homes since these target populations are vastly underserved.
- Ensure inclusion of rural and urban areas in the service territories

Ameren Missouri is working in efforts to assist Laclede Gas in the development of a tariff for the Multifamily Income Qualified program. Current progress leads to a likely partnership with Laclede Gas to attain energy efficiency savings with the Low Income program. Partnering with community action agencies will alleviate some administrative and implementation hardships due to their stronger relationship and influence on the community.

The planning team explored a variety of options for the program design, but the essential question was how to best utilize a limited budget: is it better to reach a small number of customers with deep, high-impact measures; or reach a large number of customers with more easily-deployed, lower-impact measures?

Table 7. 27 below illustrates four options that were explored, from constructing a new home with renewable energy sources and Energy Star standards to create near net-zero energy consumption to a quick retrofit consisting of a single-pass audit with easily implemented measures.

Table 7. 27: Analysis of Ameren Missouri Low Income Program Options

3 year Totals for Cycle 2	New, Near Net-Zero home	Deep Retrofit	Hybrid of Deep and Quick	Quick Retrofit
	Deep Savings ←			→ Broad Savings
Budget	**$11.4 million**	**$11.4 million**	**$11.4 million**	**$11.4 million**
First-year-kWh Savings	2,622,000	7,554,399	15,588,967	24,886,780
Utility $/ first-year-kWh	$4.33	$1.51	$0.73	$0.46
TRC	0.23	0.41	0.70	1.04
Number of homes	138	6,455	17,305	29,875
Utility $/ home	$82,609	$1,766	$659	$382
Annual bill savings/ home (Elec + Gas = Total)	$1,146 + $0 = **$1,146**	$68 + $22 = **$90**	$50 + $4 = **$54**	$46 + $0 = **$46**

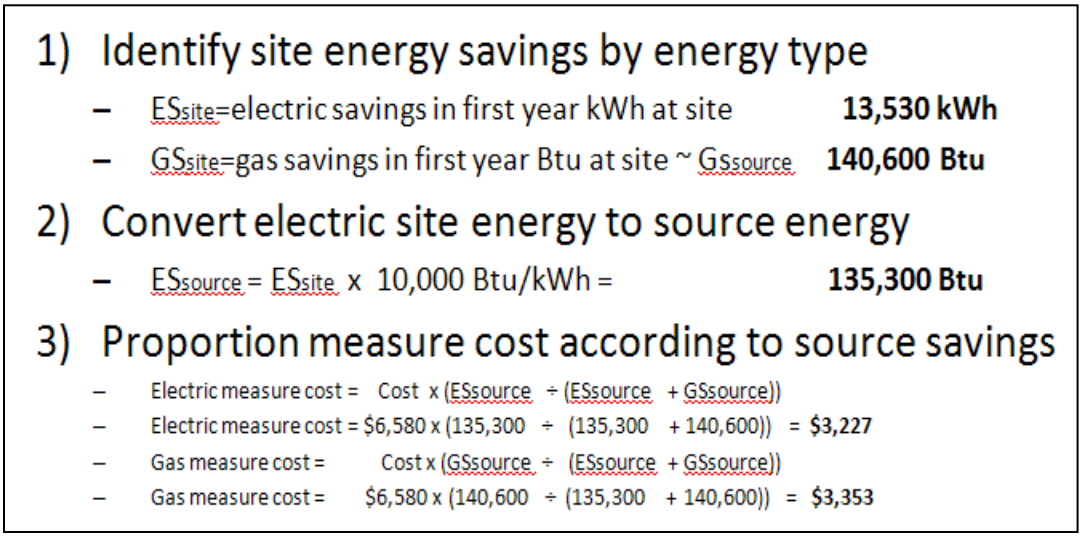
The ultimate goal of this program is to help participants understand their electric usage so that they will be able to proactively manage their own electric bills. The development team sorted through the 4 main options and considered the pros and cons of each. Further analysis and research will continue to shape how the program addresses the needs of the low income segment. Ameren Missouri plans to continue its Multi-family Income Qualified program as it has been highly successful and continues to grow. The Company will continue to explore opportunities to better serve low income and hard-to-reach customer segments.

7.6.3 Integration with Natural Gas Programs

Ameren Missouri has incorporated the ability to offer dual fuel energy savings into its portfolio. Processes have been put in place to appropriately quantify and separate savings and costs across electric and natural gas fuel types for dual fuel projects. The Business Implementation Team has collaborated with Laclede Gas on several instances to deliver dual fuel projects.

One project specifically was the installation of an energy management system at a local wireless phone store. To parse the savings, the two utilities agreed to separate the savings into SOURCE BTU using the following methodology.

Figure 7. 21: Parsing Methodology



The process flow above describes how each fuel's energy savings are converted into Source BTU's, and then the project cost is divided between the utilities by the percentage contribution of the respective fuel. This project TRC of 0.88 did not pass the 1.0 threshold when solely accounting for electric savings and full incremental cost. When both fuel benefits and fuel specific costs were assessed, the project passed the threshold with a 1.78 TRC.

Ameren Missouri will continue to work with Laclede Gas on projects similar to the example described above. Ameren Missouri will also evaluate opportunities to coordinate with internal natural gas programs and attempt to leverage synergies that may exist in the co-delivery of programs.

7.6.4 Coordination with State Administered Programs

The Missouri Department of Natural Resources (MDNR) has the responsibility of managing and implementing government sponsored DSM programs within the State of Missouri. This includes DSM programs with funding sourced from both the state and federal level (i.e. distribution of ARRA funds within Missouri).

The Ameren Missouri team has been working with the MDNR in an attempt to integrate the DSM portfolios of both entities. Peer exchanges, telephone conversations, and emails have been used between the Ameren Missouri and the MDNR DSM Implementation teams in an effort to:

- Identify the use of funds to promote DSM by both the government and the utilities
- Reduce the duplication of effort associated with promoting DSM
- Work in a manner that optimizes the co-existence of government and utility DSM programs to maximize the associated efficiency gains

Other DSM program coordination with MDNR involves $1.5 million that Ameren Missouri contributes in support of the MDNR Low Income DSM program.

7.6.5 Research & Development

Energy efficient technologies, markets, and implementation and planning practices are constantly evolving. These continual changes require innovative thinking and creative problem solving techniques to achieve energy savings targets. A large component of this effort lies in research and development. It is essential to monitor the progress of efficient technologies and continue learning about future possibilities. Ameren Missouri has taken a proactive approach to researching emerging technologies in hopes to not only maximize the net impacts of existing energy efficiency programs, but also to identify new programs, technologies, and processes that could materialize in the future.

The energy efficiency technologies proposed in the 2012-2014 Ameren Missouri DSM Implementation Plan filing focus on best practice energy efficiency measures that have been successfully deployed by IOUs across the nation. As energy efficiency measures gain market acceptance the trend is to codify the measures at either the federal and/or state level. For example, the phase out of manufacturing incandescent lights bulbs not complying with the new efficiency standards beginning in 2012 was the direct result of federal legislation in the Energy Independence and Security Act ("EISA") of 2007. Energy efficient lighting in the form of compact fluorescent lights ("CFLs") has accounted for the majority of IOU sponsored energy efficiency savings for the past 10-20 years. The opportunity for IOUs like Ameren Missouri to promote energy savings from CFLs will diminish significantly due to EISA legislation.

Ameren Missouri is facilitating the adoption of new, energy efficient technologies such as solid state lighting, advanced heat pumps, and more efficient appliances into the market through investment in applied R&D with the Electric Power Research Institute ("EPRI") and partnerships with equipment manufacturers such as Tendril in the development of pilot programs.

7.6.5.1 Funding EPRI Energy Efficiency Technology R&D

Ameren Missouri participates in the funding of the EPRI end use energy efficiency and demand response program referred to in EPRI parlance as program set 170. The specific grouping of programs is shown in the following graphic:

Figure 7. 22: EPRI Programs

As Figure 7. 22 shows, the R&D work applies to DSM analytics, systems and cutting edge technologies. A brief description of the major initiatives follows:

CO_2 Emissions Impact

EPRI is developing a model to estimate the hourly marginal impacts of CO_2 from energy efficiency. The objective of this research is to establish a standard methodology and set of CO_2 emissions intensities that are practical for both program designers and implementers at Ameren Missouri to adopt. Ameren Missouri expects to have a robust energy efficiency carbon calculator in place in its analytics toolkit in 2011.

Feedback Behavior

Programs that address customer energy behavioral change as a direct result of information feedback systems are emerging to the forefront of energy efficiency programs. The objective of this research is to develop EM&V protocols with which to measure the impact of feedback programs.

DR-Ready Appliances

Ameren Missouri primary market research shows that 52% of single family and 56% of multi-family customers indicate that someone is home during the weekday either because they work at home or regularly stay at home. The fact that a majority of people are in their homes during the day speaks to a heightened sense of concern about how customers will respond to traditional demand response programs that typically require the cycling of air conditioners. Consequently, the obvious question is whether there may be less obtrusive technologies to deploy to achieve meaningful demand response from customers. Residential appliances with inherent “demand responsive” capability could dramatically reduce the operational cost of demand response programs for obviating the need to install customer premise devices for demand response that may impact the comfort of customers. The objective of this research is to facilitate the

development of functional definitions of DR-Ready, which are precursors to designations which standards bodies may apply.

Thermal Energy Storage

This R&D included a report describing EPRI tests of the Ice Bear® 30, a hybrid air-conditioner and thermal energy storage system manufactured by Ice Energy, Inc., that uses smart integrated controls, ice storage, and a dedicated compressor for cooling. It is a relatively small size unit (5 ton), intended for use in residential and light commercial applications.

Smart Homes/Intelligent Buildings/Communications Technology and Standards

The deliverable from this R&D are technical updates describing what comprises residential, commercial and industrial energy management systems with a focus on demand response applications. The report also discusses the potential direction for the technology – considering such issues as consumer demand, technology evolution, and utility technology deployments. Specific technologies tested by EPRI and described in the report include: smart distribution panels; commercial building automation and energy management systems; and lighting control systems.

Television and Set-Top Box Energy Use and Efficiency

Household miscellaneous loads, which include consumer electronics, are the fastest growing segment of household energy use in the nation. The most prevalent form of consumer electronics in the Ameren Missouri service territory is televisions and associated equipment. Ameren Missouri primary market research shows that homes have an average of 3.3 televisions per household. Respondents report that their household watches TV on average a total of 10.1 hours per day on all their TVs combined. EPRI R&D provides information on television technology, energy use market trends and the status of efficiency improvement efforts in the U.S. – including information on the California efficiency standards for televisions.

Heat Pump Technology

EPRI is testing and reporting on a variety of heat pump technologies. In the residential sector, significant R&D focuses on the Daikin Altherma, a variable speed hydronic heat pump for residential and small commercial application. Hydronics is the use of water as the heat-transfer medium in heating and cooling systems. Some of the oldest and most common examples are steam and hot-water radiators. EPRI's research focuses on assessing the flexibility of system operation, the applicability for use in new construction and retrofit of residential and small commercial applications, and its potential for energy savings and demand reduction. One of the more exciting heat pump technologies is heat pump hot water heaters. EPRI is conducting laboratory tests of several heat pump water heaters to assess their performance and energy efficiency. Among U.S. products that were tested were new products from A.O. Smith, General Electric, and Rheem.

Light-Emitting Diode ("LED")

One of the most promising technologies for future deployment is the Light Emitting Diode ("LED"). LEDs are semiconductor light sources that utilize conductive layers to generate an electrical current to emit light rather than the gas arc tubes found in conventional light sources (incandescent, sodium vapor, etc.). LED technology has many applications that offer unique opportunities for energy efficiency. There are, however, several obstacles that are prohibiting mass market adoption including high up-front capital requirements, market immaturity, and continual product cannibalization. As manufacturing processes continue to refine and prices decline, LEDs are beginning to become more cost-effective.

A particular market segment that could benefit greatly from integrating LED technology into the available technology scope is street and outdoor area lighting. Although street lighting and dusk to dawn lighting (rate classes 5M and 6M, respectively) comprise less than 1% of the system load, there are notable energy savings that can be witnessed by changing the legacy lighting facilities to LED fixtures. A majority of the existing outdoor lights utilize high pressure sodium or metal halide technologies. These two technologies have been in the market for decades and have reached a mature product life-cycle allowing for equipment costs to be minimal. While each of these technologies is relatively efficient compared to other options (incandescent or mercury vapor), there is still room for improvement. LEDs offer several benefits including: significant energy savings, longer life, and better light directionality reducing overall light pollution and allowing tailored lighting solutions.

EPRI LED Pilot

To better analyze LED operating characteristics and long-term viability, Ameren Missouri enrolled the Electric Power Research Institute (EPRI) to assist in creating a pilot program.[85] As part of a larger, national series of demonstration projects, the Ameren Missouri pilot will allow utilities and research institutes to share best practices and findings on this evolving technology. Many LEDs have only been tested in laboratory environments, absent of weather, insects, voltage interferences, and a host of other circumstances that are relatively common in the field. It is vital that Ameren review the technology and utilize all available resources to determine if LEDs are indeed the next generation luminaire.

The LED street lighting project was initially started in January 2009. A solicitation process of interested utilities and manufacturers took place over the next several months. EPRI wanted to ensure that a wide range of geographical areas were covered to provide a robust data set with varying climates and usage patterns. Once EPRI and Ameren Missouri formally agreed to proceed, the project was in motion.

[85] 4 CSR 240-22.050(5)

The first step was to identify a proper host-site for the demonstration project. EPRI identified several key criteria that could comprise a suitable test site. Key considerations included all lights being on a single circuit, the site should bring good publicity, the area should have enough traffic to establish user feedback, and it needs to be easy to install and maintain the lights. After deliberations within the Ameren Missouri team, it was decided to move forward with a street lighting pilot (rather than a parking lot area lighting demonstration) to evaluate roadway lighting. Various municipal customers were contacted to gauge interest and willingness to work with Ameren Missouri. These customers were chosen due to previous LED-related inquiries or where Ameren knowledge existed on future street lighting retrofit activities. Ballwin, MO was chosen based off previous interest in LEDs and extreme willingness to cooperate and collaborate on this effort.

The next phase was product procurement. While EPRI would be responsible for dealing directly with the manufacturers, it was Ameren's responsibility to determine which lighting fixtures to test. To get the necessary baseline measurements and site requirements, EPRI traveled to Ballwin to assist in taking both photometric light levels and installing metering equipment on the existing high pressure sodium lights. These readings were then relayed to the lighting manufacturers to inform their lighting design/bids. There were various manufacturers that bid on the project and each was analyzed by various departments across the Ameren Missouri organization. Not only were the lights and companies assessed qualitatively, but a quantitative rating was also assessed based on pricing, energy savings, ability to conform to existing RP-8 luminance levels, color rendering index (CRI), and a host of other measurements. An example of the scoring matrix is listed in Table 7. 28.

Table 7. 28: LED Scoring Matrix

	Efficacy (lm/w)	Delivered Lumens	CRI	Industry Reputation	Matches Existing Lighting Scheme	Total
Weighting	20%	15%	15%	20%	30%	100%

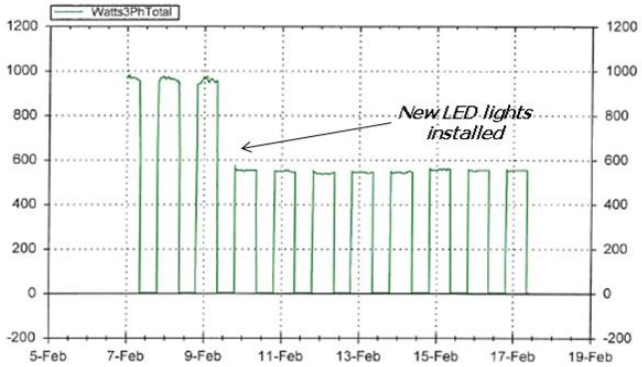
After the products were chosen and the manufacturer was contacted, the lights were ready to be installed. The existing 250 watt high pressure sodium (HPS) lights were set to be replaced with 157 watt LED fixtures. The lights themselves were erected in February 2010 and will continue to be in the field until the fourth quarter of 2011. Both Ameren Missouri and EPRI felt it was important to include multiple seasonal weather variances within the pilot to gauge and analyze the performance of the LEDs in different scenarios under different conditions.

Measuring the photometric performance of the LEDs is a challenge. EPRI has pioneered a unique methodology to quickly, and more importantly, accurately measure the luminance levels of the new lights. EPRI has developed a mobile metering device capable of capturing up to 10,000 different data points. This feature is coupled with functionality to link to software and generate a photometric plot of the test fixture. This type of data is cutting edge for the market space and will allow for large quantities of data to be stored and analyzed.

Figure 7. 23: Street Lighting Comparison

Thus far, the project has yielded measurable energy savings and noticeable light quality differences (as seen above). The energy savings associated with the project are in the graph below. The values represent 3 lights on a single circuit indicating the baseline units are using roughly 300 watts per unit (with ballast). The efficient replacement is using approximately 185 watts per unit, equating to a 40% energy savings on the three metered lights.

Figure 7. 24: LED Street Light Energy Savings



The LED pilot will continue until the fourth quarter of 2011. The data that Ameren Missouri gathers from this program will assist in future decision making processes about

street light replacement and also the potential inclusion of this technology as a DSM measure.

Accompanying the LED street light pilot, Ameren Missouri conducted a street light replacement program in 2009 – 2010. The program targeted both company owned and private lights. Specific facilities replaced include Incandescent (700 watts) and Mercury Vapor facilities (1000 watt) as they were the most cost-effective strategy (see "AmerenUE Street Light Replacement Study" in electronic appendix) with the program having a TRC of 1.38. The program was completed in February 2010.[86]

Load Building

While no load-building programs were examined as part of the demand-side analysis for this plan,[87] there are carbon-reducing opportunities that have potential load building implications. To better understand these technologies and the potential impacts on the system, Ameren is consulting various organizations and research institutes to aid in analyzing carbon-reducing technologies.

De-Carbonization Through Electrification

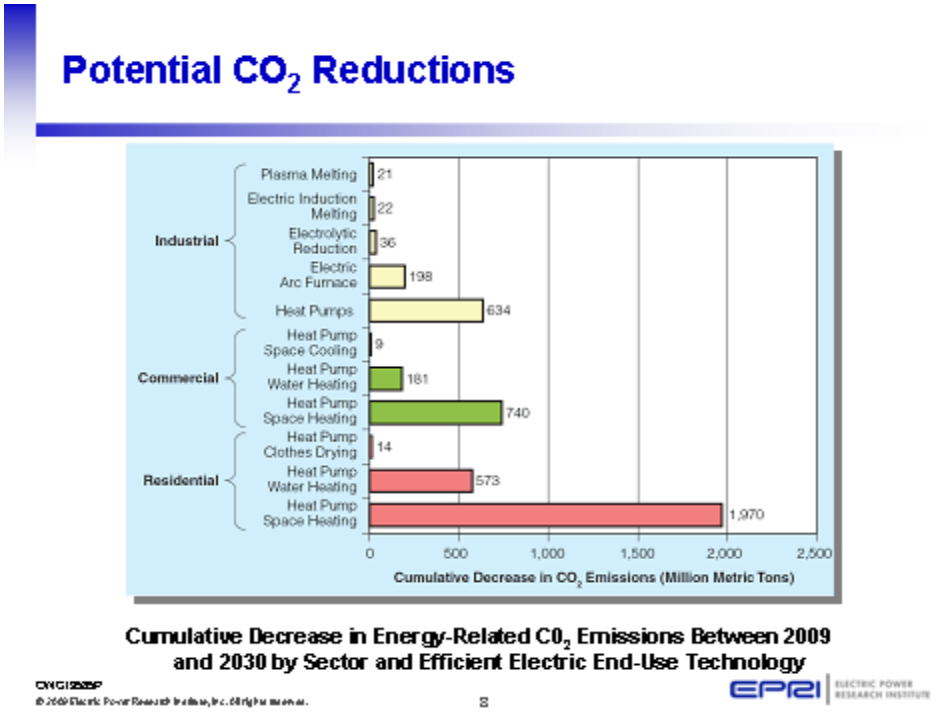
Energy efficiency has multiple, well established benefits including:

a. Lower energy bills, greater customer control, and greater customer satisfaction
b. Low cost resource – lower cost than new power plants – within bounds
c. Modular and quick to deploy
d. Potential for increased economic development
e. Energy security

The overarching long-term benefit of energy efficiency may be environmental. Energy efficiency and carbon reduction are synonymous. Cost-effective energy efficiency offers environmental benefits related to reduced demand such as reduced greenhouse gas emissions and, in some cases, lower water use. The following chart, created by EPRI, shows specific electric end-use technologies that provide end-to-end carbon reductions as compared to other technologies and non-electric fuel sources:

[86] EO-2007-0409 – Stipulation and Agreement #22
[87] 4 CSR 240-22.050(10); 4 CSR 240-22.060(05)(A-D); 4 CSR 240-22.060(06)(F)

Figure 7. 25: Electro-Technologies CO2 Reductions



Electric vehicles are perhaps the most high profile technology that exemplifies the de-carbonization through electrification concept. The attached table from the U.S. Department of Energy's Energy Efficiency and Renewable Energy Division shows indicative levels of net carbon reductions in the 25-40% range associated with plug-in hybrid electric vehicles

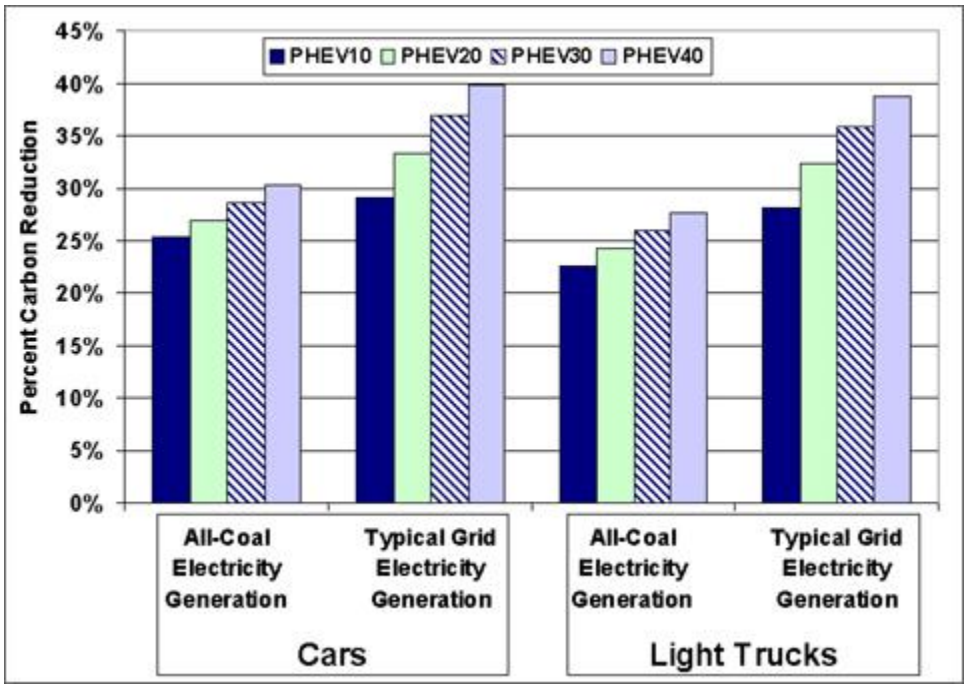
Carbon Reduction of Plug-in Hybrid Electric Vehicles

Estimates from the GREET model (see Argonne National Laboratory's information on GREET) show that passenger car PHEV10s produce about 29% fewer carbon emissions than a conventional vehicle, when plugged into an outlet connected to the typical U.S. grid. Even when PHEV10s are charged using power generated completely from coal, carbon emissions are about 25% less than those of a conventional vehicle. The use of light truck PHEV10s reduces emissions by 28% when charged on a typical grid and 23% when charged on power generated from coal. The carbon reductions are greater as the length the vehicle can travel on electricity increases.

Table 7. 29: PHEV Classifications

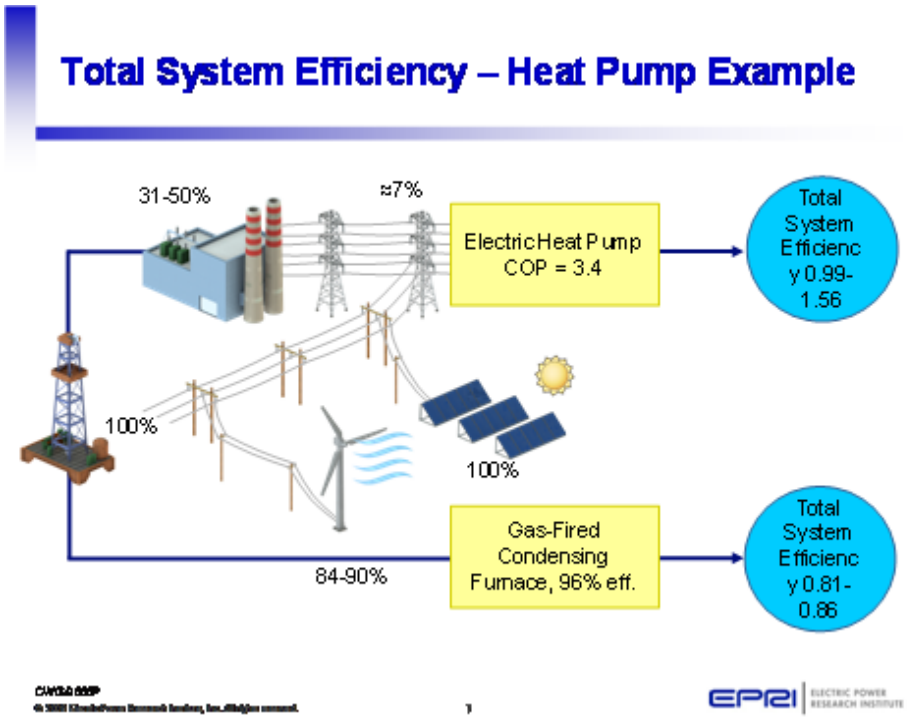
PHEV10	plug-in hybrid electric vehicle which can travel up to 10 miles on electricity alone
PHEV20	plug-in hybrid electric vehicle which can travel up to 20 miles on electricity alone
PHEV30	plug-in hybrid electric vehicle which can travel up to 30 miles on electricity alone
PHEV40	plug-in hybrid electric vehicle which can travel up to 40 miles on electricity alone
Typical Grid	electricity sources are 50.9% coal; 20.1% nuclear; 16.7% natural gas; 11.0% renewable energy; and 1.3% petroleum.

Figure 7. 26: Carbon Reduction Shares by Technology Type



Another example of a relatively well known electric technology that offers the potential for superior end-to-end carbon reductions is the heat pump. The following graphic illustrates the magnitude of heat pump efficiency savings relative to natural gas:

Figure 7. 27: Heat Pump Savings vs. Natural Gas



Ameren Missouri expects to participate in funding for EPRI R&D that addresses the potential for expanding end-use applications of electricity to save energy and reduce CO_2 emissions. The focus is on converting residential, commercial, and industrial equipment and processes – existing or anticipated – from traditional fossil-fueled end-use technologies to more efficient electric technologies. A key objective of this research is to inform Ameren Missouri leadership, the MPSC, and Ameren Missouri stakeholders of the potential to improve energy efficiency, reduce carbon and lower customer costs through electrification of processes that traditionally have been fueled by other energy sources.

7.6.5.2 Ameren Missouri Personal Energy Manager Pilot

Ameren Missouri's Personal Energy Manager (PEM) Rebate Pilot Program, implemented during the 2009 summer, had the dual purposes of assessing the effectiveness of potential residential price response programs and testing the associated technology.[88] Part of the technology test was to determine whether new vendor (Tendril) hardware was compatible with Ameren Missouri's automated meter reading (AMR) system and how well it interfaced with AMR meters.

[88] 4 CSR 240-22.050(5)

The pilot program provided bill credits to residential customers who, at Ameren Missouri's request, voluntarily reduced their electricity consumption during Price Response Events designated by Ameren Missouri. To minimize any potential customer inconveniences, participants were recruited from Ameren Missouri staff who volunteered to take part. The program provided technology that enabled interactive energy monitoring and remote thermostat control in the home, allowing Ameren Missouri to test this technology. (The technology also assisted the customer in managing their electric consumption during non-events.)

The Pilot program was implemented with installation of varying configurations of the new Tendril equipment in the homes of 374 Ameren Missouri employees during June and July of 2009. Participants were assigned to one of the configurations, described in Table 7. 30.

Table 7. 30: PEM Pilot Groups

Groups	Number of Households	Tendril Device Configuration	Purpose
No-device Comparison Group	79	No Tendril Devices	Comparison group, though with Event Notification (via e-mail) and Rebate Eligibility
Information (Event Energy Pricing plus Near Real-time Consumption) from Web Portal Only; Event Notification via e-mail	78	Web Only	Measure customer response to information accessed from Web Portal (Event Energy Pricing plus Near Real-time Consumption) with Web Portal only
Information (Event Notification, Energy Pricing, and Near Real-time Consumption) from In-Home Display or Web Portal	105	Web + In-Home Display	Measure customer response to information (Event Notification, Energy Pricing, and Near Real-time Consumption) and rebate eligibility
Information and T-stat set point remote control capability by customer and Ameren Missouri	39	Web + T-stat Control	Measure customer response to information (Event Energy Pricing plus Near Real-time Consumption from Web Portal), with T-stat remote control capability for customer and Ameren Missouri (indirect load control during Events)
Information (from both Web Portal and In-Home Display) and T-stat set point remote control capability by customer and AmerenUE	73	Web + In-Home Display + T-stat Control	Measure customer response to information (Event Energy Pricing plus Near Real-time Consumption from Web Portal and In-Home Display), with T-stat remote control capability for customer and AmerenUE (indirect load control during Events)

Due to the mild temperatures experienced during June and July 2009, it was difficult to discern with reasonable accuracy the load reduction impact associated with the Personal Energy Management pilot. However, the results of the pilot, evaluated by the Cadmus Group, suggested a set of customer attributes that were correlated with energy savings during the pilot. Table 7. 31 shows the estimate of the average impact of the PEM Pilot on a targeted group of Ameren Missouri customers that have high incomes (>= $75,000) large households (>= 4 members) and high annual energy consumption

(>= 18,000 kWh). There are approximately 29,000 customers in this category among Ameren Missouri residential customers.

Table 7. 31: PEM Impacts

	Event1	Event2	Event3	Total
Number of Participants	33	35	35	32
Average Baseline Consumption	20.1	21.5	16.4	19.3
Average Energy Savings	5.5	5.8	3.0	4.8
Average Credit	$1.42	$1.42	$0.95	$0.78
Savings Percent	27%	27%	18%	23%
Credit per kWh savings	$0.26	$0.25	$0.32	$0.28

Even so, the cost effectiveness of the pilot concept was relatively low at current technology costs. The cost effectiveness of the pilot program is shown in Table 7. 32.

Table 7. 32: Cost-Effectiveness

	Benefit/Cost	
	3 Year Program	10 Year Program
Utility Test	0.45	1.05
TRC Test	**0.48**	**1.28**
RIM Test	0.35	0.66
RIM (Net Fuel)	0.39	0.82
Societal Test	0.48	1.28
Participant Test	-	-

The field of residential energy management technologies is experiencing fast growth and increasing competition. There are numerous companies developing new technology and increasing their initial offerings at levels similar to the Tendril technology. The market has advanced significantly since Tendril was selected in early 2009, and it is likely to continue to advance over the next several years.

Ameren Missouri will continue to monitor the energy management technology industry to identify cost-effective solutions as they enter the market. Conversely, Ameren Missouri has developed a positive working relationship with Tendril, and Tendril is developing and refining its offerings based on Ameren Missouri's interests and needs, including using information from the pilot participant survey conducted for this evaluation.

7.6.5.3 Potential Pilot

A trend emerging in investor owned utility (IOU) sponsored energy efficiency portfolios is to address customer energy consumption behavior by providing relatively detailed

feedback to customers on how they consume energy – either electricity, natural gas or both. A company on the leading edge of providing home energy reports with the intent of changing customer energy consumption behavior is OPower, Inc. The premise underlying OPower's Home Energy Reports is to mail to targeted residential customers on an average bi-monthly frequency (6 reports every 12 months). Ameren Missouri would provide energy and program participation data on an ongoing basis and combine the customer data with third party data to build comprehensive profiles of each participating customer. In addition to the Home Energy Reports, a customer service interface gives customer service representatives online access to the full history of the Home Energy Reports delivered to customers. Lastly, the OPower developed Energy Insider customer-facing website provides customers online access their Home Energy Report, online benchmarking and audit-like functionality ("best tips for me" and "neighbor challenge"), and access to additional energy efficiency information beyond that presented on the mailed report.

Early evaluation, measurement and verification reports from IOUs across the nation that have been early adopters of the OPower report claim annual energy savings of 1-2%. The magnitude of the savings appears to be a function of both the frequency and number of home energy reports that customers receive annually. Persistence of the energy savings once the home energy reports stop is still being researched. Data collected to-date appears to indicate the persistence of this behavior modification program to be limited to one-year.

Ameren Missouri's affiliate electric distribution company, Ameren Illinois, plans to implement a pilot program with OPower beginning in 2011. Ameren Missouri will monitor the results from the pilot and evaluate whether to propose a similar pilot in the Ameren Missouri service territory.

7.6.6 DSM in Ameren Missouri's Facilities

As part of the EPRI End-to-End Efficiency study, Ameren Missouri conducted an effort to assess the potential and cost-effectiveness of energy efficiency opportunities at its own facilities and infrastructure that spanned the following utility sectors:

- Generation
- Transmission
- Distribution
- Facilities

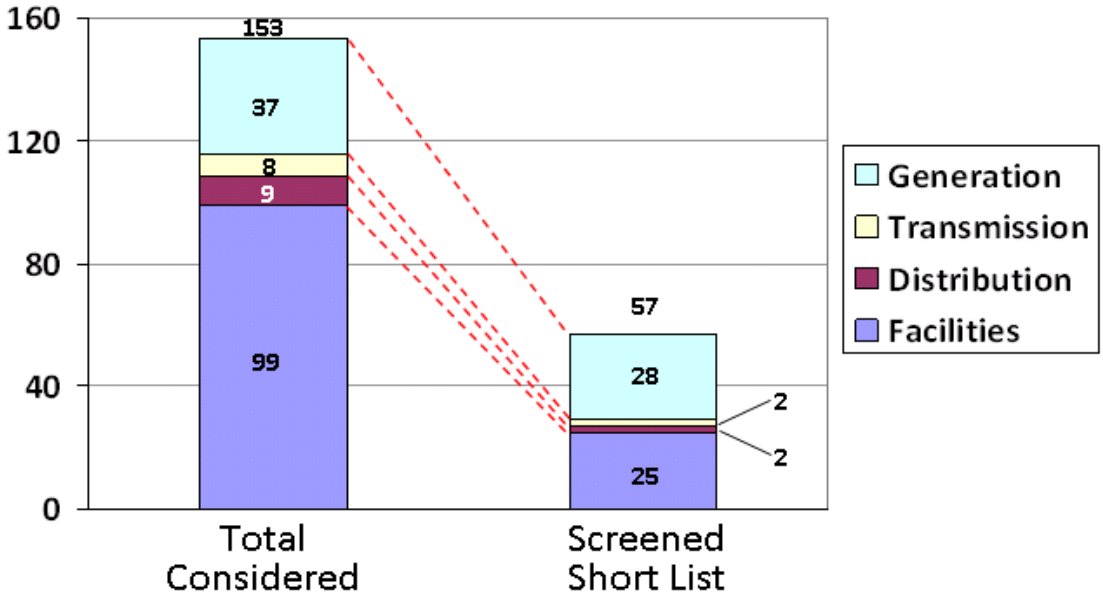
7.6.6.1 Methodology

Subgroups that were formed for each sector ultimately identified 153 types of energy efficiency projects. A qualitative screening of the projects was performed to remove projects that did not meet the following conditions:

- Technical fit with system/infrastructure
- Not previously considered and dismissed
- Not currently or previously implemented
- Sufficient project-specific data, or proxy data, available to develop a quantitative analysis

The qualitative screen reduced the number of projects from 153 to 57, as illustrated below in Figure 7. 28.

Figure 7. 28: Number of Measures Considered and Screened



The findings and opportunities for generation, transmission, and distribution were passed along to the relevant planning functions within Ameren Missouri. This write up will summarize the efficiency opportunities associated with Ameren's own facilities. Table 7. 33 describes the major types of facilities and their associated aggregate square footage areas.

Table 7. 33: Summary of Ameren Missouri Facilities

Type of Facility	Number	Sq. Ft.
Headquarters GOB	1	700,000
Works Headquarters	35	355,900
Substations: Control Houses [1]	152	228,000
Stores, Pole Yards, Shops [2]	2	160,000
Substations: Switchgears [3],[4]	304	150,000
Office Buildings	5	133,000
Training/Service Center	5	132,000
Truck Shelter	8	98,300
Garage	7	86,500
Warehouse	4	56,000

Table 7. 34 below lists the 25 types of Facility-specific energy efficiency projects that passed the qualitative screening, by sector:

Table 7. 34: Short List Energy Efficiency Projects Screened for Assessment

FACILITIES END-USE (25)	
GOB Interior Lighting (9)	**Other (16)**
• Delamping and reducing operating hours (2) • Conversion from T12 linear fluorescents to T8s, T5s, or parabolics, and reduced operating hours (4) • Conversion of T12 undercabinet task lights with LEDs equipped with occupancy sensors • Occupancy sensors in conference rooms • HVAC load reduction due to interior lighting upgrades	• GOB exterior lighting: replace existing metal halides with pulse start metal halides • Interior fluorescent lighting upgrades at works headquarters and truck shelters (3) • HVAC retrofits (9) • Remove electronically controlled steam humidifiers at GOB • Automated sleep mode for PCs • Space heating controls for substations

GOB = Ameren Missouri General Office Building headquarters in St. Louis

Accounting guidelines were developed to treat energy savings and cost efficiency programs consistently across the four utility sectors. These guidelines consisted of:

- Exclusion of projects that have already been initiated

- Project costs consisted of the incremental capital and O&M costs associated with the energy efficient project vs. the baseline project
- Exclusion of value of "saved energy" due to potential to resell the energy
- Energy savings were adjusted to the same level relative to the bus-bar
- Selection of projects whose projects are estimable (ex ante) and verifiable (ex post).

Profiles were developed for the screened project types, which included the following information:

- Description
- State of the technology
  - Maturity/development stage
  - Extent of Ameren Missouri deployment
  - Reliability
- Benefits
- Challenges and limitations (e.g. uncertainty, risk)
- Implementation considerations (e.g. scope, scale, complexity)
- Energy savings potential
- Peak load reduction
- Capital Cost (incremental cost over baseline)
- Operating Cost
- Economic Life
- Levelized cost (over useful life)

The economic screening and evaluation metric that was applied when assessing the projects was the levelized cost of electricity, expressed as an annualized cost per MWh saved, using the basic formula represented in Figure 7. 29.

Figure 7. 29: Evaluation Metric

$$\text{Levelized Cost} = \frac{(\text{Capital Cost} \times \text{LFCR}^{1}) + \text{Incremental Annual O\&M}}{\text{Annualized Electricity Savings}}$$

7.6.6.2 Results

The results of the analysis indicate that the Ameren Missouri Facilities cumulative annual energy savings potential of all 25 screened efficiency projects is approximately 17,828 MWh. As shown in Table 7. 35, about 14,905 MWh, or 84% of the total savings potential, attainable at a levelized cost of less than $50 per MWh.

Table 7. 35: Ameren Missouri Facilities Annual Savings Potential by Levelized Cost Tier

Levelized Cost Tier	Aggregate Potential (MWh)	Percent of Total Facilities Potential
Less than $50 / MWh	14,905	84%
$50 – 200 / MWh	2,165	12%
$200 – 500 / MWh	638	4%
Greater than $500 / MWh	120	1%
Total	17,828	100%

The six facilities efficiency projects with a levelized cost less than $50 per MWh are illustrated in the supply curve of Figure 7. 30. The projects are ordered from left to right in ascending order of levelized cost. Each project is displayed as a rectangle, with its width denoting its annualized energy savings potential (MWh) and its height denoting its levelized cost.

Figure 7. 30: Supply Curve of Facilities Energy Efficiency Projects less than $50 per MWh

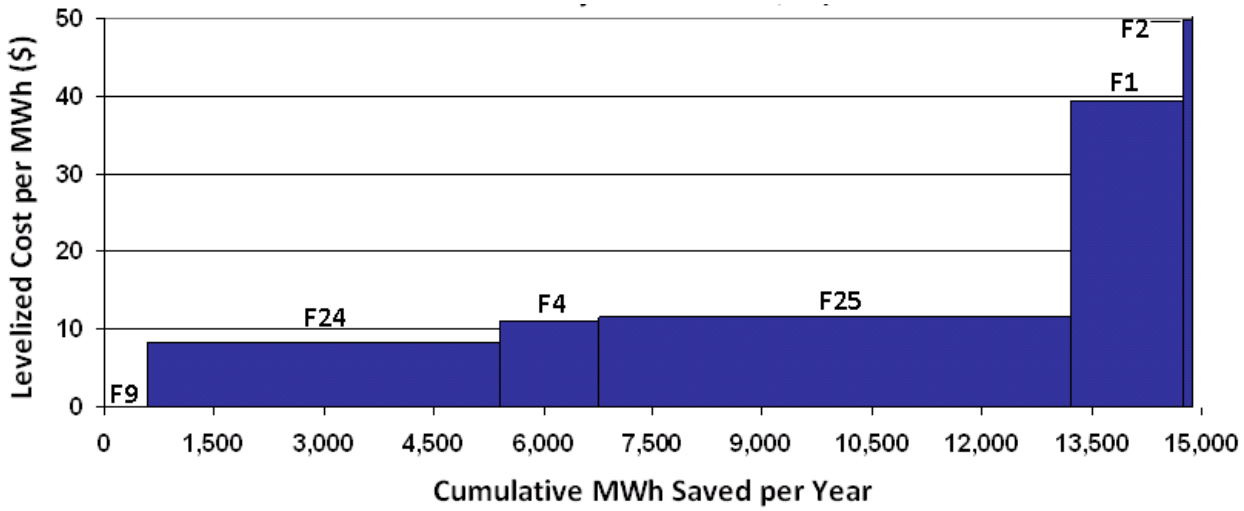


Table 7. 36 summarizes the projects with levelized costs less than $50 per MWh. It is clear that the greatest potential for cost-effective savings lies in Substation Heater Controls and utilization of PC Sleep Mode, which represents nearly 76% of the total savings available from facilities projects at a cost less than $50 per MWh. Table 7.37 shows the complete list of Ameren Missouri Facilities energy savings potentials and costs by project, ordered from lowest to highest levelized cost.

Table 7. 36: Facilities Efficiency Projects with Levelized Cost under $50 per MWh

Project Code	Description	MWh Savings	Levelized Cost ($/MWh)	Levelized Cost Rank
F9	GOB: HVAC load reduction for all proposed lighting projects**	554	-	1
F24	PC Sleep Mode	4,814	8.3	2
F4	GOB: Replace 2x4 T12s in west bldg. with 2x4 parabolics removed from east and south bldgs. Reduce op. hours.*	1,387	10.9	3
F25	Substation Heater Controls	6,474	11.6	4
F1	GOB: Delamp 2,210 2x4 parabolic T8 fixtures (6'x8' to 8'x10' spacing). Reduce op. hours.*	1,538	39.2	5
F2	GOB: Delamp 300 2x2 parabolic, U-tube 31W light fixtures (6'x8' to 8'x10' spacing). Reduce op. hours.*	138	49.5	6
	TOTAL	**14,905**		

* Total does not equal stated sum due to rounding

Table 7. 37: Summary of all Assessed Energy Efficiency Options

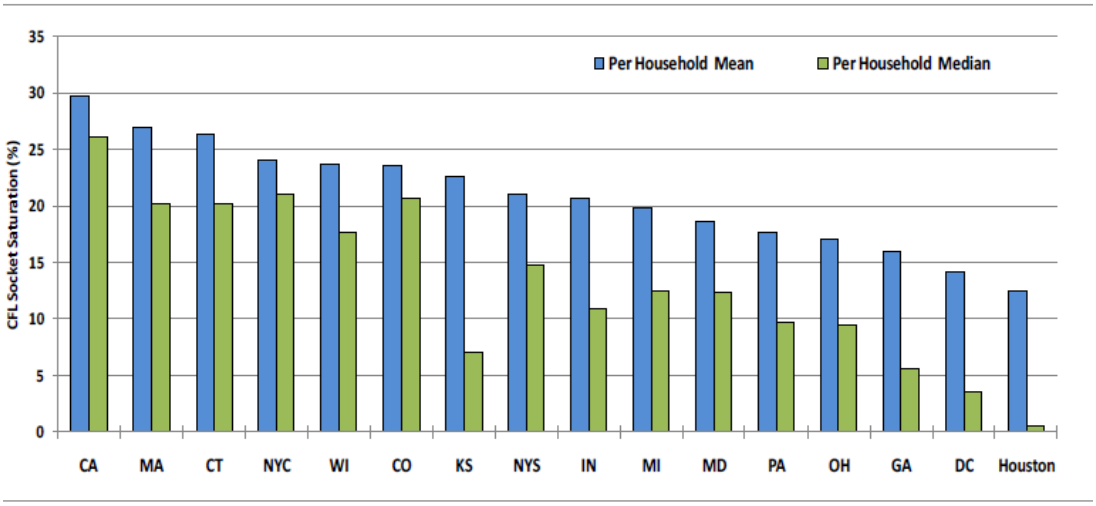
Sector	Project / Project Type	Savings Potential (MWh)	Levelized Cost ($/MWh)
Facilities	GOB: HVAC load reduction due to interior lighting upgrade	554	0.0
Facilities	PC Sleep Mode	4,814	8.3
Facilities	GOB: Replace 2x4 T12s in west building with 2x4 parabolics	1,387	10.9
Facilities	Substation Heater Controls	6,474	11.6
Facilities	GOB: Delamp 2,210 2x4 parabolic T8 lights; reduce operating hours	1,538	39.2
Facilities	HQ: Delamp 300 2x2 parabolic U-tube 31W lights; reduce night op. hours	138	49.5
Facilities	GOB: T12 --> T5 replacement in west bldg; reduce night op. hours	78	74.5
Facilities	Interior Lighting: T12 to T8 replacement at Works HQs & Truck Shelters	195	80.6
Facilities	AC Retrofit: SEER 13 to SEER 14	65	86.7
Facilities	HP Retrofit: COP 2.8 to COP 3.0	25	89.6
Facilities	GOB: Replace T12 lights in records center with T8s; reduce night op.	63	102.6
Facilities	HP Retrofit: COP 2.8 to COP 3.6	109	106.3
Facilities	Interior Lighting: T12 to T5 replacement at Works HQs & Truck Shelters	292	109.4
Facilities	HP Retrofit: COP 2.8 to COP 3.2	56	123.7
Facilities	AC Retrofit: SEER 13 to SEER 15	89	130.9
Facilities	HQ: Replace quad, 175W metal halides pulse start metal halides	295	135.4
Facilities	HQ: Remove all electronically controlled steam humidifiers.	788	160.8
Facilities	AC Retrofit: SEER 13 to SEER 16	110	161.8
Facilities	AC Retrofit: SEER 13 to SEER 18	143	210.0
Facilities	GOB: Occupancy sensors in conf. rooms; reduce 4 hrs daily operation	63	277.7
Facilities	HQ: Replace 2x2 T12s in west bldg with parabolics; reduce night op.	6	291.6
Facilities	AC Retrofit: SEER 13 to VRF	235	326.0
Facilities	Interior Lighting: T8 to T5 replacement at Works HQs and Truck Shelters	41	329.9
Facilities	AC Retrofit: SEER 13 to SEER 20	150	337.4
Facilities	HQ: Replace undercabinet T12 task lights with LEDs; occupancy sensors	120	1,084.5

7.6.7 EISA's Impact

The Energy Independence and Security Act of 2007 (EISA) requires 28% greater efficiency for incandescent light bulbs, phased in from 2012 through 2014. EISA requires roughly 20% percent greater efficiency for light bulbs, or similar energy savings, by 2020. Some argue that this effectively eliminates the sale of most current incandescent light bulbs and creates a transformed market. But, many leading organizations and reports contend that there is still ample opportunity for utilities to glean energy savings by incentivizing CFLs.

The following graph highlights several different states and their CFL socket saturation. As can be inferred, the majority of the mean saturation levels are below 30%, even for very mature markets such as California, Wisconsin, and Massachusetts. These statistics indicate a clear opportunity to continue promotion of CFLs. Furthermore, a majority of the US light bulb market share (46%) belongs to 60 watt bulbs, which will not be phased out until 2014. These bulbs are the last to be phased out, indicating an extended opportunity for 60 watt equivalent CFL replacements.[89]

Figure 7. 31: CFL Socket Saturation



CFL socket saturations are as high as 20-30% in some parts of the country, depending on how we measure it.

Source: NMR Group Inc, "Final CFL Modeling Report" (2010)

Ameren Missouri conducted its own survey to assess the market saturation levels of various lighting technologies within the residential market. The results in Table 7. 38

[89] Bickel, Stephen. D&R International.
neep.org/uploads/.../2010%20**Present**ations/NEEP%20Lighting_Swope.pdf

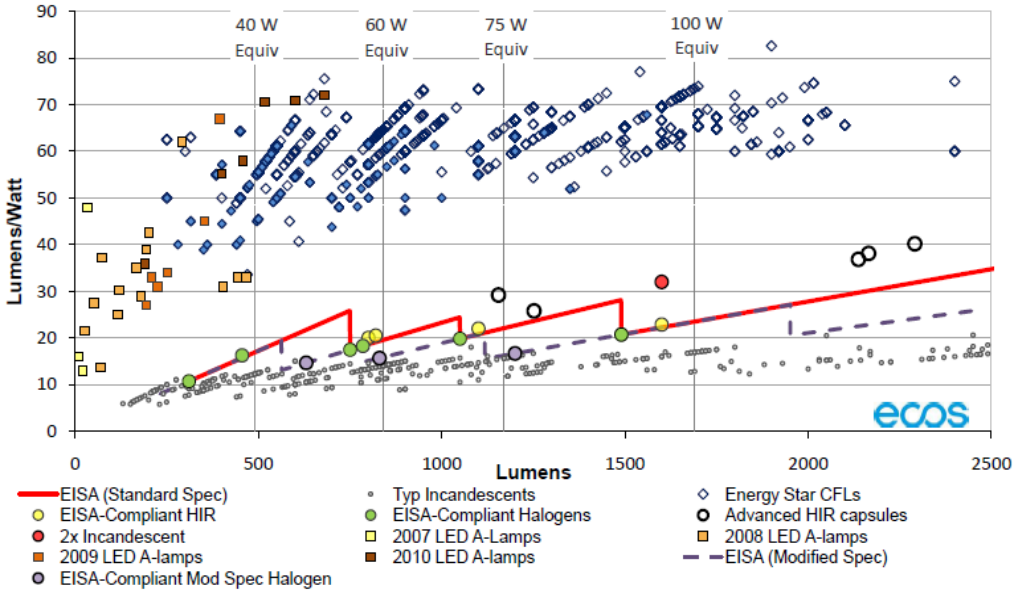
appear to link closely to the results from the national study above. CFLs only account for 21% of bulbs installed within residences in the Ameren Missouri service territory.

Table 7. 38: Type of Interior Lighting Bulbs by Type

Segment	Total Number of Light Bulbs	Percent Conventional/ Incandescent	Percent CFL	Percent Tubular fluorescent	Percent Low voltage	Percent Halogen	Percent Other
Single-family	42	59%	21%	9%	3%	6%	2%
Multi-family	24	61%	18%	8%	4%	8%	1%

Several manufacturers are offering products that are compliant with the EISA legislative mandates and mimic the light quality and functionality of incandescent bulbs. Currently, a majority of these bulbs utilize halogen technology. However, in the future, there will be new halogen infrared reflective ("HIR") coated bulbs that will fill the gap between EISA standards and CFLs. It is reasonable to assume that EISA compliant bulbs will become the new lighting baseline. Currently, these new halogen bulbs are predicted to enter the market at competitive prices with CFLs, and as the manufacturing begins to refine itself, prices will likely drop equal to or below CFL prices. The customer will have multiple lighting options, of which, CFLs will likely remain the most cost-effective energy efficient solution. While LEDs have significant potential to transform the residential lighting landscape, it will take time for the manufacturing processes to refine themselves enough to lower the cost to market acceptable rates.

Figure 7. 32: EISA Implications



Ameren Missouri's service territory has only recently been subjected to full-scale utility efficiency programs, so the market is still in the early stages of being transformed. For this reason, Ameren Missouri continues to promote CFLs in the plan, with the bulbs decreasing annually to appropriately reflect with corresponding EISA phase-out provisions. Cycle 1 increased CFL sales to the level of 3 million bulbs resulting in 35% of the total portfolio savings. Cycle 2 decreases CFL sales to 2,000,000, then 1,500,000, and finally 1,000,000 in PY6, resulting in a Lighting Program that delivers 19% in PY4, down to 14% in PY6, of total portfolio savings. Furthermore, two levels of savings for CFLs were incorporated into the modeling process, one savings level being Pre-EISA (witnessing full savings as identified in current markets) and another Post-EISA bulb (where savings are relative to EISA standards as the baseline), implemented according to the EISA schedule. By incorporating these reductions into the portfolio, Ameren Missouri reflects a reasonable estimate of the achievable energy savings related to CFLs.

7.6.7.1 Impact of Legislation on Business Lighting

EPACT 2005 influences T12 bulbs by increasing the efficiency requirements of the ballast used to drive the lighting fixture. Conventional ballasts used electro-magnetic technology to emit light. However, with the new standard set by EPACT, these magnetic ballasts no longer comply with the minimum efficiency standards, and therefore, new ballasts must be all electronic. These rules took effect July 1, 2010.[90]

T12's generally operate on magnetic ballasts, but, these lights can also operate on electronic ballasts. New, compliant electronic ballasts exist for T12 lamps and are available at most lighting retailers/distributors.

The second major piece of legislation affecting T12's is the 2009 DOE Rulemaking, which has new efficiency requirements that will begin to cause a phase-out of many general service fluorescent lamps including T12 and some less efficient T8 lamps beginning July 2012. Specifically, the lamps affected by this ruling include:

- Majority of 4ft T12 and 2ft T12 (both 34 W and 40 W ES)
- 700 series T8 4ft and 2ft U-lamps
- All 96T12 75 W & many F96T12/ES 60 W except 800/SPX
- 700 series F96T8HO
- Exemptions
    - Specialty high CRI lamps
    - 96T12 HO Cold Temperature Lamps

[90] EO-2007-0409 – Stipulation and Agreement #24

While these two pieces of legislation clearly impact T12's moving forward, data from the Ameren Missouri potential study suggests there is a large saturation of T12 bulbs in the Company's service territory. Table 7. 39 identifies different fluorescent lighting options in the different building types within the Ameren Missouri service territory. A large percentage of building types have an overwhelming amount of T12's compared to the other lighting technologies, most notably educational facilities, health, and grocery stores. In order to encourage business customers to upgrade lighting and become more efficient users of electricity, incentivizing T12 replacements for early replacement continues to be a valid program offering.

Table 7. 39: Lamps per 1,000 sq. ft. – Indoor Fluorescent Tubes

Segment	T5	T8	T12
Office	4.4	1.6	10.3
Restaurant	4.8	3.4	9.0
Retail	0.9	3.9	6.9
Grocery	0.5	1.0	10.4
Warehouse	0.7	1.8	3.0
Education	0.7	2.2	14.1
Health	2.9	3.2	14.5
Lodging	2.0	0.1	1.2
Public Assembly	1.4	3.4	2.2
Miscellaneous	3.7	2.4	3.8
Multi-family	0.1	0.1	0.9
Industrial	2.9	1.4	4.5

While there are clear opportunities to garner energy savings from incentivizing replacement of T12s, this assumption must be monitored in the field by the business implementation team as the above mentioned laws start to become enacted. It is likely the implementation team will move towards a T8 baseline given the legislative phase-outs that will occur. Dependence on energy savings gleaned from lighting will continue to decrease as the timeline of the DSM portfolio stretches and the business portfolio shifts towards other measures in heating and cooling, control systems, and motors.

7.7 Risk & Uncertainty Analysis

To analyze risk and uncertainty surrounding the Ameren Missouri DSM portfolios, we considered the following categories for both energy efficiency and demand response programs:[91][92]

- **Performance Risk** - The risk that, due to designer implementation flaws or unexpected operational factors, the program does not deliver energy savings as expected. The impact may be an over or underachievement.
- **Technology Risk / New Advances** - This risk is concentrated in programs that target emerging technologies; systems that are aggregates of specific technologies, and/or systems in which energy use is strongly influenced by technological or equipment factors. The impact may be an over or underachievement.
- **Market Risk / Customer Acceptance** - The risk that, because of poor customer uptake, a poor economic climate, or the availability of better investments, customer participation is lower than expected. Much less likely, all the above effects could be reversed, resulting in higher than expected participation. The impact may be an over or underachievement.
- **Evaluation Risk** - The risk that independent EM&V will, based on different assumptions, conclude that energy savings differ from what the implementers have estimated. The impact may be an over or underachievement.
- **Codes & Standards** - This risk considers the possibility of more stringent regulations, codes, and standards that would institutionalize energy savings opportunities, thereby removing them from the purview of utility DSM programs. The performance impact can only result in utility program underachievement. For the purposes of resource planning, however, codes and standards are assumed to have no effect, as any impact on utility programs will be offset and balanced by effects in the baseline forecast. Either way, the load will be removed from the forecast.
- **Business Customer Opt-Out** - The Missouri Energy Efficiency Investment Act has provisions that would allow eligible large business customers to opt out of DSM. An assumption is embedded in the base planning case that 20% of

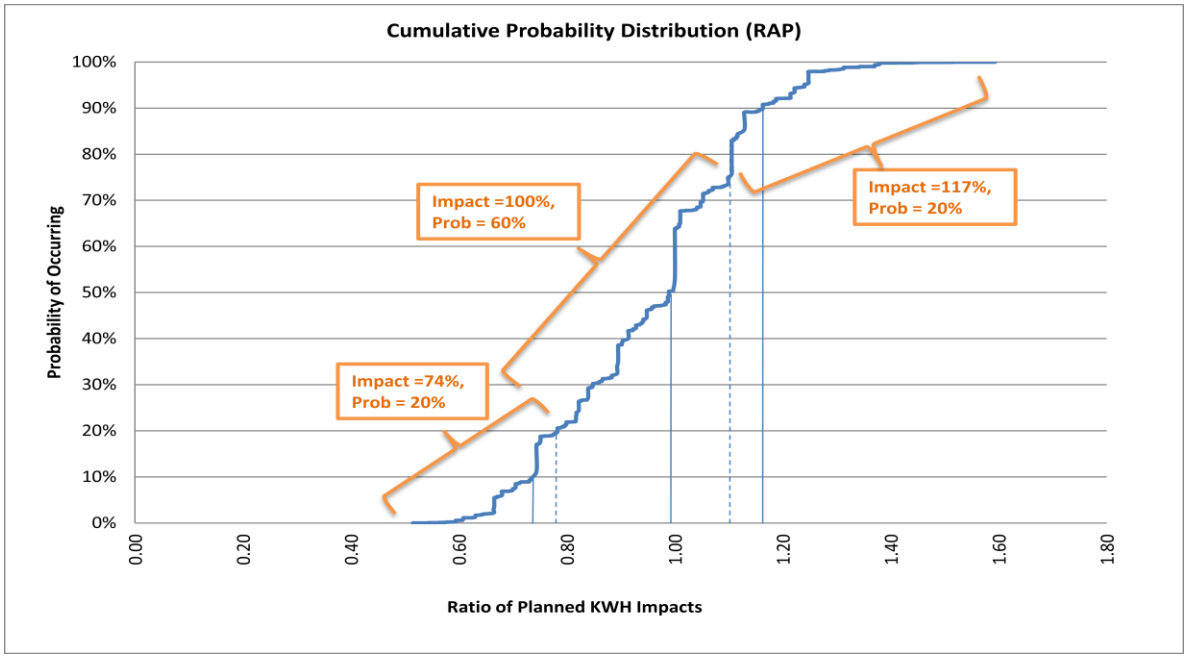
[91] It is important to note that a primary consideration in Ameren Missouri's risk and uncertainty discussion is the regulatory risk associated with fixed cost recovery. This concern is not handled within the portfolio analysis as described in this section, but rather between separate portfolios. In other words, to account for the dramatic changes associated with the different potential outcomes of this issue, entirely different portfolios are employed. As discussed in the introduction to this Demand Side Resources chapter, if existing cost recovery frameworks continue, the Low Risk DSM portfolio is the only potential portfolio that Ameren Missouri would be able to support. However, if an appropriate cost recovery mechanism is developed, Ameren Missouri would be able to support the RAP portfolio.

[92] 4 CSR 240-22.070(02)(K-L), 4 CSR 240-22.070(11)(A)2

Ameren Missouri C&I customers will opt out, removing their DSM potential from the available pool. This risk considers the possibility that the percentage of C&I customers opting out will vary from a low of 5% to a high of 35%. The impact may be an over or underachievement.

Variability in energy impacts due to the above factors was considered in fine detail by consulting a Delphi Panel of Ameren DSM experts. The Delphi Panel judged the level of variation that each of the above risks and uncertainties might have on each DSM program, as well as the probability that those variations would occur. All the responses from the panel for each program were aggregated and assembled into the joint probability distribution shown below in Figure 7. 33. This illustrates the possible combinations of factors and their impact on portfolio performance.

Figure 7. 33: Cumulative Probability Distribution of DSM Risk & Uncertainty Factors – RAP Portfolio

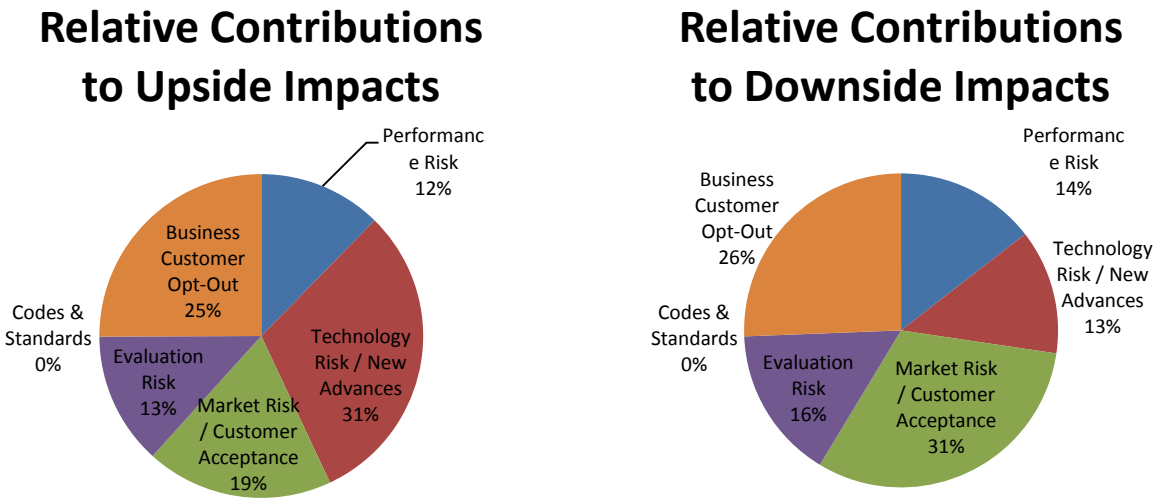


To align with the definitions utilized in the wider risk and uncertainty analysis effort, three levels of impact were discretized from the above distribution: a Base case consisting of the midpoint of the central 60% of probable impacts, a High case consisting of the midpoint of the highest 20% of probable impacts, and a Low case consisting of the midpoint of the lowest 20% of probable impacts. These three discrete points thus represented the smooth continuum of possibilities in the wider analysis.

Full detail of the program-by-program risk analysis is available in the Electronic Work Papers folder “Portfolio Screens”.

Figure 7. 34 below shows the relative contributions of the various factors to the potential upside and downside.

Figure 7. 34: Relative Contributions to Risk & Uncertainty Variations



The variability of portfolio budgets was considered holistically and at a high level, with fewer granularities than the energy impacts. Once budgets have been set in a plan, they are generally less volatile than kWh impacts. Resultantly, a simple assumption of +/-10% was made for the High case and Low case deviations from the Base budget assumption.

Table 7. 40 presents the final table of values produced by the Risk & Uncertainty analysis. Due to the intrinsically uncertain nature of DSM and the learning curve required for the relatively inexperienced regional markets, there is a significantly higher chance that planned DSM impacts will underachieve rather than overachieve.

Table 7. 40: Summary of Risk & Uncertainty Effects

	EE Impacts	DR Impacts	Budgets	
MAP	Variation as % of Plan	Variation as % of Plan	Variation as % of Plan	Probability of that Deviation
	69%	71%	90%	20%
	96%	100%	100%	60%
	113%	110%	110%	20%
RAP	Variation as % of Plan	Variation as % of Plan	Variation as % of Plan	Probability of that Deviation
	74%	76%	90%	20%
	99%	100%	100%	60%
	115%	110%	110%	20%
Low Risk	Variation as % of Plan	Variation as % of Plan	Variation as % of Plan	Probability of that Deviation
	73%	93%	90%	20%
	100%	100%	100%	60%
	112%	105%	110%	20%

7.8 DSM Portfolios Considered

7.8.1 Portfolio Descriptions

Ameren Missouri examined a number of possible DSM portfolios within alternative resource plans in the integration process. The full list of DSM portfolios considered is given below, along with a brief description of portfolio features. Further details surrounding individual program metrics within each portfolio are available in the Electronic Work Papers in the "Portfolio Screens" folder.

Low Risk Portfolio

This portfolio represents a level of DSM programs (both EE and DR) that minimize the exposure to risk and uncertainty that Ameren Missouri will be exposed to in the implementation of a DSM portfolio. The programming strategy reduces Cycle 1 levels of program spending and savings to a level commensurate with the Company's growing concerns with the current DSM regulatory framework, especially lost revenues. Then only slightly escalates these levels over time. EE programs are expansions and

evolutions of the best practice programs that Ameren Missouri currently has in the field. DR programs are best practice, direct load control programs.

Capacity Calibrated Portfolio

This portfolio represents a level of DSM programs (both EE and DR) that is tuned specifically to offset the need for additional capacity in Ameren Missouri's future supply outlook. EE programs are expansions and evolutions of the best practice programs that Ameren Missouri currently has in the field. DR programs are direct load control and pricing programs, identical to those represented in the RAP portfolio.

RAP Portfolio

The realistic achievable potential (RAP) portfolio represents a level of DSM programs based on the RAP savings that were identified within the Ameren Missouri Potential Study and updated with the latest information and assumptions from the IRP process. RAP represents estimates of Energy Efficiency and Demand Response potential based on realistic program implementation assumptions, such as: industry-standard incentive levels, customer acceptance barriers, etc. RAP corresponds to best practices, proven delivery methods, and known program experience from around the country. EE programs are expansions and evolutions of the best practice programs that Ameren Missouri currently has in the field, as well as additional programs to form a more comprehensive and innovative path forward. DR programs are both direct load control and pricing programs.

MAP Portfolio

This portfolio represents a level of DSM programs that matches the maximum achievable potential savings that were identified within the Ameren Missouri Potential Study and updated with the latest information and assumptions from the IRP process. MAP represents estimates of Energy Efficiency and Demand Response potential based on the most optimistic program implementation assumptions, such as: boosted utility budgets, high customer acceptance, cutting edge delivery methods, etc. EE programs are an enhanced mix of the programs that Ameren Missouri currently has in the field and new programs that form a more comprehensive and innovative path forward. DR programs are enhanced deliveries of both direct load control and pricing programs.

One Percent Per Year by 2015 Portfolio

This very aggressive portfolio is designed to achieve 1% incremental energy savings every year after 2015. Since this portfolio is sufficiently close to the MAP portfolio no new work needed to be performed and MAP will represent this portfolio.[93]

[93] ER-2010-0036 – Stipulation and Agreement #12a

Two Percent Per Year by 2020 Portfolio

This extremely aggressive portfolio, designed to achieve 2% incremental energy savings every year after 2020. Midway through the planning horizon, this portfolio's savings exceed economic potential as identified by the Ameren Missouri DSM Potential Study, and continue to grow. Consequently, the energy savings in this portfolio is not possible. See definition below which describes the economic potential as a theoretical limit (from Proposal to Missouri Statewide Energy Efficiency Study, Appendix A, Page 7-11, submitted by KEMA):

> "Economic potential, like technical potential, is a theoretical quantity that will exceed the amount of potential we estimate to be achievable through current or more aggressive program activities."

In order to achieve these unprecedented savings levels, several market factors must align. The market factors include, but are not limited to,

- Utility programs would require 100% participation from each customer within its service territory,
- Large incentives, likely paying up to 100% of the full measure cost, with a large amount of "give-away" measures,
- Significant increases in administrative costs to build up the marketing and implementation departments.

The EE programs modeled are an enhanced mix of the programs that Ameren Missouri currently has in the field and new programs that form a more comprehensive and innovative path forward. DR programs are enhanced deliveries of both direct load control and pricing programs, identical to those represented in the MAP portfolio.[94]

7.8.2 Portfolio Impacts and Costs

Each of the Portfolios that were developed achieves various levels of savings (energy and demand) in each year of the planning horizon at projected annual costs. Below are plots illustrating the costs and savings of the various portfolios.

[94] ER-2010-0036 – Stipulation and Agreement #12a

Figure 7. 35: Portfolio Energy Efficiency Spending

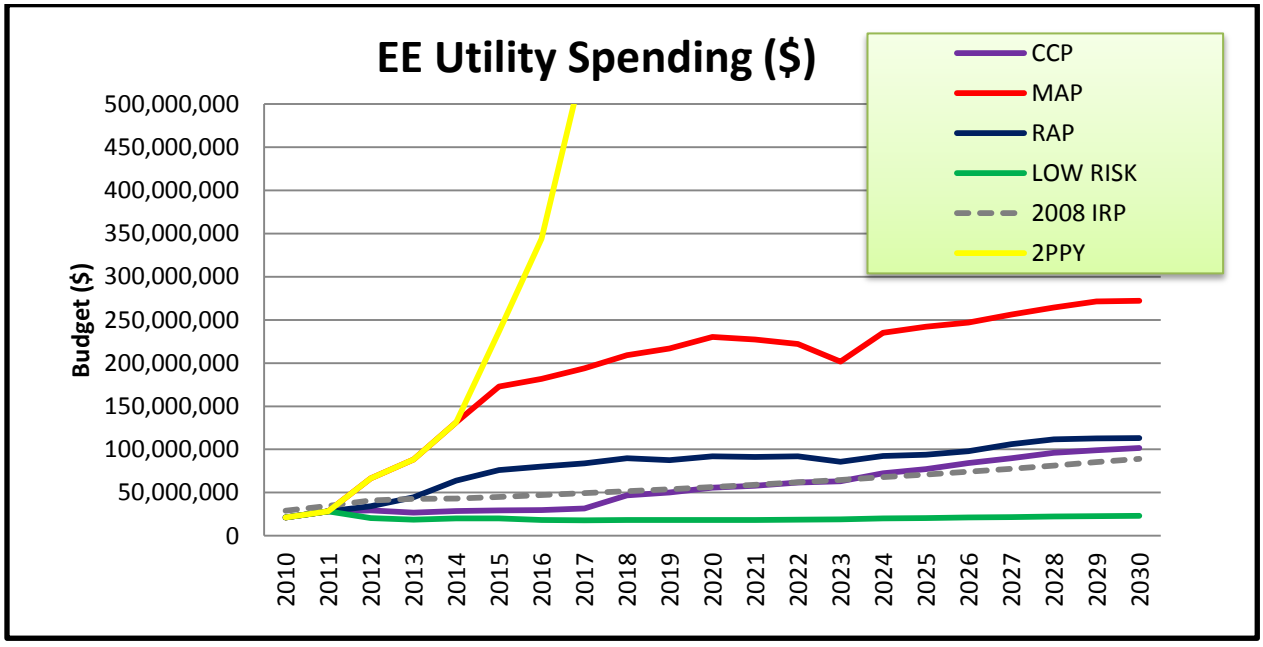


Figure 7. 36 shows the projected annual budget for each of the Demand Response portfolios that were developed. Note that the CCP portfolio uses the RAP demand response portfolio, and the Low Risk demand response portfolio is comprised of only the direct load control programs from the RAP portfolio. Also note that the 2% per year (2PPY) portfolio uses the MAP demand response portfolio.

Figure 7. 36: Portfolio Demand Response Spending

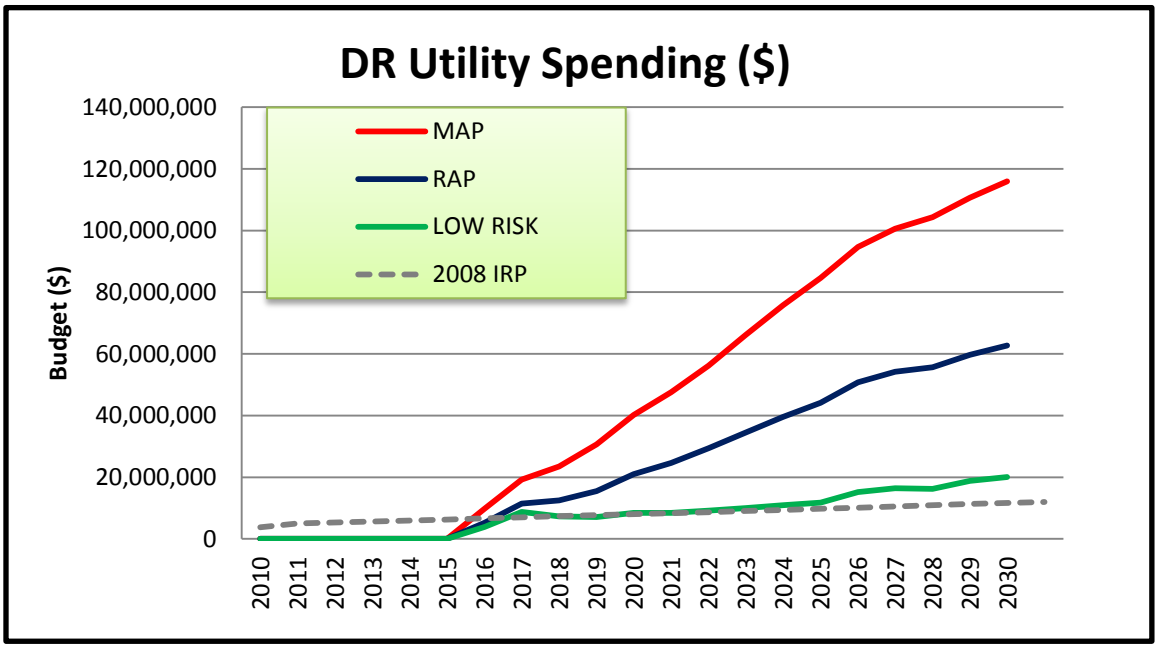


Figure 7. 37 shows the projected annual cumulative energy savings (annual energy savings realized by new measures as well as annual energy savings from existing measures that are still actively saving energy) for each of the Energy Efficiency portfolios that were developed:

Figure 7. 37: Cumulative Energy Efficiency Savings

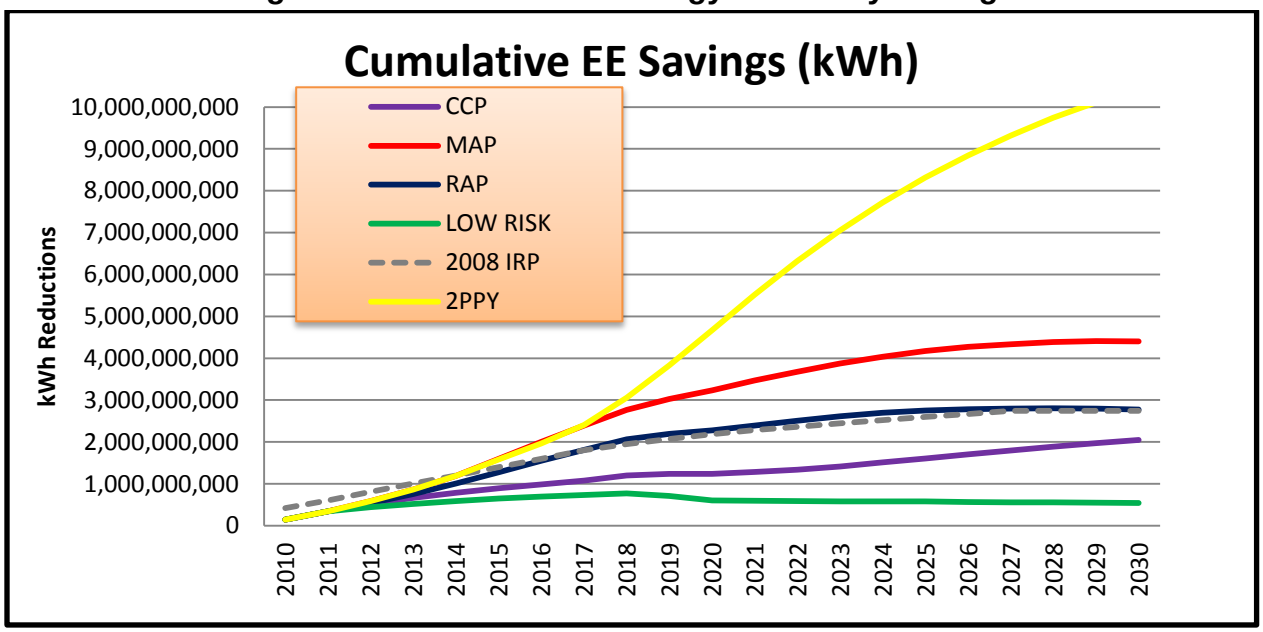


Figure 7. 38 shows the projected annual cumulative demand savings (annual demand savings being realized by new measures as well as annual demand savings from existing measures that are still active) for each of the Energy Efficiency portfolios that were developed:

Figure 7. 38: Cumulative Energy Efficiency Peak Load Reductions

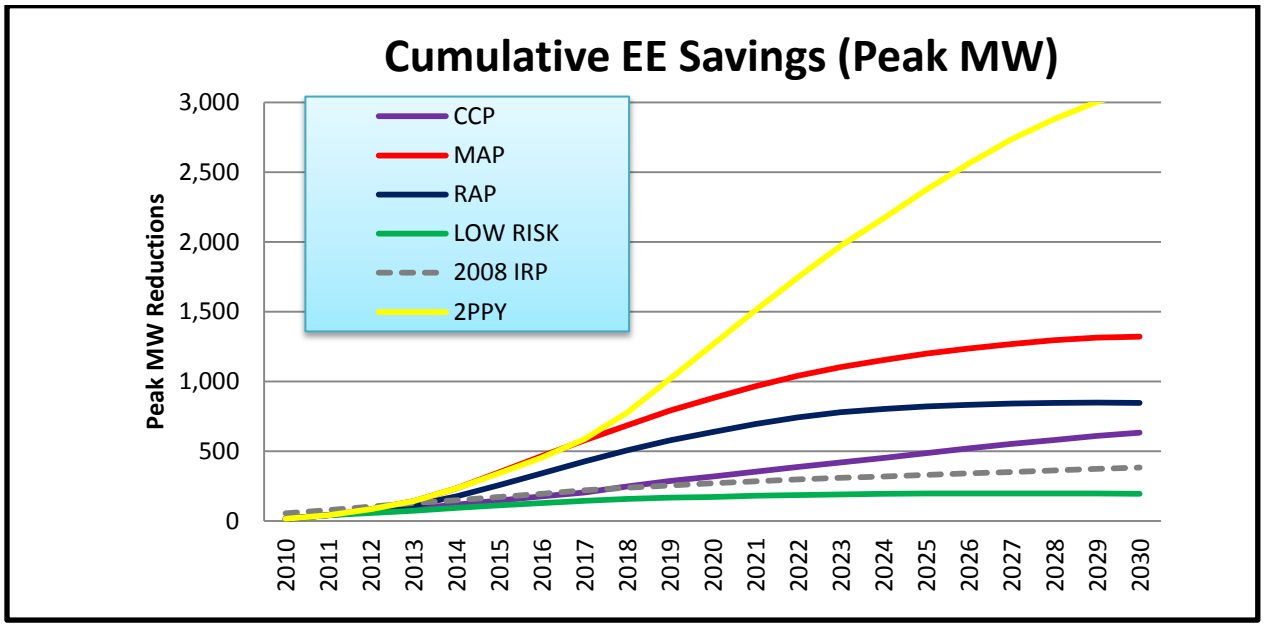


Figure 7. 39 shows the projected annual cumulative demand savings for each of the Demand Response portfolios that were developed:

Figure 7. 39: Cumulative Demand Response Peak Load Reductions

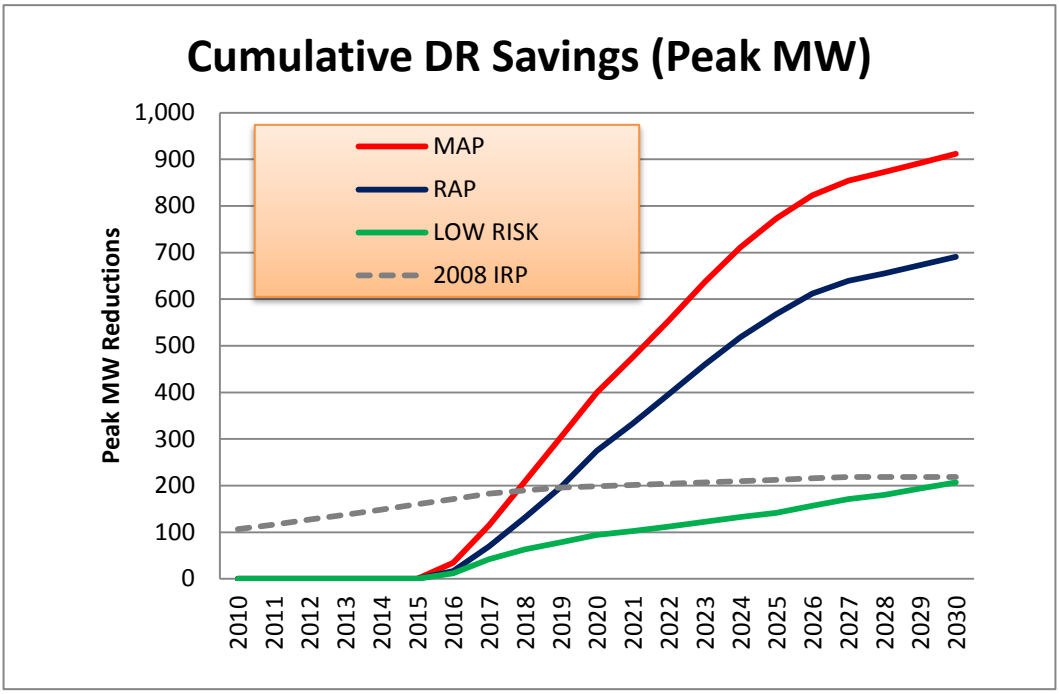


Table 7. 41 summarizes the cost-effectiveness of each portfolio. Further details can be found in the work papers in the folder entitled "Portfolio Screens". The cost-effectiveness tests below do not incorporate any demand response and are specific to energy efficiency only.

Table 7. 41: Portfolio Cost-Effectiveness Tests

Cost-Effectiveness Test Results						
Portfolio	**Utility Test**	**TRC Test**	**RIM Test**	**RIM (Net Fuel)**	**Societal Test**	**Participant Test**
Low Risk Portfolio	2.96	1.75	0.78	1.19	1.75	2.80
Capacity Calibrated Portfolio	3.50	1.67	0.84	1.31	1.67	2.27
Realistic Achievable Portfolio	3.32	1.59	0.82	1.26	1.59	2.22
Maximum Achievable Portfolio	2.25	1.31	0.73	1.05	1.31	2.07
2% Per Year Portfolio	0.48	0.51	0.34	0.39	0.51	2.73

The following tables summarize each portfolio's program level cost-effectiveness tests.

Table 7. 42: Low Risk Cost-Effectiveness Tests

Low Risk	TRC	UCT	PCT	RIM
RES-Lighting	1.99	4.66	3.29	0.70
RES-HVAC	1.42	3.19	1.85	0.83
RES-Appliance Recycling	1.31	1.31	-	0.51
RES-Low Income	0.65	0.65	2.25	0.39
RES-TOTAL	**1.43**	**2.47**	**2.53**	**0.68**
BUS-Standard	2.10	3.34	2.93	0.94
BUS-Custom	2.06	3.55	3.19	0.83
BUS-RCx	2.55	5.23	4.85	0.64
BUS-New Construction	1.70	2.39	2.95	0.83
BUS-Multifamily Common	1.66	3.39	2.48	0.77
BUS-TOTAL	**2.05**	**3.41**	**3.10**	**0.86**
PORTFOLIO TOTAL	**1.75**	**2.96**	**2.80**	**0.78**

Table 7. 43: CCP Cost-Effectiveness Tests

CCP	TRC	UCT	PCT	RIM
RES-Lighting	1.59	4.55	2.35	0.74
RES-Efficient Products	1.30	4.02	1.51	0.90
RES-HVAC	1.48	3.36	1.80	0.88
RES-Appliance Recycling	1.40	1.40	-	0.52
RES-Home Energy Performance	0.00	-	-	-
RES-New Homes	0.00	-	-	-
RES-Low Income	0.64	0.64	2.23	0.39
RES-TOTAL	**1.38**	**3.25**	**1.87**	**0.80**
BUS-Standard	2.36	3.94	2.99	0.99
BUS-Custom	2.21	3.96	3.25	0.87
BUS-RCx	2.59	5.43	4.79	0.65
BUS-New Construction	1.75	2.47	2.97	0.84
BUS-Multifamily Common	1.81	3.73	2.58	0.80
BUS-TOTAL	**2.22**	**3.86**	**3.15**	**0.90**
PORTFOLIO TOTAL	**1.67**	**3.50**	**2.27**	**0.84**

Table 7.44: RAP Cost-Effectiveness Tests

RAP	TRC	UCT	PCT	RIM
RES-Lighting	1.34	3.91	2.00	0.72
RES-Efficient Products	1.28	3.91	1.58	0.85
RES-HVAC	1.44	3.26	1.83	0.85
RES-Appliance Recycling	1.37	1.37	-	0.52
RES-Home Energy Performance	1.29	1.73	2.74	0.63
RES-New Homes	1.06	2.10	1.51	0.75
RES-Low Income	0.64	0.64	2.24	0.39
RES-TOTAL	**1.31**	**3.05**	**1.83**	**0.78**
BUS-Standard	2.29	3.89	2.88	0.98
BUS-Custom	2.11	3.75	3.20	0.84
BUS-RCx	2.58	5.40	4.92	0.63
BUS-New Construction	1.64	2.31	2.88	0.81
BUS-Multifamily Common	1.71	3.50	2.51	0.78
BUS-TOTAL	**2.13**	**3.70**	**3.08**	**0.87**
PORTFOLIO TOTAL	**1.59**	**3.32**	**2.22**	**0.82**

Table 7.45: MAP Cost-Effectiveness Tests

MAP	TRC	UCT	PCT	RIM
RES-Lighting	1.03	2.36	1.67	0.67
RES-Efficient Products	1.12	2.52	1.60	0.75
RES-HVAC	1.19	1.87	1.84	0.71
RES-Appliance Recycling	1.30	1.30	-	0.50
RES-Home Energy Performance	1.27	1.61	2.80	0.61
RES-New Homes	1.03	1.75	1.66	0.68
RES-Low Income	0.59	0.59	2.10	0.38
RES-TOTAL	**1.11**	**2.09**	**1.75**	**0.70**
BUS-Standard	1.70	2.29	2.74	0.77
BUS-Custom	1.67	3.00	2.60	0.79
BUS-RCx	1.95	3.39	3.59	0.65
BUS-New Construction	1.18	1.39	2.82	0.64
BUS-Multifamily Common	1.41	2.07	2.47	0.68
BUS-TOTAL	**1.64**	**2.47**	**2.69**	**0.77**
PORTFOLIO TOTAL	**1.31**	**2.25**	**2.07**	**0.73**

Table 7.46: 2 Percent Per Year Cost-Effectiveness Tests

2PPY	TRC	UCT	PCT	RIM
RES-Lighting	0.38	0.36	2.25	0.27
RES-Efficient Products	0.38	0.36	2.42	0.27
RES-HVAC	0.48	0.46	2.39	0.33
RES-Appliance Recycling	0.75	0.75	N/A	0.39
RES-Home Energy Performance	0.70	0.71	3.14	0.41
RES-New Homes	0.42	0.39	2.40	0.29
RES-Low Income	0.35	0.35	1.96	0.27
RES-TOTAL	**0.41**	**0.39**	**2.41**	**0.29**
BUS-Standard	0.83	0.79	3.37	0.47
BUS-Custom	0.59	0.56	3.37	0.37
BUS-RCx	0.77	0.73	4.24	0.39
BUS-New Construction	0.58	0.56	3.39	0.38
BUS-Multifamily Common	0.65	0.62	3.11	0.39
BUS-TOTAL	**0.69**	**0.66**	**3.38**	**0.41**
PORTFOLIO TOTAL	**0.51**	**0.48**	**2.73**	**0.34**

7.9 Compliance References