8. Demand-Side Resources

Highlights

- *Ameren Missouri completed its most comprehensive Demand Side Management (DSM) Potential Study and Market Assessment in 2013. Key components were:*
    - *Energy efficiency potential for the planning period 2016-2034*
    - *Demand response potential*
    - *Distributed generation potential*
    - *Combined heat and power potential*
    - *Demand-side rate potential*
- *Although Demand Response (DR) programs are not cost effective for 2016-2018, Ameren Missouri is considering an innovative pilot DR program to better understand the tolerance customers have for various frequencies and durations of DR events.*
- *Ameren Missouri plans to spend $148 million from 2016-2018 to achieve 426 GWH of energy savings and 114 MW of peak demand savings*

Ameren Missouri continues to build on its DSM planning, implementation and evaluation performance leadership from MEEIA Cycle 2013 - 2015. Examples of performance leadership include:

- The addition of formal project management processes and procedures
- The addition of a state-of-the art DSM data collection and tracking system
- The addition of a Marketing Manager
- The development of market segmentation strategies to tailor specific DSM messages to specific market segments[1]
- The addition of a state-of-the art web-based Technical Reference Manual
- The execution of national best practice EM&V processes and procedures

---

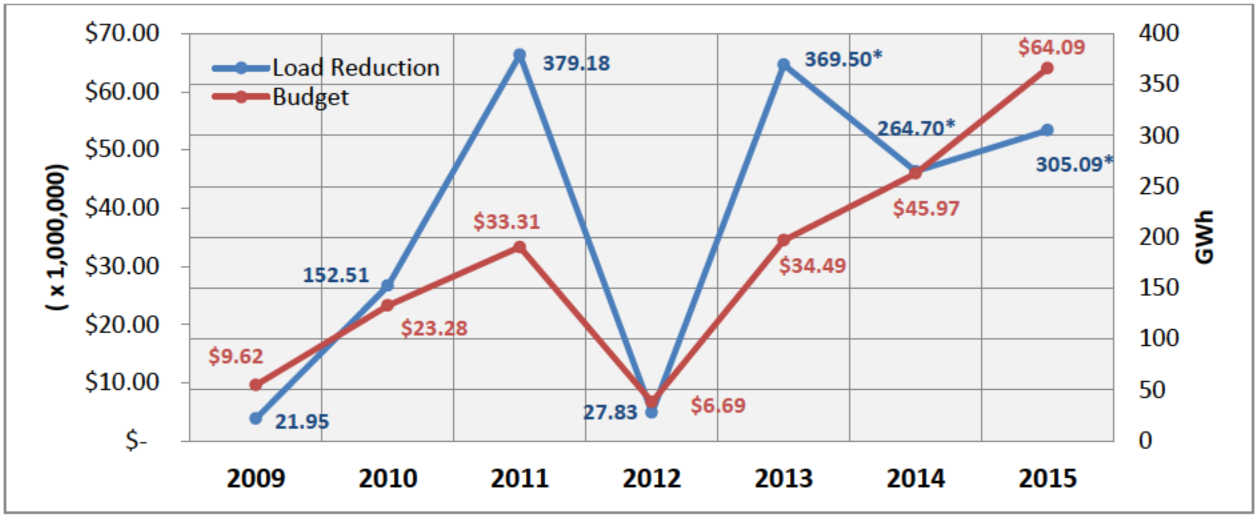
[1] 4 CSR 240-22.050(1)(A)1 through 3; 4 CSR 240-22.050(3)(B) The market segmentation is discussed further on page 2-4 thru 2-7 in Volume 3 of the Potential Study

8.1 Implementation Plan Summary

8.1.1 Introduction

Since the inception of its large scale DSM programs beginning in 2009, Ameren Missouri has achieved impressive improvements in energy efficiency. Figure 8.1 charts the changes in annual load reductions and associated energy efficiency budgets from 2009 through 2013 and projected for 2014 and 2015.

Figure 8.1: Ameren Missouri DSM Annual Load Reductions and Budgets

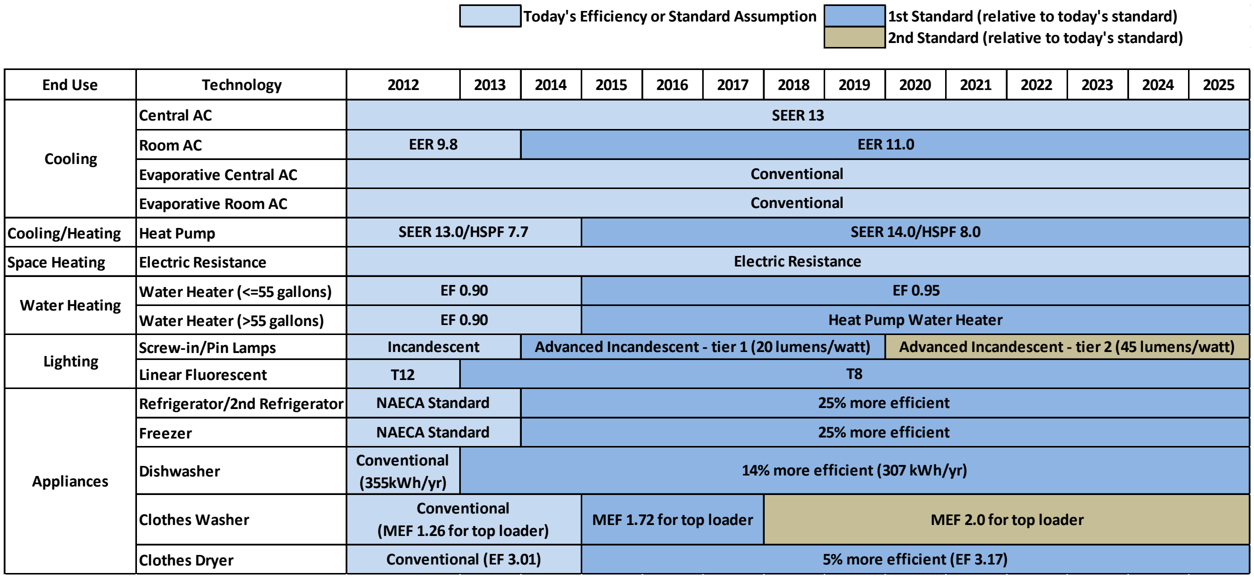


*Per draft settlement position, September 2014

However, in addition to the Ameren Missouri initiatives to encourage customers to become more energy efficient, there are other non-Ameren Missouri initiatives that impact the availability of customer energy efficiency opportunities for Ameren Missouri to pursue going forward. Those initiatives, including the enactment of new building codes and appliance efficiency standards, are diminishing some of the proverbial “low hanging fruit” or low-cost but high-yield energy efficiency opportunities, such as residential lighting.

Table 8.1 illustrates the multitude of residential appliance efficiency standards that will go into effect over the 20-year planning horizon.

Table 8.1: Residential Appliance Efficiency Standards[2]



☐ Today's Efficiency or Standard Assumption
🟦 1st Standard (relative to today's standard)
🟫 2nd Standard (relative to today's standard)

End Use	Technology	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Central AC	SEER 13													
	Room AC	EER 9.8		EER 11.0											
	Evaporative Central AC	Conventional													
	Evaporative Room AC	Conventional													
Cooling/Heating	Heat Pump	SEER 13.0/HSPF 7.7			SEER 14.0/HSPF 8.0										
Space Heating	Electric Resistance	Electric Resistance													
Water Heating	Water Heater (<=55 gallons)	EF 0.90			EF 0.95										
	Water Heater (>55 gallons)	EF 0.90			Heat Pump Water Heater										
Lighting	Screw-in/Pin Lamps	Incandescent		Advanced Incandescent - tier 1 (20 lumens/watt)						Advanced Incandescent - tier 2 (45 lumens/watt)					
	Linear Fluorescent	T12	T8												
Appliances	Refrigerator/2nd Refrigerator	NAECA Standard		25% more efficient											
	Freezer	NAECA Standard		25% more efficient											
	Dishwasher	Conventional (355kWh/yr)	14% more efficient (307 kWh/yr)												
	Clothes Washer	Conventional (MEF 1.26 for top loader)			MEF 1.72 for top loader			MEF 2.0 for top loader							
	Clothes Dryer	Conventional (EF 3.01)			5% more efficient (EF 3.17)										

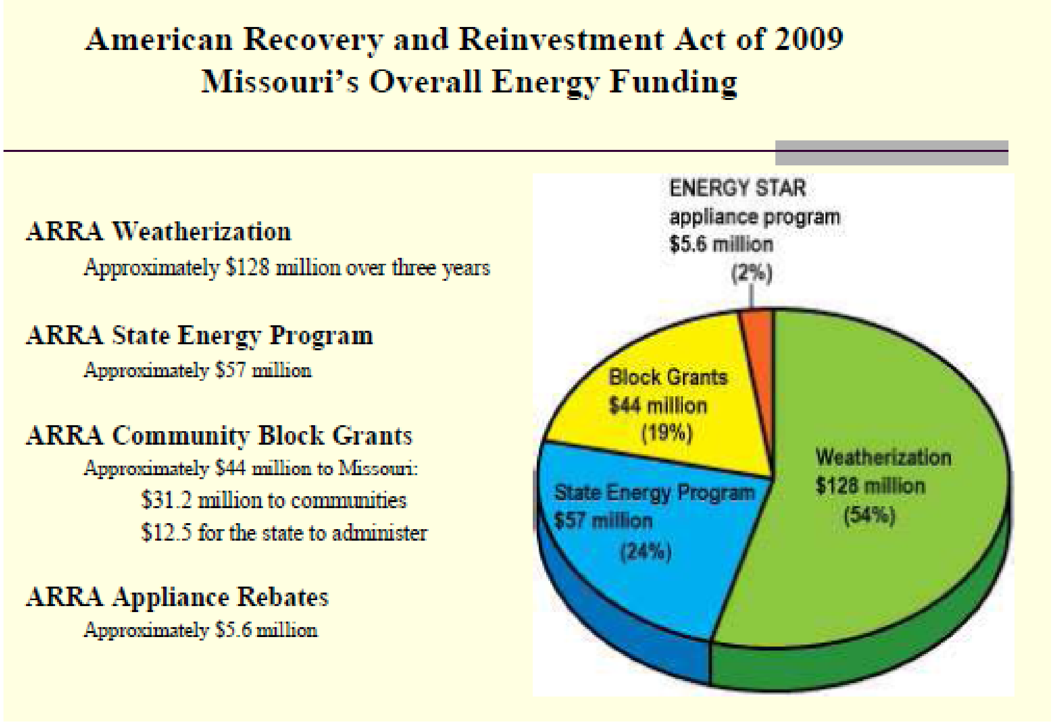
Another significant initiative was “The American Recovery and Reinvestment Act of 2009 (ARRA)” which provided approximately $235 million in funding for energy efficiency projects in Missouri through 2012. This very large state investment in energy efficiency further diminished the potential for energy efficiency for utility sponsored programs from the levels estimated in the Ameren Missouri 2009 DSM Potential Study.

---

[2] Volume 3 of the Ameren Missouri DSM Potential Study

The Missouri distribution of ARRA funds for energy efficiency related projects is shown in Figure 8.2.

Figure 8.2: Missouri ARRA Funding Source and Uses



American Recovery and Reinvestment Act of 2009
Missouri's Overall Energy Funding

ARRA Weatherization
Approximately $128 million over three years

ARRA State Energy Program
Approximately $57 million

ARRA Community Block Grants
Approximately $44 million to Missouri:
$31.2 million to communities
$12.5 for the state to administer

ARRA Appliance Rebates
Approximately $5.6 million

Finally, the Ameren Missouri assumptions for market prices for both energy and capacity have decreased from levels used in the MEEIA Cycle 2013 - 2015 program analysis work, which were based on the 2011 IRP filing. The benefits associated with energy efficiency measures are a function of the level of avoided energy and capacity costs. The lower avoided costs yield lower benefits which increase the likelihood that marginally cost effective measures from the 2011 IRP filing are no longer cost effective. If not cost effective, the measure is excluded from the DSM Potential Study and annual load reduction estimates are reduced accordingly.

The decrease in avoided costs is attributable to the drop in the price of natural gas as well as the overall state of the economy where electric load growth has flattened. Figure 8.3 illustrates the dramatic differences between the Ameren Missouri avoided energy and capacity costs assumed for both the MEEIA Cycle 2013 - 2015 and MEEIA Cycle 2016 – 2018 filings.

Figure 8.3: Avoided Energy and Capacity Comparison, MEEIA Cycle 2013 - 2015 vs. MEEIA Cycle 2016 – 2018 - **NP**

[redacted]

**

8.2 DSM Potential Study[3]

8.2.1 2013 Ameren Missouri DSM Potential Study

8.2.1.1 Overview

Ameren Missouri worked together with stakeholders to develop a scope of work, select contractor(s), review plans, analyze data, and report results for the 2013 Ameren Missouri DSM Potential Study. The contractor selected to perform the actual Study was EnerNOC Utility Solutions Consulting.

The 2013 DSM Potential Study was the most comprehensive customer market assessment analysis for either an IRP filing, or MEEIA filing, ever made by Ameren Missouri.[4] For example, in addition to estimating the technical, economic, and achievable levels of energy efficiency and demand response potential, the 2013 study also assessed the potential for:

- Customer distributed generation/combined heat and power application over the 2016-2033 planning horizon
- The implementation of demand-side rates to impact DSM potential[5]

8.2.1.2 Stakeholder Interactions during DSM Potential Study – 2014 IRP

There was significant communication with Stakeholders regarding the development of the Ameren Missouri Demand Side Market Potential Study. Ameren engaged, informed, requested, responded, presented and updated Stakeholders via numerous communication channels. Ameren involved Stakeholders with the Potential Study from the beginning, requesting Stakeholder review and comments of the Bidders List and RFP feedback, until the end, requesting review and comments of the Potential Study report. Stakeholder interactions regarding the 2013 Potential Study commenced June 2012 and continued through 2014. Stakeholder comments were considered and where applicable used in the development of the Ameren Missouri DSM Portfolios that are analyzed within the IRP. Notable Stakeholder feedback regarding adjustments to Potential Study included adjustments to the bidding process, measure lists, and project scope/budget to include provisions for focus groups.

---

[3] EO-2012-0142 13; EO-2012-0142 14

[4] 4 CSR 240-22.050(2) A comprehensive description of the market research and customer surveys performed can be found in Volume 2 of the DSM Potential Study

[5] 4 CSR 240-22.050(1)(C) A more detailed description of demand-side rates can be found in Volume 6 of the DSM Potential Study

The itemized listing of Stakeholder communications can be found in Chapter 8-Appendix A.

8.2.1.3 Overall Conclusions

- The enactment of new building codes and appliance efficiency standards are diminishing some of the proverbial “low hanging fruit” or low-cost but high-yield energy efficiency opportunities, such as residential lighting.

- For the 2016-2018 DSM Implementation Planning period, 60% of the program-level energy-efficiency potential is expected to come from business customers and the remaining 40% from residential customers.

- MISO capacity markets indicate that demand response opportunities have little market capacity value for the immediate future. Since Ameren Missouri is not projecting a need for demand response for reliability purposes, the business case for demand response for Ameren Missouri customers is dependent on the MISO capacity market.[6]

- Since 2010, new program evaluation impact reports in non-Ameren jurisdictions about certain types of demand response programs that in the 2010 study were thought to have no “losers” are now available in the public domain. Specifically, in 2010 the peak time rebate (PTR) program, where customers are paid if they respond to calls to reduce peak demand but are not penalized if they do not respond to such calls, was thought to have only winners. The evaluation reports based on new empirical data show conclusively that there are both winners and losers in this program.

- Opportunities for cost-effective combined heat and power applications for Ameren Missouri industrial customers are relatively small due in part to industrial customers who have elected to opt out of participation in Ameren Missouri energy efficiency programs.

- The analysis of demand-side rates in the study indicate that inclining block rates (IBR) and time-of-use (TOU) rates have the potential to reduce customers’ energy consumption. If offered as a customer opt-out option, demand-side rates have significant customer energy usage reduction potential. However, if they are offered as a customer opt-in option, the potential diminishes to relatively modest levels.

---

[6] 4 CSR 240-22.050(4)(F)

The complete 2013 Ameren Missouri DSM Potential Study can be found within Chapter 8-Appendix B. The supporting documentation for the 2013 Ameren Missouri DSM Potential Study can be found within the work papers.

8.2.1.4 Energy Efficiency Potential[7]

Key findings related to measure-level electric potentials are summarized as follows:[8]

- **Technical potential** reflects the adoption of all energy-efficiency measures regardless of cost-effectiveness, is a theoretical upper bound on savings. First-year net savings are 1,242 GWh, or 4.1% of the baseline projection. Cumulative net savings in 2018 are 2,728 GWh, or 8.9% of the baseline. By 2030, cumulative savings reach 9,858 GWh, or 29.2% of the baseline projection.
- **Economic potential** reflects the savings when the most efficient cost-effective measures are utilized by all customers. The first-year savings in 2016 are 858 GWh, or 2.8% of the baseline projection. By 2018, cumulative net savings reach 1,923 GWh, or 6.3% of the baseline. By 2030, cumulative savings reach 7,718 GWh, or 22.9% of the baseline projection.
- **Maximum achievable potential (MAP)** establishes a maximum target for the savings a utility can hope to achieve through its programs. MAP involves incentives that represent up to 100% of the incremental cost of energy efficient measures above baseline measures, combined with high administrative and marketing costs. It also considers a maximum participation rate by customers. In 2016, savings for this case are 510 GWh, or 1.7% of the baseline and by 2018 cumulative net savings reach 1,179 GWh, or 3.8% of the baseline projection. By 2030, cumulative MAP savings reach 5,377 GWh, or 15.9% of the baseline projection.
- **Realistic achievable potential (RAP)** represents a forecast of likely customer behavior under realistic program design and implementation. It takes into account existing market, financial, political, and regulatory barriers that are likely to limit the amount of savings that might be achieved through energy efficiency programs. For example, it considers more realistic incentives (i.e., less than 100% of incremental cost), defined marketing campaigns, and internal budget constraints. Political barriers often reflect differences in regional attitudes toward energy efficiency and its value as a resource. The RAP also takes into account recent utility experience and reported savings. In

---

[7] 4 CSR 240-22.050(4)(C); Volume 3 of the Potential study addresses how the study included the EIA technology forecast updates on page 2-14

[8] 4 CSR 240-22.050(2)

2016, net realistic achievable savings are 105 GWh, or 0.3% of the baseline projection. By 2018, RAP reaches 426 GWh, or 1.4% of the baseline. By 2030, RAP reaches 3,958 GWh, or 11.7% of the baseline projection.

There is an important distinction to make when describing energy efficiency potential. There are two types of potential estimates – measure level and program level. Measure level potential does not include two significant costs – program administration and portfolio administration. When these two costs are included, it is not unusual to remove marginally cost effective energy efficiency measures from a program in order to make the program cost effective. For this reason, program potential is usually less than measure level potential.

Table 8.2 reflects the EnerNOC measure and proposed program potential both in terms of annual GWh and in terms of % of sales for the 2016-2033 planning period. Figure 8.4 shows the distribution of measure level potential by residential, commercial and industrial customer segments. Ameren Missouri subsequently updated program potential estimates to reflect 2013 EM&V data and updated program field implementation direction.

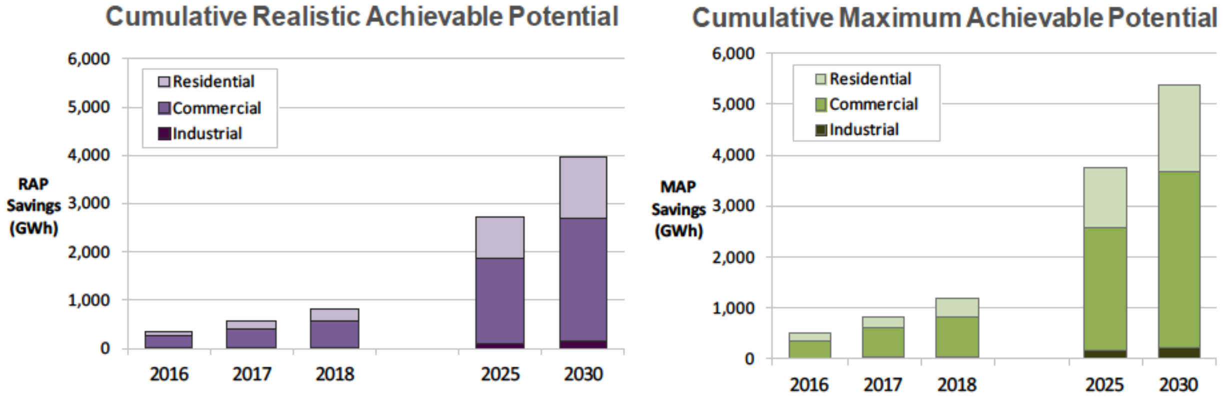
Table 8.2: Summary of Cumulative Measure and Program Energy Efficiency Potential (Energy Savings in GWh) – Pre 2013 EM&V[9]

	2016	2017	2018		2025	2030
Baseline Projection (GWh)	30,249	30,449	30,694		32,228	33,721
Cumulative Savings (GWh)						
Program RAP	174	346	539		1,629	2,133
Program MAP	251	495	768		2,235	2,890
RAP (Measure-Level)	339	561	806		2,697	3,958
MAP (Measure-Level)	510	833	1,178		3,753	5,376
Cumulative Savings (% of Baseline)						
Program RAP	0.6%	1.1%	1.8%		5.1%	6.3%
Program MAP	0.8%	1.6%	2.5%		6.9%	8.6%
RAP (Measure-Level)	1.1%	1.8%	2.6%		8.4%	11.7%
MAP (Measure-Level)	1.7%	2.7%	3.8%		11.6%	15.9%

---

[9] Table from Volume 3 of the DSM Potential Study

Figure 8.4: Source of Annual Load Reductions 2016-2030[10]



To summarize Figure 8.4, results from the 2013 DSM Potential Study for the 2016-2018 DSM Implementation Planning period, show that approximately 70% of the measure-level energy-efficiency potential is expected to come from business customers and the remaining 30% from residential customers.

It is important to note that the 2013 Ameren Missouri DSM Potential Study used the MEEIA Cycle 2013 - 2015 Technical Reference Manual (TRM) as the source of energy efficiency measure incremental energy savings estimates. On February 15, 2014, approximately two months after the completion of the 2013 DSM Potential Study, the Ameren Missouri Evaluation, Measurement, and Verification (EM&V) contractors published the first draft of the 2013 program individual measure EM&V impacts and distributed it to Ameren Missouri and all stakeholders simultaneously. As expected, the EM&V individual measure impacts differed from the deemed measure savings listed in the MEEIA Cycle 2013 - 2015 TRM. Depending on the individual energy efficiency measure, some of the 2013 EM&V impact assessments were higher than what was in the MEEIA Cycle 2013 - 2015 TRM and some were lower. For both residential and business energy efficiency potential, the overall impact of the 2013 EM&V impact estimates was to lower annual energy efficiency potential from what was stated in the DSM Potential Study.

---

[10] Volume 3 of the Ameren Missouri DSM Potential Study

8.2.1.5 Reassessment of Annual Load Reductions in DSM Potential Study

As new Ameren Missouri customer specific EM&V data becomes available, the TRM should be revised to reflect current Ameren Missouri specific individual measure impact analyses. In an ideal setting, the TRM would be updated prior to the start of a new DSM Potential Study. However, since the 2013 DSM program EM&V impacts were not known until February 15, 2014, that was not possible. In fact, if any stakeholder chooses to contest the 2013 EM&V impact reports, there is a schedule for resolution of EM&V disputes in the MEEIA Cycle 2013 - 2015 Stipulation and Agreement that could extend the finalization of 2013 EM&V impacts until September 2014.

Ameren Missouri, however, took the draft February 15, 2014 individual measure and program EM&V impact assessments and made adjustments to the individual measure level savings in the 2013 DSM Potential Study in order to have a more accurate assessment of DSM potential for the MEEIA Cycle 2016 – 2018 plan as well as the 20-year planning horizon for the 2014 Ameren Missouri IRP filing.

The results of updating the 2013 DSM Potential Study to reflect 2013 EM&V individual measure impacts are shown in Table 8.3:

Table 8.3: Measure Level Potential Inclusive of 2013 EM&V Impact Assessments

	2016	2017	2018		2025	2030
Baseline Projection (GWh)	30,249	30,449	30,694		32,228	33,721
Cumulative Savings (GWh)						
RAP (Measure-Level)	314	527	758		2,409	3,481
Cumulative Savings (% of Baseline)						
RAP (Measure-Level)	1.04%	1.73%	2.47%		7.47%	10.32%

Ameren Missouri did not update the EnerNOC program potential, at least as EnerNOC designed programs for the Potential Study, to reflect 2013 EM&V results. Rather, Ameren Missouri proceeded independently with its own program design parameters, using post 2013 EM&V results, to design the DSM programs for the 2014 IRP and MEEIA Cycle 2016 – 2018 filings. The Ameren Missouri program design process, specifically the mapping process from EnerNOC DSM potential to Ameren Missouri DSM program potential, is described in detail in Section 8.6 Planning Process.

Key components in the Ameren Missouri program design process that differed from EnerNOC DSM Potential Study program designs included the following:[11]

1. Update program cost effectiveness to reflect 2013 EM&V measure savings
2. Re-visit EnerNOC proposed programs, such as residential consumer electronics, for which EnerNOC relied on secondary data sources for measure incremental savings and costs if there was no TRM measure level data to use
3. Work with Ameren Missouri implementation team, including contractors, to develop better estimates of future program administration and incentive costs
4. Consider and remove, if not cost effective, programs proposed by EnerNOC

---

[11] 4 CSR 240-22.050(1)(D)

8.3 Portfolio Programs

8.3.1 Proposed Portfolio Programs[12]

Table 8.4 presents a high level summary of the proposed programs.

Table 8.4: Realistic Achievable Potential (RAP) Portfolio Programs

Residential - Lighting	Incentives are provided to retail partners to increase sales and awareness of ENERGY STAR® qualified lighting products whereby the end-user receives a discount on the price of ENERGY STAR qualified or other high efficiency lighting products in stores or online.
Residential - Efficient Products	Incentives are provided to customers to raise awareness of the benefits of "high-efficiency" products whereby the end-user receives a discount on the price of qualified products via mail-in rebate or from program allies and contractors.
Residential - HVAC	Incentives are provided to customers for improving the efficiency of new and existing HVAC systems, heat pumps, and air conditioners by achieving electric energy savings.
Residential - Appliance Recycling	An incentive and free pickup is provided to a customer for the retirement and recycling of an inefficient refrigerator or freezer in working condition. A turnkey appliance recycling company will verify customer eligibility, schedule pick-up appointments, pick up appliances, recycle and dispose units, and perform incentive processing.
Residential – Low Income	Delivers energy savings to low income qualified customers by directly installing measures and educating the customer regarding energy efficiency.
Residential – Energy Efficiency Kits	Kits provided to raise customer awareness of the benefits of "high-efficiency" products and educate residential customers about energy use in their homes and to offer information, products, and services to residential customers to save energy cost-effectively.
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.
Residential Demand Response	Ameren Missouri is considering a pilot program in 2016-2018 to test customers' tolerance for the frequency and duration of DR events
C&I Demand Response	Ameren Missouri is considering a pilot program in 2016-2018 to test customers' tolerance for the frequency and duration of DR events.

The detailed program templates can be found in Chapter 8-Appendix C.

---

[12] 4 CSR 240-22.050(1)(B); 4 CSR 240-22.050(1)(D); 4 CSR 240-22.050(3)(G)3 An in depth look into the design of each potential demand-side program can be seen in the work papers.

8.3.2 Portfolio Overview

The RAP portfolio is the set of Energy Efficiency Programs that:

- **Is cost-effective** at the measure, program, and portfolio level – albeit marginally cost effective for some proposed programs. The overall portfolio benefit-cost ratio using the Total Resource Cost test is 2.01 for energy efficiency programs.
- **Aligns with best practice**. The program designs selected for this portfolio have been based on a review of program experience across the country as well as by the June 2013 ACEEE Review of Exemplary Programs.
- **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 within the proposed program design and implementation flexibility requirements discussed in detail in Section 8.11.3 of this report. Specific program designs are still conceptual. Incentive levels are still broadly and formulaically developed for some programs and developed via latest 2013 market information from implementation contractors for other programs. Detailed program design and implementation planning typically occur after the Commission reviews the Company's IRP planning process and corresponding MEEIA 2016 – 2018 filing. Once the review process is complete, the Company works with implementation contractors (or subcontractors) to develop more detailed plans that include specific incentive levels,[13] 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 RAP portfolio plan is based on a formal assessment of the risks associated with each program and is designed to manage those risks, but strict 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.
- **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 energy efficiency efforts**. Ameren Missouri continuously works to coordinate with the natural gas energy efficiency programs offered by Ameren Missouri. The Company is also

---

[13] 4 CSR 240-22.050(3)(G)5B; The levels of incentives paid by the utility are discussed further in Volume 2 of the Potential study; 4 CSR 240-22.050(3)(G)5C; Incentives paid by entities other than the utility are discussed in Volume 5 of the Potential Study

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.[14]

The MEEIA Cycle 2016 – 2018 portfolio proposed for 2016-2018 includes many enhancements, improvements, and evolutions relative to the MEEIA Cycle 2013 - 2015 portfolio. The key changes for MEEIA Cycle 2016 - 2018 include:

- Degree of portfolio flexibility requested is greater for MEEIA Cycle 2016 – 2018 than for MEEIA Cycle 2013 - 2015 for reasons described in Section 8.11.3.
- The MEEIA Cycle 2016 - 2018 DSM programs included in the plan were designed in 2013 for reasons related to the schedule requirements needed for Ameren Missouri to be in a position to implement programs in January 2016. Yet, the market for DSM products and services continues to evolve quickly. It is important that this filing include regulatory mechanisms that enable Ameren Missouri to make appropriate changes to the proposed 2016-2018 DSM implementation plans between the time of this filing and January 2016 to reflect changes in the DSM marketplace.
- Avoided costs, on which benefits are calculated for energy efficiency programs, are approximately half of what they were for the MEEIA Cycle 2013 - 2015 filing.
- CFLs, the most prominent energy efficiency measure in MEEIA Cycle 2013 - 2015, are no longer cost effective in MEEIA Cycle 2016 - 2018 due to federal legislation requiring higher levels of lighting efficiency beginning in 2020.
- More than 60% of annual load reductions are projected to come from business DSM programs in MEEIA Cycle 2016 - 2018. This is the inverse of MEEIA Cycle 2013 – 2015 filing where residential programs provided approximately 70% of total portfolio load reductions.

---

[14] 4 CSR 240-22.050(3)(F)

Table 8.5 summarizes annual incremental portfolio energy savings, demand savings, and program costs for the 3-year implementation planning period 2016-2018.

Table 8.5: Estimated Incremental Annual Net Savings at Meter and Costs for the Implementation Period - RAP Portfolio[15]

	2016	2017	2018	Total
Residential EE Programs net energy savings (MWh)	58,505	45,691	61,472	165,668
Business EE Programs net energy savings (MWh)	46,252	91,927	122,536	260,715
Total estimated net energy savings (MWh) at meter	104,757	137,617	184,008	426,382
Residential EE Programs net demand reduction (MW)	14	9	13	36
Business EE Programs net demand reduction (MW)	13	28	37	78
Estimated net demand reduction (MW) at meter	27	37	50	114
Residential EE Programs annual costs ($ millions)	$21.81	$18.61	$22.96	$63.38
Business EE Programs annual costs ($ millions)	$14.60	$30.23	$39.36	$84.19
Estimated costs (Program costs in millions)*	$36.41	$48.84	$62.32	$147.57

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

---

[15] 4 CSR 240-22.050(3)(H); More comprehensive tables can be found in the work papers including participants, utility costs, and program participant costs for each year of the planning horizon

The breakdown of the portfolio energy saving and budget metrics by individual program is shown in Table 8.6 below:

Table 8.6: Ameren Missouri Portfolio Summary for Implementation Cycle 2016-2018[16]

Realistic Achievable Potential	Net Incremental Energy Savings (GWh) at Meter			Net Incremental Demand Reductions (MW) at Meter			Annual Budget ($M)		
	2016	2017	2018	2016	2017	2018	2016	2017	2018
Lighting	20.2	18.3	22.9	0.01	0.01	0.01	$5.70	$5.50	$6.72
Efficient Products	5.7	1.9	6.7	2.09	0.71	2.24	$2.44	$1.30	$2.50
HVAC	19.9	13.9	17.2	8.94	6.24	7.74	$8.30	$6.87	$7.78
Appliance Recycling	3.0	2.7	4.1	0.74	0.66	1.02	$1.22	$1.11	$1.67
Low Income	3.5	2.7	4.3	0.84	0.61	0.92	$2.35	$1.99	$2.49
EE Kits	6.2	6.2	6.2	1.03	1.03	1.03	$1.81	$1.84	$1.81
EE Residential Total	**58.5**	**45.7**	**61.5**	**13.66**	**9.25**	**12.95**	**$21.81**	**$18.61**	**$22.96**
Standard	18.6	20.9	35.0	3.32	3.72	6.24	$5.89	$6.59	$10.96
Custom	27.6	53.5	72.0	10.05	19.47	26.18	$8.71	$16.82	$22.54
RCx	0.0	10.0	8.9	0.00	3.21	2.84	$0.00	$3.92	$3.38
New Construction	0.0	7.5	6.7	0.00	1.80	1.60	$0.00	$2.91	$2.48
EE Business Total	**46.3**	**91.9**	**122.5**	**13.37**	**28.19**	**36.86**	**$14.60**	**$30.23**	**$39.36**
EE PORTFOLIO TOTAL	**104.8**	**137.6**	**184.0**	**27.03**	**37.45**	**49.81**	**$36.41**	**$48.84**	**$62.32**

	Total System Energy (GWh)			Total System Peak (MW)		
	2016	2017	2018	2016	2017	2018
Ameren Missouri Baseline Forecasts	30,249	30,449	30,694	8,226	8,239	8,273
DSM as %	0.35%	0.45%	0.60%	0.33%	0.45%	0.60%

---

[16] 4 CSR 240-22.050(3)(G)4; 4 CSR 240-22.050(3)(G)5 A through F A more detailed look including cumulative savings, measure specific cost, incentives can be found in the work papers

The breakdown of cost effectiveness by individual program is shown in Table 8.7 below:

Table 8.7: Cost Effectiveness Tests for Implementation Cycle 2016-2018[17]

REALISTIC ACHIEVABLE POTENTIAL (RAP) Portfolio						
	TRC	**UCT**	**PCT**	**RIM**	**RIM (Net Fuel)**	**SOC**
ENERGY EFFICIENCY						
RES-Lighting	1.05	1.06	∞	0.32	0.37	1.61
RES-Efficient Products	1.29	1.98	2.66	0.65	0.74	2.17
RES-HVAC	1.34	1.99	3.51	0.54	0.61	2.00
RES-Appliance Recycling	1.08	1.08	∞	0.36	0.41	1.38
RES-Low Income	0.79	0.81	5.82	0.35	0.39	1.07
RES-EE Kits	1.53	1.53	15.43	0.38	0.44	2.05
RES-TOTAL	**1.22**	**1.50**	**5.59**	**0.45**	**0.51**	**1.81**
BUS-Standard	1.49	1.93	3.66	0.54	0.64	2.07
BUS-Custom	1.67	2.43	3.42	0.62	0.75	2.37
BUS-RCx	1.59	1.59	7.10	0.50	0.61	2.20
BUS-New Construction	1.46	2.40	2.80	0.64	0.77	2.14
BUS-TOTAL	**1.61**	**2.22**	**3.54**	**0.59**	**0.72**	**2.26**
EE PORTFOLIO TOTAL	**1.45**	**1.91**	**4.17**	**0.53**	**0.63**	**2.08**

Ameren Missouri’s portfolio for MEEIA Cycle 2016 - 2018 contains a substantial list of improvements to the planning process from methods previously employed for MEEIA Cycle 2013 - 2015. For example, the knowledge gained from the actual program implementation and evaluation experience of MEEIA Cycle 2013 - 2015 as well as program years prior to MEEIA Cycle 2013 - 2015 allows Ameren Missouri to incorporate actual field experience into the program design process. Deployment of industry leading project management practices in MEEIA Cycle 2013 - 2015 and the addition of a full-time DSM project manager is a significant improvement in integrating DSM program design with portfolio and program implementation and evaluation. Continuous updating of primary market research on customer demographics, psychographics and appliance saturations is an aid to developing more efficient programs and program delivery mechanisms. Ameren Missouri’s active participation in the Electric Power Research Institute’s (EPRI) Industrial Center of Excellence (ICOE) has been invaluable in designing new business programs or adjuncts to existing programs that include options for business customers to achieve Energy Star For Industry certification.

---

[17] 4 CSR 240-22.050(5)(E); 4 CSR 240-22.050(5)(F);4 CSR 240-22.050(5)(G) A more detailed look at the cost-benefit test can be found in the work papers

8.3.3 DSM Portfolios Considered

8.3.3.1 Portfolio Descriptions

Ameren Missouri examined a number of possible DSM portfolios within alternative resource plans in the integration process. The DSM portfolios considered are shown 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.

RAP Portfolio

The realistic achievable potential (RAP) portfolio represents a level of DSM programs that are based on the RAP measure level savings which were identified within the Ameren Missouri Potential Study and subsequently updated with the latest information and assumptions from Ameren Missouri program implementation experience, EM&V assessments of program implementations, and the IRP process. The RAP Portfolio of programs represents estimates of Energy Efficiency and Demand Response program 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, with emphasis on program experience obtain from Ameren Missouri program implementations. The Ameren Missouri RAP EE programs are expansions and evolutions of the best practice programs that Ameren Missouri currently has in the field that form a more comprehensive and innovative path forward. The Ameren Missouri DR programs are limited to direct load control programs, which are currently the only type of DR programs that the MISO capacity markets accept as capable of providing market capacity value.[18]

MAP Portfolio

The maximum achievable potential (MAP) portfolio represents the most aggressive level of DSM programs that could be delivered by Ameren Missouri and are based on the MAP measure level savings which were identified within the Ameren Missouri Potential Study and subsequently updated, as with the RAP portfolio of programs, with the latest information and assumptions from Ameren Missouri program implementation experience, EM&V assessments of program implementations, and the IRP process. MAP represents estimates of Energy Efficiency and Demand Response potential that are based on the most optimistic program implementation assumptions, such as: boosted utility budgets, higher incentive levels, high customer acceptance, cutting edge delivery methods, etc. The Ameren Missouri MAP EE programs are an enhanced mix of the programs that Ameren Missouri currently has in the field that form a more

---

[18] 4 CSR 240-22.050(6)(A)

comprehensive and innovative path forward with the goal of maximizing the amount of EE program savings that can be achieved. The Ameren Missouri DR programs maximize the capacity saving potential that can be achieved by assuming favorable conditions, such as the need for reliability resources in a capacity constrained world and the easing of MISO capacity market acceptance criteria to allow the inclusion of DR pricing programs, which enhances the potential for capacity deliveries from both direct load control and pricing DR programs.

Mid Portfolio

This aggressive portfolio, in the most simplistic of terms, is basically a mathematical construct that is designed to be a set of programs that will deliver a level of savings that are half-way between those of the RAP portfolio and the MAP portfolio. This portfolio was developed to determine the potential merit, if any, of delivering DSM programs at a level that is between RAP and MAP.

8.3.3.2 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 portfolios that were investigated.

Figure 8.5: Portfolio Energy Efficiency Spending

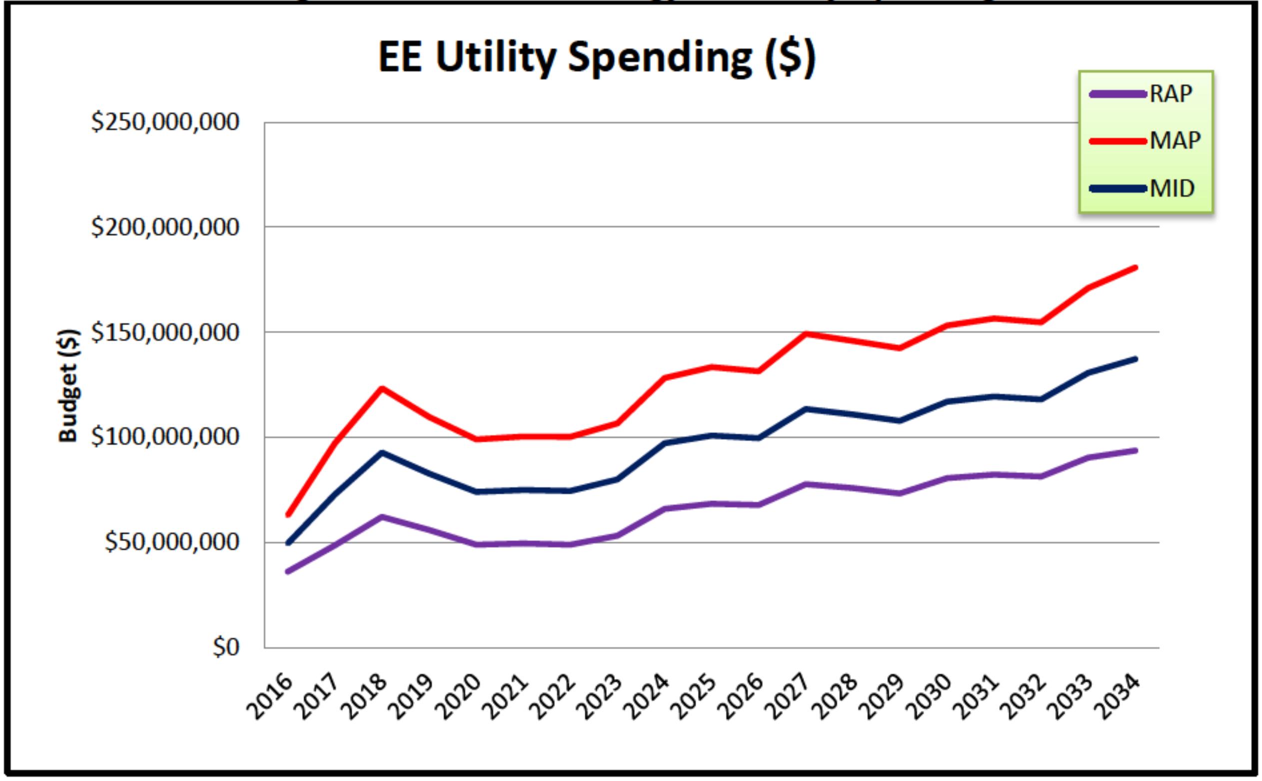


Figure 8.6 shows the projected annual budget for each of the Demand Response portfolios that were developed. Note that the MAP portfolio budget is lower than the RAP portfolio budget for 2025 through 2032 due to the introduction of DR pricing programs within the MAP portfolio. The cost to deliver DR pricing programs is less than the price of direct load control programs.

Figure 8.6: Portfolio Demand Response Spending

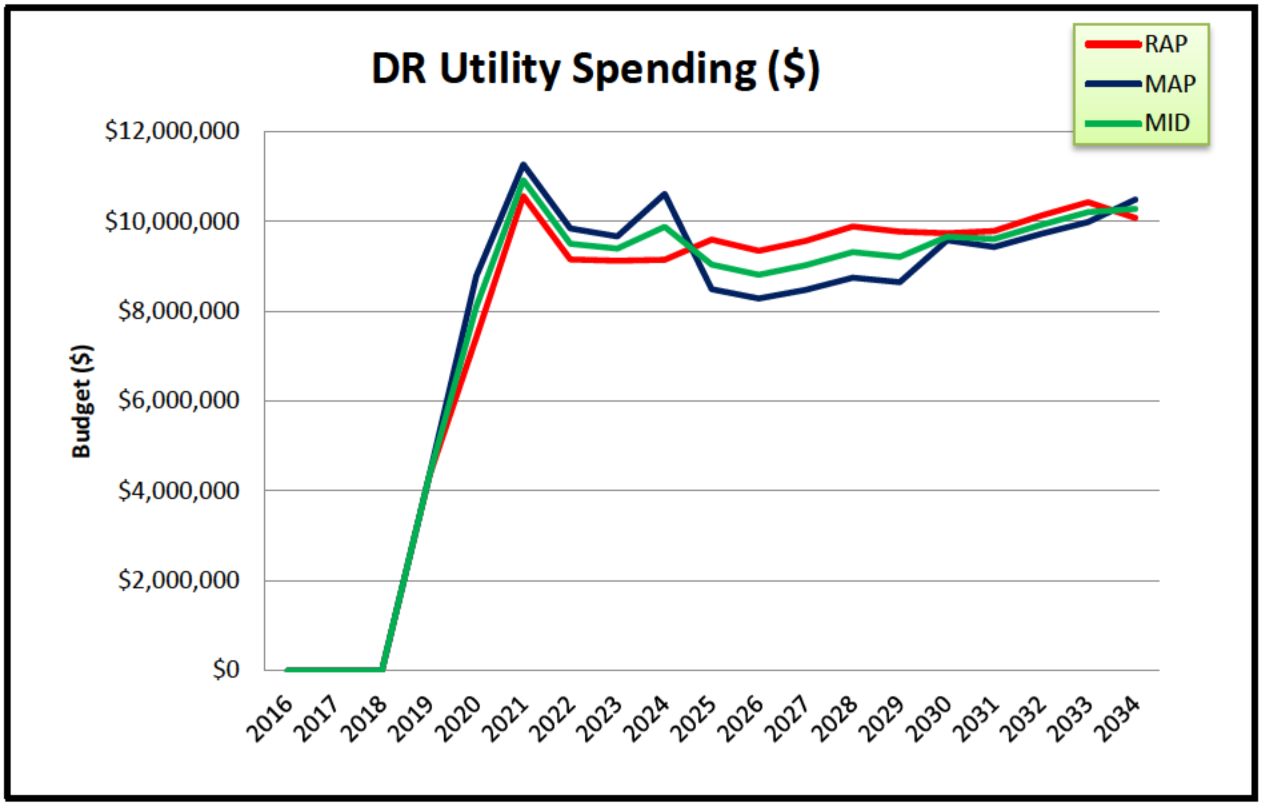
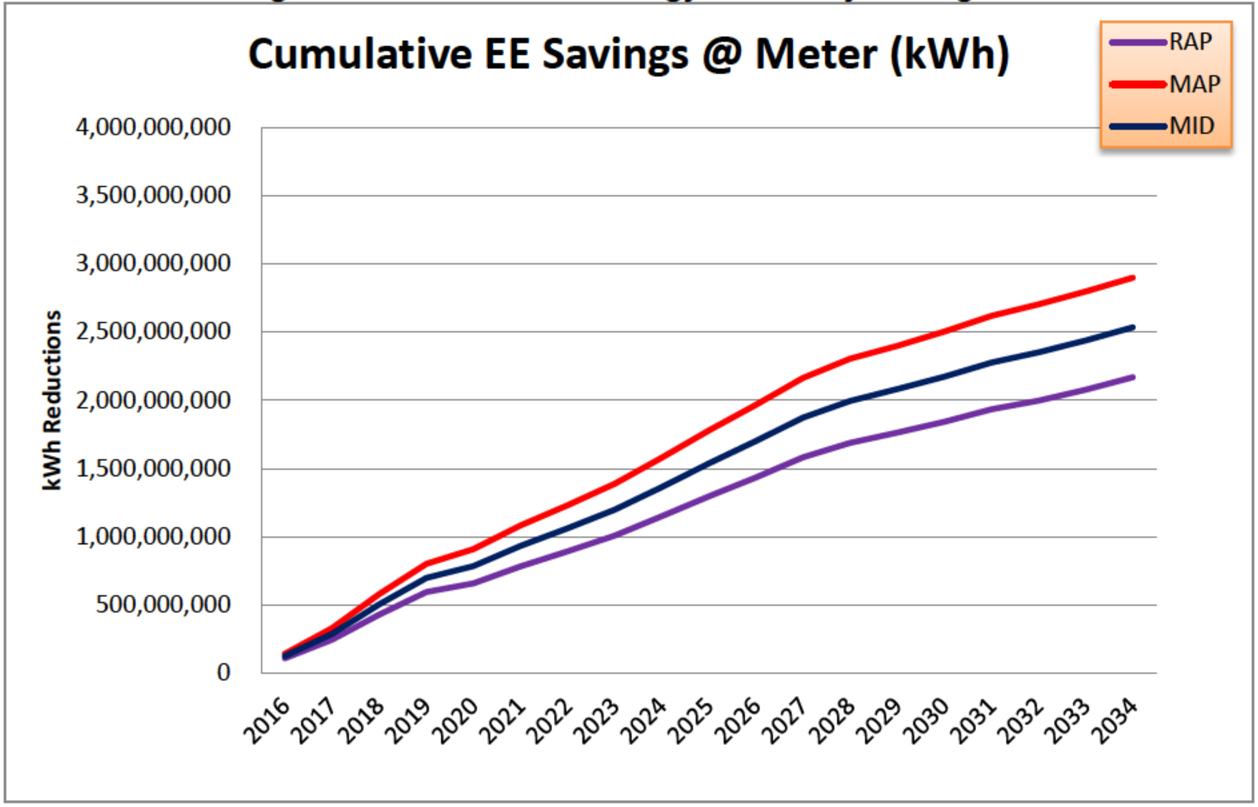


Figure 8.7 shows the projected annual cumulative energy savings (annual energy savings realized by new measures as well as annual energy savings from existing measures that are still actively saving energy) for each of the Energy Efficiency portfolios that were developed:

Figure 8.7: Cumulative Energy Efficiency Savings[19]



---

[19] 4 CSR 240-22.050(6)(B)

Figure 8.8 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 8.8: Cumulative Energy Efficiency Peak Load Reductions

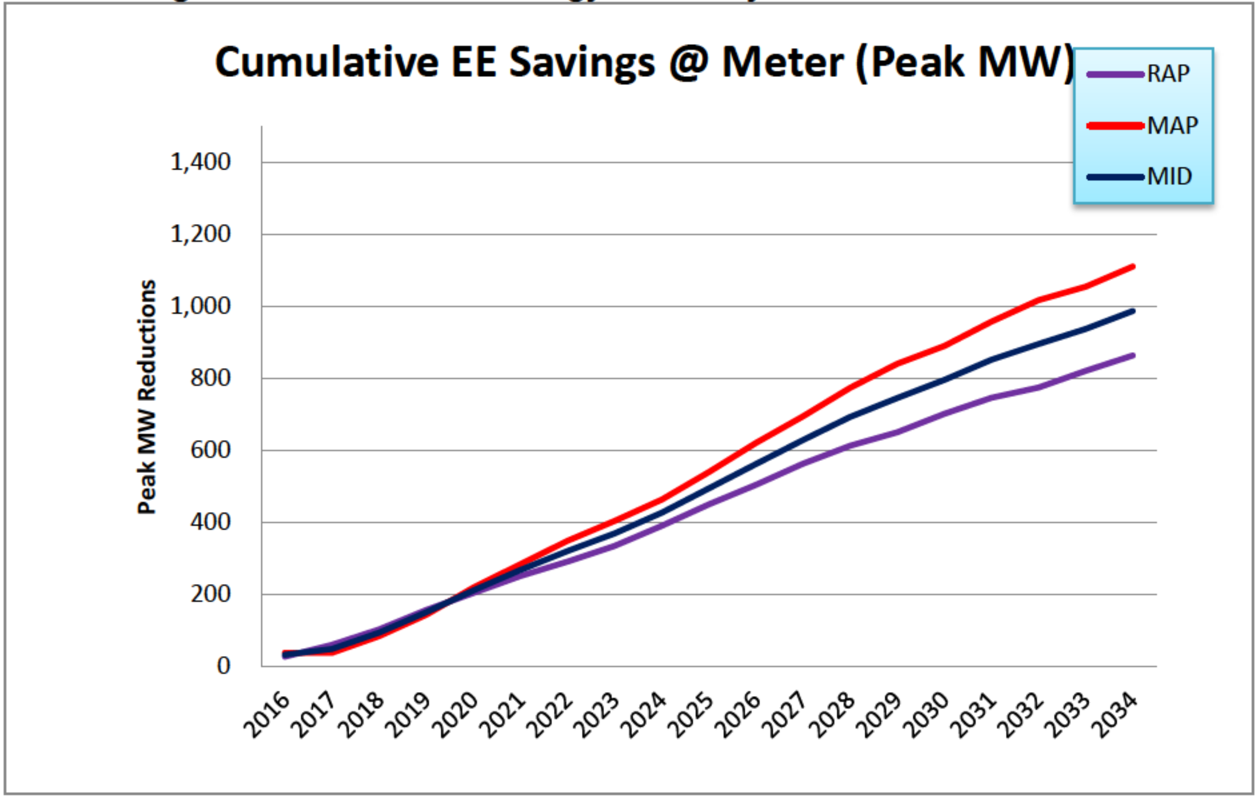


Figure 8.9 shows the projected annual cumulative demand savings for each of the Demand Response portfolios that were developed:

Figure 8.9: Cumulative Demand Response Peak Load Reductions

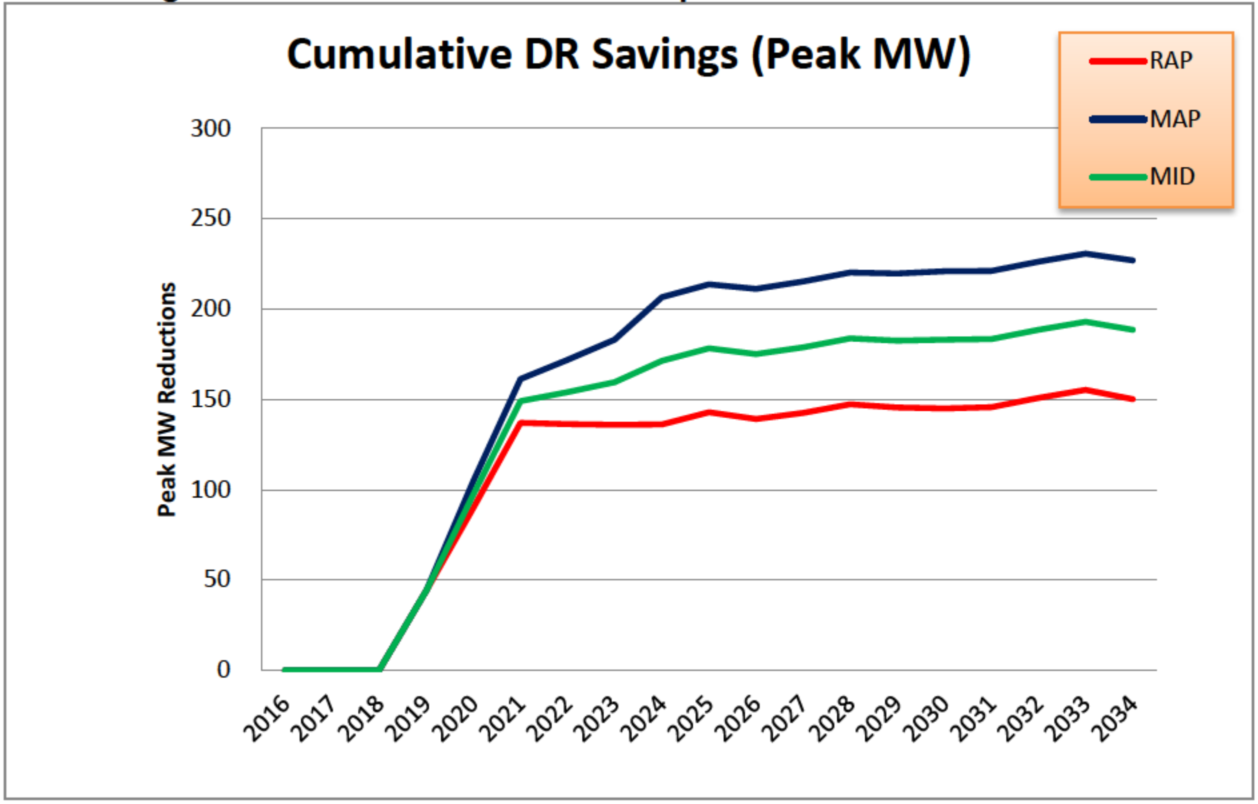


Table 8.8 summarizes the cost-effectiveness of each portfolio. Further details can be found in the work papers in the folder entitled "Portfolio Screens". The cost-effectiveness tests below do not incorporate any demand response and are specific to energy efficiency only.

Table 8.8: Portfolio Cost-Effectiveness Tests (2016-2034)

Cost-Effectiveness Test Results						
Portfolio	**Utility Test**	**TRC Test**	**RIM Test**	**RIM (Net Fuel)**	**Societal Test**	**Participant Test**
RAP	2.72	2.01	0.66	0.82	2.96	4.31
MAP	1.89	1.69	0.60	0.72	2.52	4.45
MID	2.18	1.81	0.63	0.76	2.69	4.39

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

Table 8.9: RAP Cost-Effectiveness Tests (2016-2034)

Program Cost-Effectiveness Test Results						
RAP	**Utility Test**	**TRC Test**	**RIM Test**	**RIM (Net Fuel)**	**Societal Test**	**Participant Test**
RES-Lighting	0.96	0.96	0.33	0.39	1.49	∞
RES-Efficient Products	3.17	1.71	0.65	0.78	2.77	3.22
RES-HVAC	2.70	1.72	0.63	0.73	2.46	3.65
RES-Appliance Recycling	1.27	1.27	0.39	0.45	1.64	∞
RES-Low Income	1.01	1.00	0.40	0.45	1.35	6.87
RES-EE Kits	1.57	1.57	0.38	0.45	2.11	15.59
RES-TOTAL	**2.19**	**1.54**	**0.56**	**0.65**	**2.30**	**4.26**
BUS-Standard	3.32	2.75	0.85	1.09	4.11	4.46
BUS-Custom	2.84	2.13	0.65	0.82	3.04	4.42
BUS-RCx	3.21	2.36	0.64	0.83	3.33	5.08
BUS-New Construction	3.82	2.42	0.90	1.17	3.63	3.36
BUS-TOTAL	**3.11**	**2.37**	**0.73**	**0.93**	**3.47**	**4.36**
PORTFOLIO TOTAL	**2.72**	**2.01**	**0.66**	**0.82**	**2.96**	**4.31**

Table 8.10: MAP Cost-Effectiveness Tests (2016-2034)

Program Cost-Effectiveness Test Results						
MAP	**Utility Test**	**TRC Test**	**RIM Test**	**RIM (Net Fuel)**	**Societal Test**	**Participant Test**
RES-Lighting	0.96	0.96	0.33	0.39	1.49	∞
RES-Efficient Products	2.07	1.44	0.58	0.69	2.39	3.34
RES-HVAC	1.73	1.29	0.56	0.63	1.82	3.65
RES-Appliance Recycling	1.02	1.02	0.36	0.41	1.31	∞
RES-Low Income	0.95	0.93	0.39	0.44	1.26	6.84
RES-EE Kits	1.11	1.10	0.35	0.40	1.48	15.55
RES-TOTAL	**1.63**	**1.27**	**0.52**	**0.60**	**1.91**	**4.14**
BUS-Standard	2.20	2.32	0.75	0.93	3.49	4.82
BUS-Custom	1.90	1.83	0.58	0.71	2.63	4.72
BUS-RCx	2.02	1.97	0.57	0.72	2.78	5.45
BUS-New Construction	2.47	2.10	0.79	1.00	3.17	3.62
BUS-TOTAL	**2.05**	**2.02**	**0.65**	**0.81**	**2.97**	**4.68**
PORTFOLIO TOTAL	**1.89**	**1.69**	**0.60**	**0.72**	**2.52**	**4.45**

Table 8.11: MID Cost-Effectiveness Tests (2016-2034)

Program Cost-Effectiveness Test Results						
MID	**Utility Test**	**TRC Test**	**RIM Test**	**RIM (Net Fuel)**	**Societal Test**	**Participant Test**
RES-Lighting	0.96	0.96	0.33	0.39	1.49	∞
RES-Efficient Products	2.43	1.54	0.61	0.73	2.54	3.29
RES-HVAC	2.05	1.44	0.58	0.67	2.05	3.65
RES-Appliance Recycling	1.13	1.13	0.37	0.43	1.45	∞
RES-Low Income	0.97	0.96	0.39	0.45	1.30	6.85
RES-EE Kits	1.27	1.26	0.36	0.42	1.70	15.57
RES-TOTAL	**1.84**	**1.38**	**0.53**	**0.62**	**2.06**	**4.19**
BUS-Standard	2.56	2.49	0.79	1.00	3.73	4.67
BUS-Custom	2.20	1.94	0.61	0.75	2.79	4.59
BUS-RCx	2.39	2.12	0.60	0.76	2.99	5.29
BUS-New Construction	2.91	2.22	0.83	1.06	3.35	3.51
BUS-TOTAL	**2.40**	**2.16**	**0.68**	**0.86**	**3.17**	**4.54**
PORTFOLIO TOTAL	**2.18**	**1.81**	**0.63**	**0.76**	**2.69**	**4.39**

8.4 Evaluation Measurement and Verification (EM&V)

8.4.1 Existing EM&V Model

Separate evaluators are currently under contract for the Residential and Business portfolios. The consultants provide an annual independent review of the gross and net program impacts. They also provide process evaluations including reviews of databases and marketing materials, conduct implementer interviews, and measure customer satisfaction with programs.

The Commission has hired a State Auditor to audit and report on work of Ameren Missouri's independent EM&V contractors. The Auditor a) monitors EM&V planning, implementation, and analysis of the EM&V contractors, (b) provides on-going feedback to the Energy Efficiency Regulatory Stakeholder Advisory Team (EERSAT) on EM&V issues and (c) provides EERSAT with a copy of their final report in a timely manner.[20]

The evaluators submit their draft annual process and impact evaluation reports to EERSAT and the State Auditor for review and comment 45 days after the completion of each program year and their final annual process and impact evaluation reports 135 days after the completion of each program year.[21]

8.4.2 Proposed EM&V Model

8.4.2.1 Evaluation Contractor Role

For the MEEIA 2016 – 2018 Cycle, a competitive procurement process will take place to ensure that the most qualified evaluation contractor(s) is hired prior to the start of the programs in order to understand the program details and ensure adequate data requirements are implemented. Ameren Missouri has allocated 5% of portfolio resources to EM&V to ensure a balanced approach is utilized to estimate net savings.

An independent process evaluation provides recommendations for program improvements while impact evaluation accurately accounts for energy impacts.

Evaluation Contractors enhance implementation efforts in several ways. For example, evaluators provide valuable training for Ameren Missouri staff, implementers, and regulatory stakeholders on NTG calculation methodologies, deemed savings approaches, and share experiences from other utility service areas. 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.

---

[20] Case No. EO-2012-0142 Unanimous Stipulation and Agreement Resolving Ameren Missouri's MEEIA Filing 11.c, EO-2012-0142 14

[21] Case No. EO-2012-0142 Unanimous Stipulation and Agreement Resolving Ameren Missouri's MEEIA Filing 11.c

The development of a statewide TRM is an effort that may occur in MEEIA Cycle 2016 - 2018. IOU EM&V contractors could make meaningful contributions to the collaborative development of the specific protocols, algorithms, and inputs for each measure included in the statewide TRM. If Missouri develops a statewide TRM, an additional $1 million should be added to the EM&V (3)-year budget for this Cycle to cover the evaluator's incremental efforts to support the development of the statewide TRM.

8.4.2.2 Evaluation Plan

The Evaluation Plans are detailed work plans that fulfill the evaluation objectives and identify the activities that will be undertaken in each program year.

The EPA has proposed GHG rules, Section 111(d) of the Clean Air Act. This may impact MEEIA Cycle 2016 – 2018 EM&V. The EM&V plan will lay the foundation for how these new rules impact the EM&V results. EPA should provide guidance to states, as soon as practicable, but no later than June 2015, setting forth a non-exhaustive list of approvable approaches/provisions that may be included in state compliance plans. Missouri should have the option to adopt those and other policies and programs in their compliance plans.

Translating electricity energy efficiency savings into avoided emissions has not been part of previous EM&V plans. However quantifying CO_2 savings from energy efficiency savings may be a change to the EM&V plan in MEEIA Cycle 2016 – 2018 and beyond. Ameren Missouri will need to begin to understand the magnitude of CO_2 savings as well as kWh savings for individual measures. The significant value of energy efficiency programs may well come from CO_2 savings going forward. Consequently, the measure mix of the program may change to emphasize measures with the most CO_2 savings

The EM&V plans described within this section should be considered a preliminary planning document and subject to change based upon program design changes incorporated by the implementation team in 2015. The evaluation plans for each DSM program will be developed the first quarter of 2016. Each evaluation plan will be composed of three – one year work plans which support the overall three year program cycle. As programs and markets evolve each year, the evaluation methods may need to change to ensure the evaluation method(s) being used continue to be appropriate. Findings from process evaluations and market assessments can help identify when to reassess impact evaluation methods. This will give the evaluation team the same type flexibility as the implementation teams to make appropriate modifications to respond to program and market condition changes. The EERSAT will be engaged with the development and review of the overall three year EM&V plans prior to its implementation and be informed as modifications are made throughout the program cycle.

8.4.2.3 Impact Evaluations[22]

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.[23] The impact evaluation estimates of gross program savings may include engineering analysis and formulas, building simulation models, meter data, statistical models and billing analysis.

In its MEEIA 2016 - 2018 filing, Ameren Missouri will propose all program NTG values be deemed. In addition, Ameren Missouri will propose an alternative methodology to adjust deemed NTG values over the course of the 3-year implementation plan. However, should Ameren Missouri's NTG proposal not be accepted, Ameren Missouri will continue to require evaluators to use a balanced approach when calculating NTG by using the following formula and measure each component of the equation:

> NTG = 1 – Free Ridership + Participant Spillover + Nonparticipant Spillover + Market Effects

For the low income program, the evaluation will also include an analysis of how the program affects bill payments, arrearages, and disconnections.

8.4.2.4 Process Evaluations[24]

Ameren Missouri has collaborated with its evaluators to identify appropriate process evaluation goals, procedures, and practices.[25] These evaluations focus more on program design and delivery, market segments, and other societal factors that affect the program's performance.

Process evaluations use program implementer/contractor interviews, retailer surveys and review of program materials to inform the process evaluation. Stakeholder and retailer interviews provide details on program design, database review, staffing levels, training, implementation, marketing to retailers and trade allies, retailer and trade ally satisfaction, marketing to consumers, products, payments and invoicing, communications, tracking and market feedback. Program data reviews provide further information on program design and implementation processes.

---

[22] 4 CSR 240-22.070(8)(B)
[23] 4 CSR 240-22.050(7)
[24] 4 CSR 240-22.070(8)(A)
[25] 4 CSR 240-22.050(7)

8.4.2.5 Data Collection[26]

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.[27] 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. A centralized data tracking system will be utilized by the implementation contractors to track program metrics for use by the evaluators in the EM&V process.

8.4.2.6 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. Evaluators will review these QA/QC procedures.

8.4.2.7 Annual EM&V Reporting

The evaluation contractors will prepare annual draft and final impact and process evaluation reports. The reports will include ex-ante gross, ex-post gross and ex-post net energy savings and demand reduction for each of the programs and residential and non-residential portfolios. The reports will also include a summary of the process evaluation and will identify specific detail regarding the impact methodologies and results as well as key findings, conclusions and recommendations. Based on the annual report results, Ameren Missouri will complete the cost effectiveness analysis at the program and portfolio level.

8.4.3 Stakeholder Considerations[28]

Ameren Missouri will continue to work with the evaluation contractors and make the necessary plans to incorporate EERSAT and the State Auditor into the planning/evaluation process. It would be beneficial to have all parties participate early in the process by reviewing evaluation plans prior to finalizing.

---

[26] 4 CSR 240-22.070(8)(C)
[27] 4 CSR 240-22.050(7)
[28] EO-2012-0142 14

8.5 Outreach, Marketing and Communications[29]

Developing and executing a comprehensive marketing communications plan is essential to reaching the residential and business energy efficiency goals. Executing a mix of marketing simultaneously with a consistent message creates repetitive exposure which drives recognition and as a result drives participation. In addition, a multi-media plan enables Ameren Missouri to reach their diverse customer base. All marketing execution is approved and managed by Ameren Missouri, however all implementation contractors and Ameren Missouri's communication Agency of Record will contribute to the marketing efforts.

The most opportunistic means to market the business energy efficiency programs is through Trade Allies, Program Business Development staff and key customer facing employees such as Key Account Executives and Customer Service Advisors. Trade Allies are experts in energy efficient technology, understanding market conditions, and are whom customers go-to when seeking energy efficient products and services. They are the primary channel for marketing and outreach. The marketing efforts for the business portfolio are also a combination of internal and external activities.

8.6 The Planning Process

8.6.1 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), the societal cost test (SCT) and the ratepayer impact measure (RIM) test.[30] In each year of the planning horizon, the benefits of each demand-side program are calculated as the cumulative energy and demand impact multiplied by all applicable avoided costs, and then summed into net present values for the timeframe considered.[31] 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

---

[29] 4 CSR 240-22.050(3)(E)

[30] 4 CSR 240-22.050(5)(E); 4 CSR 240-22.050(5)(F); 4 CSR 240-22.050(5)(G)

[31] 4 CSR 240-22.050(5)(A); the cost effectiveness of each demand-side program can be found in the workpapers

costs and full incremental costs (both utility and participant contributions), but no incentive payments that offset incremental costs to customers and no lost revenues.[32] The full incremental costs include single upfront costs and operational & maintenance costs where applicable.[33] 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.[34]

The Utility Cost Test (UCT) measures the costs and benefits from the perspective of the utility administering the program.[35] 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 but do not include lost revenues.[36] 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.[37]

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 participating customers receive on their electric bills as a result of the implementation of the energy efficiency and demand response measures plus incentives received by the customer. 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 added to the customer's total benefits.[38]

The Societal Cost Test (SCT) is a variation of the TRC that includes "externalities" and uses a social discount rate. Since there has been no protocol to establish inputs to the SCT in Missouri, Ameren Missouri calculated the SCT for each of its DSM programs using "placeholder" values. Benefits were increased by 10% across the board and a lower discount rate was used to estimate SCT values for each program.[39]

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

---

[32] 4 CSR 240-22.050(5)(B)3
[33] 4 CSR 240-22.050(5)(B)1
[34] 4 CSR 240-22.050(5)(D)
[35] 4 CSR 240-22.050(5)(C)
[36] 4 CSR 240-22.050(5)(C)1; 4 CSR 240-22.050(5)(C)2&3
[37] 4 CSR 240-22.050(5)(D)
[38] 4 CSR 240-22.050(5)(F)
[39] 4 CSR 240-22.050(5)(F)

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.[40]

8.6.1.1Avoided Costs[41]

The avoided cost curve that was provided for use in the 2014 EE Potential Study was derived from the results of a simulation model used to reflect an expectation of market prices. These forward price forecasts were developed using modeling software provided by Ventyx and commonly referred to as “Strategic Planning” or “MIDAS”. This detailed simulation modeling software provides a production cost projection and that process has been outlined in Chapter 2 (Planning Environment) in much greater detail. The results of this production cost model provided 15 unique forward power price forecasts that would include probable environmental costs by adjusting the following input variables;

1. Natural gas
2. Load growth
3. Coal plant retirements
4. Cost of carbon[42]

Each of these power price forecasts was given a weighting based on the combined probabilities of the inputs. This probability and weighting process is further discussed in chapter 2 (Planning Environment). To present a single forecast for use in the study, the final procedure was to use each price forecast and weight it appropriately to derive a single probability weighted average that would represent a power price forecast representative of the range of possibilities that were used for analysis in the 2014 IRP.

Finally, to better reflect the expected prices in the Ameren Missouri area, a basis adjustment was applied to adjust the Indy Hub prices to Ameren Missouri prices.

---

[40] 4 CSR 240-22.050(5)(F)

[41] 4 CSR 240-22.050(5)(A)1 through 3; 4 CSR 240-22.050(6)(C)2; Volume 3 of the Potential Study discusses the sensitivity analysis performed around avoided cost

[42] 4 CSR 240-22.050(6); 4 CSR 240-22.050(5)(A)3

Table 8.12 shows the avoided costs used for the valuation of Ameren Missouri's DSM efforts in the IRP analysis.

Table 8.12: Avoided Costs – **NP**

Year	Energy ($/MWH)	Capacity ($/kW-Year)	Distribution ($/kW-Year)	Transmission ($kW-Year)
2016	$27	** [redacted] **	$17	$6
2017	$29	** [redacted] **	$18	$6
2018	$32	** [redacted] **	$18	$6
2019	$34	** [redacted] **	$18	$6
2020	$36	** [redacted] **	$19	$6
2021	$39	** [redacted] **	$19	$6
2022	$42	** [redacted] **	$19	$7
2023	$45	** [redacted] **	$20	$7
2024	$48	** [redacted] **	$20	$7
2025	$53	** [redacted] **	$21	$7
2026	$56	** [redacted] **	$21	$7
2027	$58	** [redacted] **	$21	$7
2028	$61	** [redacted] **	$22	$7
2029	$64	** [redacted] **	$22	$7
2030	$67	** [redacted] **	$23	$8
2031	$70	** [redacted] **	$23	$8
2032	$74	** [redacted] **	$24	$8
2033	$77	** [redacted] **	$24	$8
2034	$82	** [redacted] **	$25	$8

8.6.2 New Web-Based Technical Reference Manual (TRM)[43]

The most significant improvement to the planning process, however, may very well be Ameren Missouri's acquisition of new, state-of-the art software to both develop and periodically update a secure, online Technical Reference Manual (TRM) database capable of capturing, organizing, and tracking the comprehensive set of Ameren Missouri's energy efficiency measures, their corresponding data elements and values, along with accompanying documentation. The TRM software will also support Ameren Missouri in the calculation of its 2013-2015 ex-post actual annual kWh. Ameren

---

[43] EO-2012-0142 14

Missouri, the Commission, stakeholders and ultimately customers will realize the following benefits of the system:

- **Total transparency**: Consolidation and organization of efficiency measures, measure attributes, and supporting data, including all savings values, costs, assumptions, equations, savings estimation protocols and source documentation. An easy-to-use, web-based interface to facilitate access to measure parameters, savings calculation algorithms, effective useful life, and incremental measure costs.

- **Automated version control**, including logging, retention, and archiving of all measure versions, including interim measure updates. Greater transparency into measure assumptions due to the fact that source documentation can be directly linked to a measure and the relevant attributes and parameters.

- **Reporting:** Ability to create customized measure specific reports and/or export files in various file formats; this can be used to develop batch upload files for Ameren Missouri's program tracking systems.

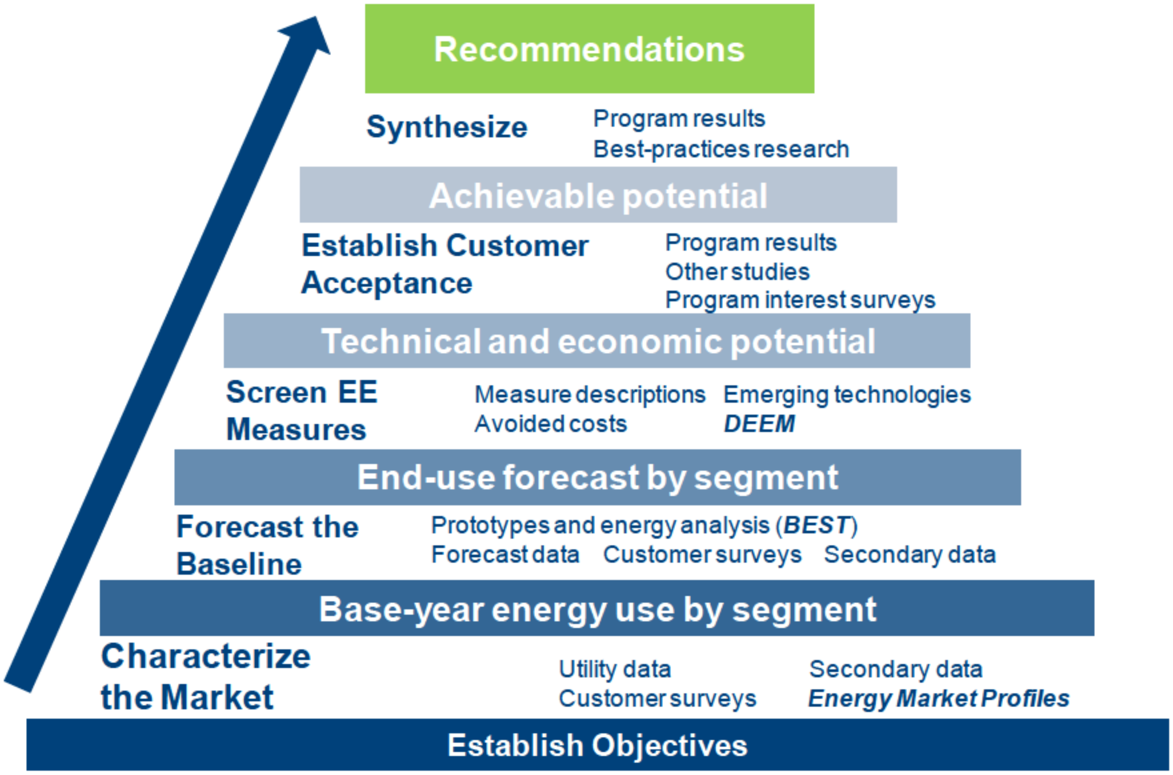
- **Maintenance of accurate records** of TRM savings based on versions for tracking and reporting using the online TRM tool.

Significant improvements are evident when comparing the web-based TRM to the previous hard copy version of the TRM. The first version of the TRM was a WORD document supported by voluminous work papers in multiple formats and file locations. Ameren Missouri leveraged previous evaluation reports from its programs implemented between 2009 and 2011, Ameren Missouri specific data from its DSM Potential Study, its internal database of measures, and other states' TRMs where applicable to develop the first Ameren Missouri TRM. In MEEIA Cycle 2016 - 2018, Ameren Missouri is adopting a transparent, online TRM tool to identify measure level savings values and algorithms based on Ameren Missouri specific EM&V measure impact savings from 2013 program evaluations measured directly from Ameren Missouri customers to develop energy efficiency measure savings estimates. All documentation and workpapers supporting individual measure savings estimates will be included in the online tool. As was true in MEEIA Cycle 2013 - 2015, it is critical that individual measure savings estimates be agreed upon at the beginning of the program implementation and applied prospectively. The automated, online TRM will be used by Ameren Missouri to provide the transparency and the ability to maintain and update, if required, the measure energy and demand savings throughout the implementation period.

8.6.3 Program Design Process[44]

The flow of the overall planning process is illustrated in Figure 8.10.

Figure 8.10: Overview of DSM Planning Process



---

[44] 4 CSR 240-22.050(3)(G); 4 CSR 240-22.050(3)(I) Additional documentation for the assessments and sources can be found in the work papers

The results of the 2013 Potential Study generated measure level energy efficiency savings potential for different tiers including Realistic Achievable Potential (RAP) and Maximum Achievable Potential (MAP). The measure level potentials were developed by EnerNOC using measure level data from the MEEIA Cycle 2013 - 2015 TRM.[45] LoadMAP, EnerNOC's modeling tool, displays the results of inputs and outputs used to derive the measure level energy savings of each measure assessed in the 2013 Potential Study.

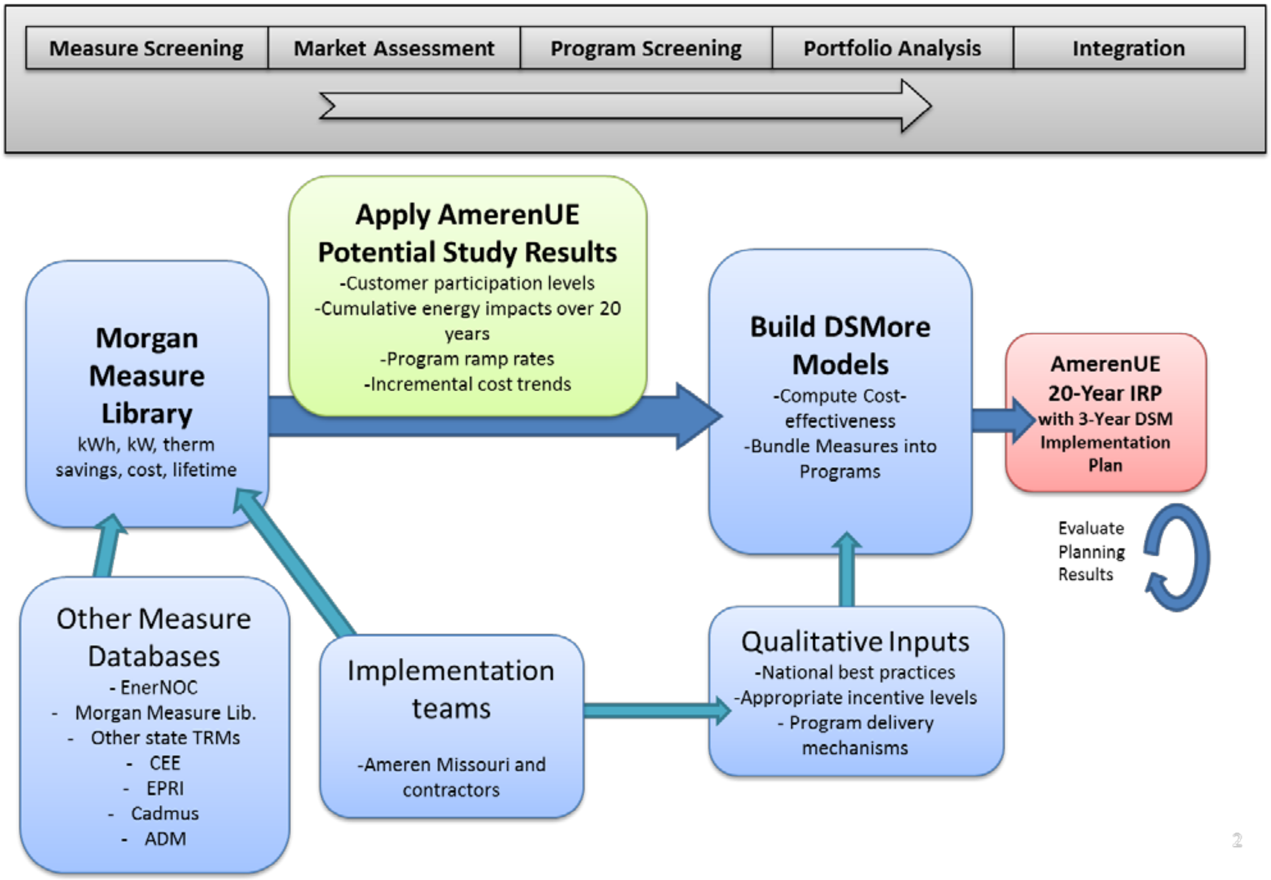
EnerNOC Utility Solutions developed The Load Management Analysis and Planning (LoadMAP™) tool in 2007 and has used it for the EPRI National Potential Study and more than two dozen end-use forecasting and potential studies. LoadMAP can provide energy savings in a variety of ways. The LoadMAP model provides forecasts of baseline energy use by sector, segment, end use, and technology for existing and new buildings. Ameren Missouri forecasting personnel and EnerNOC worked together closely to ensure that the baseline forecast for the Potential Study and Ameren Missouri's own load forecast were similar in assumptions and results. LoadMAP also provides forecasts of total energy use and savings associated with various levels of energy-efficiency (or DSM or conservation) potential — technical, economic, RAP, and MAP. Figure 8.10 depicts the bottom-up analysis approach of the LoadMAP process.

---

[45] 4 CSR 240-22.050(3)(C) The comprehensive list of end-use measures and demand side programs can be found in the work papers

Figure 8.11 elaborates on the Ameren Missouri DSM program design process from what was done for purposes of the DSM Potential Study in the achievable potential segment in Figure 8.10.

Figure 8.11: Overview of Ameren Missouri DSM Program Design Process



Within the LoadMAP taxonomy, measures can be categorized into types, equipment measures and non-equipment measures. Equipment measures, or efficient energy-consuming equipment, save energy by providing the same service with a lower energy requirement. An example is the replacement of a standard efficiency refrigerator with an ENERGY STAR model. For equipment measures, many efficiency levels are available for a specific technology that range from the baseline unit (often determined by code or standard) up to the most efficient product commercially available. Non-equipment measures save energy by reducing the need for delivered energy but do not involve replacement or purchase of major end-use equipment (such as a refrigerator or air conditioner). Examples include building shell measures such as insulation, equipment controls, equipment maintenance, and whole building design. Non-equipment measures can apply to more than one end use. For example, insulation levels will affect the energy use of cooling and space heating. In addition certain measures within LoadMAP take into account the interaction of building systems and how they affect the savings of other measures.[46]

The deliverables of the 2013 Potential Study included 3 types of Microsoft Excel LoadMAP files generated for three class sectors – residential, commercial, and industrial:[47]

1. LoadMAP.xlsx – performs the baseline forecast and analyzes equipment measures
2. LoadMAP Measures.xlsx – analyzes non-equipment measures
3. LoadMAP Final Results.xls – collects results from the two other files and includes pre-defined figures and tables for summarizing analysis results.

Flexibility to update the measure level and program level potentials is fundamental to Ameren Missouri's ability to manage risk and uncertainty due to:

1. Program design based on the 2013 DSM Potential Study which relies on older data
2. Changing customer interest
3. Changing baselines
4. Market transformation

EM&V results of Ameren Missouri's 2013 DSM programs became available after the completion of the 2013 Potential Study. Ameren Missouri updated the DSM Potential Study to reflect the 2013 individual measure impacts based on Ameren Missouri customer specific data. 2013 EM&V results were applied to the Potential Study results by updating Potential Study deliverable files. EnerNOC provided LoadMAP files as described above but also provided Program Expansion files to provide program level energy savings by tier. Ameren analyzed the Program Expansion files to generate energy savings for measure level and program level as indicated by EnerNOC. The measures included in the Program Expansion files were screened via EnerNOC's benefit/cost tests. Ameren Missouri updated the Program Expansion file for measure level savings to include EM&V results. Specifically, the EM&V realization rates were applied to EnerNOC's Program Expansion file for both the residential and commercial data. Measures in the Program Expansion File that did not correspond to an EM&V assessment remained the same and were not adjusted. This allowed for an update to measure level potentials based on the 2013 Potential Study. Next, all measures were screened by Ameren via the DSMore software. Measures that were not cost-effective

---

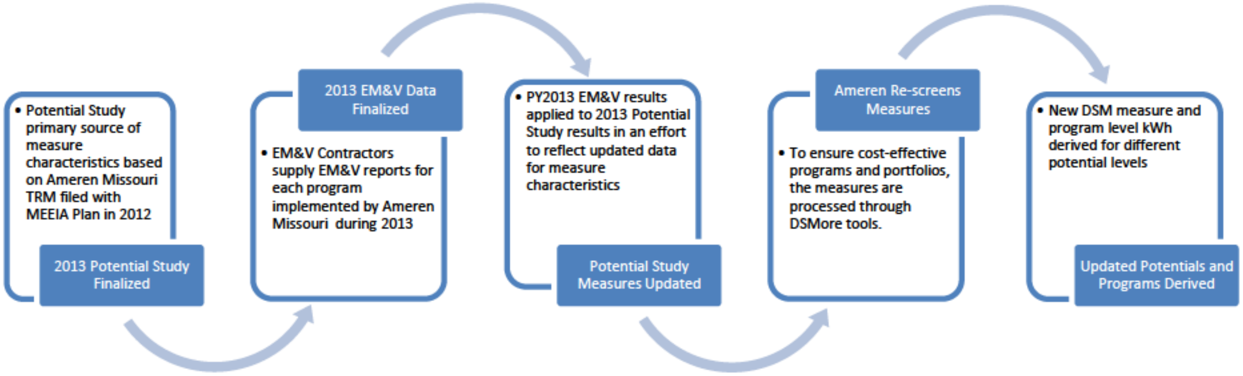
[46] 4 CSR 240-22.050(3)(G)2 A further description of these measures is found on page C-11 of Volume 3 of the DSM Potential Study

[47] 4 CSR 240-22.050(3)(G)1 The analysis of each stand-alone end-use measure can be found in the work papers

after the application of the EM&V realization rates were removed from the potential and portfolio. Subsequently, the program level potential was generated using updated EM&V results.

Figure 8.12 below depicts the process of updating the Potential Study with 2013 EM&V data. The same methodology will apply for 2014 and 2015 EM&V data when it becomes available.

Figure 8.12: Overview of DSM Potential Study Update Process



8.6.4 Interactive Effects[48]

Interactive effects were assessed by Ameren Missouri's contractors for the Ameren Missouri DSM Potential Study. 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.

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.

---

[48] 4 CSR 240-22.050(3)(G)2

8.7 Demand Response Potential[49]

8.7.1 Definition(s) of Demand Response

The Federal Energy Regulatory Commission (FERC) defines demand response as changes in electric use by demand-side resources from their normal consumption patterns in response to changes in the price of electricity or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized. FERC’s definition of demand response conforms to the North American Reliability Corporation (NERC) definition developed by a consortium of utilities and end users – of which Ameren Missouri had a leadership role.

The Midcontinent Independent System Operator (MISO) describes demand response as the ability of a Market Participant (MP) to reduce its electric consumption in response to an instruction received from MISO. MPs can provide such demand response either with discretely interruptible or continuously controllable loads (Demand Resources) or with behind-the-meter generation (BTMG).

The Missouri Integrated Resource Planning (IRP) rules define demand response in the context of the definition of an energy management measure. The Missouri IRP rules define energy management as any device, technology, or operating procedure that makes it possible to alter the time pattern of electricity usage so as to require less generating capacity or to allow the electric power to be supplied from more fuel efficient generating units. Energy management measures are sometimes referred to as demand response measures.

While the definitions have commonalities, the FERC definition of demand response is clear that the purpose of demand response is to either (1) induce lower electricity use at time of high wholesale market prices or (2) provide relief when system reliability is jeopardized. It is important in any analysis of Ameren Missouri's demand response potential to keep both of these purposes in mind when examining the value proposition to all of Ameren Missouri's end-use customers.

An aspect to note in the Missouri IRP rule’s definition of demand response is the inclusion of the term “demand response measures” which includes both energy efficiency and demand response. Energy efficiency refers to using less energy to provide the same level of service to the energy consumer in an economically efficient way. Energy efficiency is about replacing an inefficient measure, such as an incandescent light bulb, with an efficient measure such as a compact fluorescent light bulb. Demand response, in contrast, is a program based on a change in customer

---

[49] EO-2012-0142 12

behavior changing their normal electricity consumption patterns. There are no industry standard baseline expectations for such changes in behavior as there are for energy efficiency (where one can simply calculate the change in energy consumption from installing a new light bulb for example). Since demand response is a customer behavior change program and not a specific measure, there simply are no effective useful life standards to be applied in the cost effectiveness analyses of demand response programs.

The National Action Plan For Energy Efficiency (NAPEE) paper entitled "Coordination of Energy Efficiency and Demand Response" published in January 2010 echoes these facts (that energy efficiency is about the implementation of measures and demand response is about programs). Here are two extracts from the NAPEE paper:

Page 2-1:

"The definition of energy efficiency makes three key assumptions: (1) existing consumer devices are replaced with devices that use less energy, assuming no change in operating practice; (2) new energy-using devices should perform their functions using less energy; and (3) actual kilowatt-hour usage is reduced, irrespective of when that reduction occurs (i.e., it is not time-sensitive)."

Page 2-7:

"When customers participate in demand response, there are three possible ways in which they can change their use of electricity (DOE, 2006):

- *Customers can forego or reduce some uses of electricity. Raising thermostat settings, reducing the run time of air conditioners, dimming or reducing lighting levels, or taking some elevators out of service are common customer load curtailment strategies.*
- *Customers can shift electricity consumption to a time period outside the demand response event or when the price of electricity is lower. For example, an industrial facility might employ storage technologies to take advantage of lower cost off-peak energy, reschedule or defer some production operations to an overnight shift, or in some cases, shift production to companion plants in other service areas. Similarly, with enough notice, commercial or residential customers could pre-cool their facilities and shift load from a higher to lower cost time period. Residential and commercial customers could also choose to delay running certain appliances until prices are lower. Most successful demand response programs have a customer override capability that allows the customer to choose not to adjust its energy use when a specific demand response event is called."*

8.7.2 Ameren Missouri History of Implementation of Customer Demand Response Programs

- Ameren Missouri offered an interruptible rate to large industrial customers from 1983 through 2000. Five (5) participating Ameren Missouri customers provided a total contractual commitment of 54 MW of interruptible load. The interruptible tariff was structured with a 50% demand charge credit which averaged approximately $5/kw-month at the time. Interruptible events were limited to system reliability emergencies. Few interruptible events were called each year. As stated above, the interruptible rate tariff was discontinued in 2000.

- In 1994, Ameren Missouri also offered a subsequent pilot interruptible rate referred to as Rider G for smaller industrial customers with smaller demand charge credits. Four (4) participating Ameren Missouri customers provided a total contractual commitment of 17 MW of interruptible load. Each of these 4 customers experienced a need for increased firm power due to growth of operations and, subsequently, each eventually opted out of participating on the rate. Rider G was discontinued in 2003.

- The Company offered commercial and industrial customers a voluntary curtailment rate option or a peak power rebate (PPR) program referred to as Rider L beginning in 1999. The Company opted to offer a non-penalty based price-responsive DR on the premise that customers may be more likely to sign-up for non-penalty based programs and that penalty based and non-penalty based programs have similar response characteristics. The PPR program structure allows customers to remain on the standard rate for all non-event hours and switch to an incentive rate for a pre-determined number (in this case 60) of critical-peak event hours during a program year.

  There was a total of twenty (20) customers representing a total potential load of 67 MW enrolled in Rider L of the Company's retail electric service tariff. The last Rider L curtailment event was called in 2009. A total of 4 Rider L customers participated in the 2009 curtailment events and all 4 customers combined offered a range of approximately 6 to 9 MW peak demand reduction per event. The Company removed Rider L from its tariffs in 2013.

- The Company also offered a commercial and industrial customer interruptible program with a slight difference from the Rider L program structure. The Company implemented Rider M in 2000, and it remains available to qualifying customers. Rider M is also voluntary and pays participating customers a monthly curtailment option fee plus a price per (KWH). These fees and kWh prices provided for under Rider M were agreed upon in advance by the Company and the customer, based upon various customer selected curtailment options contracted for with the Company, and are applicable during the summer billing months of June – September.

- In Case No ER-2007-0002 Ameren Missouri proposed a tariff to implement a new industrial demand response pilot program known as Rider IDR. The pilot program was designed to assess whether industrial process customers would/could respond to load curtailments to interrupt their use of power when they are directed to do so by the Company. The tariff defined the occasions when a customer could be asked to interrupt, but the decision to interrupt would be at the discretion of Ameren Missouri. Rider IDR limited the hours available for interruption to 200 hours per year. The customer could choose the amount of curtailable load to be included in the program. The availability of the program was to be limited to no more than five customers with a total demand response aggregated load of 100 MW and would last for three years. Customers who agreed to participate in the program would be paid a demand credit of $2.00 per kW per month with an additional credit of 8 cents per kWh when interrupted. Rider IDR was never implemented due primarily to the inability to align the provisions in the Rider with the MISO requirements for qualification of a program for resource adequacy purposes necessary to qualify the program for participation the MISO market.

- In 2004 and 2005 the Ameren Missouri conducted a Residential Time-Of-Use (RTOU) Pilot study. The RTOU Pilot study encompassed two innovative rate offerings that provided financial incentives for customers to modify their consumption patterns during higher priced "critical peak periods" (i.e., CPP). Originally, the rate offerings were organized into three treatment groups for the Pilot study and included:

  Treatment Group #1 – These customers received a three-tier time-of-use rate[50] with high differentials;

  Treatment Group #2 - These customers received the same time-of-use rate as the first treatment group but were also subject to a critical peak pricing (CPP) element; and

  Treatment Group #3 - These customers received the same treatment, i.e., TOU rate and CPP, as treatment group number two but had enabling technology, i.e., a "smart" thermostat, installed by Ameren Missouri. The enabling technology automatically increased the customer's thermostat setting during critical peak pricing events.

  For 2005, the first treatment group, i.e., the time-of-use rate only, was dropped from the Pilot Study. The principal reason for dropping the time-of-use only group was that this group failed to display a significant shift in load from the on-peak to the mid-peak or off-peak periods. Therefore, the second year pilot focused on the critical peak pricing element and those customers with "smart" thermostats. Fifteen-minute interval load monitoring equipment was available on the total premises load for a statistically representative sample of customers in each treatment group. In addition to the treatment groups, the Company constructed control groups for use in the analysis. Once again, fifteen-minute interval load monitoring equipment was available on a statistically representative sample of control group customers.

---

[50] The TOU rates differ by season (i.e., summer versus winter).

Table 8.13 presents findings for the eight critical peak pricing periods in 2005. The table presents the average demand for the control and RTOU treatment groups. An additional 0.52 kW on average was achieved by the group with the enabling technology of a programmable controllable thermostat.

Table 8.13: Peak Pricing Periods 2005[51]

Three Tier TOU with CPP (CPP)

CPP Event			Control	RTOU Pilot	Difference	Percent			
	Hour Ending		Group	Group	Control-RTOU	Difference			
Date	Start	End	(kW)	(kW)	(kW)	(%)	T-Test	Pr>|t|	Ho: Control=RTOU
30-Jun-05	3:00 PM	6:59 PM	5 35	4 85	0 50	9 3%	2 63	0 0088	Reject
21-Jul-05	3:00 PM	6:59 PM	5 71	4 91	0 80	14 1%	3 75	0 0002	Reject
22-Jul-05	3:00 PM	6:59 PM	5 84	5 05	0 79	13 5%	3 54	0 0005	Reject
26-Jul-05	3:00 PM	6:59 PM	5 98	4 91	1 06	17 8%	5 28	0 0000	Reject
2-Aug-05	3:00 PM	6:59 PM	5 38	4 73	0 65	12 1%	3 24	0 0013	Reject
9-Aug-05	3:00 PM	6:59 PM	5 64	4 74	0 90	16 0%	4 33	0 0000	Reject
10-Aug-05	3:00 PM	6:59 PM	5 01	4 24	0 76	15 2%	4 00	0 0000	Reject
19-Aug-05	3:00 PM	6:59 PM	5 61	4 88	0 74	13 1%	3 54	0 0004	Reject
Average			5 56	4 84	0 72	13 0%	3 90	0 0001	Reject

Three Tier TOU with CPP and Thermostat (CPP-THERM)

CPP Event			Control	RTOU	Difference	Percent			
	Hour Ending		Group	Group	Control-RTOU	Difference			
Date	Start	End	(kW)	(kW)	(kW)	(%)	T-Test	Pr>|t|	Ho: Control=RTOU
30-Jun-05	3:00 PM	6:59 PM	5 02	4 30	0 72	14 4%	2 93	0 0036	Reject
21-Jul-05	3:00 PM	6:59 PM	5 37	4 09	1 27	23 7%	5 22	0 0001	Reject
22-Jul-05	3:00 PM	6:59 PM	5 38	4 18	1 20	22 4%	5 39	0 0001	Reject
26-Jul-05	3:00 PM	6:59 PM	5 56	4 38	1 18	21 2%	4 93	0 0001	Reject
2-Aug-05	3:00 PM	6:59 PM	5 23	3 66	1 57	30 0%	6 30	0 0001	Reject
9-Aug-05	3:00 PM	6:59 PM	5 47	4 01	1 46	26 7%	5 76	0 0001	Reject
10-Aug-05	3:00 PM	6:59 PM	4 95	3 82	1 13	22 8%	4 95	0 0001	Reject
19-Aug-05	3:00 PM	6:59 PM	5 38	3 97	1 41	26 1%	5 49	0 0001	Reject
Average			5 29	4 05	1 24	23 5%	6 05	0 0001	Reject

- From 1993 to 1998 Ameren Missouri implemented a residential central air conditioner direct load control program called “No Sweat”. The Company invested a total of $1.9 million implementing the program during that time. The program paid customers an annual incentive payment of $40 for the option to interrupt their air conditioners a finite number of times. Customers participating in the program also received free HVAC diagnostic services from HVAC contractors hired by Ameren Missouri. Communication to switches that cycled customer air conditioners off and on was handled by the existing 154 MHz radio infrastructure at Ameren Missouri. Dead zones and poor reception reduced the cycling benefits, while the manual policing of the radio system added to the program cost.

---

[51] Volume 4 of the Ameren Missouri DSM Potential Study

- In 2009, Ameren Missouri conducted a Personal Energy Manager (PEM) Rebate Pilot Program that had the dual purpose of assessing the effectiveness of potential residential price response programs and testing the associated technology. 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 would interface with the AMR meters.

  This 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 employees 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 the technology. (The technology also assisted the customer in managing their electricity 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.

  The industry name for demand response programs with voluntary participation and no penalties for non-participation when load curtailment events are called is Peak Time Rebates (PTR). A key finding from the 2009 Ameren Missouri PEM pilot in the independent third party evaluation of the program conducted by the team of Cadmus and PA Consulting was the difficulty in estimating an accurate baseline against which to assess load reductions by program participants. Cadmus and PA noted that customers who had taken no load reduction actions were often given an incentive payment and customers who had taken load reduction actions were often not compensated for their efforts. This may have been the first documentation that questioned the premise that PTR programs had no "losers." Subsequent evaluation, measurement and verification of large scale PTR programs in other jurisdictions, most notably California, have shown that voluntary PTR is not a "no losers" program when payment for non-performance due to measurement error is considered.

8.7.2.1 Summary of Ameren Missouri Demand Response Program History

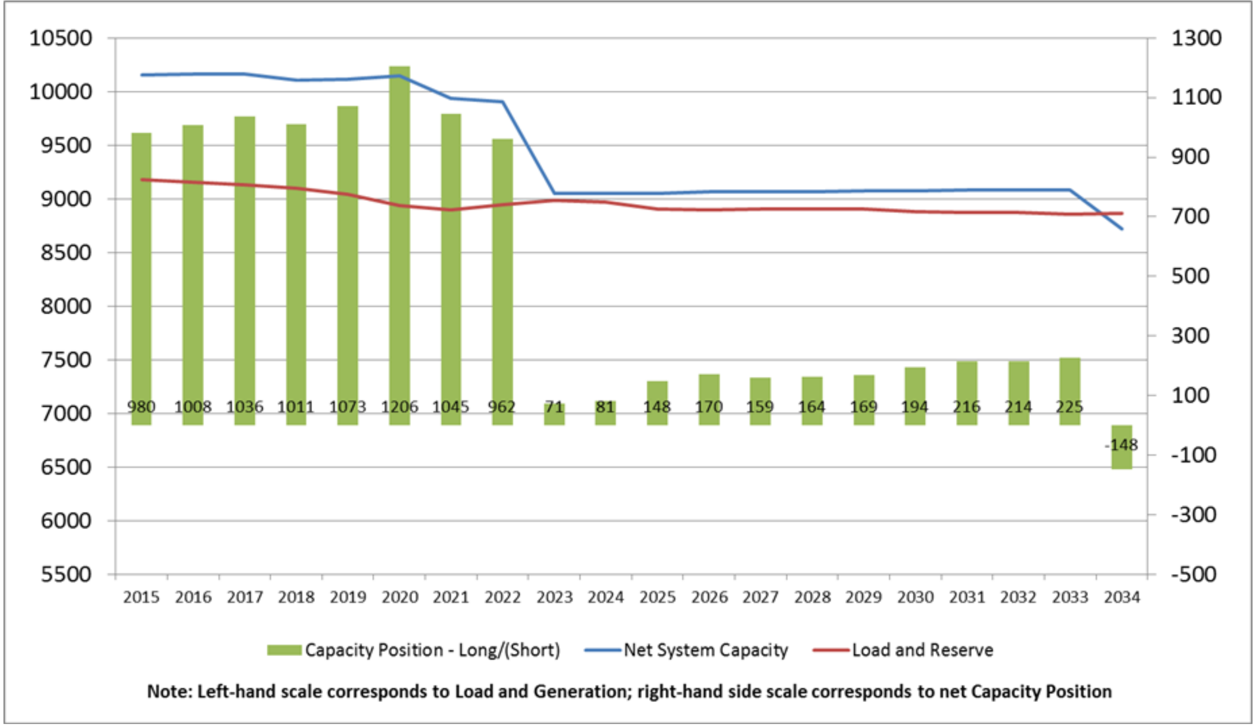
Each of the eight Ameren Missouri demand response programs had a finite effective useful life. Some programs were terminated because the value received was not commensurate with the value paid. Some programs were terminated because they were pilot programs and fulfilled their pilot program testing objectives. Some programs were terminated because they were determined through evaluation not to be cost effective. Some programs were terminated simply because customers were not interested in participating.

8.7.3 Ameren Missouri Capacity Position

Referring back to the definitions of demand response, recall that the purpose of demand response is to either (1) induce lower electricity use at times of high wholesale market prices or (2) provide relief when system reliability is jeopardized. The purpose or objective(s) for implementing demand response programs for Ameren Missouri customers is essential in the development of the realistic achievable potential for cost effective demand response.

Figure 8.13 depicts the Ameren Missouri's baseline capacity position through 2030 at the time of this analysis.

Figure 8.13: 2013 Baseline Capacity Position



Note: Left-hand scale corresponds to Load and Generation; right-hand side scale corresponds to net Capacity Position

The graph in Figure 8.13 indicates that Ameren Missouri expected to be long on capacity through 2030. Consequently, Ameren Missouri would not need, at least under circumstances at the time of this analysis, demand response capability to provide capacity for system reliability through 2030. Granted, there may be circumstances under which the Ameren Missouri capacity position may change, as evidenced by the analysis of alternative resource plans discussed in Chapter 9. Examples of such circumstances include the retirement of one or more existing coal plants and an increase in the electric sales forecast.

The discussion of the Ameren Missouri current capacity position shows (1) that Ameren Missouri has sufficient resources to meet its own resource adequacy requirements under the MISO tariff in the near term planning horizon of 2016-2018 as well as in the long term through 2030. Ameren Missouri continuously re-evaluates its capacity position as conditions change – conditions including plant retirement studies and load forecast sensitivities. However, acquiring additional resources (whether demand response or other resources) in the near term will only increase the current surplus position for the Company in that time period.

8.7.4 Market Prices for Capacity

Referring back to the definitions of demand response, recall that one of the purposes of demand response is to induce lower electricity use at times of high wholesale market prices.

Given that Ameren Missouri does not currently require demand response to meet its own reliability needs, the primary benefit of utilizing such a resource in the 2016-2018 implementation planning period would be in the form of providing an incremental resource to the marketplace – primarily in the form of additional capacity. It is critical in this discussion to recognize that Ameren Missouri is a participant in the MISO markets. As such, its generation is dispatched into the market whenever its incremental production cost is less than the Locational Marginal Price (LMP) established for that generators' pricing zone. What this means is that as long a generator is "in the money" it will run. Adding additional energy resources does not directly result in a reduction in Ameren Missouri's generation, unless a specific generator is the marginal unit in the MISO market.

It is impossible in today's current market to structure a "cost based" tariff for DR programs where the compensation amount is pre-specified ($ amount, not formula) without ending up with significant deviations to actuals (and thus other customers either subsidizing or being enriched by participants).[52] The most effective means of ensuring

---

[52] 4 CSR 240-22.050(4)(F)

that customers are not over (or under) paid would be to structure the tariffs to provide for the pass through to demand response customers of actual revenues (and charges) received from the applicable MISO market (less a reasonable admin fee). The exception to this rule would be for a program which was designed specifically to avoid construction of capacity – and even then, if the customer is not obligated to participate for the period of time in which the capacity deficiency is expected to occur, then they are simply being overpaid in the interim.

The reality is that most DR service providers require compensation somewhere in the vicinity of the effective annualized cost of a new combustion turbine generation (CTG) for each MW of load reduced to make the business case for providing demand response services. Among other costs, significant investments for DR service providers include network operations centers, telecommunications systems, IT infrastructure, marketing expertise, risk management frameworks and the provision of financial incentives to customers to participate in DR programs. A DR business model that would allow the compensation received for DR customer load reduction services to vary and to fall to almost zero as the MISO market experienced for capacity in 2013 would not be a viable business model for DR service providers.

MISO demand response market participation rules are established in its FERC approved Tariff and further detailed in its Business Practice Manual (BPM) No. 026. The MISO demand response market participation rules will be discussed in more detail later in the description of how Ameren Missouri defines Realistic Achievable and Maximum Achievable demand response potential.

It is important to put context around the current value of capacity in the MISO market. MISO capacity market results for the 2013/2014 year cleared at $1.05/MW-day. MISO cleared with 8,100 MW of excess capacity not clearing and 96% of bids offered as price takers at a price of zero. UBS Investment Research, in a discussion of the MISO capacity markets on April 18, 2013 stated, “Given substantial oversupply and the current market construct, we would expect prices to continue to clear at low prices going forward.”

The PJM 2016/2017 Base Residual Auction (BRA) experienced declines from prior auctions in the market value of capacity as shown in the Table 8.14 from PJM:

Table 8.14: PJM Market Value of Capacity

	RTO									
Auction Results	**2007/2008**	**2008/2009**	**2009/2010**	**2010/2011**	**2011/2012[1]**	**2012/2013**	**2013/2014[2]**	**2014/2015[3]**	**2015/2016[4]**	**2016/2017[5]**
Resource Clearing Price	$40.80	$111.92	$102.04	$174.29	$110.00	$16.46	$27.73	$125.99	$136.00	$59.37
Cleared UCAP (MW)	129,409.2	129,597.6	132,231.8	132,190.4	132,221.5	136,143.5	152,743.3	149,974.7	164,561.2	169,159.7
Reserve Margin	19.2%	17.5%	17.8%	16.5%	18.1%	20.9%	20.2%	19.6%	20.2%	21.1%

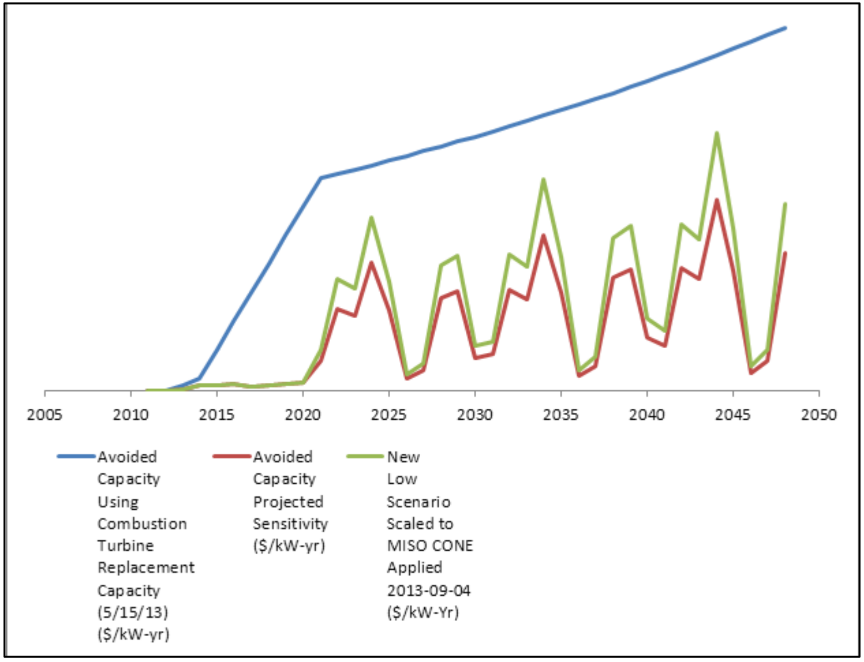
1) 2011/2012 BRA was conducted without Duquesne zone load.
2) 2013/2014 BRA includes ATSI zone
3) 2014/2015 BRA includes Duke zone
4) 2015/2016 BRA includes a significant portion of AEP and DEOK zone load previously under the FRR Alternative
5) 2016/2017 BRA includes EKPC zone

While the PJM 2016/2017 BRA capacity price of $59.37/MW-day is significantly higher than the 2013/2014 MISO capacity price of $1.05/MW-day, $59.37/MW-day is equivalent to approximately $22/kw-year, far below the levelized cost of a CTG or the typical cost of a DR program.

The discussion of the acquisition of demand response resources from Ameren Missouri customers for purposes of bidding into the MISO capacity market shows that there is market price volatility and prices are far below that of the typical cost of a DR program.

With the preceding background, the following graph shows the Ameren avoided capacity assumptions at the time of the completion of the 2013 DSM Potential Study versus a projection of avoided capacity costs based on a multi-dimensional analysis of MISO's projected capacity position over time as well as an analysis of the market price of capacity in other more mature RTO capacity markets:

Figure 8.14: Avoided Cost Sensitivity Curves



Ameren Missouri assumptions for the market price for capacity are based on the assumption that load and generation come into equilibrium at some future point. When equilibrium is reached and there is no excess generating capacity, new resources will be required to meet resource adequacy requirements, and these resources will have a cost comparable to MISO's assumed Cost of New Entry (CONE). Ameren Missouri's assumption is that capacity price remains at CONE to the end of the planning horizon.

The alternative or market sensitivity capacity view is indicative of a more dynamic market with the balance between load and generation ebbing and flowing such that capacity prices approaching those of new CTGs may seldom, if ever, be reached. The alternative view is based on an analysis of actual historical capacity transactions.

The graph of the RTO historical view for capacity versus the assumption that the market price for capacity will eventually approach those of the cost to build a new CTG illustrates high risk and wide bands of uncertainty associated with considering Ameren Missouri customer demand response programs for which customers derive value if the opportunity to reduce customer revenue requirements as the result of a supply and demand imbalance situation in MISO should arise.

It is important to note again that Ameren Missouri revised assumptions for MISO market capacity prices shortly after the completion of the 2013 DSM Potential Study. Repeating Figure 8.15 illustrates the revised assumptions for capacity price relative to the assumptions used for the DSM Potential Study:

Figure 8.15: Avoided Energy and Capacity Comparison, MEEIA Cycle 2013 - 2015 vs. MEEIA Cycle 2016 - 2018 (2010 vs 2013 Potential Comparison) - **NP**

[redacted]

**

The dashed purple line denotes the current Ameren Missouri assumptions for avoided capacity. It approximates the lower alternative view of capacity prices referenced in the 2013 Ameren Missouri DSM Potential Study.

8.7.5 Demand Side Management Program Qualification to Participate in MISO Markets and Resource Adequacy Construct

Provisions exist in the MidContinent ISO (MISO) for demand side management programs to participate in markets for energy, capacity and ancillary services, depending on the capabilities of the resource and the manner in which the program owner has chosen to register the resource with MISO. Of particular importance is the requirement that only those programs with mandatory curtailment provisions requiring the resource to be available for use in the event of an emergency declared by the MISO, pursuant to their emergency operating procedures, qualify for capacity purposes or as an Emergency Demand Resource. Programs which make curtailment an economic option for the participant do not qualify for those purposes.

In addition to participating in the capacity markets, qualified and properly registered DSM programs may also participate in the MISO energy and ancillary services markets. Programs which are not qualified to be properly registered in the MISO market may still be able to indirectly participate in the energy markets by reducing output in a given hour thereby reducing Ameren Missouri's load clearing requirement in the MISO for that hour.

As such, the valuation of a given DSM program necessarily requires an understanding of whether the program will qualify for registration in the MISO Markets, and for which specific products. A program which does not contain mandatory curtailment provisions during MISO emergency events cannot properly be assigned a value for capacity (the current assumption being that this provides the primary value to DSM programs), but may be assigned a value for energy.

8.7.6 Determination of Realistic Achievable and Maximum Achievable Demand Response Potential

The definitions of Realistic Achievable Potential (RAP) and Maximum Achievable Potential (MAP) necessarily are different for energy efficiency and demand response for Ameren Missouri. The reason is the current MISO demand response market construct within which Ameren Missouri would bid its demand response capacity resources. Ameren Missouri does not have similar MISO constructs for its customer energy efficiency programs.

For energy efficiency, RAP represents a forecast of likely customer behavior under realistic program design and implementation. It takes into account existing market, financial, political, and regulatory barriers that are likely to limit the amount of savings that might be achieved through energy efficiency programs. For example, it considers more realistic incentives (i.e., less than 100% of incremental cost), defined marketing campaigns, and internal budget constraints. Political barriers often reflect differences in regional attitudes toward energy efficiency and its value as a resource. The RAP also takes into account recent utility experience and reported savings.

For energy efficiency, MAP establishes a hypothetical upper limit for the savings a utility can hope to achieve through its programs. MAP involves incentives that represent up to 100% of the incremental cost of energy efficiency measures above baseline measures combined with high administrative and marketing costs.

Demand response RAP and MAP definitions are much different than for energy efficiency due to the fact that demand response is a totally different product offered in a totally different market – the MISO capacity market. The analysis approach for estimating demand response potential is, by necessity, different from the approach used for energy efficiency. Energy efficiency can occur outside of utility programs to the extent that it is naturally occurring or technology driven; but can be enhanced and enabled by utility programs. Demand response, however, does not exist without a utility program in the Ameren Missouri service territory. Therefore, a program-by-program analysis is at the core of a demand-response Potential Study. The basic steps to perform this assessment are as follows:

- **Characterize the market**. The first step is to segment the market into the relevant customer segments. The first level of segmentation is by sector: residential and C&I customers. Within residential customers, the population is segmented further by describing housing types and presence of end uses (such as single family homes with central air conditioning and electric water heating). For C&I customers, the next level of segmentation is based on the maximum demand values, typically following utility rate schedules. Segmentation may also be by building type or industry

- **Identify the baseline forecast**. The second step is to identify what the peak demand forecast will be absent any DR programs for the relevant peak season, typically summer.

- **Define relevant DR options**. The next step is to identify applicable DR options for each customer segment.

- **Outline DR program participation hierarchy**. For each customer segment that has more than one DR option, the next step is to define the participation hierarchy. This accounts for program overlaps and ensures that cross-participation in DR events and double counting does not take place.

Ameren Missouri defines RAP for the case in which Ameren Missouri might acquire customer demand response resources for the sole purpose of bidding into the MISO capacity market as:

> A forecast of likely customer behavior under realistic program design and implementation within the current MISO capacity market construct. It takes into account existing market, financial, political, and regulatory barriers that are likely to limit the amount of savings that might be achieved through demand response programs in other RTO jurisdictions.

Ameren Missouri defines MAP to be the case in which Ameren Missouri might acquire customer demand response resources for system reliability under revised

MISO demand response business practices where voluntary customer curtailment programs would be eligible to participate in the MISO capacity market.

8.7.7 Capacity Equivalence

Capacity Equivalence is the true capacity value of a program (DSM, DR, wind, hydro, etc.).

1 MW of DSM ≠ 1 MW of Gas ≠ 1 MW of Coal Generation

The calculation of the amount of reserve MW at time of system peak may not provide an indication of the capacity, or load relief that will be available throughout the ***entire year*** to meet customer requirements. Capacity equivalence is determined at system level with adjustments for reserve margin and distribution losses. It varies according to the pattern of load relief afforded by the potential program.

Examples of typical capacity equivalence factors include:

Table 8.15: Typical Capacity Equivalence Factors

Programs	CE	comments
Water Heating & Lighting Measures	1.286	Informational
Central AC and Heat Pump Cycling	0.553	50% cycling using radio receiver
Water Heater Cycling	0.605	
Refrigerator Removal	1.016	prevent primary refrigerators from becoming secondary refrigerators
Freezer Removal	0.947	
Central A/C and Heat Pump Shading	0.929	Informational

Capacity equivalence is factored into the capacity benefit of demand response programs in the following manner:

Avoided Capacity Benefit = Avoided Capacity Cost X Peak Demand Reduction X Capacity Equivalence

Although Ameren Missouri has conducted rigorous capacity equivalence analyses on potential new intermittent type resources in the past when system reliability was an issue, Ameren Missouri did not calculate capacity equivalence for potential demand side resources because demand response programs are not required in the planning horizon for system reliability.

8.7.8 Demand Response Program Effective Useful Lives

Demand response is a customer behavior change program. It is not like an energy efficiency measure which is equipment related and may have an effective useful life of 18 years such as a central air conditioning unit or 25+ years for an LED light bulb.

Demand response is modular. It can be installed in discrete chunks, i.e., 50 MW blocks and it can be removed in discrete chucks. The history of the eight Ameren Missouri demand response programs illustrates the modularity of customer demand response programs. A non-Ameren Missouri example of the modularity of demand response programs is the 2013 decision by the Idaho Public Utilities Commission (IPUC) to ramp down two existing customer demand response programs at Idaho Power Company due to Idaho Power having sufficient generation capacity to meet 100% of its load obligations. The IPUC subsequently reinstated demand response after mandating two critical assumptions which resulted in the programs being found to be cost effective. These assumptions were: (1) the effective useful life is 20 years, and (2) the avoided capacity cost against which to evaluate the benefits of demand response is a new 170 MW combustion turbine generator. Another example is the ramp down of demand response resources bid into the 2016/2017 PJM capacity auction due to PJM’s acquisition of new natural gas power supply sources and increased capacity import capabilities. There are no “best practice” guidelines as to what the effective useful lives of demand response programs should be because demand response is modular by design.

The development of an effective useful life assumption is critical to the cost effectiveness calculation of any demand response resource. Ameren Missouri has chosen to assume a three year useful life for all demand response resources in the estimation of demand response potential. The three year useful life is assumed to coincide with each of Ameren Missouri’s three year Missouri Energy Efficiency Investment Act (MEEIA) implementation plans.

Ameren Missouri has chosen to assume a three year effective useful life in large part to mitigate MISO capacity market price risk and uncertainty. This is due to the fact that the primary value proposition of demand response to Ameren Missouri customers in the current planning horizon is to sell capacity into the MISO market for the purpose of reducing revenue requirements. The 2013/2014 MISO capacity auction yielded capacity prices of $1.05/MW-day or essentially $0 per kw-year.

8.7.9 Peak Time Rebate (PTR) Programs

The 2010 Ameren Missouri DSM Potential Study, used in the development of the Ameren Missouri MEEIA Cycle 2013 - 2015 DSM implementation plan, selected a customer opt-out Peak Time Rebates (PTR) construct to represent the potential for mass market demand response. PTR was selected because it is a credit only program and customer opt-in rates are better for credit only programs than other penalty and dynamic pricing programs such as critical peak pricing (CPP). Since 2010 there has been significant activity in the evaluation of PTR programs. The results have refuted the heretofore held belief that PTR programs had no “losers” and only “winners.”

In 2012, San Diego Gas & Electric Company (SDG&E) enrolled approximately 1.2 million residential customers in a PTR program, branded as “Reduce Your Use Rewards.” PTR is a pay for performance program that pays customers to reduce electricity use during the peak period on selected days (referred to as event days) that are not known until the day before they occur. The incentive is paid based on the difference between the metered load during the peak period on event days and an estimate of what the customer would have used during the same period if the PTR event had not occurred. This estimate is referred to as the baseline load. The accuracy and magnitude of incentive payments are dependent on the accuracy of the baseline estimate. Given the normal fluctuation in any given residential customer’s usage across days, it is very difficult to accurately estimate baselines for individual customers on individual event days. The evaluation of the SDG&E PTR pilot showed conclusively that baseline and payment errors resulted in payments being made to customers who do not reduce demand. These payment errors must be recovered from all customers.

Consequently, for the 2013 Ameren Missouri DSM Potential Study, Ameren Missouri selected CPP rather than PTR to represent residential dynamic pricing demand response potential.

8.7.10 FERC National Assessment of DSM Potential – 2009

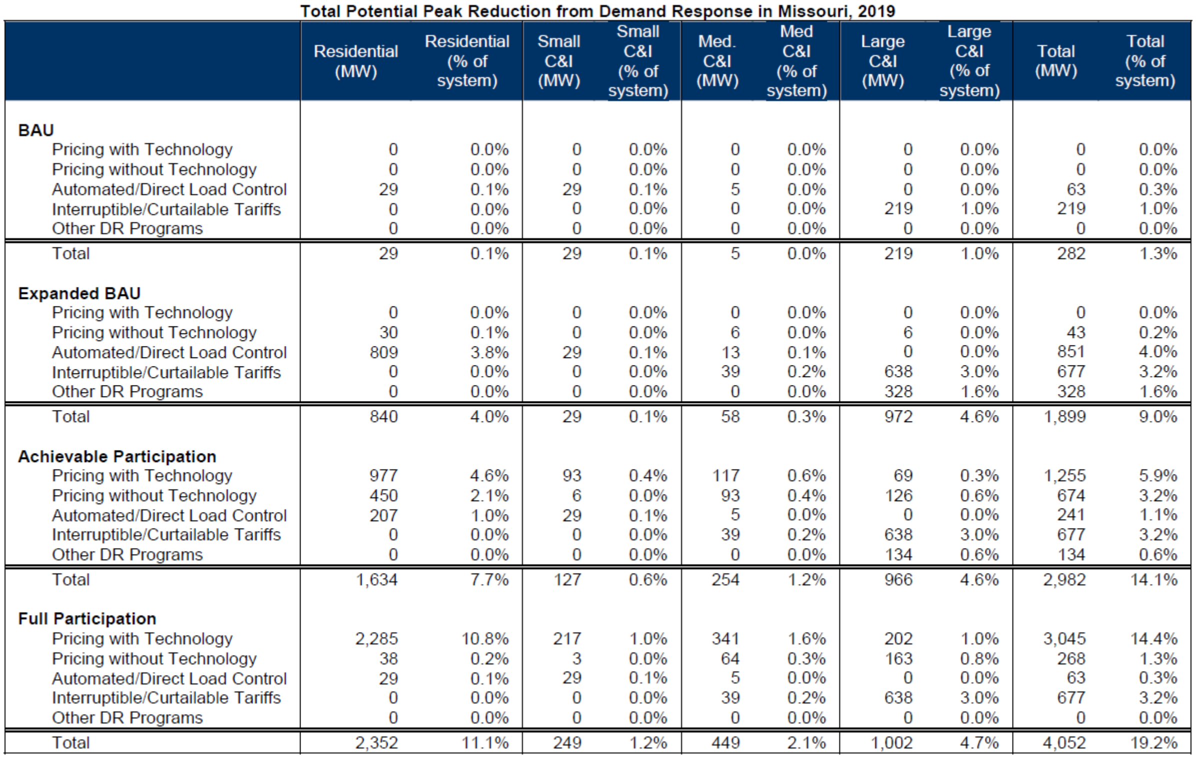
Many DR Potential studies attempt to benchmark to the June 2009 FERC National Assessment of DSM Potential. In fact, the 2010 Ameren Missouri DR Potential Study was benchmarked to the FERC study.

The 2013 Ameren Missouri DR Potential Study does not attempt to benchmark to the 2009 FERC study for a variety of reasons including:

- The age of the report. The industry has advanced its knowledge of DR potential considerably since 2009. One example is the analysis of empirical data on the true costs and benefits of a PTR program, as described in the previous section.

- The study does not address the situation where an IOU is long on capacity as is the RTO in which it operates.
- The applicability of secondary data sources for DR impacts should be supplanted by Ameren Missouri primary data sources for DR impacts in any instance.
- Assumptions around dynamic pricing rates, dynamic pricing customer participation estimates and dynamic pricing load reduction impacts are not representative of Ameren Missouri. For example, the 2009 FERC study shows the following amounts of DR potential for Missouri in 2019:

Table 8.16: Total Potential Peak Reduction from DR in MO, 2019



Total Potential Peak Reduction from Demand Response in Missouri, 2019

	Residential (MW)	Residential (% of system)	Small C&I (MW)	Small C&I (% of system)	Med. C&I (MW)	Med C&I (% of system)	Large C&I (MW)	Large C&I (% of system)	Total (MW)	Total (% of system)
BAU										
Pricing with Technology	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pricing without Technology	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Automated/Direct Load Control	29	0.1%	29	0.1%	5	0.0%	0	0.0%	63	0.3%
Interruptible/Curtailable Tariffs	0	0.0%	0	0.0%	0	0.0%	219	1.0%	219	1.0%
Other DR Programs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	29	0.1%	29	0.1%	5	0.0%	219	1.0%	282	1.3%
Expanded BAU										
Pricing with Technology	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pricing without Technology	30	0.1%	0	0.0%	6	0.0%	6	0.0%	43	0.2%
Automated/Direct Load Control	809	3.8%	29	0.1%	13	0.1%	0	0.0%	851	4.0%
Interruptible/Curtailable Tariffs	0	0.0%	0	0.0%	39	0.2%	638	3.0%	677	3.2%
Other DR Programs	0	0.0%	0	0.0%	0	0.0%	328	1.6%	328	1.6%
Total	840	4.0%	29	0.1%	58	0.3%	972	4.6%	1,899	9.0%
Achievable Participation										
Pricing with Technology	977	4.6%	93	0.4%	117	0.6%	69	0.3%	1,255	5.9%
Pricing without Technology	450	2.1%	6	0.0%	93	0.4%	126	0.6%	674	3.2%
Automated/Direct Load Control	207	1.0%	29	0.1%	5	0.0%	0	0.0%	241	1.1%
Interruptible/Curtailable Tariffs	0	0.0%	0	0.0%	39	0.2%	638	3.0%	677	3.2%
Other DR Programs	0	0.0%	0	0.0%	0	0.0%	134	0.6%	134	0.6%
Total	1,634	7.7%	127	0.6%	254	1.2%	966	4.6%	2,982	14.1%
Full Participation										
Pricing with Technology	2,285	10.8%	217	1.0%	341	1.6%	202	1.0%	3,045	14.4%
Pricing without Technology	38	0.2%	3	0.0%	64	0.3%	163	0.8%	268	1.3%
Automated/Direct Load Control	29	0.1%	29	0.1%	5	0.0%	0	0.0%	63	0.3%
Interruptible/Curtailable Tariffs	0	0.0%	0	0.0%	39	0.2%	638	3.0%	677	3.2%
Other DR Programs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	2,352	11.1%	249	1.2%	449	2.1%	1,002	4.7%	4,052	19.2%

It is apparent that residential pricing accompanied by DR enabling technology accounts for the majority of DR potential in 2019.[53]

Compare and contrast the FERC 2009 National Demand Response study for Missouri with the 2013 Ameren Missouri Demand-Side Rates Potential Study. It should be noted that the Brattle Group conducted both studies.

---

[53] 4 CSR 240-22.050(3)(D)

Table 8.17: 2013 Ameren Missouri Demand-Side Rates Potential Study[54]

Combination	Participation Scenario	Residential Rate	SGS Rate	LGS Rate	Peak Reduction (MW)	Peak Reduction (% of System Peak)
1	Opt-In	TOU	TOU	CPP	69	0.82%
2	Opt-In	IBR	TOU	CPP	78	0.93%
3	Opt-Out	TOU	TOU	CPP	259	3.07%
4	Opt-Out	IBR	TOU	CPP	294	3.48%

- One size does not fit all. For example, most of Ameren Missouri residential air conditioning load has a peak demand below 5 kW. This impacts the peak load reduction per home which, in turn, impacts the cost effectiveness of RES demand response programs.

The FERC study has a “Full Participation” scenario which is similar to technical potential which has little value for an Ameren Missouri DSM Potential Study.

8.7.11 2013 DR Potential Study Results

There are three sets of avoided capacity costs used to assess demand response potential over the 2016-2034 planning horizon. The first is the Ameren Missouri avoided capacity cost curve at the time the 2013 DSM Potential Study began. The second is the MISO market based sensitivity capacity cost curve developed to emulate actual capacity prices in MISO and other RTOs. The third is the most recent Ameren Missouri avoided capacity cost curve that was approved in February 2014, approximately two months after the completion of the 2013 DSM Potential Study.

Knowing the history and chronology of the Ameren Missouri avoided capacity cost curves, Table 8.18 below is an extract from the 2013 DR Potential Study using the avoided capacity curves set forth at the outset of the study.

---

[54] Volume 6 of Ameren Missouri DSM Potential Study

Table 8.18: Ameren Missouri Peak Demand Savings Potential[55]

	2016	2017	2018		2025	2030
System Peak Forecast (MW)	7,328	7,368	7,420		7,901	8,241
Peak Demand Savings (MW)						
RAP Program Potential		16	60		234	238
MAP Program Potential		16	60		286	303
Savings (% of System Peak)						
Realistic Achievable Potential	0.0%	0.2%	0.8%		3.0%	2.9%
Maximum Achievable Potential	0.0%	0.2%	0.8%		3.6%	3.7%

Table 8.19 below is also an extract from the 2013 DR Potential Study. This table shows the results of the sensitivities around the results in Table 8.18. The row named "Market-based Avoided Costs" reflects the results using market-based avoided capacity costs.

Table 8.19: Peak Demand Savings Sensitivities

	2016	2017	2018	2025	2030
RAP DR Potential (MW)					
Base Case	-	16	60	234	238
Market-based Avoided Costs	-	-	-	-	-
Longer Program Life	55	126	238	434	446
RAP DR Potential (% of the system peak)					
Base Case	-	0.22%	0.80%	2.96%	2.89%
Market-based Avoided Costs	-	-	-	-	-
Longer Program Life	0.75%	1.71%	3.21%	5.49%	5.41%
MAP DR Potential (MW)					
Base Case	-	16	60	286	303
Lower Avoided Costs	-	-	-	52	53
Longer Program Life	55	126	238	540	563
MAP DR Potential (% of the system peak)					
Base Case	-	0.22%	0.80%	3.62%	3.68%
Lower Avoided Costs	-	-	-	0.66%	0.64%
Longer Program Life	0.75%	1.71%	3.21%	6.83%	6.83%

---

[55] Volume 4 of Ameren Missouri DSM Potential Study

The preceding table illustrates that demand response programs are not cost effective for the Ameren Missouri MEEIA Cycle 2016 - 2018 implementation period spanning from 2016-2018 based on the most current Ameren Missouri forward view of MISO capacity prices. A corollary critical assumption associated with demand response program cost ineffectiveness from 2016-2018 is the assumption of a three-year demand response program life. In turn, the three-year program life assumption is tied to the scenario where Ameren Missouri deploys demand response as an additional resource to MISO to induce lower electricity use at times of high wholesale market prices. At such time that Ameren Missouri requires demand response resources to primarily provide relief when system reliability is jeopardized - this implies service as a longer term asset. Ameren Missouri would analyze the cost effectiveness under longer demand response program lives. The purpose or objective(s) for implementing demand response programs for Ameren Missouri customers is essential in the development of the realistic achievable potential for cost effective response.

8.7.12 Ameren Missouri DR Pilot Consideration for 2016-2018[56]

The fundamental objectives of a demand response pilot program are to test either new technologies or theories about innovative program logic prior to implementing a full scale program.[57]

Ameren Missouri is in the process of putting context around a potential DR pilot program that will assess the promise of customer demand-side management in the context of the smart grid. The implementation of the potential pilot is premised on Ameren Missouri converting its customer metering technology from one-way automated meter reading (AMR) to two-way advanced meter infrastructure (AMI) technology beginning as early as 2017. Although Ameren Missouri discusses a framework for the potential pilot in this filing, the final design of the pilot should include the input and insight of the Ameren Missouri EE Regulatory stakeholder working group.[58]

The next generation of demand response programs will evolve from a primary focus on utility “command and control” type programs to also include customer choice type DR programs. The next generation of DSM technologies will enable customers to make more informed decisions about their energy consumption, adjusting when they use electricity and how much they use. A major component of the utility smart grid infrastructure is technology to enable customers to make more informed decisions about their energy consumption. AMI is an architecture for automated, two-way

---

[56] 4 CSR 240-22.050(2)
[57] 4 CSR 240-22.050(3)(D)
[58] EO-2012-0142 14

communication between a smart utility meter and a utility company. The goal of AMI is to provide utility companies with real-time data about power consumption and allow customers to make informed choices about energy usage based primarily on the price of energy at the time of use.

As the 2014 IRP and MEEIA Cycle 2016 - 2018 filings were being developed, Ameren Missouri is in the process of understanding the business case for converting customer meters from AMR to AMI technology. AMI is a pre-requisite technology for this pilot. Therefore, if AMI installation do not begin by early 2017, it is unlikely that a DR pilot can be implemented during the 2016-2018 implementation period.

There is no budget specified for a potential DR program for the 2016-2018 implementation period. This is due to the lack of certainty around when the next generation metering technology may be installed as well as to the outcome of the collaborative efforts to mutually design a DR pilot that will provide the greatest net benefits to Ameren Missouri customers.

Proposed DR Pilot Program Objective(s)

A preliminary list of objectives for this pilot includes:

1. Deploy statistically significant samples to measure the impacts of the following potential program designs or a subset thereof:
    a. Innovative rates
        i. Critical peak pricing (CPP) and its close relative Peak time rebates (PTR)
        ii. Time of use (TOU)
        iii. Real-time pricing (RTP)
    b. Customer incentives
        i. No incentives
        ii. Cash compensation
        iii. Innovative compensation, i.e., variable bill credits depending on degree of customer behavior change
    c. Information
        i. None
        ii. Event notification
        iii. Historical and real-time consumption and cost
        iv. Comparative usage
        v. Device specific usage
    d. DR technology
        i. None
        ii. Smart thermostats

        iii. Smart appliances/plugs
        iv. Home area networks
        v. Non-obtrusive business DR technologies
    e. Customer education
        i. None
        ii. Targeted by customer segment
2. Test tolerance for increasing frequency and duration of DR events
    a. Reliability events
    b. Price events
3. Quantify both annual peak demand and energy reductions associated with each program design option
4. Understand utility infrastructure challenges, including:
    a. Integrate utility information systems
    b. Understand infrastructure requirements for potential third-party DR providers
    c. Customer contact capabilities to maximize customer satisfaction
5. Define regulatory reforms that will allow Ameren Missouri to capture value from this project if subsequent full scale deployment ensues

8.8 Targeted DSM[59]

As electric distribution networks approach capacity limitations and where there is an expectation for future load growth, building new infrastructure represents a capital intensive and, in some cases, a difficult endeavor.

Targeted load reduction via energy efficiency and demand response, i.e., “targeted DSM”, could, in some but not all cases, be more financially beneficial than upgrading infrastructure. With this objective, the Ameren Missouri Energy Delivery team performed a comprehensive review of potential targeted DSM opportunities in 2013 using a well-defined process.

Missouri Division supervising engineers were contacted to request that their engineers review circuits to identify potential candidates for a targeted demand-side management programs. The engineers were asked to identify those circuits where a targeted DSM program might help Energy Delivery avoid capital and O&M expenditures which would otherwise have to be made to provide load relief. In addition to being heavily loaded, the ideal candidate circuits should also have a significant amount of industrial or large commercial load such that the impact could be mitigated by targeted DSM in the near future. The engineers reviewed their most recent 5-year load analysis projections in

---

[59] EO-2014-0062 f

order to identify any potential candidates. The criteria for significant industrial and large commercial loads were not specified so that the engineers were not constrained and could utilize their engineering judgment regarding the size of the loads relative to circuit overload projections, load growth rates, and other factors.

Two potential candidate circuits were identified. Many of the projects in the 5-year budgets involved rehab and upgrade work, relocations, mandatory reliability work, and other non-load growth related projects. However, two circuits were identified as possible candidates:

Spring Forest 575-52: This feeder needs load relief by 2016 and has two large primary metered connections (approx. 1 MVA each) to supply a school district. Most of the other loads are residential or small commercial.

Barrett Station 318-52: This feeder will require future load relief if a new project proceeds and the addition of a second unit and feeders at Barrett Station are delayed (currently not budgeted, but pending review). Both this circuit and some of the surrounding circuits have heavy commercial loads. The 2nd Unit at Barrett Station may itself be a candidate if a significant driver for the project is determined to be load-related rather than reliability-related. Since there is no capital budget currently in place to upgrade Barrett Station, no financial analysis was performed to determine the magnitude of benefits, if any, relative to a targeted DSM solution.

8.8.1 Spring Forest Situation Analysis

Due to construction of a new 242-home subdivision, there is insufficient capacity from the Spring Forest Feeder to reliably supply it. The subdivision is to be built in four phases. With the addition of the subdivision's 3rd phase, the existing single-phase portion of this feeder is close to its 135-amp limit and the feeder is over its 600 amp limit. The plan is to add a new three-phase feeder to serve customers in the new development. The new feeder will have an average capacity in the 8 MVA range and is currently budgeted for installation in 2015 at a budgeted cost of $597,000. In addition to the increased capacity associated with the new three-phase feeder, the new feeder will also provide increased reliability improvements in terms of splitting circuits which results in less customers being out of service during an outage situation due to having increased switching abilities.

Since the Spring Forest feeder already had an existing budget ($597,000) for capital improvements, Ameren Missouri Energy Delivery engineers worked with the Ameren Corporate Planning department to study the potential for a targeted DSM solution versus the budgeted solution. For purposes of determining a budgetary estimate, Corporate Planning sought cost estimates from a targeted DSM company.

The targeted DSM company focuses on commercial and industrial (C&I) customer load reduction opportunities. Their targeted DSM solution is a fully automated switch installed at C&I customer premises. It intelligently taps embedded responsive load from customers. The utility can schedule, dispatch and monitor events via a secure, real-time portal or any existing utility control system(s).

The targeted DSM solution proposal was turn-key. That means the work and the price included:

- Enrolling and contracting with the end-use customer (with Ameren Missouri Customer/Marketing groups' approvals of the materials and engagement),
- Performing the site surveys,
- Installing the equipment on the site,
- Operating the equipment and
- Provisioning the capacity to Ameren Missouri operators in a fashion that they understand, can schedule and monitor.

The targeted DSM Company provided the following high level bid to address the Spring Forest feeder situation.

- $695/kW plus $43/kW O&M per year and $40/kW Customer incentive per year.

To translate the bid into equivalent dollars to the proposed $597,000 investment at Spring Forest, the following math applies. Assume 8 MVA is equivalent to 8,000 kW. $695/kW x 8,000 kW is $5,560,000. Since $5,560,000 is multiples of $597,000 there is no need to quantify the additional O&M and customer incentive costs associated with the proposed Innovari solution.

Ameren Missouri Energy Delivery engineers will continue to use the targeted DSM methodology outlined above to assess cost effective targeted DSM opportunities in future budget cycles.

8.9 Distributed Generation and Combined Heat and Power Potential[60]

Ameren Missouri commissioned this Demand Side Management (DSM) Market Potential Study to assess the various categories of distributed generation (DG), and

---

[60] EO-2012-0142 14, EO-2014-0062 f

combined heat and power (CHP) potentials in the residential, commercial, and industrial sectors for the Ameren Missouri service area from 2016 to 2033. The study used updated baseline estimates based on the latest information pertaining to federal, state, and local codes and standards for improving energy efficiency. It also quantified and included estimates of naturally occurring energy efficiency in the baseline projection.

8.9.1 CHP Case Studies

As mentioned above, the study included two types of customer-sited resources as follows:

a) **Distributed generation:** DG systems are technologies that generate electricity and are located onsite at customer premises.

b) **Combined heat and power:** CHP systems generate both electricity and thermal energy that are used onsite.

Before performing the service-territory analysis, we conducted two in-depth case studies of DG-CHP opportunities that were being considered by Ameren Missouri large industrial customers: one at a major corn milling facility and another at a major manufacturing facility.

Specifics regarding installed costs and fuel costs are proprietary to the subject customers. Major, non-proprietary assumptions for the case study analyses were as follows:

a) Natural gas fueled combustion turbine generator with 3+ MW of electricity generating capacity; producing waste heat in the form of steam for process heating

b) Waste heat valuation based on displacing boiler fuel use

c) Annual O&M costs include turbine overhaul cost at half-life

d) 20 year system life

e) $10,000 grid interconnection study cost

f) Real discount rate of 3.95%

g) Uptime of 90%+ hours per year

h) Avoided cost benefits for energy and capacity as provided by Ameren Missouri

The cost effectiveness results of the analysis are shown in Table 8.20. Although the TRC ratios are marginally above 1.0, indicating that the projects are marginally cost-effective, they are sensitive to many factors. For example, during a drought-year, production and heating requirements at the milling facility may fall, reducing the value of waste heat. Another example, in a colder than normal winter, natural gas pipeline capacity may be 100% utilized for home heating, leaving industrial customers with non-firm natural gas transportation contracts subject to natural gas supply interruptions. In a sensitivity analysis to model a prolonged drought scenario, the TRC ratio dropped to 1.01. An additional factor to consider is the customer's Ameren Missouri rate structure, which contains a standby charge (Rider E) for Ameren to maintain the necessary capacity if the customer would choose to revert to grid power in the event of an emergency shut-down of their DG-CHP system. For sizeable systems, the details of this cost result from a complex interconnection study, scenario analysis, and negotiation — and can have a significant impact on the overall project economics. Finally, there are contractual terms and conditions that may alter the benefits of CHP for customers. For example, cost effective electric generation from CHP is dependent upon full utilization of steam output. If steam demand is reduced for any reason, CHP contracts with customers may require take or pay provisions to protect the financial interests of the CHP facility owner if the event of a decline in steam requirements. These are among the considerations that must be taken into account in estimating DG-CHP potential.

Table 8.20: Total Resource Cost (TRC) Test Results for DG-CHP Case Studies[61]

Case Study	TRC Ratio	NPV Net Benefits	NPV Benefits	NPV Costs
Major Corn Milling Facility	1.17	$8,577,664	$58,910,946	$50,333,283
Major Manufacturing Facility	1.04	$1,378,710	$32,167,172	$30,788,462

8.9.2 DG/CHP Technology Options

The first step toward estimating DG-CHP achievable potential was to identify applicable technology options. Based on a thorough review of available and applicable technologies, as well as input from stakeholders, we arrived at the following list:

i) Solar photovoltaic (PV) systems
j) Small wind
k) Reciprocating engine
l) Reciprocating engine with heat recovery
m) Micro-turbine

---

[61] Volume 5 of the Ameren Missouri DSM Potential Study

n) Micro-turbine with heat recovery
o) Combustion turbine (CT)
p) Combustion turbine with heat recovery
q) Boiler with back-pressure steam turbine
r) Fuel cell
s) Fuel cell with heat recovery
t) Combined cycle combustion turbine (CCCT)
u) Stirling engine
v) Organic rankine cycle

Table 8.21: DG-CHP Technology and Cost Data[62]

Technology	System Size (kW)	Lifetime	$/kW installed cost (2011)	Non-fuel $/kWh annual O&M (2011)	Load factor (% available)	Nat Gas Fuel Use, BTU/kWh	Nat Gas Fuel Avoided, BTU/kWh	Federal tax credit	Inst. Cost Decline from Yr 1 to YrFinal	Peak Coinc. Factor	Useful Thermal Output, BTU/kWh	Effic.of Displaced Boiler	Data Source
Solar PV	6	20	$3,953	$0.002	15 0%	-	-	10 0%	78.7%	47.0%	-		4,5,6,8,10
Solar PV	20	20	$3,867	$0.001	15 0%	-	-	10 0%	78.7%	47.0%	-		4,6,7,10
Solar PV	100	20	$3,688	$0.001	15 0%	-	-	10 0%	78.7%	47.0%	-		4,5,6,7,10
Solar PV	1,000	20	$3,570	$0.001	15 0%	-	-	10 0%	78.7%	47.0%	-		4,5,7,10
Small Wind	3	20	$8,215	$0.020	15 0%	-	-	0 0%	10 0%	20.0%	-		4
Small Wind	30	20	$6,038	$0.020	20 0%	-	-	0 0%	10 0%	20.0%	-		4
Small Wind	300	20	$3,600	$0.020	25 0%	-	-	0 0%	10 0%	20.0%	-		1
Recip Engine	500	15	$1,950	$0.012	80 0%	9,755	-	0 0%	0 0%	80.0%	-		1,2
Recip Engine w/ Heat Recovery	500	15	$2,326	$0.012	80 0%	9,755	5,291	0 0%	0 0%	80.0%	4,233	80.0%	1,2
Recip Engine	1,500	15	$1,650	$0.007	80 0%	9,738	-	0 0%	0 0%	80.0%	-		1,2
Recip Engine w/ Heat Recovery	1,500	15	$1,980	$0.007	80 0%	9,738	5,298	0 0%	0 0%	80.0%	4,238	80.0%	1,2
Micro- turbine	200	15	$3,068	$0.020	80 0%	12,247	-	0 0%	0 0%	80.0%	-		1,2
Micro- turbine w/ Heat Recov.	200	15	$3,068	$0.020	80 0%	12,247	5,331	0 0%	0 0%	80.0%	4,265	80.0%	1,2
Micro- turbine	500	15	$3,068	$0.020	80 0%	12,247	-	0 0%	0 0%	80.0%	-		1,2
Micro- turbine w/ Heat Recov.	500	15	$3,068	$0.020	80 0%	12,247	5,331	0 0%	0 0%	80.0%	4,265	80.0%	1,2
Combustion Turbine (CT)	2,000	20	$3,000	$0.010	90 0%	14,085	-	0 0%	0 0%	80.0%	-		1,2,3
CT w/ Heat Recovery	2,000	20	$2,969	$0.010	90 0%	14,085	7,434	0 0%	0 0%	80.0%	5,947	80.0%	1,2,3
Combustion Turbine (CT)	5,000	20	$1,500	$0.010	90 0%	13,754	-	0 0%	0 0%	90.0%	-		1,2,3
CT w/ Heat Recovery	5,000	20	$1,485	$0.010	90 0%	13,754	7,206	0 0%	0 0%	90.0%	5,765	80.0%	1,2,3
Boiler w back-press steam turb.	3,000	50	$500	$0.005	80 0%	-		0 0%	0 0%	80.0%			2
Fuel Cell w/ Heat Recovery	5	12	$11,976	$0.022	90 0%	8,600	5,000	0 0%	10 0%	80.0%	4,000	80.0%	1,9
Fuel Cell	200	15	$5,048	$0.030	90 0%	8,022	-	0 0%	10 0%	80.0%	-		1, 2
Fuel Cell w/ Heat Recovery	200	15	$5,196	$0.030	90 0%	8,022	2,685	0 0%	10 0%	80.0%	2,148	80.0%	1,2
Fuel Cell	1,000	15	$5,048	$0.030	90 0%	8,022	-	0 0%	10 0%	90.0%	-		1, 2
Fuel Cell w/ Heat Recovery	1,000	15	$5,196	$0.030	90 0%	8,022	2,655	0 0%	10 0%	90.0%	2,124	80.0%	1,2
Stirling Engine	1	15	$18,000	$0.010	90 0%	12,186	7,614	0 0%	0 0%	80.0%	6,091	80.0%	8,10,11,12,13
Organic Rankine Cycle	500	15	$5,700	$0.007	80 0%	-	-	0 0%	0 0%	80.0%	-		1,10

---

[62] Volume 5 of the Ameren Missouri DSM Potential Study

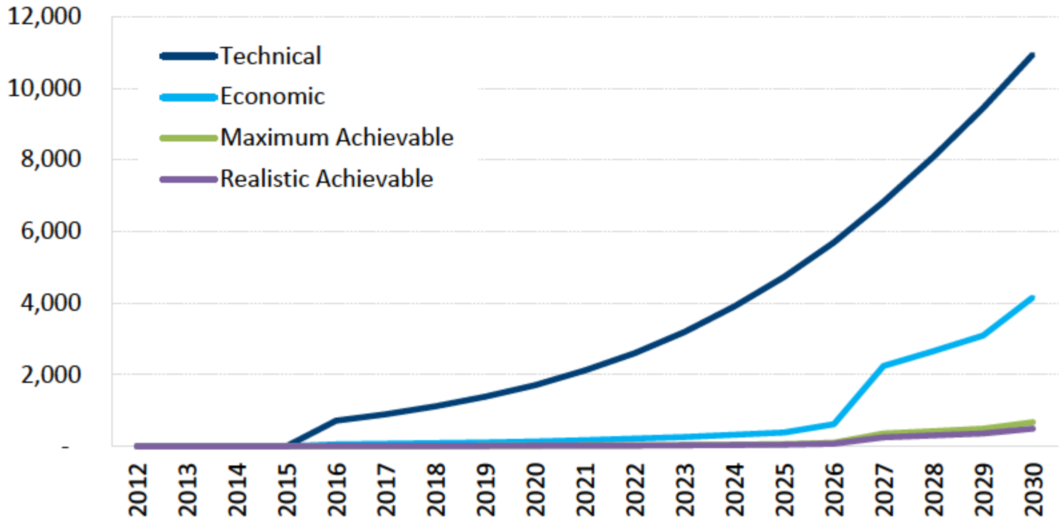
Key to data sources:

1. *Cost-Effectiveness of Distributed Generation Technologies*, CPUC Self-Generation Incentive Program 2011	7. *Catalog of CHP Technologies*, EPA, 2008
2. *Combined Heat and Power: Policy Analysis and 2011-2030 Market Assessment*, CA Energy Commission/ICF, 2012	8. *Sunshot Vision Study*, NREL, 2012; http://www1 eere.energy gov/solar/pdfs/47927.pdf
3. Budgetary Quotes (5) from manufacturer Solar Turbines	9. *MicroCHP blog*, http://www.microchap.info/Stirling_engine.htm
4. *Distributed Generation Renewable Energy Estimate Costs*, NREL, July 2012	10. *Tracking the Sun VI:* LBNL Report, 2013
5. *Cost and Performance Data for Power Generation Technologies*, NREL, prepared by Black & Veatch, 2012	11. *Tax Credit information: http://energy.gov/savings/business-energy-investment-tax-credit-itc*
6.Residential, Commercial, and Utility-scale PV System Prices in the United States: NREL, 2012	

8.9.3 DG/CHP Potential

Based on the inputs and assumptions described in Table 8.21, Figure 8.16 shown below is an extract from the study that shows the various forms of DG/CHP potential over the planning horizon. As this figure shows, realistic potential is very limited until the 2025-2030 timeframe.

Figure 8.16: DG-CHP Energy Impact Results (GWh)[63]



---

[63] Volume 5 of the Ameren Missouri DSM Potential Study

8.10 Demand-Side Rate Potential[64]

8.10.1 Approach

The analysis of demand-side rate potential is a new requirement in the IRP rules since Ameren Missouri's last triennial IRP compliance filing in 2011. The specific rule requirement is: "*The utility shall develop potential demand-side rates designed for each market segment to reduce the net consumption of electricity or modify the timing of its use. The utility shall describe and document its demand-side rate planning and design process.*"

Ameren Missouri 2013 DSM Potential Study contractor engaged a subject matter expert subcontractor, The Brattle Group (*Brattle)*, to conduct this analysis.[65] *Brattle* reviewed demand-side rates that have been offered to customers by utilities across the U.S. and internationally.[66] Table 8.22 summarizes the utilities that were considered in the analysis.[67] *Brattle* assembled a "menu" of demand-side rates based on this review, and presented them at a workshop with Ameren Missouri's stakeholders. The rates' applicability to Ameren Missouri's service territory was determined through this stakeholder process.[68]

---

[64] 4 CSR 240-22.050(4) Demand-Side Rates is discussed further in Volume 6 of the DSM Potential Study, EO-2012-0142 14

[65] 4 CSR 240-22.050(4)(G)

[66] 4 CSR 240-22.050(3)(A); 4 CSR 240-22.050(4)(A)

[67] The time varying rates are discussed further in: Ahmad Faruqui and Jennifer Palmer, "The Discovery of Price Responsiveness – A Survey of Experiments Involving Dynamic Pricing of Electricity," Energy Delta Institute, Vol.4, No. 1, April 2012. http://www.energydelta.org/mainmenu/edi-intelligence-2/our-services/quarterly-2/edi-quarterly-vol-4-issue-1

[68] 4 CSR 240-22.050(3)(A); 4 CSR 240-22.050(2)

Table 8.22: Utilities Considered in Demand-Side Rates Analysis[69]

Inclining Block Rates (IBRs)	
Utility	**Location**
Arizona Public Service	Arizona
Avista Utilities	Washington
Consumers Enery	Michigan
FPL	Florida
Georgia Power	Georgia
Idaho Power	Idaho
Indiana Michigan Power Co.	Michigan
Jersey Central Power & Light	New Jersey
Pacific Gas & Electric	California
Pacific Power	Oregon
PECO Energy	Pennsylvania
Progress Energy	Florida
PSE&G	New Jersey
San Diego Gas & Electric	California
Southern California Edison	California

Time-varying Rates	
Utility	**Location**
Ameren Missouri	Missouri
Anaheim Public Utilities	California
Baltimore Gas & Electric	Maryland
BC Hydro	Ontario, Canada
Commonwealth Edison	Illinois
Connecticut Light & Power	Connecticut
Consumers Energy	Michigan
Country Energy	Australia
GPU	New Jersey
Gulf Power	Florida
Hydro One	Ontario, Canada
Hydro Ottawa	Canada
Idaho Power	Idaho
Integral Energy	Australia
Irish Utilities	Ireland
Istad Nett AS	Norway
Marblehead Municipal Light Department	Massachussets
Mercury Energy	New Zealand
Newmarket Hydro	Ontario, Canada
Oklahoma Gas & Electric	Oklahoma
Olympic Peninsula Project	Washington
Pacific Gas & Electric	California
Pepco DC	District of Columbia
Public Service Electric and Gas Company	New Jersey
Pudget Sound Energy	Washington
Sacramento Municipal Utility District	California
Salt River Project	Arizona
San Diego Gas & Electric	California
Sioux Valley Energy	South Dakota
Southern California Edison	California

Brattle conducted a brief survey of external stakeholders and Ameren Missouri employees connected with ratemaking. The purpose of the survey was to assist Brattle and Ameren Missouri in selecting appropriate new rates that would serve as representative overall demand-side rates for an impact assessment study. The survey sought to answer two primary questions:

1. What are the most important rate-making objectives/criteria for Ameren Missouri and its stakeholders?
2. How do various candidate rates perform in meeting these objectives?

A total criteria-weighted score was created for each rate, based on how individuals assessed each rate's performance for each objective, and weighted by the importance they placed on that objective.

---

[69] Volume 1 of the Ameren Missouri DSM Potential Study

Based on the results of the survey, four representative demand-side rates were developed as shown in Table 8.23:[70]

Table 8.23: Demand-Side Rates

	Residential	Small General Service	Large General Service
Inclining Block Rate (IBR)	X		
Time-Of-Use (TOU)	X	X	
Critical Peak Pricing (CPP)*			X

---

[70] 4 CSR 240-22.050(4)(B)

8.10.2 Demand-Side Rate Potential Results

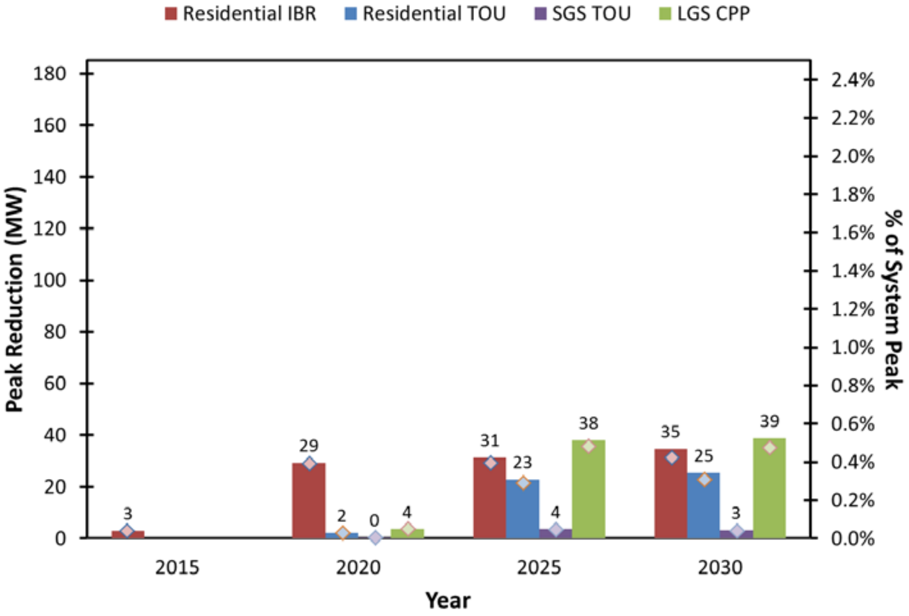
Each of the four demand-side rates were then developed using Ameren Missouri specific revenue requirement data. Data used in the development of the rates includes:[71]

1. Marginal costs
2. Existing rates (i.e., the class revenue requirement)
3. Class load profiles and consumption distribution

Each rate is revenue neutral, meaning that it will generate the same revenue for the class as the existing tariff (in the absence of a change in the class load profile).

The results of the analysis in terms of the potential for peak demand reduction from demand-side rates are shown in Figures 8.17 and 8.18, which show the potential results based on opt-in and opt-out constructs, respectively.[72]

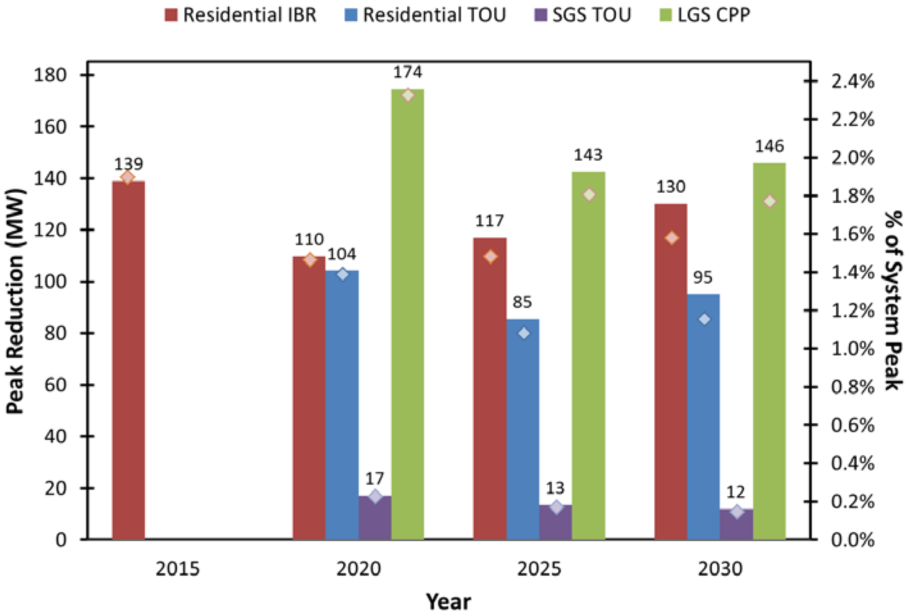
Figure 8.17: Peak Demand Reductions by Year (Opt-In)[73]



---

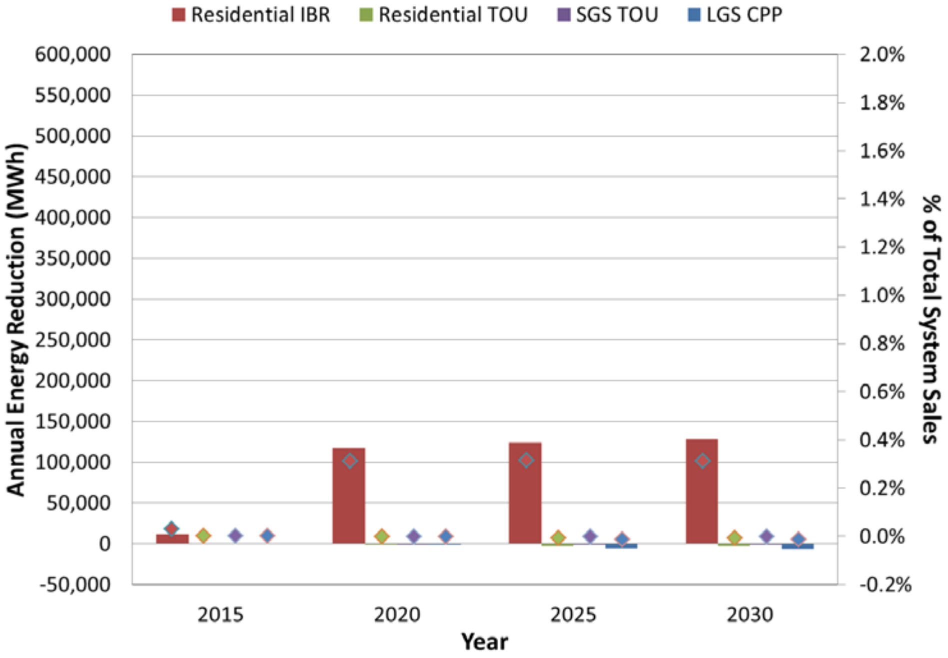
[71] 4 CSR 240-22.050(4)(D)
[72] 4 CSR 240-22.050(4)(D)1
[73] Volume 6 of the Ameren Missouri DSM Potential Study

Figure 8.18: Peak Demand Reductions by Year (Opt-Out)[74]



The results of the analysis in terms of the potential for energy reductions from demand-side rates are shown in Figures 8.19 and 8.20, again opt-in and opt-out constructs.

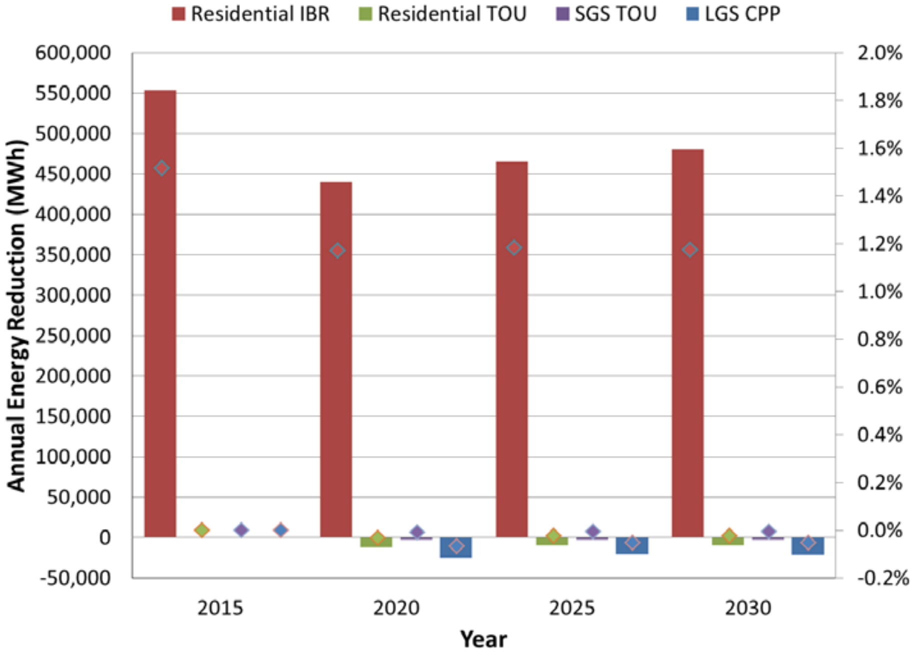
Figure 8.19: Energy Reductions by Year (Opt-In)[75]



---

[74] Volume 6 of the Ameren Missouri DSM Potential Study
[75] Volume 6 of the Ameren Missouri DSM Potential Study

Figure 8.20: Energy Reductions by Year (Opt-out)[76]



In summary, demand-side rates have the potential to cumulatively reduce system peak demand in the range of 0.8% to 3.5% by 2034.[77] The low end of the range assumes customer opt-in and the high end assumes customer opt-out implementation approaches.

At this time, it is not feasible to attempt an assessment of how the interactions between potential demand-side rates and potential demand-side programs would affect the impact estimates of the potential demand side programs and potential demand-side rates. Accurately capturing interactions between potential demand-side rates and other demand-side programs would require an entirely new study.[78] The study would involve primary market research – specifically referred to as “conjoint analysis” – to determine customer preferences for various demand-side options when offered a menu of choices. Depending on the scope of questions to be answered through such a study, the budget for this type of research is typically in the $100,000 to $300,000 range. However, absent the type of study outlined above, Ameren Missouri studies to date show that demand-side rates, specifically rates with inclining block structures, would likely reduce energy consumption by up to 1.8% per year. The question is whether energy savings induced by rate structures are the result of conservation actions by customers, by energy efficient equipment and services purchases by customers or a combination of

---

[76] Volume 6 of the Ameren Missouri DSM Potential Study

[77] 4 CSR 240-22.050(4)(D)4; 4 CSR 240-22.050(4)(D)5A through D; 4 CSR 240-22.050(4)(E&G): A comprehensive summary of the Demand Side Rates Analysis can be found in Volume 6 of the potential study

[78] 4 CSR 240-22.050(4)(D)2&3

both. To the extent that reductions are the result of conservation actions, i.e. raising thermostat settings during the cooling season, those actions would diminish cost effective energy efficient equipment and services opportunities for Ameren Missouri energy efficiency programs. The reason is that the conservation activities reduce energy consumption which reduces the incremental energy savings attributable to more efficiency equipment and service. Conversely, to the extent that energy savings induced by rates lead customers to more energy efficient products and services to either reduce overall consumption or to adjust the timing of when energy consuming devices are turned on and off, then those actions would complement Ameren Missouri energy efficiency equipment and service program opportunities.

Ameren Missouri considers the 2013 demand-side rates analysis the beginning of a broader discussion with stakeholders and the Commission around the complex issue of rate design where there is the potential to have customers who are winners and losers relative to the status quo.[79] Consequently, no rate design potential impacts have been assumed in the 2014 Ameren Missouri IRP filing. However, Ameren Missouri is in the process of taking an in-depth look at a Prepay or pay-as-you-go rate delivery option that has the potential to offer multiple customer benefits – one being customer behavior changes that result in lower energy consumption. The potential for an Ameren Missouri DSM program focused on encouraging customers to choose the Prepay option is discussed in Section 8.13.3 of this report.

8.11 2016 – 2018 Implementation Plan[80]

8.11.1 Overview

After adjusting the 2013 DSM Potential Study with 2013 program EM&V impact assessments, Ameren Missouri's proposed energy efficiency plan for 2016 – 2018 contains 10 energy efficiency programs and is projected to produce total first year savings of 426 GWH over the three years of its MEEIA Cycle 2016 – 2018 Implementation Plan.[81] The proposed plan also projects 114 megawatts (MW) of annual peak demand reduction from 2016-2018 attributable to energy efficiency programs. In terms of demand response programs (DR), the 2013 DSM Potential Study shows that demand response is not cost effective for the 2016-2018 implementation period. However, Ameren Missouri is considering the development of a DR pilot program during the 2016-2018 implementation plan. The objective of the DR pilot would be to assess Ameren Missouri customers' tolerance for different demand

---

[79] 4 CSR 240-22.050(5)(B)2

[80] EO-2012-0142 14

[81] 4 CSR 240-22.050(4)(E); A detailed look at each program including impacts, costs and participation is included in the attached Program Batchtools

response event frequencies and durations. Information from this pilot will be used to assess Ameren Missouri's ability to call upon DR to mitigate system peaks as well as to provide ancillary services to support integration of large scale renewable generation. Finally, Ameren Missouri's proposed budget for the 3-year MEEIA Cycle 2016 - 2018 implementation plan is $147 million in comparison to the MEEIA Cycle 2013 - 2015 implementation plan budget of approximately $150 million.

Table 8.24 shows the projected annual kWh and kW savings, budgets and benefit/cost ratios for the MEEIA Cycle 2016-2018 DSM implementation plan.

Table 8.24: MEEIA Cycle 2016-2018 DSM Implementation Plan

Ameren Missouri Residential Program Designs August 2014 - RAP	TRC		UCT		Net Incremental Energy Savings @ Meter (MWh)				Net Incremental Demand Reductions (MW)				Total Program Cost ($ Millions)			
	3 Yr	19 Yr	3 Yr	19 Yr	2016	2017	2018	3 Yr Total	2016	2017	2018	3 Yr Total	2016	2017	2018	3 Yr Total
Residential EE Portfolio																
Lighting	1.05	0.96	1.06	0.96	20,234	18,345	22,928	61,507	0.008	0.008	0.009	0.025	$ 5.696	$ 5.500	$ 6.717	$ 17.913
Efficient Products	1.29	1.71	1.98	3.17	5,686	1,857	6,737	14,280	2.092	0.706	2.238	5.036	$ 2.441	$ 1.301	$ 2.496	$ 6.238
HVAC	1.34	1.72	1.99	2.70	19,884	13,875	17,198	50,958	8.943	6.241	7.735	22.920	$ 8.301	$ 6.867	$ 7.775	$ 22.944
Appliance Recycling	1.08	1.27	1.08	1.27	2,974	2,664	4,106	9,743	0.737	0.660	1.017	2.414	$ 1.215	$ 1.115	$ 1.667	$ 3.997
Low Income	0.79	1.00	0.81	1.01	3,533	2,735	4,275	10,543	0.844	0.608	0.917	2.370	$ 2.346	$ 1.986	$ 2.488	$ 6.820
EE Kits	1.53	1.57	1.53	1.57	6,194	6,214	6,228	18,636	1.031	1.031	1.031	3.093	$ 1.814	$ 1.838	$ 1.812	$ 5.464
Res EE Portfolio Total	1.22	1.54	1.50	2.19	58,505	45,691	61,472	165,667	13.656	9.254	12.948	35.858	$ 21.813	$ 18.608	$ 22.956	$ 63.377
Res EE Portfolio Total					165,667				35.858				$63.377			

Ameren Missouri Business Program Designs August 2014 - RAP	TRC		UCT		Net Incremental Energy Savings @ Meter (MWh)				Net Incremental Demand Reductions (MW)				Total Program Cost ($ Millions)			
	3 Yr	19 Yr	3 Yr	19 Yr	2016	2017	2018	3 Yr Total	2016	2017	2018	3 Yr Total	2016	2017	2018	3 Yr Total
Business EE Portfolio																
Standard	1.49	2.75	1.93	3.32	18,619	20,853	35,004	74,476	3.320	3.718	6.241	13.278	$ 5.886	$ 6.586	$ 10.963	$ 23.435
Custom	1.67	2.13	2.43	2.84	27,633	53,515	71,962	153,110	10.053	19.467	26.178	55.698	$ 8.709	$ 16.815	$ 22.538	$ 48.063
Retro-commissioning	1.59	2.36	1.59	3.21	-	10,016	8,882	18,898	-	3.206	2.843	6.049	$ -	$ 3.921	$ 3.380	$ 7.301
New Construction	1.46	2.42	2.40	3.82	-	7,543	6,689	14,231	-	1.801	1.597	3.398	$ -	$ 2.909	$ 2.483	$ 5.392
Biz EE Portfolio Total	1.61	2.37	2.22	3.11	46,252	91,927	122,536	260,715	13.372	28.192	36.858	78.422	$ 14.595	$ 30.231	$ 39.364	$ 84.190
Biz EE Portfolio Total					260,715				78.42				$84.190			
TOTAL EE Portfolio	1.45	2.01	1.91	2.72	104,757	137,617	184,008	426,382	27.028	37.446	49.806	114.281	$ 36.408	$ 48.838	$ 62.321	$ 147.57
TOTAL EE Portfolio					426,382				114.28				$147.567			

8.11.2 Timing Issues Associated With Proposed Plan

8.11.2.1 Risk and Uncertainty Associated with Plan

In order to ensure DSM program continuity from MEEIA Cycle 2013 - 2015 with MEEIA Cycle 2016 - 2018 beginning on January 1, 2016, Ameren Missouri must submit its MEEIA Cycle 2016 - 2018 filing no later than December 2014. Working backwards from a January 1, 2016 start date, the following are critical path tasks that have to be in place in order to have MEEIA Cycle 2016 - 2018 programs in place by January 1, 2016:

1. Contractor selection (3 months: April 2015 – June 2015)

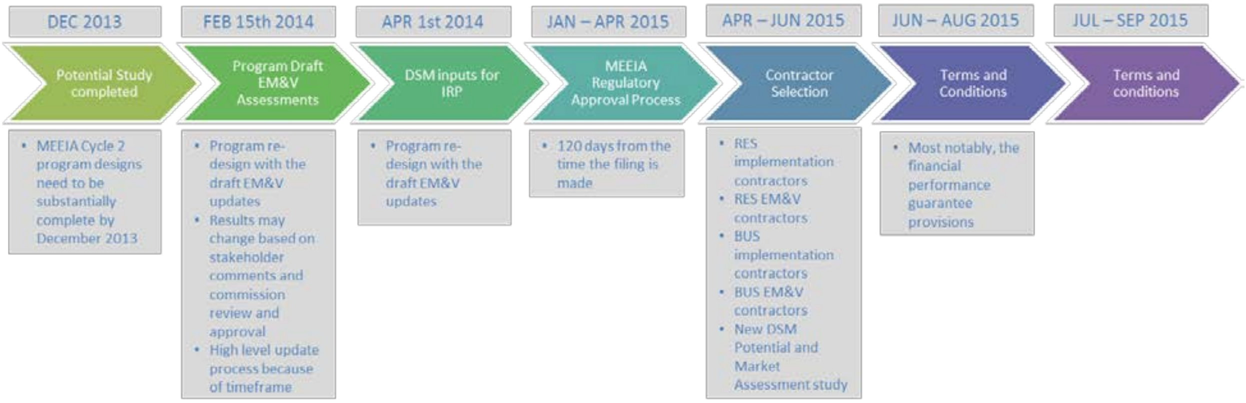
   This process involves procuring the following:

    a. RES implementation contractors
    b. RES EM&V contractors
    c. BUS implementation contractors
    d. BUS EM&V contractors
    e. New DSM Potential and Market Assessment study

2. Development of contractual terms and conditions (June – August 2015)
3. Development of detailed scopes of work (SOW) for each contractor (July – September 2015)
4. MEEIA regulatory approval process
    a. 120 days from the time the filing is made (January – April 2015)
5. 2014-2034 DSM inputs required for integrated resource planning modeling (April 1, 2014)
6. 2013 Ameren Missouri DSM Program draft EM&V assessments issued (February 15, 2014)
7. 2013 Ameren Missouri DSM Potential Study completed (December 2013)

A pictorial view of the timeline for making the Ameren Missouri MEEIA Cycle 2016 - 2018 filing described in steps 1 through 8 above is shown in Figure 8.21 below.

Figure 8.21: MEEIA Cycle 2016 - 2018 Filing Timeline



MEEIA Cycle 2016 - 2018 program designs for DSM programs beginning in 2016 had to be substantially complete by December 2013 in order to meet an October 1, 2014 Ameren Missouri IRP filing due date. This required Ameren Missouri to design programs before having even a full year of DSM program field implementation and evaluation experience from the first year or 2013 of MEEIA Cycle 2013 - 2015 programs.

Draft EM&V reports covering 2013 program impact and process evaluations of each of the nine Ameren Missouri DSM programs were issued on February 15, 2014. Ameren Missouri attempted to update its MEEIA Cycle 2016 - 2018 DSM program designs with the latest EM&V information from those reports in the first Quarter of 2014. However, the 2013 EM&V impact reports were in draft form and the results therein may change based on stakeholder comments and, ultimately, based on Commission review and approval. Also, since the EM&V reports were issued on February 15, 2014 and the IRP project schedule required that DSM program design be complete by April 1, 2014 the review and update process had to be completed at a relatively high level. The final 2013 EM&V report was filed in June, 2014 but is still under approval consideration by the Commission at the time of this filling.

The preceding timeline illustrates the risk and uncertainty associated with MEEIA Cycle 2016 - 2018 DSM program design due to the fact that DSM programs to be implemented beginning in 2016 have to be designed in 2013 using relatively dated information.[82] An explanation of the specific risks and uncertainty is in order.

All cost effective energy efficiency for 2016-2018 annual load reduction goals are based on results from the Ameren Missouri 2013 DSM Potential Study. Energy efficiency measure incremental savings for the 2013 DSM Potential Study came from the Ameren Missouri MEEIA Cycle 2013 - 2015 Technical Resource Manual (TRM) since Ameren Missouri did not have 2013 EM&V data to draw from at the time the DSM Potential Study was commissioned. It is reasonable to adjust the DSM Potential Study results and Ameren Missouri annual load reduction goals accordingly to reflect the best information available at the time to design programs for MEEIA Cycle 2016 – 2018. Likewise beginning with 2016 EM&V results and continuing again in 2017 and 2018 in MEEIA Cycle 2016 - 2018, energy efficiency measure savings and annual load reduction goals should be updated as soon as Commission approved EM&V results are known for each year. Absent this proposed flexibility, Ameren Missouri would be required to meet annual goals that may be based on individual energy efficiency measure savings that may change substantially over time from actual EM&V primary data collected by Ameren Missouri customers who participated in Ameren Missouri DSM programs.

There are competing factors impacting energy savings year over year such that it is imprudent to lock in estimates of DSM portfolio energy savings for 2016 in 2013. The convergence of prior successful Ameren Missouri DSM programs moving the market baselines for many energy efficiency measures coupled with federal intervention in the form of ever increasing appliance efficiency standards and building codes is a challenge. There is the issue with ever changing primary EM&V data collection and ensuing

---

[82] 4 CSR 240-22.050(6)(C); Additional details can be found in the work papers.

changes in energy efficiency incremental energy consumption. There are the issues of the speed of technological innovation and changes in DSM program structure and delivery in a smarter grid environment. There are regulatory policy issues that could, among other things, change the definitions of demand-side programs to include distributed generation, electric vehicles and electro technologies that may result in lower overall greenhouse gas emissions and lower customer energy intensities and energy costs. These types of issues require Ameren Missouri, stakeholders and the Commission to re-think the issue of how to address 3-year DSM program implementation planning flexibility from plan filing to plan implementation.

8.11.3 Recommendation for Framework to Adjust MEEIA Cycle 2016 - 2018 Program Designs

The building blocks for any DSM implementation plan are:

- Incremental energy savings associated with hundreds of energy efficiency measures
    - A corollary to incremental energy savings is incremental energy measure costs
    - Another corollary to incremental energy savings is the selection of the baseline energy technology against which the more efficient technology is being compared
- Cost effectiveness screening of individual energy efficiency measures
    - Cost-effectiveness is a function of the Ameren Missouri avoided cost of energy, capacity and investment in transmission and distribution infrastructure
        - Although avoided costs are typically “locked in” for a 3-year implementation plan, avoided cost volatility from year-to-year can be meaningful
        - The Commission definition of avoided costs, if changed, could result in substantive changes in the magnitude of benefits associated with DSM measures. For example, the quantification of non-energy benefits including such components as environmental, economic (job creation), and/or comfort are included in some jurisdictions’ definitions of benefits. Other energy related benefits include water and natural gas benefits in addition to electric benefits.
    - Assembly of cost effective measures into individual DSM programs
        - The primary issue in assessing DSM program cost effectiveness is the estimation of the individual program net-to-gross (NTG) ratio. This is typically a qualitative assessment on the part of EM&V

contractors that has no statistical validity. NTG results will vary based on contractor, methodology employed, timing of survey – both in proximity to purchase of efficient measure as well as time of day, respondent and weighting or scaling of respondent answers to qualitative questions.

- Another significant program design concern is interactive effects of measures. The installation of one efficient measure may impact the energy savings of a distinctly different efficient measure. For example, assume a home's attic insulation is increased from R-11 to R-30. The increased insulation allows the house to hold heat or cold longer, depending upon the season, thereby reducing run times for HVAC equipment which reduces HVAC equipment incremental energy savings – possibly to levels that render the HVAC incremental energy savings as not cost effective. This is exactly what Ameren Missouri experienced in the evaluation of its 2013 residential new construction program – rendering the program not cost effective.

- The final issue is the appropriate cost effectiveness threshold value or range of values to use in determining whether a program is cost effective. In theory, a program benefit/cost ratio of 1.0 assumes that program net benefits are equivalent to program net costs. However, the risk and uncertainty associated with ex-post impact analysis as well as ex-post NTG analysis is high. On top of this is the consideration of the Ameren Missouri and Commission approved demand-side investment mechanism regulatory framework for DSM program cost recovery, program throughput disincentive and the opportunity to earn financial performance incentives. That mechanism is based on a net shared benefits model that necessarily requires that DSM program benefits exceed costs.

Noting the plethora of uncertainties associated with future DSM program EM&V impacts and changing baselines, it becomes evident that the regulatory filing requirements that necessitate making the MEEIA Cycle 2016 - 2018 plan regulatory filing in the 4th Quarter of 2014 may make the MEEIA Cycle 2016 - 2018 plan, either in whole or in part, obsolete at worst or in need of substantial revision at best by the time implementation begins in 2016. As discussed previously, vast changes in DSM program assumptions can and will occur in a span of two years. Individual energy efficiency measure baseline energy savings may change. An example is residential lighting energy efficiency measures. Current 2014 residential lighting program assumptions are that the halogen bulb which represents the Energy Independence and Security Act of 2007 (EISA) baseline energy consumption represents the baseline. The reality, however, is that the baseline lighting technology should be represented by whatever lighting technology that has the highest market share. What if the majority of residential customers who purchase light bulbs in 2015 purchase CFLs rather than halogens? If so, should the baseline in 2016 be changed to CFLs?

Individual energy efficiency measure incremental energy savings may change. An example is the appliance recycling program. The EM&V contractor developed a regression model to estimate appliance energy usage based on secondary data on refrigerator energy usage from DSM programs in California and Michigan. If the EM&V contractor adds additional secondary data from other jurisdictions to the model, the model parameters will change as will energy savings associated with appliances. In addition, as the age of refrigerators collected in the program decline and/or as the average manufacture date of refrigerators specifically becomes post 1993, energy consumption of collected refrigerators is expected to decline. This is due primarily to newer, more stringent federal refrigerator energy efficiency standards put in place beginning in 1993. Either one of these two occurrences or both will change the energy savings associated with the Appliance Recycling program from what they were assumed to be in the 2013/2014 program designs.

Estimates of NTG include some amount of subjectivity and may vary significantly year over year. The issue is what discrete value for NTG should be assumed for each program that is designed in 2013 but that begins in 2016 and runs through 2018? For example, consider the 2013 residential lighting program. EM&V contractors calculated a 1.19 NTG value for the residential lighting program in 2013. Should 1.19 be assumed as a reasonable placeholder for 2016-2018 for the program? The sum of the parts that equates to a NTG = 1.19 includes free ridership, “like” participant spillover, “unlike” participant spillover, non-participant spillover and market effects. How will each of those individual NTG inputs change between 2014 and 2016 and then through 2018?

New program design concepts and associated metrics can take years to develop. New data and information, not available in 2013, may become available in 2014 or 2015 after the Ameren Missouri IRP and MEEIA Cycle 2016 – 2018 filings are made that justify new DSM programs. An example is the development of cutting edge customer energy behavior change programs. Ameren Missouri is interested in understanding how customer rate and billing options can impact energy consumption behavior. An example of a program under consideration is a customer Prepay or pay as you go billing option for which studies at other electric utilities have quantified annual energy savings of approximately 10% or more. However, the Prepay option ideally requires more advanced metering technologies and IT infrastructure to put in place and to cost out in order to determine if such a program is cost effective from a DSM perspective. Ameren Missouri is in the process of acquiring the data necessary to cost out such a program. The data was not available at the time of the preparation of the 2014 IRP filing.

The benefits of energy efficiency measures and programs are based on the Ameren Missouri avoided costs which are based on the market price of electricity. Avoided energy, capacity and transmission and distribution costs are based on the market price of these commodities at the time program designs were developed for the 2014 IRP filing. Electricity commodity markets are volatile and the forward view of the market price of these commodities change daily, monthly, and annually. The forward view of these commodities at the time program designs were developed for the 2014 IRP filing were at a low point due primarily to the low price of natural gas as well as a sluggish economy that resulted in relatively flat electric load growth. Should the market price of these commodities change prior to the start of MEEIA Cycle 2016 - 2018 programs in the 2016-2018 DSM implementation planning period, the cost effectiveness of the DSM portfolio may change.

Ameren Missouri seeks the flexibility to adjust MEEIA Cycle 2016 - 2018 program designs between the time the IRP is submitted in the 4th Quarter of 2014 to the start of program implementation in January 2016. In addition, Ameren Missouri seeks the flexibility to annually adjust both the TRM as well as annual load reduction targets during the 2016-2018 implementation period to reflect the best available individual measure energy savings estimates from the most recent EM&V impact analyses of all programs. The proposed process to make adjustments has the following components:

- 2014 EM&V results are to be finalized no later than September 2015 per the MEEIA Cycle 2013 - 2015 Stipulation and Agreement;
    - Ameren Missouri proposes that revised protocols be established that would finalize EM&V results by June

- MEEIA Cycle 2016 - 2018 DSM programs begin in January 2016. Ameren Missouri will adjust its MEEIA Cycle 2016 - 2018 Technical Reference Manual (TRM), which was developed using 2013 EM&V individual measure impact results, to reflect 2014 EM&V results in the 4th Quarter 2015. The adjusted TRM will then be the basis for adjusting 2016 portfolio and program annual load reduction targets.

- The same timing and process will be used to adjust 2017 and 2018 annual load reduction targets for the DSM portfolio and individual programs. In other words, the realities of finalizing annual EM&V impacts and updating the TRM and portfolio and program design result in a process that optimizes updating the TRM for any current program year using actual EM&V data from the program year completed two years prior.

- The Ameren Missouri process and procedure to adjust its DSM Potential Study to reflect changes in individual measure impacts from the latest EM&V impact analyses as described in the latest TRM is described in detail in Section 8.6.3

- The results from the annual updated TRMs will be applied prospectively for purposes of calculating lost revenues and financial performance incentives. TRMs will be based on actual EM&V results that are two years in arrears.

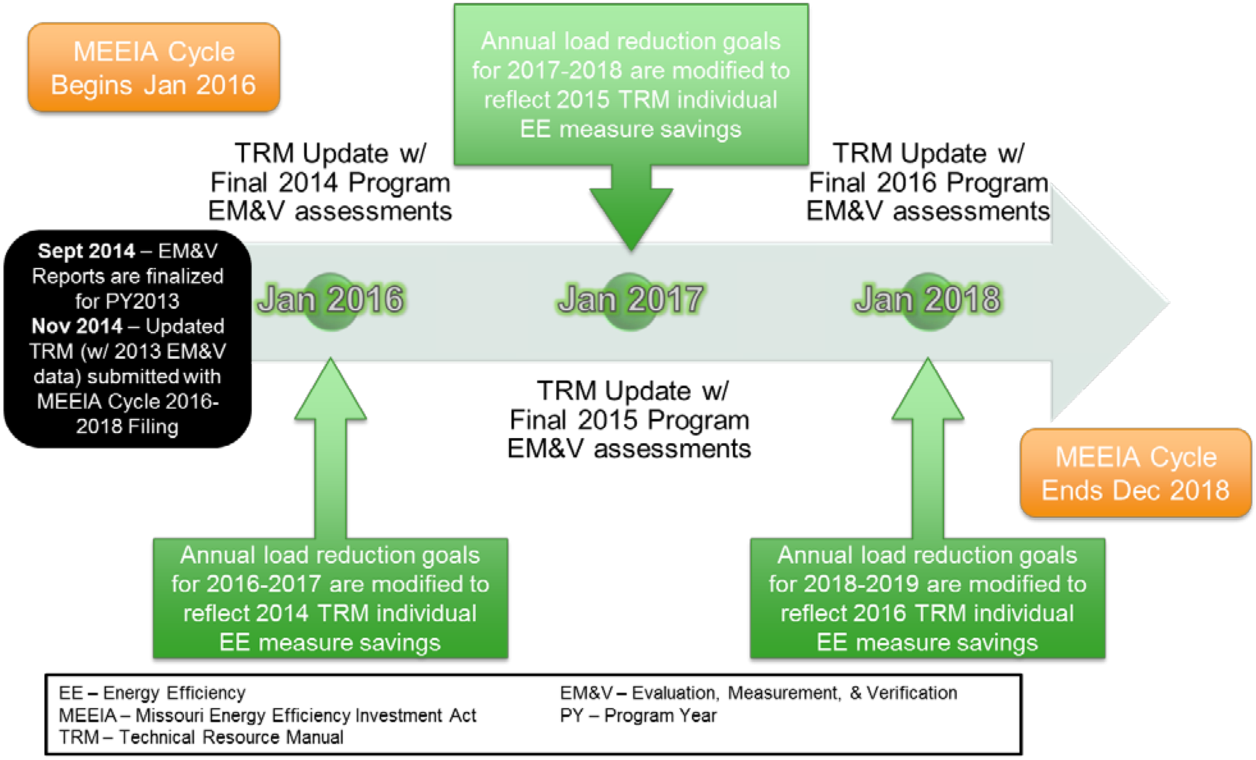
Ameren Missouri also seeks the flexibility to make changes to the programs submitted in 2014 in the MEEIA Cycle 2016 - 2018 filing up to the start date of January 1, 2016 for the MEEIA Cycle 2016 - 2018 DSM programs. Those changes may reflect any one or any combination of the following:

- Information from 2014 and 2015 EM&V impact analyses including:
    - Incremental measure energy savings and costs
    - Efficient measure baseline changes
    - NTG assumptions
- New program design proposals
    - May include input from DSM Implementation contractors engaged to manage MEEIA Cycle 2016 - 2018 programs
    - May include proposals from Ameren Missouri DSM stakeholders
- Modifications to proposed MEEIA Cycle 2016 - 2018 program designs to reflect changes in the constructs of proposed delivery mechanisms, marketing campaigns, EM&V approaches, cutting edge cost effective technologies and customer behavioral change programs
    - Unforeseen but significant changes in DSM program cost effectiveness modeling inputs
    - Lessons learned from MEEIA Cycle 2013 - 2015 program implementation and evaluation
- Future revisions, if any, to MEEIA legislation that may impact program design

If a proposed program change reflects changing the kWh associated with a measure or program, the annual load reduction goals will change proportionally using the procedure identified in Section 8.6.3.

The following timeline illustrates how the desired flexibility would be implemented in MEEIA Cycle 2016 – 2018 for updating the TRM:

Figure 8.22: TRM Updates Timeline



8.11.4 Potential Uncertainty

The potential uncertainty associated with the load impact estimates of the demand-side resource portfolio was calculated for each of the scenarios as can be seen in the table below.[83]

Table 8.25 Uncertainty Scalars

Scenario	Scalar
MAP High	0%
MAP Low	-18%
RAP High	+9%
RAP Low	-9%

The RAP Low and High scenarios were based on a formulaic approach where the top 20 measures for residential, commercial, and industrial customers that accounted for the majority of the energy savings were identified. The 2013 EM&V realization rates for those measures were applied and Post-EM&V values were calculated. The total realization rate was calculated to be 91.2%. The difference between complete

---

[83] 4 CSR 240-22.050(6)

realization (100%) and 91.2% was deemed to be the scalar (+/- 8.8% ≈ +/- 9%) for the RAP scenarios.

Since there is more EM&V risk around MAP levels and because customers are harder to reach, the RAP scalar was doubled for the MAP low scenario (-18%). By definition MAP is the hypothetical upper limit or ceiling for potential and therefore the MAP high scenario is equivalent to the MAP base scenario.[84] The table below shows the how the realization rates were applied.

Table 8.26: Application of Realization Rates

	Pre-EM&V Top Measures GWH and % of Total Measures		Pre-EM&V Total GWH	PY 2013 EM&V RR for Top Measures	Post-EM&V Total GWH	Overall RR
Residential	228.97	91%	250.97	72.7%	182.52	72.7%
Commercial	403.91	77%	523.00	100.0%	522.89	100.0%
Industrial	24.5	77%	31.67	93.8%	29.71	93.8%
Total			805.64		735.12	91.2%

8.12 MEEIA Cycle 2016 - 2018 Technical Reference Manual (TRM)[85]

Ameren Missouri developed its first TRM to support its first Missouri Energy Efficiency Investment Act (MEEIA) filing in January 2012. The first version of the TRM was a Microsoft Word document supported by voluminous work papers in multiple formats and file locations. Ameren Missouri leveraged previous evaluation reports from its programs implemented between 2009 and 2011 (Cycle 2013 - 2015), Ameren Missouri specific data from its DSM Potential Study, its internal database of measures, and other states' TRMs (where applicable) to develop the first TRM.

Ameren Missouri's second TRM will support its second MEEIA filing for the 3-year DSM implementation plan covering 2016-2018. Ameren Missouri has engaged a contractor to implement TRM development software and populate the software with Ameren Missouri's latest results from its evaluation, measurement and verification (EM&V) of its 2013 DSM programs to provide the basis for its MEEIA Cycle 2016 - 2018 TRM.

Ameren Missouri's primary objective in improving its TRM development process was to acquire a transparent TRM software tool to identify measure level savings values and algorithms (and associated documentation preferably based on primary data collection)

---

[84] 4 CSR 240-22.050(6)(C)1

[85] EO-2012-0142 14

to develop energy efficiency measure savings estimates. As was also articulated in the MEEIA Cycle 2013 - 2015 filing, it is critical that these values be agreed upon at the beginning of the program implementation and applied prospectively; the MEEIA Cycle 2016 - 2018 TRM will be used by Ameren to provide the transparency sought and the ability to maintain the measure data throughout the implementation period.

The MEEIA Cycle 2016 - 2018 TRM is an online technical reference database containing measure-level data, including savings, savings estimation protocols, and source documentation for all measures in the existing Ameren Missouri TRM.

Customers, Ameren Missouri, the Commission, and stakeholders will realize the following benefits of the state-of-the art TRM system:

- Consolidation and organization of efficiency measures, measure attributes, and supporting data, including all savings values, costs, assumptions, equations, savings estimation protocols and source documentation. An easy-to-use, web-based interface to facilitate access to measure parameters, savings calculation algorithms, effective useful life, and incremental measure costs.

- Automated version control, including logging, retention, and archiving of all measure versions, including interim measure updates. Greater transparency into measure assumptions due to the fact that source documentation can be directly linked to a measure and the relevant attributes and parameters.

- Ability to create customized measure specific reports and/or export files in various file formats; this can be used to develop customized files for program reporting.

- Maintenance of accurate records of TRM savings based on versions for tracking and reporting using the online TRM tool.

8.13 R&D Issues that will Evolve from 2014 to 2016 (Start of MEEIA Cycle 2016 - 2018)[86]

8.13.1 Residential Light Program Design for 2016 – 2018

Background

Ameren Missouri's residential lighting program has provided the majority of the residential DSM portfolio kWh savings since 2009. The majority of the savings from the program have come from the promotion of CFLs.

The Energy Independence and Security Act of 2007 (EISA) changed the landscape for residential lighting programs by effectively mandating that CFL technology become the baseline energy standard for residential lighting beginning in 2020. Citing specific EISA language:

> **…IF THE FINAL RULE DOES NOT PRODUCE SAVINGS THAT ARE GREATER THAN OR EQUAL TO THE SAVINGS FROM A MINIMUM EFFICACY STANDARD OF 45 LUMENS PER WATT, EFFECTIVE BEGINNING JANUARY 1, 2020, THE SECRETARY SHALL PROHIBIT THE SALE OF ANY GENERAL SERVICE LAMP THAT DOES NOT MEET A MINIMUM EFFICACY STANDARD OF 45 LUMENS PER WATT.**[87]

Continuing to provide incentives for CFLs is not cost effective for 2016 and beyond. This is due to the fact that CFLs typically have 8-10 year effective useful lives. Consequently, assuming an 8-year effective useful life, a CFL installed in 2016 would last until 2024. However, since EISA mandates that CFLs, or at least the lumens per watt equivalent to a CFL, become the minimum baseline lighting technology beginning in 2020 then CFLs installed in 2016 should not receive incremental energy savings benefits in 2020, 2021, 2022, 2023, and 2024. If CFLs installed in 2016 only receive incremental energy savings benefits for 2016, 2017, 2018 and 2019, they are not cost effective at the avoided costs used in the MEEIA Cycle 2016 - 2018 filing. It should be obvious that CFLs installed in 2017 and 2018 would be even less cost effective than CFLs installed in 2016.

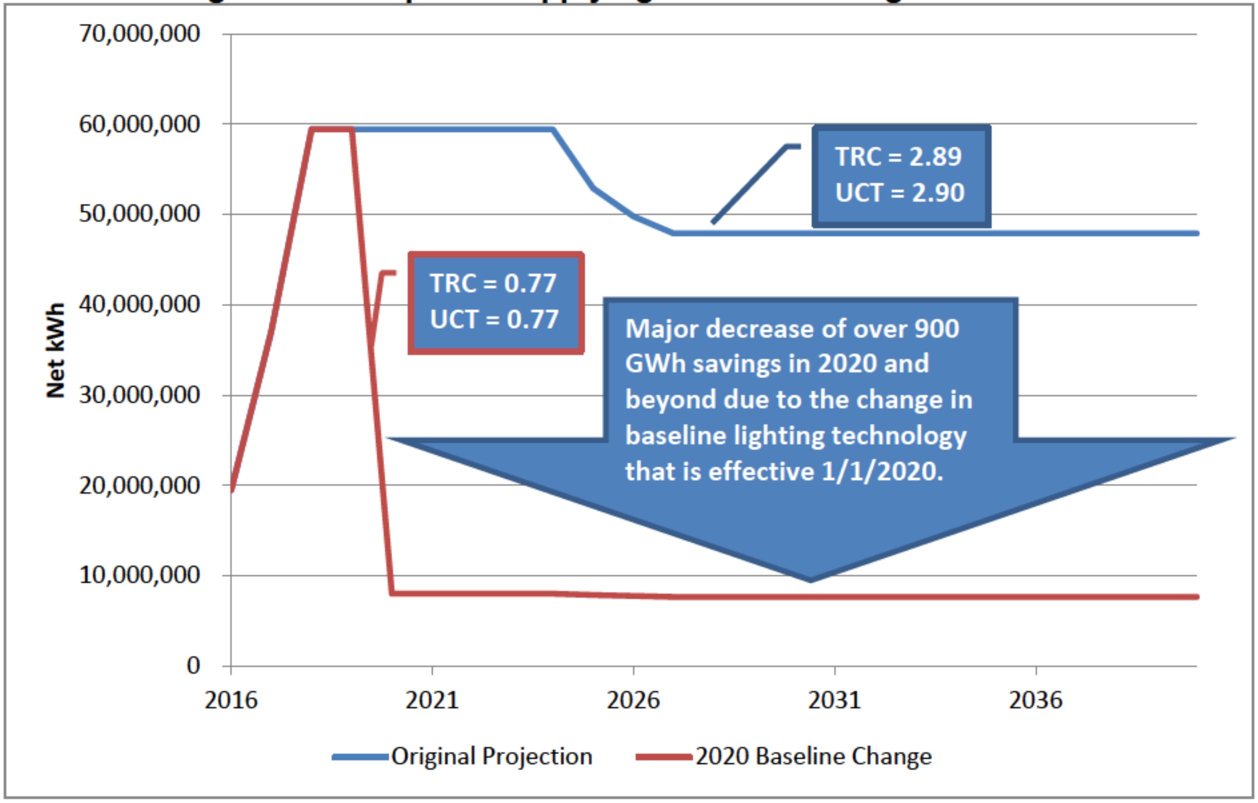
---

[86] EO-2014-0062 j

[87] http://www.gpo.gov/fdsys/pkg/PLAW-110publ140/html/PLAW-110publ140.htm

The following graph illustrates the magnitude of the decrease in CFL savings associated with EISA requirements beginning January 2020.

Figure 8.23: Impact of Applying Baseline Change after 2020

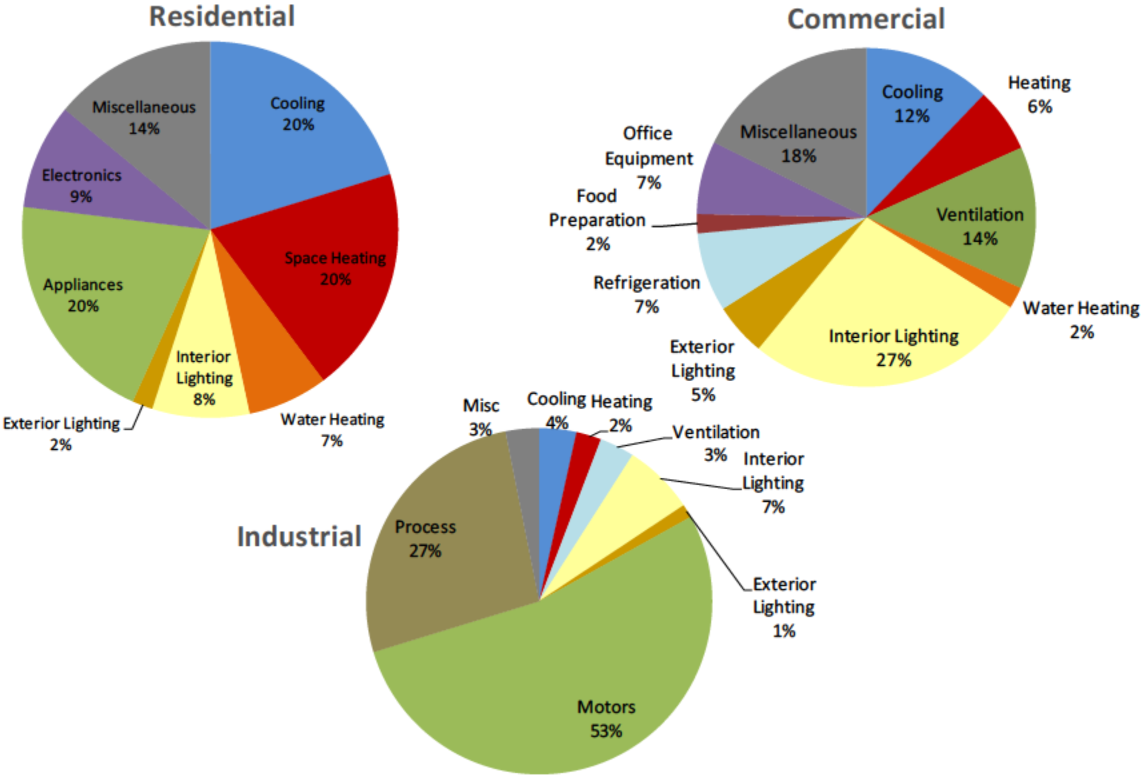


Major decrease of over 900 GWh savings in 2020 and beyond due to the change in baseline lighting technology that is effective 1/1/2020.

8.13.2 Smart Thermostats

The thermostat may be the single most important ubiquitous device that controls electricity use in the home. From the 2013 Ameren Missouri DSM Potential Study primary market research, approximately 40% of all the electricity consumed in the average home goes to heating and cooling the home. See the graph from the DSM Potential Study below:

Figure 8.24: Annual Electricity Use by End Use and Sector (2011)[88]



Ameren Missouri has attempted to maximize energy savings opportunities inherent in thermostatic controls through multiple residential DSM programs – including the HVAC, Efficient Products, and Low Income programs. Unfortunately, 2013 DSM program EM&V results show that customers in general (but there are exceptions) continue to use smart or programmable thermostats in a manual mode thereby negating the energy savings opportunities associated with the technology. In fact, the 2013 EM&V reports for the residential HVAC program, calculated a 15% realization rate for thermostats. The realization rate is the ratio of actual savings to the Ameren Missouri MEEIA Cycle 2013 - 2015 TRM savings.

The fact that customers tend to use smart thermostats in a manual mode is not unique to Ameren Missouri. It is well documented by electric utilities throughout the nation. So much so that in the 2005 timeframe Energy Star rescinded its thermostat certification program citing several studies showing that the programming features were not being used properly, or at all, and that the promised savings had not materialized. However, Energy Star is working collaboratively with thermostat vendors and utilities to devise a new set of thermostat specifications. The new Energy Star thermostat specification that shows promise in terms of the thermostat delivering meaningful energy savings is a

---

[88] Volume 3 of the Ameren Missouri DSM Potential Study

communications protocol that allows 3rd party developers to enable access to the thermostat's full range of communication and remote control capabilities.

Enter the emerging smart thermostat technologies. The NEST immediately comes to mind due to its prominence in national news articles when Google acquired NEST in early 2014. However, there are several other prominent, user friendly emerging smart thermostats – Carrier ComfortChoice Touch, Honeywell FocusPro, Emerson Smart Energy and Ecobee Smart Si to name a few.

It appears that a transformation of thermostat functionality is imminent. The shift towards communicating thermostats opens the potential for new communications-based functionality. The question remains, however, whether the new standards are an improvement on the previous standards, i.e., whether the new thermostats will actually be used by customers in a way that uses less energy.

It is difficult at the time of this filing to separate the promise from the reality of emerging thermostat technologies.[89] This healthy skepticism is based on the fact that Ameren Missouri incented smart thermostats as part of its residential DSM portfolio in 2013 and EM&V results showed a 15% realization rate. The thermostat marketing blitz touts significant potential for both energy and peak demand savings from the new generation of smart communicating thermostats. For example, early NEST marketing brochures cited potential annual energy savings of 19-35% for the heating and cooling requirements of a home. Savings of this magnitude are basically unprecedented for any type of smart thermostat in the nation heretofore.

The initial NEST marketing blitz was toned down after NEST did a trial of NEST users in 45 states in March 2013. NEST wrote a subsequent white paper on the results of the trial that showed more reasonable average actual energy savings for both heating and cooling seasons in the 5-10% range.

Ameren Missouri is monitoring national EM&V work on emerging smart thermostat technologies being conducted by organizations such as E-Source and electric utilities such as Austin Energy to acquire as accurate and reasonable data as possible to assess the cost effectiveness of this emerging technology.

8.13.3 Prepay

A Prepay program is one where a participant purchases credit for service in advance of consumption, then uses the service, and at any point can purchase additional credit. If the credit is depleted then the consumer no longer has access to that service. A

---

[89] 4 CSR 240-22.050(1)(E)1&2 Emerging technologies is discussed further on page 6-2 of Volume 3 of the DSM Potential Study

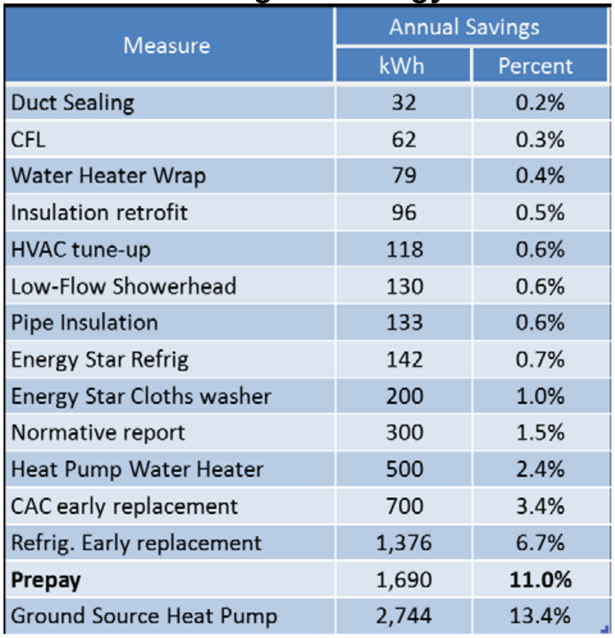
mainstream example is prepaid cell phone service. An additional example is prepaid toll programs like Sun Pass in Florida.

A growing trend among utilities is electric Prepay programs. They were designed to eliminate credit checks, deposits, monthly bills, late charges, disconnect/reconnect charges, help customers budget and manage energy cost, and these programs consistently provide significant energy savings – hence the energy efficiency connection.

Prepaid electricity is a rapidly growing payment option for electric utilities and is a concept widely used with Electric Co-ops. DEFG's (Distributed Energy Financial Group) Prepay Energy Working Group found that customers saved on average 11% of energy consumption in a study of Oklahoma Electric Cooperative (OEC), with a 95% confidence interval going from savings of 10.2% to 13.0%.[90] DEFG engaged economist Michael Ozog, Ph.D. to apply statistical techniques accepted in the evaluation of utility sponsored energy efficiency programs to measure the effect of prepayment on energy use.[91]

The table below shows how significant the OEC Prepay savings are compared to the other OEC efficiency measure savings.

Table 8.27: Annual Savings of Energy Efficient Measures



Measure	Annual Savings	
	kWh	Percent
Duct Sealing	32	0.2%
CFL	62	0.3%
Water Heater Wrap	79	0.4%
Insulation retrofit	96	0.5%
HVAC tune-up	118	0.6%
Low-Flow Showerhead	130	0.6%
Pipe Insulation	133	0.6%
Energy Star Refrig	142	0.7%
Energy Star Cloths washer	200	1.0%
Normative report	300	1.5%
Heat Pump Water Heater	500	2.4%
CAC early replacement	700	3.4%
Refrig. Early replacement	1,376	6.7%
Prepay	1,690	**11.0%**
Ground Source Heat Pump	2,744	13.4%

---

[90] "The Effect of Prepayment on Energy Use," a report of the Prepay Energy Working Group, DEFG LLC, Washington DC, March 2013.

[91] "The Effect of Prepayment on Energy Use," a report of the Prepay Energy Working Group, DEFG LLC, Washington DC, March 2013.

The reduction in energy consumption has been attributed to the increased awareness of the link between usage and cost. That is because an important aspect of a prepaid program is the constant communication to the customer about usage and cost. This type of communication forces participants to better understand how changes in consumption can save money which then allows those customers to manage their usage more actively.

Ameren Missouri is investigating the potential for a Prepay program, but at this time does not have enough information to propose a formal program.

Metering Hardware

As stated earlier the enabler of Prepay is two-way communication. A typical program would provide information with respect to how much credit is available and how long it will last before more credit is necessary. There are a limited number of hardware options available to allow for this capability. One option is an advanced smart meter, which many utilities are rolling out or already have in place.[92] Another option is a cellular meter and yet another is a local based meter with an in-home-display (IHD). With the advances in smart meter technology and wide use of smart-phones and tablets the IHDs are becoming an outdated technology, which customers will not favor.

Ameren Missouri currently has an AMR system, which is reaching the end of its effective useful life, but is developing a business case for an AMI system. The potential roll out of AMI has considerable effect on a Prepay program and is why Ameren Missouri is unable to file for a program at this time.

Customer satisfaction

Another added benefit of Prepay electric programs is that it increases customer satisfaction. In another study by DEFG, customers had high levels of satisfaction with their Prepay service as 92% of the surveyed customers indicated they were “very satisfied” or “somewhat satisfied” with their Prepay service.[93] Prepay gives customers another option for payment and provides constant communication with the customer with updates on account balance and usage.

Is Prepay An Option For Consideration As A MEEIA DSM Program?

4 CSR 240-3.164 (F) defines a demand-side program as “any program conducted by the utility to modify the net consumption of electricity on the retail customer’s side of the

---

[92] 4 CSR 240-22.050(3)(D)

[93] “Northwest utility Prepay Study,” a report of the Prepay Energy Working Group, DEFG LLC, Washington DC, April 2014.

meter including, but not limited to, energy efficiency measures, load management, demand response, and interruptible or curtailable load."

4 CSR 240-3.164 (O) defines an energy efficiency measure as "any device, technology, or operating procedure that makes it possible to deliver an adequate level and quality of energy service while (1) using less energy than would otherwise be required; or (2) altering the time pattern of electricity so as to require less generating capacity or to allow the electric power to be supplied from more fuel-efficient units."

Therefore, Prepay qualifies as a potential MEEIA energy efficiency program pending the passing of appropriate cost effectiveness tests.

8.13.4 LED Street Lights

The MEEIA statute defines "Demand-side program" as any program conducted by the utility to modify the net consumption of electricity on the retail customer's side of the electric meter, including, but not limited to energy efficiency measures, load management, demand response, and interruptible or curtailable load.

Roadway street lighting, however, is primarily Company owned and therefore typically considered a utility infrastructure investment. However, retail customers pay directly for street lighting lumens they use. Unlike other utility infrastructure investments in generation, transmission and distribution, there is a direct link between Customer usage and corresponding customer value from Company owned street lights and customers' electric bills. Consequently, Ameren Missouri would like to explore with the Commission and stakeholders[94] the possibility of proposing both a Company owned and customer owned LED street lighting DSM program utilizing the proposed MEEIA Cycle 2016 - 2018 regulatory framework.

The reason for considering a LED street lighting DSM program is so that Ameren Missouri can complete the majority of the conversion of existing street lighting from high pressure sodium lighting technology to LED lighting technology(ies) during the 2016-2018 MEEIA Cycle 2016 - 2018 implementation period. Absent the MEEIA regulatory framework, traditional rate base approaches may not result in an economic financial decision for the Company and therefore would not result in a "win-win" (i.e., the Company's incentives would not be aligned with the customer incentives to use energy more efficiently, as required by MEEIA). The high up-front capital costs and the lag associated with recovering these investments can outweigh the savings in maintenance costs. The significance of introducing ratemaking realities is that between rate cases the Company may retain any expense savings (i.e., the avoided maintenance costs) but

---

[94] EO-2012-0142 14

conversely the Company is unable to recover the costs of new capital investments until a new rate case. Therefore there is tension between these two aspects and a thorough analysis can determine which of those effects is more significant. Ameren Missouri performed such an analysis in its July 2013 LED street lighting report to the Commission. The results showed that the initial capital investments were high enough that even when accounting for the maintenance cost savings, the net present value is unfavorable to the Company. It is noteworthy that the previously described revenue requirement modeling analysis assumes all costs are recovered and the analysis indicates positive net benefits (albeit relatively small); however, this analysis shows that under the current ratemaking paradigm in Missouri the Company would not recover all of its costs. The table below summarizes the analysis for each scenario.

Table 8.28: Ameren Financial Impacts

Implementation Scenario	NPV of After Tax Earnings
100% over 3 years	-$1.44 million
100% over 5 years	-$1.42 million
100% over 5 years; 3 year delay	-$1.38 million

The Commission required that the Company update its LED business case analyses again in 2014. The Company is in the process of updating its study and results are not available at the time of the 2014 IRP filing.

<u>Background</u>

In July 2013, Ameren Missouri filed its first LED street lighting Business Case analysis with the Commission. The conclusion was that LED technology was not (as of July 2013) quite suitable for a mass change-out at that time. However, Ameren Missouri learned a great deal about LEDs as a result of doing such an in-depth analysis and recognized that LED technology holds promise in the future. The key observations from the July 2013 analysis were:

1. Although LED SAL technology may be ready for efficiency programs, the technology is not yet cost effective for all LED lighting applications.
2. Key uncertain factors regarding LED SAL cost-effectiveness include: the labor cost of installation, maintenance trip savings, LED price trends, and the effective useful life of LED SAL.
3. Potential stranded costs and regulatory lag in Missouri are additional implementation barriers for LED SAL.
4. There is a high level of risk and uncertainty associated with installing LED SAL.
5. Ameren Missouri will enhance customer choice of light options by proposing a tariff to allow customers to own and install LED SAL.

The Commission approved Ameren Missouri's analysis that the LED business case for street lights did not merit a full scale implementation proposal. However, the Commission also required that Ameren Missouri file annual updates to the LED street light study and determine when the business might be cost effective.

In the third Quarter of 2014 Ameren Missouri sought price quotations from LED street light manufacturers to begin the process to update critical inputs to the LED street light business model. Perhaps the single most critical component of the business case is the capital cost of the LED lights. The refreshed LED price quotations showed that LED street light prices decreased significantly for most of the LED lights in a 12-month time period. The price decrease was of a sufficient magnitude to make many LED light products that were not cost effective in the July 2013 business case cost effective in the 2014 business case analysis.

Table 8.29 shows each type of LED street light, associated quantities of Company owned lights, and associated benefit/cost ratios:

Table 8.29: LED Street Light Types

Light	TRC	Count
Horizontal - enclosed on existing wood pole HPS 117	3.42	16,975
Horizontal - enclosed on existing wood pole HPS 306	2.14	13,639
Horizontal - enclosed on existing wood pole HPS 473	0.96	2,993
Horizontal - enclosed on existing wood pole MV 206	3.36	8,506
Horizontal - enclosed on existing wood pole MV 477	4.39	3,952
Horizontal - enclosed on existing wood pole MV 1095	4.07	76
Horizontal - enclosed on existing wood pole MV 2160	6.47	
Open bottom on existing wood pole HPS 70	∞	59
Open bottom on existing wood pole HPS 117	6.09	56,230
Open bottom on existing wood pole MV 118	∞	3,013
Open bottom on existing wood pole MV 206	15.29	16,691
Post top including 17 foot post HPS 117	0.15	40,831
Post top including 17 foot post MV 118	0.15	110
Post top including 17 foot post MV 206	0.61	9,812
Directional HPS 306	0.33	3,522
Directional HPS 473	0.62	3,574
Directional MH 450	0.57	5,069
Directional MH 1077	2.25	1,005
Directional MV 294	0.29	326
Directional MV 1095	1.91	28
Total Lights		186,411
Total Cost-effective Lights		123,167
% Cost-effective		66.1%

Additional information will be provided in Ameren Missouri's 2014 LED Street Light update.

8.13.5 Small Business Direct Install (SBDI) Program

Ameren Missouri is actively pursuing alternative program design options to better serve small commercial customers. An option is an Ameren Missouri Small Business Direct Install (SBDI) program. The primary components of an SBDI program design typically include:

1. An energy audit performed most likely by a third party contractor
2. Processing of the audit data into information for the customer on relevant cost effective energy efficiency opportunities
3. A specific energy efficiency project proposal complete with energy savings, cost savings, project costs and project paybacks and applicable Ameren Missouri incentives
4. All work is done on a turn-key basis by the Ameren Missouri third party contractor and associated trade allies

Typically audit programs of this type include some type of direct install, "on-the-spot" component, such as efficient light bulbs or faucet flow aerators, so that at least a minimal amount of kWh savings can be garnered from a site visit should the customer choose not to go forward with identified cost effective energy savings opportunities.

In summary, the services to small business customers offered through this program encompass all aspects of project implementation including strategic planning, identification of potential measures through energy audits and other tools such as retro-commissioning, direct installation of low-cost/no-cost measures, as well as installation and financial incentives for capital investment energy efficiency measures. The program would be open to all of Ameren Missouri's qualified commercial customers (typically to those small commercial customers with less than 150 kW demand). The program would target all cost effective end-uses including, but not limited to, lighting, HVAC, refrigeration, and plug loads.

The program design challenge with SBDI is cost effectiveness. Direct install programs generally are more costly to administer and implement. For example, prior to the implementation of the Energy Investment and Security Act (EISA) of 2007 when CFL energy savings were measured relative to a baseline of incandescent light energy savings, SBDI programs generally were marginally cost effective. With more efficient lighting baselines for the 2016-2018 implementation period, it is difficult to adjust the energy efficiency measure mix or to alter the program delivery mechanisms such that the SBDI program is cost-effective – at least from a cost effectiveness modeling perspective.

Ameren Missouri will continue to gather data and analyze alternative program designs and delivery mechanisms to determine if the SBDI program can be cost-effective for the 2016-2018 implementation period. Alternative approaches under consideration include:

- Limit the program to direct install measures only
- Focus on low-cost/no-cost measures including:
    - Chiller or hot water settings
    - Reprogramming the energy management system
    - Correcting building schedules
    - Correcting supply and return fan VFD settings
    - Repairing damaged installation
    - Installing faucet aerators

8.13.6 Weekly Customer Usage Updates

Ameren Missouri expects to roll out a new customer weekly usage update program. This will be an opt-in option for customers to receive real time usage and billing information in a variety of forms delivered via e-mail. Although the program's primary purpose is to assist customers, the program also has energy efficiency implications in the form of customer energy behavior change. Ameren Missouri is exploring opportunities to include targeted energy efficiency messaging with the Billing Alerts program to determine the potential to extract meaningful energy efficiency savings from this program.

8.13.7 Electric Vehicles

Ameren Missouri is considering the development of a program in which residential electric vehicle charging stations are incented to promote the adoption of electric vehicles (EVs).

As defined by MEEIA a:

(F) Demand-side program means any program conducted by the utility to modify the net consumption of electricity on the retail customer's side of the meter including, but not limited to, energy efficiency measures, load management, demand response, and interruptible or curtailable load;

This is a unique program in that most energy efficiency programs apply a measure to replace or upgrade an existing piece of equipment, while a program of this nature involves the shift of “fuel type” from one industry to another in the interest of reducing CO_2 emissions (i.e., the Oil Industry to the Electric Industry).

The internal combustion engine (ICE) has powered motor vehicles for years and dominated the market. Auto manufacturers, in an effort to comply with federal regulation and to attract customers, have tried to increase the fuel economy of their fleet. Many automakers are switching some of the product offerings to EVs, but one of the hindrances to their adoption is the need for charging stations. Ameren Missouri is considering a potential energy efficiency program to incent the full cost and installation of a residential charger for customers who purchase an EV.

A supply chain analysis (of Ameren Missouri generation); comparing a vehicle with an ICE averaging 30 mpg and an electric vehicle with a 16.5 kWh battery results in the electric vehicle emitting almost 3 tons less CO_2 into the atmosphere than the ICE vehicle. If the overall environmental goal is to reduce carbon and mitigate climate change influences from the transportation sector then this is a segment of the market that should be considered alongside other energy efficiency initiatives.

The difference in carbon emissions between ICE and EVs is expected to increase going forward as Ameren Missouri adds more renewable energy resources to its portfolio.

Energy Savings Calculations

Since the traditional way of calculating incremental energy savings (kWh) doesn’t apply to a program of this nature Ameren Missouri developed a methodology to convert the carbon savings from CO_2 to kWh. The supply chain energy for both ICEs and EVs was converted to a common unit (BTUs) and then the difference was converted to kWh. In the case of comparing one vehicle powered by an ICE and another by electricity, the resulting savings is 26.44 mmBTU or 7,750 kWh per year per automobile.

An illustrative example of the carbon reduction potential from an EV program - if Ameren incents 100 residential charging stations each year (2016 – 2018), the estimated reduction in CO_2 Emissions is shown below. The first graph shows the emissions saved at the wheel and the second graph includes the source emissions saved.

Figure 8.25: "At the Wheel" Emissions Reduction

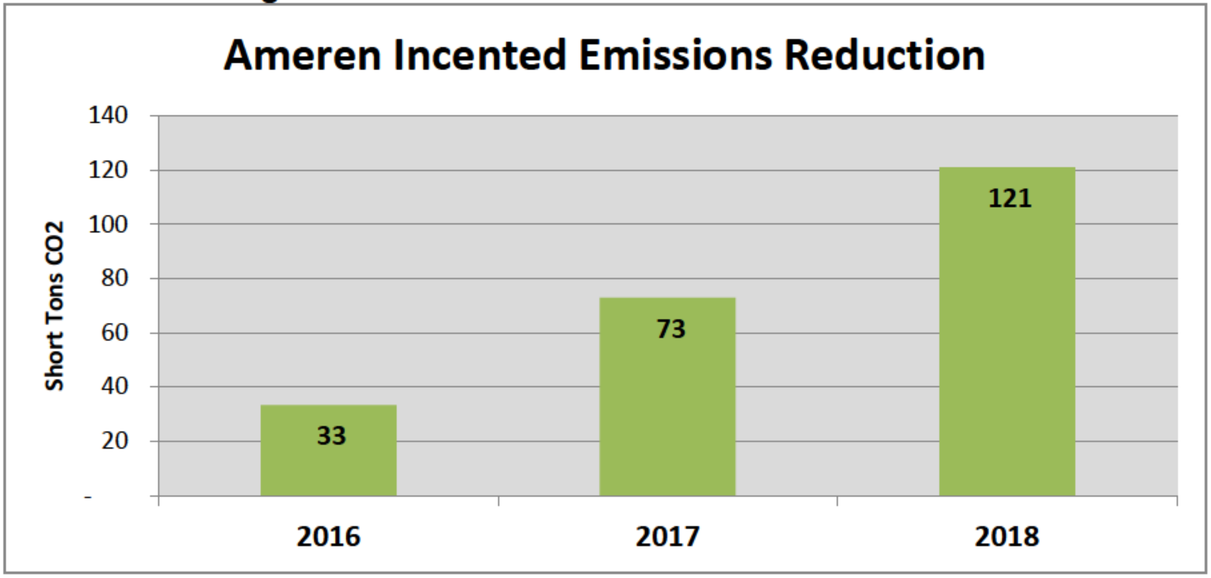
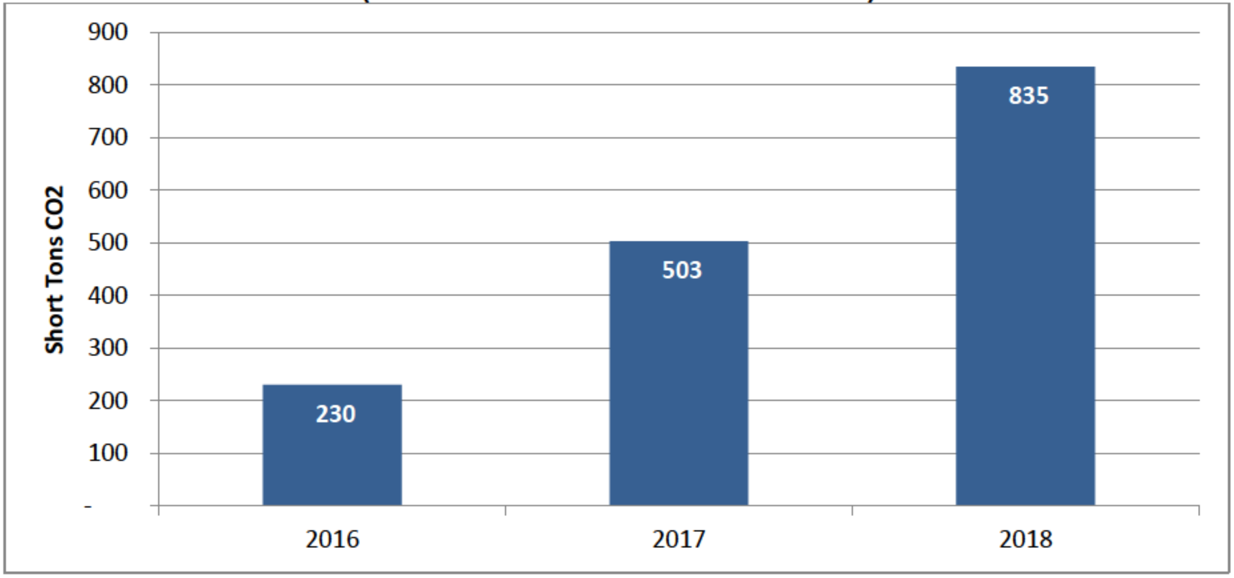


Figure 8.26: Ameren Incented Emissions Reduction
(Source Emissions for ICE & PEV)



Issues with Filing an EV Program for MEEIA Cycle 2016 - 2018

The nature of the program does not currently comply with the MEEIA rules as it does not reduce electrical load. However, as cost effective energy efficiency opportunities from traditional electric equipment upgrades diminish over time due to ever increasing baseline efficiency standards, Ameren Missouri seeks innovative approaches to reduce its service territory's carbon footprint. In order for an electric vehicle charging station program to be implemented effectively, MEEIA rule changes appear to be required.

8.14 Compliance References