MISSOURI DEMAND-SIDE MARKET POTENTIAL REPORT

Missouri Public Service Commission

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I. Executive Summary

This report ("Report") is prepared by the Staff of the Missouri Public Service Commission ("Commission") to inform the Commission and other Missouri energy policy-makers on how demand-side market potential studies are performed for and used by decision makers of private and public organizations in the United States. Since the 1980s, demand-side market potential studies have supported the needs of states and utilities to identify major opportunities for energy and demand savings including support for designing efficiency policies and demand-side management ("DSM") programs, setting energy savings goals, incorporating energy efficiency into the integrated resource planning ("IRP") process, or determining funding levels for DSM programs and policies.

While demand-side market potential studies provide significant value to decision makers, each individual potential study is the product of the specific timing of the study and the ability, experience, judgment, budgetary constraints, data resources and proprietary computer modeling tools of the consulting firm performing the potential study. There are no standards and few recognized reference guides for performing potential studies.[1] Variations in any of the following aspects of a potential study can make it difficult – if not impossible – to compare the results of that potential study to the results of another potential study:

- Assumptions for and processes to construct baseline forecasts for energy and demand;
- Definitions of and processes to estimate achievable energy and demand savings;
- Types of end-use measures and programs to be included in the potential study;
- Lives and deemed energy and demand savings of individual measures;
- Assumptions for avoided energy costs and avoided demand costs;
- Savings reported as measure-level potentials or program-level potentials or both;
- Net savings potentials or gross savings potentials or both;
- Opt-out customers are included in or excluded from potential study;
- Distributed generation is included in or excluded from potential study;
- Behavior-based programs are included in or excluded from potential study;

[1] http://www.epa.gov/cleanenergy/documents/suca/potential_guide.pdf

- Cost effectiveness for electric measures include or exclude benefits from natural gas savings; and
- Start and end dates for potential studies.[2]

Further, given the inherent inaccuracies of modeling and forecasting, particularly over long periods of time, potential studies are most informative when assessing potential in the short term. Studies can provide a snapshot of existing market conditions and, when coupled with recent historical program performance, can help program administrators develop expectations about performance in the near future. This analysis breaks down once studies begin to consider time periods longer than five years or so.

Based upon its literature review of potential studies in the United States and its review of the five most recent potential studies performed for Missouri decision makers (two Missouri statewide potential studies and utility service territory potential studies for Ameren Missouri, for Great Plains Energy[3] and for Empire District Electric Company), Staff determines that these Missouri potential studies include annual energy savings potentials within the reasonable range of similar studies. However, once again, direct comparisons of individual studies are difficult and are of limited value. Further, a compilation and extrapolation of the results of the potential studies for the four Missouri investor-owned electric utilities to estimate the annual energy and demand savings potentials for Missouri – including the electric cooperatives and municipal electric systems – is expected to be of limited value.

This Report discusses the Commission's rules related to performance of and uses for potential studies and finds that the Commission's rules help assure that individual investor-owned electric utilities have demand-side market potential studies which are:

- Current – performed no less frequently than every four (4) years;

[2] For example, a study with a start date of 2014 can have meaningfully different results from a study with a start date of 2016 due to changes in the baseline forecast assumptions for enacted efficiency codes and standards and emerging technologies.

[3] The Great Plains Energy potential study was performed by Navigant and published in 2013 for each of the individual service territories of Kansas City Power & Light Company (Kansas jurisdiction and Missouri jurisdiction) and for the KCP&L Greater Missouri Operations Company.

- Utility specific and of reasonable quality – use primary data[4] and analysis for the utility's service territory and have baseline forecasts which account for:
    - ✓ Customers who have opted out;
    - ✓ Changes in building codes and/or appliance efficiency standards;
    - ✓ Changes in customer combined heat and power applications; and
    - ✓ Third party and other naturally occurring demand-side savings;
- Transparent – performed by a third party contractor; Staff and other stakeholders can review and provide input during the planning stages of potential study analyses including review of assumptions and methodology; and
- Used for long term electric utility resource planning - technical potential, economic potential, maximum achievable potential, and realistic achievable potential for a twenty (20)-year planning horizon.

Finally, this Report identifies a number of opportunities to improve Missouri's potential studies and their usefulness including:

- Improving the accuracy of short term savings potentials through greater understanding of the impact of demand-side programs' marketing and education efforts;
- Leveraging resources to enhance and improve future Missouri potential studies to inform:
    - ✓ Missouri's State Energy Plan;
    - ✓ Missouri's plan for compliance with federal environmental regulations;
    - ✓ Missouri's Statewide Advisory Collaborative efforts to:
        - o Address creation of a statewide technical resource manual;
        - o Discuss demand-side programs' planning and implementation;
        - o Discuss statewide energy policy issues;
    - ✓ Individual investor-owned electric utility potential studies in compliance with 4 CSR-240-3.164(2)(A);[5] and

[4] Primary data is the result of recent research studies of the utility's service territory's a) inventory of energy consuming equipment, and b) consumers' attitudes, preferences and behaviors related to demand-side resources. Alternatively, secondary data may include publicly available data based on the result of research performed for other regions of the country.

[5] 4 CSR 240-3.164(2)(A): " … The determination of whether to conduct a market potential study for the utility's service territory or for all statewide investor-owned electric utilities shall be at the discretion of the electric utility. If the current market potential study of the electric utility that is filing for approval of demand-side programs or a demand-side program plan is part of a statewide investor-owned electric utilities market potential study, the sampling methodology shall reflect each utility's service territory and shall provide statistically significant results for that utility."

- Using stakeholder/workshop processes to review the Commission's Chapter 22 Rules and MEEIA Rules[6] and to recommend revisions for improving the overall value of potential studies for Missouri.

II. Overview of Demand-Side Market Potential

A. National Perspective from ACEEE

A demand-side market potential study is a tool to help utilities and states advance smart energy policies and DSM programs by providing critical data resources to inform decision makers. These studies have been conducted by states and utilities since the 1980s to quantify the size of the energy efficiency and demand response resources in their territories and to identify major opportunities for energy and demand savings. A study could support a number of state or utility needs for designing efficiency policies and DSM programs, such as setting energy savings goals, incorporating energy efficiency into the IRP process, or determining funding levels for DSM programs and policies.

In the traditional approach to performing demand-side potential studies, there are three broad categories of potential energy and demand savings:

- Technical, an ideal scenario which sums all energy efficiency measures that are feasible given technology limitations;
- Economic, the fraction of the technical potential that is cost-effective; and
- Achievable, or fraction of the economic potential that is attainable given actual program infrastructure and both societal and market limitations.[7]

In August 2014, ACEEE released its report titled *Cracking the TEAPOT: Technical, Economic, and Achievable Energy Efficiency Potential Studies* by Max Neubauer**,** Report U1407[8]. This Missouri Demand-Side Market Potential Report includes instructive excerpts from *Cracking the TEAPOT* to provide background information and ACEEE's findings and conclusions concerning demand-side market potential studies.

[6] Section 536.175.1. requires that each state agency periodically review all of its rules according to the following review schedule: (1) Rules contained in titles 1 through 6 of the code of state regulations shall begin the review process no later than July 1, 2015, and every five years thereafter. Although triggering notice, to Staff's knowledge, has not yet been provided to the Commission, Staff is working under the assumption that the Commission's review process must be completed, and a detailed report file with the Joint Committee on Administrative Rules by June 30, 2016.

[7] http://www.aceee.org/topics/efficiency-potential-and-market-analysis

[8] http://www.aceee.org/sites/default/files/publications/researchreports/u1407.pdf

From *Cracking the TEAPOT:*

Executive Summary

Energy system modeling and planning are inherently complex and subject to many uncertainties. Still, this critical and common exercise can provide important insights. There is growing understanding that energy planning should give as much consideration to demand-side resources like energy efficiency[9] as it does to supply-side resources. Whether on the demand or supply side, modeling market dynamics across all customer classes over long periods of time is bound to be subject to complications and inaccuracies. Yet these projections ultimately influence related utility regulatory policy, which, in turn, influences utilities' expenditures on supply- and demand-side resources and the programs that deliver them.

… It is important to realize that the value of potential studies depends on the effort and resources that go into them, and the assumptions—whether reasonable or constrained—that underlie them.

… Even accounting for geographic, demographic, and economic differences, assumptions and methodologies can vary significantly across studies. *This makes direct comparisons difficult.* Furthermore, potential studies rely on a large number of inputs that can have significant impacts on results. Some of the more important inputs for which detailed information can be opaque or missing entirely include models for forecasting participation rates; assumptions about these rates; assumptions about incentive levels; the impacts of codes, standards, and emerging technologies; policy limitations; and utility avoided-cost assumptions. Many of these assumptions are inherent in the models used and in specific inputs, and as a result they are rarely disclosed or discussed, often for proprietary reasons. *Lack of transparency about assumptions is a major issue for potential studies.*

BEST PRACTICES IN POTENTIAL STUDY DESIGN

… For a number of reasons, potential studies are best suited to guide short-term rather than long-term energy efficiency program development and deployment. They can also be informative when incorporated into the IRP process and when used to develop utility savings targets. In the long term, the availability of energy efficiency resources has major implications for decisions to invest in and deploy generation resources, so a thorough quantification of energy efficiency can be very useful. Potential studies should also be sure to account for the full benefits of energy efficiency. There is a good deal of research on the non-energy benefits of energy efficiency, and while these

[9] As used in *Cracking the TEAPOT*, energy efficiency includes both energy efficiency resources and demand response resources.

benefits are hard to quantify, there is little doubt that the overall effect is greater than zero.

Transparency is also a major issue: a discouraging number of studies we reviewed are subject to at least some opacity. This lack of information is particularly confounding when it comes to the more influential elements of a study, including the assumptions behind maximum achievable and program/realistic [achievable] potential scenarios, customer participation models, avoided costs, and emerging technologies. However, given the proprietary and competitively sensitive nature of many of the study elements, this opacity is unsurprising and perhaps unavoidable.
…

CONCLUSION:

Energy efficiency potential studies have been common for decades. But since 2000, they have moved beyond their traditional use as a tool for informing program design. *They are increasingly integrated into long-term energy system planning and used as a resource for informing regulatory policy.* Studies will likely proliferate as more states and utilities without much program experience expand their portfolios. *Stakeholders need a better understanding of the mechanics of these studies and their limitations, how various methodologies and assumptions can impact savings potential, and how nuances make direct comparisons of studies difficult.*

Median estimates of energy efficiency savings potential have not changed noticeably over the past decade or more, despite a major recession, a precipitous drop in natural gas prices, and the impacts of codes and standards. *Our 2004 meta-analysis found a median annual savings of 1.2% for electric and 0.5% for natural gas (Nadel et al. 2004). In this report we find a median annual savings of 1.3% for electric and 0.9% for natural gas.* …

Given the inherent inaccuracy of modeling and forecasting, particularly over long periods of time, potential studies are most informative when assessing potential in the short term. Studies can provide a snapshot of existing market conditions and, when coupled with recent historical program performance, they can help program administrators develop expectations about performance in the near future. This analysis breaks down once studies begin to consider time periods longer than five years or so. Moreover, given the fact that most studies base their customer-participation models on economics, even short-term forecasts of market dynamics are murky. This is because studies tend to downplay the impact of program design elements such as marketing and education, as well as the non-energy justifications[10] for investing in energy efficiency.

[10] Including externalities such as societal cost related to environmental impacts.

> These limitations certainly do not render potential studies useless. But they do elucidate the need for greater clarity and transparency. *Whether intentionally or not, practically every study we reviewed lacked sufficient transparency when it came to discussing important variables such as participation, emerging technologies, and avoided costs.* If potential studies are to continue to play a major role in energy planning, stakeholders must be able to scrutinize their methodologies in order to evaluate the veracity of the results. This transparency will lead to more active, constructive stakeholder discussions and more reflective assessments. It appears that potential studies will continue to be an important tool for energy system planning. But how useful a tool is entirely dependent on the amount of data and the degree of transparency the authors and their clients are willing to provide.
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> [Emphasis added.]

B. Missouri Public Service Commission Rules for Demand-Side Market Potential Studies

In 2009, Missouri took a significant step toward regulatory changes necessary to align utility financial objectives with saving energy through customer energy efficiency programs. This step was the enacting of the Missouri Energy Efficiency Investment Act[11] ("MEEIA"), which declares that it is the policy of the state to value demand-side investments such as energy efficiency equal to traditional investments in energy supply and delivery infrastructure. Following the implementation of MEEIA, the Commission conducted a rulemaking proceeding that involved many of the state's energy stakeholders. In April 2011, the Commission published a final rulemaking to implement MEEIA. The Commission's MEEIA Rules[12] became effective May 30, 2011, and allow utilities to submit cost recovery and incentive mechanisms along with their energy efficiency plans.

The Commission's MEEIA Rules include the following minimum requirements concerning electric utility demand-side market potential studies (with emphasis added) for each rule's most relevant requirements:

[11] Section 393.1075.
[12] 4 CSR 240-3.163, 4 CSR 240-3.164, 4 CSR 240-20.093 and 4 CSR 240-20.094.

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

(2) When an electric utility files for approval of demand-side programs or demand-side program plans as described in 4 CSR 240-20.094(3), the electric utility shall file or provide a reference to which commission case contains the following information. All models and spreadsheets shall be provided as executable versions in native format with all formulas intact.

(A) A current market potential study. *The current market potential study shall use primary data and analysis for the utility's service territory*. The determination of whether to conduct a market potential study for the utility's service territory or for all statewide investor-owned electric utilities shall be at the discretion of the electric utility. If the current market potential study of the electric utility that is filing for approval of demand-side programs or a demand-side program plan is part of a statewide investor-owned electric utilities market potential study, the sampling methodology shall reflect each utility's service territory and shall provide statistically significant results for that utility. *The current market potential study shall be updated with primary data and analysis no less frequently than every four (4) years*. To the extent that primary data for each utility service territory is unavailable or insufficient, the market potential study may also rely on or be supplemented by data from secondary sources and relevant data from other geographic regions. *The current market potential study shall be prepared by an independent third party with opportunities for commission staff and stakeholder review and input in the planning stages of the analysis including review of assumptions and methodology in advance of the performance of the study and shall include at least the following*:

1. Complete documentation of all assumptions, definitions, methodologies, sampling techniques, and other aspects of the current market potential study;

2. Clear description of the *process used to identify the broadest possible list of measures and groups of measures for consideration*;

3. Clear description of the *process used to determine technical potential, economic potential, maximum achievable potential, and realistic achievable potential for a twenty (20)-year planning horizon for major end-use groups (e.g., lighting, space heating, space cooling, refrigeration, motor drives, etc.) for each customer class*; and

4. *Identification and discussion of the twenty (20)-year baseline energy and demand forecasts.* If the baseline energy and demand forecasts in the current market potential study differ from the baseline forecasts in the utility's most recent 4 CSR 240-22 triennial compliance filing, the current market potential study shall provide a comparison of the two (2) sets of forecasts and a discussion of the reasons for any differences between the two (2) sets of forecasts. *The twenty (20)-year baseline energy and demand forecasts shall account for the following:*

A. Discussion of the treatment of all of the utility's customers who have opted out;

B. Changes in building codes and/or appliance efficiency standards;
C. Changes in customer combined heat and power applications; and
D. Third party and other naturally occurring demand-side savings.

4 CSR 240-20.094 Demand-Side Programs

(2) Guideline to Review Progress Toward an Expectation that the Electric Utility's Demand-Side Programs Can Achieve a Goal of All Cost-Effective Demand-Side Savings. The goals established in this section are not mandatory and no penalty or adverse consequence will accrue to a utility that is unable to achieve the listed annual energy and demand savings goals.

(A) *The commission shall use the greater of the annual realistic achievable energy savings and demand savings as determined through the utility's market potential study or the following incremental annual demand-side savings goals as a guideline to review progress toward an expectation that the electric utility's demand-side programs can achieve a goal of all cost-effective demand-side savings*:

1. For 2012: three-tenths percent (0.3%) of total annual energy and one percent (1.0%) of annual peak demand;

2. For 2013: five-tenths percent (0.5%) of total annual energy and one percent (1.0%) of annual peak demand;

… and

9. For 2020 and for subsequent years, unless additional energy savings and demand savings goals are established by the commission: one-and-nine-tenths percent (1.9%) of total annual energy and one percent (1.0%) of annual peak demand each year.

(B) *The commission shall also use the greater of the cumulative realistic achievable energy savings and demand savings as determined through the utility's market potential study or the following cumulative demand-side savings goals as a guideline to review progress toward an expectation that the electric utility's demand-side programs can achieve a goal of all cost-effective demand-side savings:*

1. For 2012: three-tenths percent (0.3%) of total annual energy and one percent (1.0%) of annual peak demand;

2. For 2013: eight-tenths percent (0.8%) of total annual energy and two percent (2.0%) of annual peak demand;

… and

9. For 2020 and for subsequent years, unless additional energy savings and demand savings goals are established by the commission: nine-and-nine-tenths percent (9.9%) of total annual energy and nine percent (9.0%) of annual peak demand for 2020, and then increasing by one-and-nine-tenths percent (1.9%) of total annual energy and by one percent (1.0%) of annual peak demand each year after 2020.

(8) Collaborative Guidelines.
(A) Utility-Specific Collaboratives. Each electric utility and its stakeholders shall form a *utility-specific advisory collaborative for input on the design, implementation, and review of demand-side programs as well as input on the preparation of market potential studies.* This collaborative process may take place simultaneously with the collaborative process related to demand-side programs for 4 CSR 240-22. Collaborative meetings are encouraged to occur at least once each calendar quarter.

The Commission's Chapter 22 Electric Utility Resource Planning provides in its:

4 CSR 240-22.050 Electric Utility Resource Planning Demand-Side Resource Analysis

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

Comparing and contrasting the minimum requirements concerning demand-side market potential studies in the Commission's rules with the conclusions in the ACEEE's *Cracking the TEAPOT* results in the following observations for Missouri's approach to and requirements for demand-side market potential studies:

- The Commission's Rules 4 CSR 240-3.164(2) and 4 CSR 240-22.050(2) help assure that individual investor-owned electric utilities have demand-side market potential studies which are:
    - ✓ Current – performed no less frequently than every four (4) years;
    - ✓ Utility specific and of high quality – use primary data and analysis for the utility's service territory and have baseline forecasts which account for:

- Customers who have opted out;
- Changes in building codes and/or appliance efficiency standards;
- Changes in customer combined heat and power applications; and
- Third party and other naturally occurring demand-side savings;

✓ Transparent – Staff and stakeholder review and input in the planning stages of the analysis including review of assumptions and methodology; and

✓ Used for long term energy system planning - technical potential, economic potential, maximum achievable potential, and realistic achievable potential for a twenty (20)-year planning horizon.

- Remaining challenges concerning use of demand-side market potential studies include:

✓ Accuracy and value of long term impacts - inaccuracy of modeling and forecasting beyond a five year period due to uncertainty of future codes and standards, emerging technologies and naturally occurring[13] energy savings; and

✓ Accuracy and value of short term impacts - most market potential studies are based on customer-participation models of economics and tend to downplay the impact of marketing and education.

C. Missouri Electric Utilities' DSM Programs and MEEIA

Kansas City Power & Light Company ("KCPL") and Empire District Electric Company ("Empire") were the first Missouri investor-owned electric utilities to each implement a portfolio of DSM programs as the result of Commission-approved Experimental Regulatory Plans in 2005 and 2006, respectively. KCP&L Greater Missouri Operations Company ("GMO") and Union Electric Company d/b/a Ameren Missouri ("Ameren Missouri") first implemented DSM programs as a result of each utility's Chapter 22 adopted preferred resource plan in 2008 and 2009, respectively.

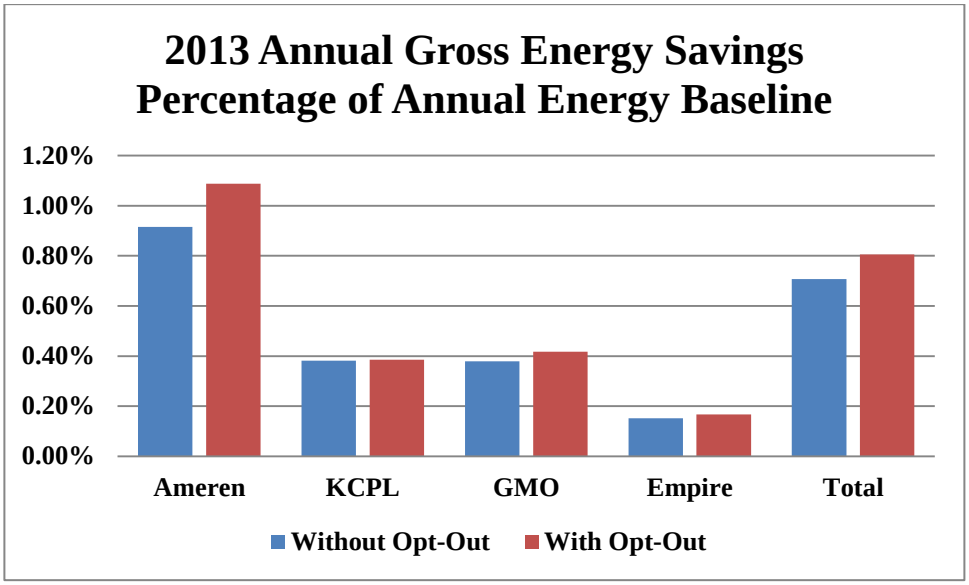
Ameren Missouri, GMO and KCPL recently received Commission approval to implement MEEIA DSM programs and demand-side programs investment mechanisms ("DSIM"). Empire has a MEEIA application which is currently part of an open case.

[13] Naturally occurring energy savings are changes in energy usage which are not the direct result of standards or DSM programs.

The following table summarizes the dates and docket numbers for each investor-owned electric utility's initial DSM programs and MEEIA DSM programs and DSIM.[14]

	First DSM Programs		MEEIA DSM Programs	
	Started In	Case No.	Case No.	Cycle One
Ameren	Feb. 2009	EO-2007-0409	EO-2012-0142	Jan. 2013 - Dec. 2015
KCPL	Oct. 2005	EO-2005-0329	EO-2014-0095	July 2014 - Dec. 2015
GMO	Mar. 2008	EO-2007-0298	EO-2012-0009	Jan. 2013 - Dec. 2015
Empire	Sep. 2006	EO-2005-0263	EO-2014-0030	Open Case

The following chart provides the 2013 percentage of gross[15] incremental annual energy savings for each investor-owned electric utility's DSM programs[16] relative to each utility's unadjusted weather normalized retail sales and weather normalized retail sales adjusted for opt-out[17] customers.



[14] While Ameren Missouri's initial DSIM was approved in Case No. EO-2012-0142, its current Rider EEIC was approved in File No. EO-2014-0075 and Tariff Tracking No. YE-2014-0223. KCPL's DSIM Rider was approved as a part of File No. EO-2014-0095 and Tariff Tracking No. YE-2014-0533.

[15] Estimates of gross savings reflect the changes in energy consumption and/or demand that result from program-related actions taken by participants in an efficiency program, regardless of why they participated. In contrast, a net savings approach measures the changes in energy consumption/demand that are specifically attributable to or are a direct result of a particular energy efficiency program that would not otherwise have happened in the absence of the program.
http://mwalliance.org/sites/default/files/uploads/4_10_2013_Net%20v%20Gross%20White%20Paper.pdf

[16] Chart shows MEEIA programs' savings for Ameren Missouri for January 2, 2013 through December 31, 2013, and for GMO from January 26, 2013 through December 31, 2013. The chart shows KCPL and Empire pre-MEEIA programs' savings for calendar year 2013.

[17] See 4 CSR 240-20.094(6).

III. Missouri's Statewide Demand-Side Market Potential Studies

A. KEMA, Inc. 2011 Missouri Statewide DSM Potential Study[18]

The 2011 KEMA study assessed the electric and natural gas DSM potential for the residential, commercial, and industrial sectors in the state of Missouri. The study was contracted by the Commission with additional support provided by the Missouri Department of Natural Resources. The goal of this study was to determine the levels of DSM savings available in Missouri; the costs associated with procuring these savings; and whether the measures delivering the savings are cost effective. The Commission did not accept the study, but there are some general assumptions that are worth noting in this Report.

In this study, which was performed with secondary data, there were three types of energy-efficiency potential estimated. The first was technical potential, which is defined as the complete penetration of all measures analyzed in applications where they were deemed technically feasible from an engineering perspective. The second potential estimate was economic potential, which is defined as the technical potential of those energy-efficiency measures that are cost-effective when compared to supply-side alternatives. The third estimated potential was achievable program potential, the amount of savings that would occur in response to specific program funding and measure incentive levels. Also, naturally occurring energy-efficiency impacts were estimated in this study. These are savings that result from normal market forces.

Two program-funding scenarios were developed at the specific direction of the Commission based on measure payback levels. These scenarios were one-year payback and three-year payback. The one-year payback scenario assumed customer incentives were provided such that all cost-effective measures have a payback period of one year. For measures that have payback periods of one year or less without incentives, no incentives are provided. The three-year payback provided customer incentives such that all cost-effective measures have a payback period of three years.

To estimate demand response ("DR") impacts, the study reviewed the impacts from the Federal Energy Regulatory Commission's ("FERC") 2009 National Assessment of Demand Response Potential ("NADR") for Missouri and customized the results to the state,

[18] http://mocefllc.com/web_documents/modsmpotential110304.pdf

utilizing information developed by the KEMA team from Missouri-specific sources. The study suggests there is a significant amount of energy efficiency potential remaining in Missouri. For electricity, the residential and commercial sectors appear to provide the largest sources of potential savings.

Primary residential end uses included cooling, lighting, and refrigeration. Whole-building new construction measures were also presented as a large source of potential savings. The study suggested that it may be necessary to offer relatively large incentives to capture the larger amounts of residential savings potential. Plug loads, home entertainment equipment, and home office equipment provided a significant amount of energy savings potential. The use of customer incentives for measures in these end uses did not appear to be the preferred method as there was very little cost differential between standard-efficiency and high-efficiency equipment. Customer education and upstream activities were deemed as more useful approaches to increase the availability and purchases of more efficient electronic equipment.

In the commercial sector, lighting and cooling continued to provide the largest sources of electric energy efficiency potential. Demand response programs will continue to be a large source of peak demand savings.

The KEMA study also provided potential energy efficiency for natural gas. The residential sector was presented as providing the largest source of natural-gas savings potential. The key residential end-uses were space heating and water heating. Other significant measures included high efficiency water heaters, furnaces and boilers, and building shell measures such as insulation and weatherization. New construction measures were also presented as providing a large source of potential natural-gas savings. As with the electric findings, it was suggested that it would take fairly large incentives to capture higher levels of residential gas potential.

This study indicated that emerging technologies would play an increasing role in the energy efficiency portfolio as traditional measures reach high market saturation levels in the coming years. KEMA recommended that Missouri run pilot programs to test both the technical effectiveness and the market acceptance of emerging technologies before rolling out full scale programs.

B. ACEEE 2011 Missouri's Energy Efficiency Potential Study[19]

The ACEEE study was broader in scope than the contracted KEMA study. The ACEEE study began by stating that, in 2010, Missourians spent about $12 billion on their energy bills to heat, cool, and power their homes and businesses, which exceeded total tax collections from individuals and businesses that year. Missouri is known for having some of the lowest average electricity prices in the nation. Residential homes and businesses are a substantial portion of annual costs to the state, and the energy needs for the state are increasing. The ACEEE found that the state's population is expected to grow 10% by 2025, which will increase demand for energy resources and services. This study defined energy efficiency as the long-term improvements in technology performance and practices that reduce energy demand; deem energy efficiency as Missouri's lowest cost energy resource; and offer significant potential to meet this growing demand for new energy sources.

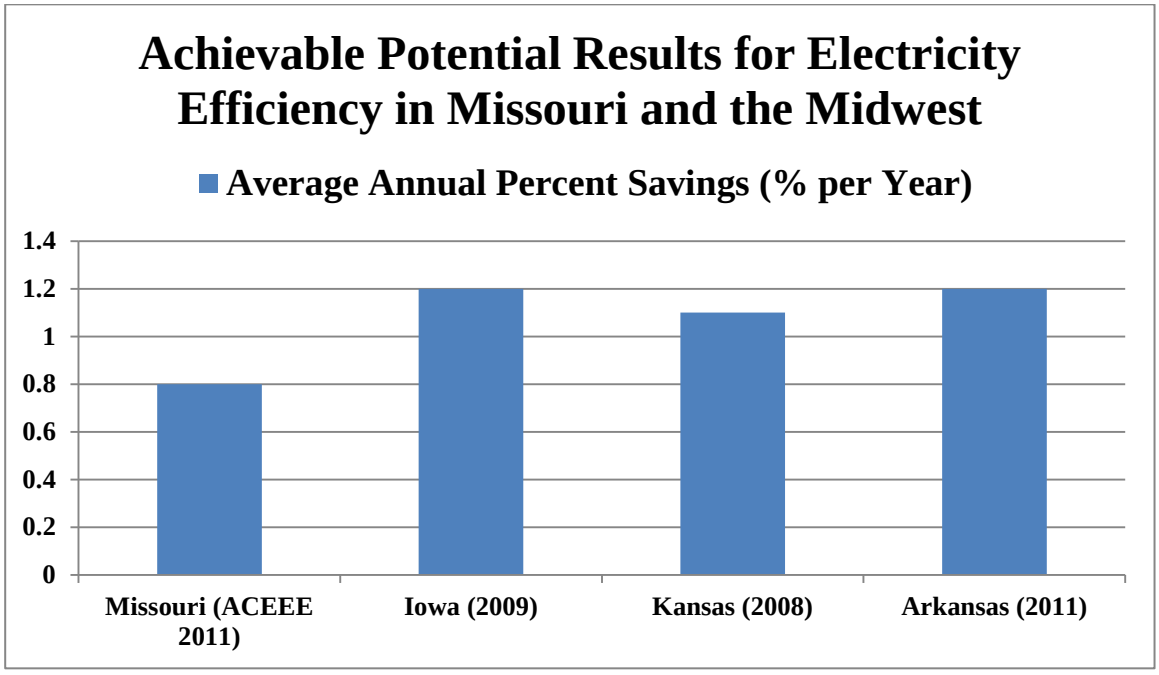
The ACEEE found that national estimates showed that energy efficiency improvements cost only a fraction of new electricity supply. Even with relatively low electricity prices in the state, energy efficiency can be a critical resource to adopt a secure and sustainable energy future for the state. This study examined how energy efficiency policies and programs can reduce energy bills for Missouri homes, businesses, and governments while stimulating the economy and reducing reliance on more expensive energy resources. The multiple economic benefits of efficiency analyzed in this study demonstrated that efficiency is a financially responsible strategy for Missouri that will set the state on a path toward economic growth and energy sustainability.

During the years prior to the ACEEE study, Missouri demonstrated a growing commitment to energy efficiency as a means to attain energy, economic, environmental, and sustainability goals. The ACEEE study deemed that recent developments, however, suggest that the state is struggling to make the major strides needed to significantly advance energy efficiency. ACEEE indicated that Missouri stands to gain much more by broadening policies and programs that encourage improvements in energy efficiency. The ACEEE cited that several recent studies had demonstrated that there is a large amount of cost-effective, untapped efficiency that the state could take advantage of over the next 15 years to save energy and money. This study presented a series of concrete, long-term state policies and

[19] http://www.aceee.org/sites/default/files/publications/researchreports/e114.pdf

program strategies that have the potential to meet 17% of the state's electricity needs and create up to 8,500 new jobs. A comprehensive set of ACEEE's presented state and local policy strategies, along with a collective commitment by policymakers, businesses, and individuals, would enable Missouri to reap the potential efficiency resource, while returning numerous benefits to Missouri's economy and environment.

This study concluded that energy efficiency policies in Missouri could potentially meet 17% of the state's electricity needs by 2025 and reduce peak demand by 25%. The ACEEE estimated that energy efficiency policies could return $3 in energy savings to participants for every $1 invested in programs. They estimated that Missouri consumers will save $6.1 billion cumulatively through 2025 in lower energy bills if the state were to follow the policies and guidelines outlined in this study.



IV. Missouri's Investor-Owned Electric Utilities' Potential Studies

Missouri's investor-owned electric utilities - Ameren Missouri, KCPL, GMO, and Empire - have conducted their own DSM potential studies to comply with Commission Rules, 4 CSR 240-3.164 Electric Utility Demand-Side Programs Filing and Submission Requirements [for MEEIA] and 4 CSR 240-22 Electric Utility Resource Planning.

A. Ameren Missouri

Ameren Missouri released its first comprehensive demand-side market potential study in January 2010.[20] This study was produced by Global Energy Partners, LLC, and was used most notably by Ameren Missouri in its 2011 IRP, Case No. EO-2011-0271.

Ameren Missouri recently contracted with EnerNOC Utility Solution Consulting (EnerNOC) to produce a potential study to assess the various categories of electrical energy efficiency ("EE"), DR, distributed generation ("DG"), and combined heat and power ("CHP") potentials in the residential, commercial, and industrial sectors for the Ameren Missouri service area from 2016 to 2034. The EnerNOC study was released in December, 2013.

Ameren Missouri's key objectives in its 2013 potential study are:

- Conduct primary market research to collect data for the Ameren Missouri service territory, including: electric end-use data, saturation data, and customer demographics and psychographics;
- Characterize how customers in the Ameren Missouri service territory make decisions related to their electric use and energy efficiency investment decisions and translate that understanding in a clear and transparent manner to establish annual market acceptance rates for EE measures;
- Employ updated baselines that reflect both current and anticipated federal, state, and local energy efficiency legislation. Identify all known pending legislation that may also impact DSM potential;
- Develop Ameren Missouri-specific market acceptance rates for EE for the planning cycle of 2016 through 2034 that, when applied to economic potential, will yield estimates of maximum achievable and realistic achievable potential;
- Analyze the potential for energy efficiency, demand response, and customer distributed generation/combined heat and power applications over the 2016-2033 planning horizon;[21]
- Develop sensitivity analyses for assessing uncertainty around DSM potential; and
- Analyze the impact of demand-side rates on DSM potential.

[20] http://www.ameren.com/sites/aue/Environment/Renewables/Documents/Chapter7AppendixB.pdf

[21] Although estimates were developed through 2034, Ameren Missouri's study reports results for 2033, which is 20 years out from the start of the forecast in 2014.

B. KCPL and GMO

KCPL and GMO selected Navigant to conduct a potential study[22] in January 2012 to assess the potential for energy and peak demand savings from energy efficiency, combined heat and power, and demand response in the residential, commercial, and industrial sectors from 2014 to 2033. Navigant finalized its study in August 2013.

In their 2013 potential study, KCPL and GMO have the following key objectives:

- Conduct extensive primary data collection as part of the study;
- Identify nearly 500 possible measures to consider as part of the study. (The study ultimately characterized 298 of the measures considered most likely to contribute to savings.);
- Estimate the technical, economic, realistic achievable ("RAP"), and maximum achievable potential ("MAP") for energy and peak demand savings for this study using Navigant's proprietary Demand Side Management Simulator (DSMSim™) model;
- Estimate the potential energy and peak demand savings from combined heat and power (CHP) measures; and
- Estimate DR potential using Navigant's Demand Response Simulator (DRSim™) model, which follows the approach used in the FERC National Assessment of Demand Response Potential.

C. Empire

Empire contracted with Applied Energy Group ("AEG") to produce its 2012 potential study.

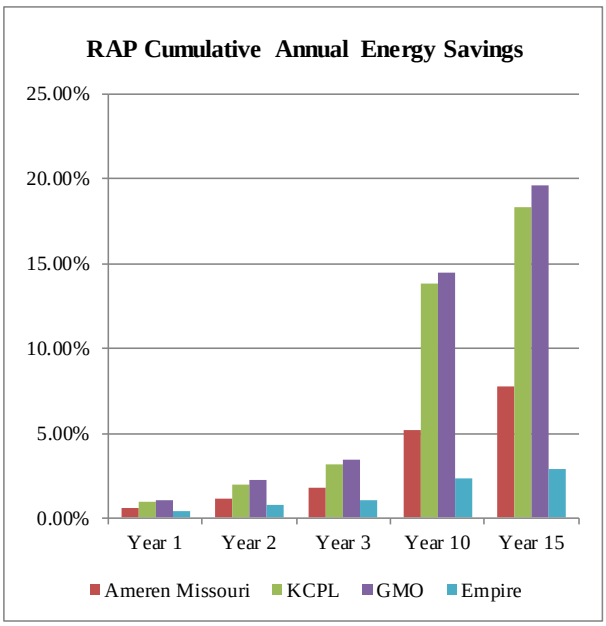
The two key tenets of Empire's programs are:

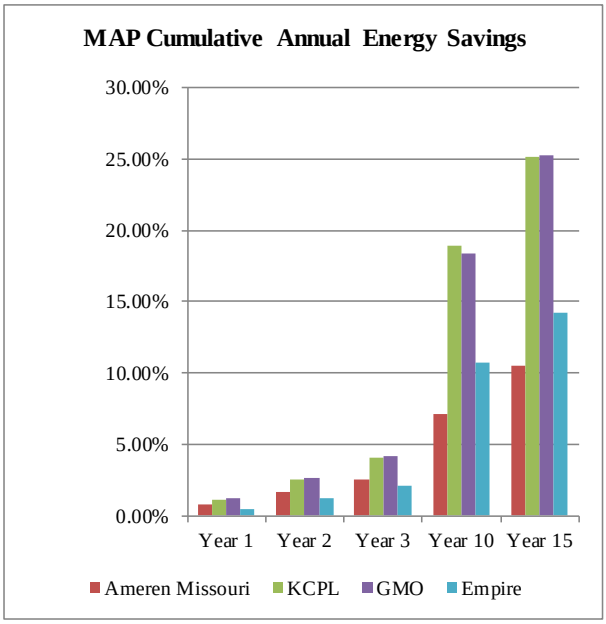
- The service territory benefits from energy efficiency programs. As part of the overall strategy for meeting the need of its customers, cost-effective energy-efficiency programs offer an alternative to the construction of infrastructure and purchase of fuel for generation.
- Empire customers benefit from energy efficiency programs. Energy efficiency can result in lower energy bills, immediately reducing program participant's consumption of electricity. Furthermore, the programs are designed to be inclusive, giving all customers the opportunity to benefit from participating in Empire's energy efficiency programs.

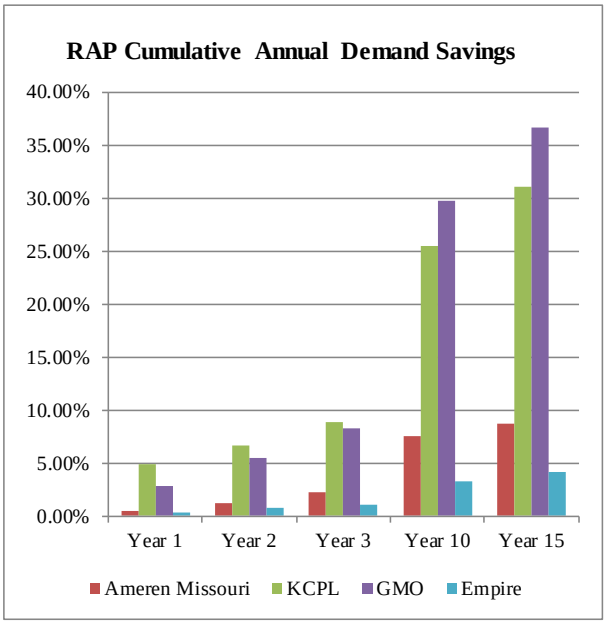
[22] Schedule khw-5 of direct testimony of Kimberly H. Winslow filed on January 7, 2014 in MPSC File No. EO-2014-0095

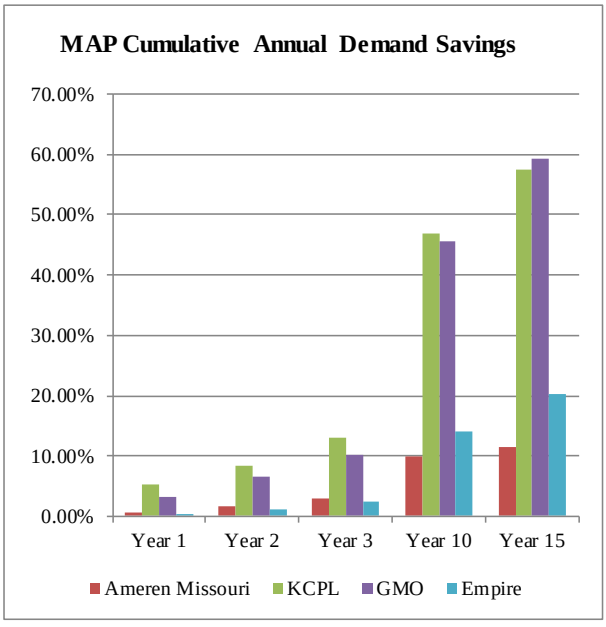
D. Comparison of Electric Utilities' Potential Study Results

As shown in the following charts, each utility's potential study estimated potential amount of energy savings and demand savings with their own DSM program portfolio. It is, however, difficult to compare directly each potential study's energy and demand savings potential due to different definitions for RAP and MAP, different assumptions and different methodologies.









The more significant drivers for the results of the four electric utilities' potential studies include:

- Assumptions for and processes to construct baseline forecasts for energy and demand;
- Definition of and process to estimate achievable energy and demand savings;
- Types of end-use measures and programs to be included in the potential study;
- Lives and deemed energy and demand savings of individual measures;
- Assumptions for avoided energy costs and avoided demand costs;
- Savings reported as measure-level potentials or program-level potential or both;
- Net savings potentials or gross savings potentials or both;
- Opt-out customers are included in or excluded from potential study;
- Distributed generation is included in or excluded from potential study;
- Behavior based programs are included in or excluded from potential study;
- Cost effectiveness for electric measures include or exclude benefits from natural gas avoided cost; and
- Start and end date of the potential study.

Each potential study consultant used different approaches to define RAP savings and MAP savings. For example, in its Ameren Missouri potential study, EnerNOC developed market adoption rates for each end-use measure that specify the percentage of customers that will select the highest-efficiency economic option. Then, EnerNOC used the average take rates for a 3-year payback period and a 1-year payback period for each end-use measure to estimate RAP and MAP, respectively. For KCPL's and GMO's potential study, Navigant defined the MAP scenarios with incentive levels at 100% of the incremental cost of the measure and the RAP scenarios with incentive levels by limiting the maximum $/kWh paid (calculated on a levelized cost basis) for any given measure. For Empire's potential study, AEG included the end-use measures that became cost-effective over the 20-year planning horizon and the 3-year planning horizon for the MAP and the RAP, respectively. Also, for the MAP, AEG adjusted the program participation rates to meet the MEEIA energy and demand savings goals. [23] These differences in the definitions of MAP and RAP make it difficult – if not impossible – to compare the results of one potential study to the results of another potential study.

[23] 4 CSR 240-20.094(A) and (B)

Because of the variations in the previously listed significant drivers of the results in the three electric utilities' potential studies,[24] a compilation and extrapolation of the results of these studies to estimate the annual energy savings potentials for Missouri – including the electric cooperatives and municipal electric systems – is expected to be of very limited values.

E. Potential for Distributed Generation Including Combined Heat and Power

In Ameren Missouri's potential study, EnerNOC estimated the potential of DG-CHP with the following list based on a thorough review of applicable technologies as well as input from stakeholders:

- Solar photovoltaic (PV) systems;
- Small wind;
- Reciprocating engine;
- Reciprocating engine with heat recovery;
- Micro-turbine;
- Micro-turbine with heat recovery;
- Combustion turbine (CT);
- Combustion turbine with heat recovery;
- Boiler with back-pressure steam turbine;
- Fuel cell;
- Fuel cell with heat recovery;
- Combined cycle combustion turbine (CCCT);
- Stirling engine; and
- Organic rankine cycle.

In general, unfavorable economics screen out a large swath of technical potential, and even for those technology applications that are cost-effective, market adoption is low, given the relative complexity of purchasing, owning, operating, and maintaining the units. The realistic achievable potential savings in 2030 are 488 cumulative GWh or 1.4% of the baseline projection. The corresponding maximum achievable potential savings in 2030 are 672 GWh,

[24] The three potential studies were performed for Ameren Missouri, Great Plains Energy and Empire District Electric. The Great Plains Energy potential study was performed by Navigant for each of the individual service territories of Kansas City Power & Light Company's Kansas jurisdiction and Missouri jurisdiction and for the KCP&L Greater Missouri Operations Company.

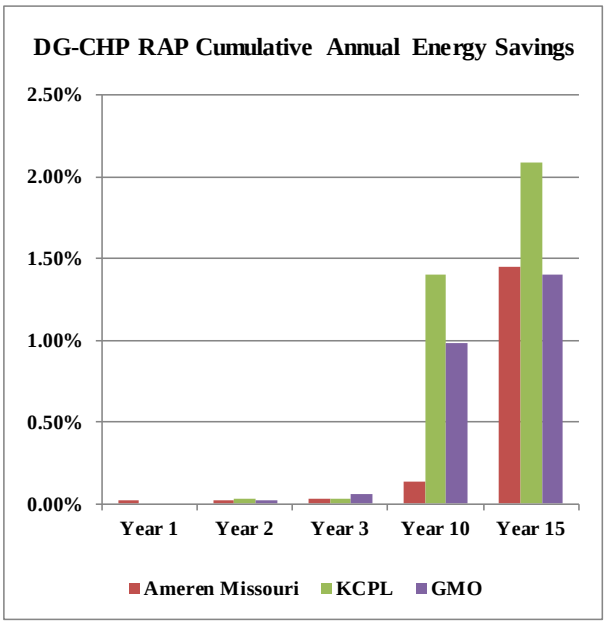
or 2.0% of the baseline projection. The only potential impacts until 2025 come from the segment groups of college, health, and other industrial with the technology groups of boiler with back-pressure steam turbine, CT with heat recovery, and reciprocating engine with heat recovery. Despite heavy subsidies and declining costs, solar PV is not cost-effective from a TRC perspective until 2026 for commercial and industrial sector and 2027 for the residential sector.

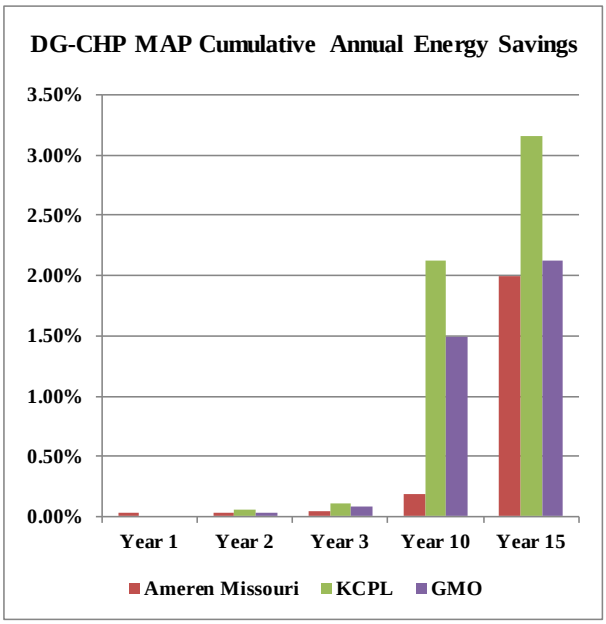
In KCPL's and GMO's potential studies, Navigant conducted an analysis of CHP systems to identify DSM opportunities from this technology. Navigant limited this analysis to large commercial and industrial customers and assumed that CHP systems would be fueled by natural gas.

MW scale steam and gas turbine CHP systems appear to be cost effective in the KCPL and GMO territory, but the number of sites with achievable potential over the 20-year study period is small (approximately 24 per utility). Candidate sites include both traditional CHP adopters (i.e., industrial and medical sites) and less typical CHP adopters that could utilize thermal energy for both heating and cooling (i.e., large offices). The realistic achievable potential savings of the KCPL service territory in 2030 are 218 cumulative GWh and 30 cumulative MW or 2.1% of the baseline energy and 1.3% of system peak demand projection, respectively. The realistic achievable potential savings of the GMO service territory in 2030 are 159 cumulative GWh and 22 cumulative MW or 1.4% of the baseline energy and 0.8% of system peak demand projection, respectively.

Empire did not perform a DG-CHP potential analysis in its potential study.

While there is meaningful energy and demand savings potential from DG-CHP in the 10-year to 15-year timeframe, the following chart illustrates that there is very little energy and demand savings potential from DG-CHP in the near term due to economic and market barriers to adoption.





V. Possible Uses for Missouri's Statewide Demand-Side Market Potential Studies

A. State Energy Plan

Through Executive Order 14-06, Missouri Governor Jay Nixon directed: "The Division of Energy shall lead a statewide initiative to develop a comprehensive State Energy Plan to chart a course toward a sustainable and prosperous energy future that will create jobs and improve Missourians' quality of life. The State Energy Plan shall include analyses and recommendations to guide the State of Missouri and its stakeholders in reliably meeting future energy needs, while fostering energy-related economic development. The State Energy Plan shall include an inventory and assessment of current and future energy supply and demand, examine existing energy policies, and identify emerging challenges and opportunities. … The Plan shall include, but not be limited to, the following energy-related topics: 1) Electric Generation; 2) Fuels and Resource Extraction; 3) Energy Distribution; 4) Energy Usage; 5) Energy Storage; 6) Energy-related Land Use; 7) Energy/Water Nexus; 8) Energy Pricing and Rate-setting Processes; 9) Energy Security and Assurance; and 10) Energy Resources in Emergencies. … The Division of Energy shall deliver a State Energy Plan to the Governor by May 31, 2015."

While the five potential studies discussed in this Report can inform the Division of Energy and stakeholders during their work to develop a comprehensive State Energy Plan, the opportunity for continued timely improvement of Missouri's statewide potential studies – with consideration of the lessons learned in this Report – should be discussed during the initial organization of the stakeholder process and planning for development of the State Energy Plan.

B. Compliance with Federal Environmental Regulations

On June 2, 2014, the U.S. EPA issued draft Section 111(d) regulations for states to meet carbon emission limits. There are four "building blocks" in the Clean Power Plan for states to meet targets, and demand side energy efficiency is one of them. One of the most promising compliance strategies for low-cost pollution abatement is end-use energy efficiency. There are already several sources of guidance published and available to states for this effort, from various sources such as academia, consulting firms, trade groups, etc. The EPA has even developed a tool specifically for estimating emissions displaced by energy efficiency and renewable energy, called AVERT[25]. While this tool was not intended to be used in preparation of a State Implementation Plan ("SIP"), it is a clear endorsement of DSM efforts.

The Missouri Department of Natural Resources will propose a SIP to EPA for review and approval, and then utilities will have to find ways to comply with the targets. For DSM efforts in the SIPs, the EPA will require SIPs to include quantification, monitoring, and verification protocols for renewable energy and energy-efficiency measures. If a state chooses to implement a rate-based approach to compliance, that state's SIP will need to include evaluation, measurement, and verification ("EM&V") of these measures.[26] ACEEE has identified DSM and CHP as valid ways for states to receive credit toward compliance with Section 111(d).[27]

[25] http://epa.gov/avert/
[26] http://www.cadmusgroup.com/articles/key-considerations-using-energy-efficiency-state-compliance-mechanism-epa-111d/
[27] http://www.aceee.org/sites/default/files/publications/researchreports/e1401.pdf

C. Statewide Advisory Collaborative

4 CSR 240-20.094 Demand-Side Programs

> (8) Collaborative Guidelines.
> …
> (B) State-Wide Collaboratives. Electric utilities and their stakeholders shall form a state-wide advisory collaborative to: 1) address the creation of a technical resource manual that includes values for deemed savings, 2) provide the opportunity for the sharing, among utilities and other stakeholders, of lessons learned from demand-side program planning and implementation, and 3) create a forum for discussing statewide policy issues. Collaborative meetings are encouraged to occur at least once each calendar year. Staff shall provide notice of the statewide collaborative meetings and interested persons may attend such meetings.

A current high-quality statewide demand-side market potential study could be an invaluable resource for the state-wide advisory collaborative during its discussions of statewide energy policy issues. Further, a statewide potential study could be used by the individual investor-owned electric utilities to comply with 4 CSR 240-3.164(2)(A): " … The determination of whether to conduct a market potential study for the utility's service territory or for all statewide investor-owned electric utilities shall be at the discretion of the electric utility. If the current market potential study of the electric utility that is filing for approval of demand-side programs or a demand-side program plan is part of a statewide investor-owned electric utilities market potential study, the sampling methodology shall reflect each utility's service territory and shall provide statistically significant results for that utility."

D. Review of Commission Rules

Section 536.175.1. requires that each state agency periodically review all of its rules according to the following review schedule: (1) Rules contained in titles 1 through 6 of the Code of State Regulations shall begin the review process no later than July 1, 2015, and every five years thereafter. The Commission's first review process under Section 536.175.1 must be completed, and a detailed report filed with the Joint Committee on Administrative Rules by June 30, 2016. Review of the Commission's Chapter 22 Rules and MEEIA Rules will be organized and led by the Commission's Tariff, Safety, Economic and Engineering Analysis Department.

VI. Glossary

The following terms are defined on the ACEEE website.[28] These definitions are representative of definitions for these terms found in potential studies generally and in literature concerning potential studies. Many of these terms are defined in the Commission's Chapter 22 Rules and/or MEEIA Rules and in the Missouri electric utilities' potential studies to have different meanings.

> **Achievable Potential** means potential that could be achieved through normal market forces, new state building codes, equipment efficiency, utility energy efficiency programs, and other policies.
>
> **Behavior-based Programs** means energy efficiency programs that utilize an understanding of how individuals interact with energy in order to decrease energy demand.
>
> **Combined Heat and Power or CHP** means a system by which multiple usable energy outputs (both electricity and steam/heat) are derived from a single fuel supply using an integrated system.
>
> **Cumulative Savings** means the sum of the total annual energy savings over a certain time frame. (For example, if we install a measure for each of two years, the cumulative savings would be the sum of the measure installed in the first year, plus the incremental savings from the savings installed in the second year plus the savings in the second year from the measure installed in the first year.)
>
> **Demand Response or DR** means the reduction of customer energy usage at times of peak usage in order to help address system reliability, reflect market conditions and pricing, and support infrastructure optimization or deferral.
>
> **Demand-Side Management or DSM** means the planning, implementation, and monitoring of utility activities designed to encourage consumers to modify patterns of electricity usage, including the timing and level of electricity demand. It refers to only energy and load-shape modifying activities that are undertaken in response to utility-administered programs. It does not refer to energy and load-shaped changes arising from the normal operation of the marketplace or from government-mandated energy efficiency standards. Demand-side management covers the complete range of load-shape objectives, including strategic conservation and load management, as well as strategic load growth.

[28] http://www.aceee.org/glossary/

Distributed Generation or DG means electric power generation located at or near the point of use.

Economic Potential means potential based on both the technical potential and economic considerations (e.g., system cost, avoided cost of energy).

Emerging Technology means a technology or practice that is not yet commercialized but is likely to be commercialized within a period (for example, within five years) or is already commercialized, but currently has a market share of less than about 2%.

Energy Efficiency or EE means a particular good or practice that provides an energy efficiency benefit. Upgraded insulation, energy efficient appliances, and adjusting a boiler's limit control are examples of EE measures.

Incremental Annual Energy Savings means annual energy savings in one year corresponding to the energy efficiency measures implemented in that same year.

Load Shifting means policies and technologies that shift electricity consumption from periods of high demand to periods of low demand. These can include rate structures as well as technologies such as energy storage.

Net-To-Gross ratios are important in determining the actual energy savings attributable to a particular program, as distinct from energy efficiency occurring naturally (in the absence of a program). The net-to-gross ratio equals the net program load impact divided by the gross program load impact. This factor is applied to gross program savings to determine the program's net impact.

Peak Demand means the highest level of electricity demand during the year for a particular service area (e.g., customer, service territory, or state), measured in kilowatts (kW) or megawatts (MW).

Supply-Side refers to new sources of energy (including both renewable sources and fossil fuels). These resources are sometimes contrasted with the "demand-side" resources that utilities can access through energy efficiency programs.

Technical Potential means the potential based on technological limitations only (no economic or other considerations).

Total Annual Savings means energy savings occurring in a single year from the energy efficiency measures implemented in that year and from measures installed in prior years that are continuing to provide benefits.