VOLUME 5:

DEMAND-SIDE RESOURCE ANALYSIS

KCP&L GREATER MISSOURI OPERATIONS COMPANY (GMO)

INTEGRATED RESOURCE PLAN

4 CSR 240-22.050

APRIL, 2015

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VOLUME 5: DEMAND-SIDE RESOURCE ANALYSIS

HIGHLIGHTS

- GMO completed its Demand-Side Management (DSM) Potential Study in August 2013, which included an assessment of:
    - Realistic Achievable Potential (RAP) and Maximum Achievable Potential (MAP) energy efficiency potential for the period of 2014-2033
    - RAP and MAP demand response potential including time-based rates
    - Combined heat and power potential
- GMO adjusted the RAP and MAP scenarios to account for the roll-off of measures at the end of the measures' life, commercial and industrial opt-outs, and aligned the time period to 2016-2034 for the IRP analysis.
- GMO engaged Applied Energy Group (AEG) to design a demand side management (DSM) scenario (Option C) beginning in 2016.
- GMO designed a fourth DSM scenario (Option E) that mirrors Option C for 2016-2018 and then transitions to adjusted RAP level annual impacts.

INTRODUCTION

KCP&L Greater Missouri Operations (GMO) engaged Navigant Consulting, Inc. (Navigant) to conduct a Demand Side Management (DSM) Resource Potential Study (Potential Study) in January 2012. The Potential Study was delivered to GMO in August 2013 and included both a RAP level of DSM and a MAP level of DSM, as defined in the IRP Rules. This Potential Study was used as the basis for the scenarios evaluated in this integrated analysis.

RAP and MAP

Adjustments were needed for the Potential Study RAP and MAP scenarios before they could be used in the 2015 integrated analysis. The Potential Study reported energy and

demand savings that did not account for the roll-off of measures at the end of the measures' life, nor did it account for opt-out of commercial and industrial customers.

At GMO's request, Navigant adjusted the RAP and MAP scenarios to adjust for measure roll-off. GMO then applied an additional adjustment using an estimated 15% opt-out of commercial and industrial customers. This assumption is based upon GMO's actual opt-out rate for the 2014 program year. Additionally, GMO adjusted the Potential study RAP and MAP scenarios to align with the time period needed for the 2015 IRP (2016-2034). The Potential Study analysis was based on a time period of 2014-2033. GMO has an approved portfolio for 2013-2015; therefore the effects of programs that were assumed to be adopted by customers in 2014 and 2015 were removed and savings were extended to 2034.

The impacts of these adjustments are shown in Tables 48-50. The remainder of the tables and charts represent the unadjusted Potential Study results. These adjustments can be found in the GMO workpapers[1].

OPTION C

GMO began its initial planning for its DSM portfolio for the 2016-2018 period concurrent with its planning for its 2015 IRP filing period. In September 2014, GMO engaged with AEG to review its current DSM program offering, which was approximately 18 months into a 36 month approved program cycle. The objectives of the program design included:

(1) design programs that have a TRC cost effectiveness ratio greater than 1.0,

(2) seek programs that have high peak demand impacts in order to reduce supply-side capacity needs,

(3) increase customer satisfaction by delivering DSM programs with a positive customer experience in mind,

[1] GMO IRP Output - Maximum, FINAL - Program Totals IRP HC.xlsx
GMO IRP Output - Realistic, FINAL - Program Totals IRP HC.xlsx

(4) consider additional programs and measures such as whole building approaches, multi-family, and LED street lighting initiatives.

Option C reflects the portfolio design resulting from AEG's analysis.

Option C demonstrates a strong level of energy efficiency commitment and it continues to build upon our experience with and learnings from our existing portfolio; however at a level lower than RAP or MAP identified in the Potential Study. Option C was developed based on our current and previous experience; understanding of customer adoption of energy efficiency within our service territory; and 2013 evaluation, measurement, and verification (EMV) results, while designing an overall portfolio that is cost effective.

Option C represents a more conservative level of achievable DSM levels than RAP or MAP identified in the Potential Study. The RAP and MAP levels developed are from a single Potential Study at a point in time based on assumptions that may or may not be comprehensive to achieve such results as defined in the study. For example,

(1) A NTG ratio of 1.0 was used in the Potential Study for all measures, with the exception of appliance recycling. For appliance recycling a NTG ratio of 0.52 was used as agreed upon with the stakeholders. Thus, the potential estimates for all other measures are "gross" savings.

(2) The Potential Study did not include an allowance for commercial and industrial customer opt-outs. (However, as noted above, GMO did make an adjustment to the RAP and MAP levels used in the integrated analysis by factoring in an estimated 15% opt-out of commercial and industrial customers.)

(3) GMO has also learned that the new baselines that begin in 2020 as a result of the Energy Independence and Security Act of 2007 (EISA) were not reflected in the Potential Study.

(4) The Potential Study also includes gas impacts for certain measures (19 residential measures and 10 C&I measures), which result in both significant

electric and gas savings, such as shell and envelope measures. Technologies that focused primarily on natural gas savings, however, were not included.

(5) The Potential Study conducted by Navigant is at the measure level. As such, the Potential Study did not consider or adjust for the interactive effects between measures when multiple energy efficiency measures are installed at a single location.

(6) GMO has learned that some potential studies estimate and adjust for naturally occurring energy efficiency. Naturally occurring energy efficiency is savings that would occur over and above those that would occur from changes in codes and standards but in the absence of any market intervention. No such adjustment was made in the GMO potential study.

Each of the above input assumptions would result in the potential savings to be overestimated, however, the effects of these assumption have not been quantified individually or in total.

Option C reflects the following assumptions that are not considered in the Potential Study:

(1) Recent program developments, evaluations, and new technology,

(2) An update of the net-to-gross (NTG) ratios for measures (programs) indicated in GMO's 2013 EMV,

(3) Cost effectiveness that does not include the impacts from natural gas savings,

(4) New EISA baselines that are effective in 2020,

(5) Commercial and industrial opt-outs, and

(6) After a review of GMO's existing programs and the Potential Study, as well as interviews with GMO program managers and staff, the programs were modified

to enhance their performance and incorporate the updated measure characteristics.

AEG performed industry standard cost-effectiveness tests in order to gauge the economic merits of the measures, programs and portfolio. The end-use measures most likely to achieve cost-effective savings were then selected and bundled into programs.

OPTION E

GMO developed a fourth DSM scenario (Option E) that includes the same DSM levels as Option C for 2016-2018 and then transitions quickly to the adjusted Potential Study RAP level annual impacts for 2019-2034.

PURPOSE: *This rule specifies the principles by which potential demand-side resource options shall be developed and analyzed for cost effectiveness, with the goal of achieving all cost-effective demand-side savings. It also requires the selection of demand-side candidate resource options that are passed on to integrated resource analysis in 4 CSR 240-22.060 and an assessment of their maximum achievable potentials, technical potentials, and realistic achievable potentials.*

SECTION 1: POTENTIAL DEMAND-SIDE RESOURCES

(1) ***The utility shall identify a set of potential demand-side resources from which demand-side candidate resource options will be identified for the purposes of developing the alternative resource plans required by 4 CSR 240-22.060(3). A potential demand-side resource consists of a demand-side program designed to deliver one (1) or more energy efficiency and energy management measures or a demand-side rate. The utility shall select the set of potential demand-side resources and describe and document its selection —***

1.1 DESCRIBE AND DOCUMENT SELECTIONS

(A) To provide broad coverage of —

1.1.1 MARKET SEGMENTS COVERAGE

1. Appropriate market segments within each major class; —

KCP&L Greater Missouri Operations (GMO) engaged Navigant Consulting, Inc. (Navigant) to conduct a Demand Side Management (DSM) Resource Potential Study in January 2012. Navigant identified GMO's market segments by categorizing historic customer energy usage by SIC code. The market segments included:

- Residential: single family, single family low-income, multi-family, multi-family low-income
- Commercial: grocery, healthcare, lodging, office – large, office – small, restaurants, retail, schools, warehouses, other commercial
- Industrial: chemicals, electronics, food, rubber-plastics, stone-clay-glass, motor freight transportation, other industrial

Table 1: Market Segments (2014), MWh

Segment	GMO
Industrial-Chemicals	161,806
Industrial-Electronics	238,731
Industrial-Food	308,581
Industrial-Motor Freight	80,461
Industrial-Other Industrial	705,581
Industrial-Rubber-Plastics	101,682
Industrial-Stone-Clay-Glass	90,187
Commercial-College	82,229
Commercial-Grocery	186,563
Commercial-Healthcare	284,708
Commercial-Lodging	76,924
Commercial-Office - Large	580,911
Commercial-Office - Small	363,401
Commercial-Other Commercial	366,053
Commercial-Restaurant	209,552
Commercial-Retail	404,073
Commercial-School	388,158
Commercial-Warehouse	159,154
Residential-Single Family	2,438,300
Residential-SF Low Income	1,044,986
Residential-Multi-Family	122,334
Residential-MF Low Income	52,429
Total	**8,446,806**

1.1.2 DECISION-MAKER COVERAGE

2. All significant decision-makers, including at least those who choose building design features and thermal integrity levels, equipment and appliance efficiency levels, and utilization levels of the energy-using capital stock; and —

GMO staff meets regularly with customer groups, architects, engineers, trade representatives, contractors, distributors, public agency staff and others to discuss energy usage issues, review GMO's energy plan, discuss energy efficiency and demand response programs, and elicit feedback and suggestions.

Navigant provided a broad range of stakeholders opportunities to review and comment on the potential study methodologies, survey instruments and findings. The

stakeholders included the Missouri Public Service Commission, Missouri Office of Public Counsel, Missouri Department of Natural Resources, National Resources Defense Council, Empire Electric District, Renew Missouri, and Ameren.

1.1.3 MAJOR END USES COVERAGE

3. All major end uses, including at least the end uses which are to be considered in the utility's load analysis as listed in 4 CSR 240-22.030(4)(A)1.; —

GMO engaged Navigant to conduct a DSM Resource Potential Study. Navigant developed a comprehensive list of conventional and emerging technologies considering all customer sectors and end uses. The major end uses by sector include:

- Residential: lighting, space cooling, space heating, ventilation, water heating, refrigerators, freezers, cooking, clothes washers, clothes dryers, television, personal computers, fans, plug loads, behavioral
- Commercial: heating, space cooling, ventilation, water heating, refrigeration, lighting, office equipment, cooking equipment, combined heat and power (CHP), data centers, behavioral
- Industrial: machine drives, space heating, space cooling, ventilation, lighting, process heating, CHP, compressed air, fans, pumps, refrigeration, transformers

1.2 DESIGNING EFFECTIVE POTENTIAL DEMAND-SIDE PROGRAMS

(B) To fulfill the goal of achieving all cost effective demand-side savings, the utility shall design highly effective potential demand-side programs consistent with subsection (1)(A) that broadly cover the full spectrum of cost-effective end-use measures for all customer market segments; —

GMO engaged Navigant to conduct a DSM Resource Potential Study. Navigant developed a set of DSM programs by grouping market segments and end-use

measures into programs. The table below includes brief descriptions of the programs included in Navigant's *Demand-Side Resource Potential Study Report.*

Table 2: Brief Description of Navigant DSM Programs

Program	High Level Program Description
C&I Custom Rebates	Encourage and assist non-residential customers improve the energy efficiency of existing facilities through a broad range of options that address all major end uses and processes. The program is designed for non-prescriptive retrofit and replacement projects and offers financial incentives, paid on a fixed kWh basis, based on the project's first year energy savings.
C&I Prescriptive Rebates	Encourage and assist non-residential customers improve the energy efficiency of existing facilities through a broad range of options that address all major end uses and processes. The program offers fixed, per-unit rebates to customers and engages equipment suppliers and contractors to promote eligible equipment.
C&I New Construction	Work with design professionals and construction contractors to influence prospective building owners and developers to construct high-performance buildings that provide improved energy efficiency, systems performance, and comfort. Energy saving targets will be accomplished by stimulating incremental efficiency improvements. The program will seek to capture synergistic energy savings by encouraging the design and construction of buildings as integrated systems.
Small Business Direct Install	Encourage and assist small businesses improve the energy efficiency of their facilities through turn-key installation and rapid project completion. The program includes lighting, refrigeration, air-conditioning, water heating and control measures that are typically low-cost with reliable, prescriptive energy savings and costs per unit. The program is designed to assist small business owners overcome barriers to achieving energy efficiency, including time constraints, capital constraints, lack of energy efficiency awareness, and lack of labor resources.
Building Operator Certification (BOC)	Training and certification program for operations and maintenance staff working in commercial, institutional, or industrial buildings. Operators attend training and complete project assignments in their facilities. BOC achieves energy savings by training individuals directly responsible for the maintenance of energy-using building equipment and day-to-day building operations.
Home Performance with ENERGY STAR	Coordinate the development of a statewide network of independent contractors trained and mentored on the delivery of comprehensive energy analysis and measure installations under the Home Performance with ENERGY STAR model. Train contractors to Building Performance Institute standards on building science and offer marketing and incentive packages to accelerate customer awareness and demand. Customers will pay a market-based fee for the analysis and receive partial reimbursement when recommendations are implemented.

Program	High Level Program Description
Low-Income Weatherization	Facilitate the implementation of cost-effective electric saving measures in residential low-income households. In an ongoing effort, KCP&L intends to work with the agencies responsible for implementing the federal LIHEAP program to leverage its funding, thereby increasing the number of homes served. If local weatherization agencies initially lack the resources to handle the additional workload, KCP&L will temporarily contract with private sector firms to address the overload.
Efficient Products	Promote ENERGY STAR® appliances, lighting and home electronics. The program also promotes products that are energy efficient, for which there are not yet ENERGY STAR labels, such as solid state lighting and light emitting diode technologies.
Multifamily Rebate	Offer property owners a comprehensive service for reducing common area energy use and help residents reduce energy use in their living units. Property owners will be given the opportunity to participate in either or both components of the program.
Cool Homes	Influence the installation of high-efficiency heating, cooling and water heating technologies through a combination of market push and pull strategies that stimulate demand, while simultaneously increasing market provider investment in promoting high-efficiency products. The program will stimulate demand by educating customers about the energy and money-saving benefits associated with efficient equipment and providing financial incentives to overcome the first cost barrier. The program will stimulate market provider investment in stocking and promoting efficient products by offering HVAC contractors several services including training, educational materials, cooperative advertising and sales brochures.
Appliance Turn-In	The average household replaces a refrigerator or freezer every ten years. Many of these units replaced are still functioning and often end up as back-up appliances in basements and garages or are sold in a used appliance market. The program will target these “second” refrigerators and freezers, providing the dual benefit of cutting energy consumption and keeping the appliances out of the used market. Units removed will be recycled and disabled through a certified recycling agency.
Home Energy Reports	Provide residential customers with an energy report that provides an analysis of their household energy usage information along with comparison to similar customers or “neighbors.” The intention of the energy report is to provide information that will influence customers’ behavior in such a way that they lower their energy usage.
Energy Education	Provide curriculum, teacher training, and supplies for in-class instruction about how to use energy efficiently at home. The program will target students in 5th through 8th grades, providing education and a “take-home” kit that raises awareness about how individual actions and low-cost measures can provide significant reductions in electricity and water consumption.
ENERGY STAR Homes	Provide education and rebates to inform and encourage architects, builders, and home buyers on the benefits of ENERGY STAR homes as well as requirements for gaining certification.

GMO also engaged Applied Energy Group (AEG) to design an additional DSM portfolio (Option C) for the GMO service territory. AEG took the following steps:

1. **Review Existing GMO DSM Portfolio**. AEG reviewed program descriptions and evaluations as well as program tracking data, including program participation, budgets versus expenditures and program savings. AEG held two collaborative program design workshops with GMO program managers and staff to discuss the program design process and gain insight into the existing DSM programs.

2. **Review DSM Potential Study**. AEG reviewed the *Demand-Side Resource Potential Study Report* and the *Demand-Side Resource Potential Study Report – Demand Response* completed by Navigant in August 2013. AEG compared the existing GMO portfolios with the potential study and best practice programs from industry research, primarily using information from utilities that are similar in size and customer composition as GMO. AEG updated measure inputs and incorporated additional measures on an as-needed basis to reflect more recent program developments, evaluations, and new technology developments (e.g. the dramatic cost and efficacy improvements occurring in the LED lighting market).

3. **Review Stakeholder Input and Regulatory Requirements**. AEG reviewed GMO stakeholder input on the DSM programs provided through written comments and prior collaborative workshops. Similarly, AEG reviewed reporting and filing requirements, as well as the Stipulation and Agreement, which specified items to be considered in the design of future DSM programs. AEG attempted to design the portfolio and programs in such a way to address and satisfy all of these concerns.

4. **Develop DSM Program Plan**. AEG constructed program design for the 20-year period from 2016 through 2034. With the existing GMO DSM programs and the Navigant potential study as a starting point, the programs were modified to enhance their performance and incorporate the updated measure characteristics.

   AEG analyzed cost-effectiveness in order to gauge the economic merits of the measures, programs and portfolio. Cost-effectiveness was measured using four of the industry standard cost-effectiveness tests; total resource cost test, utility cost test, participant cost test, and rate impact measure test. As required in 22.050 (5) (B) the total resource cost test was used as the final determination of cost-effectiveness.

As permitted in 22.050 (5) (D), the cost-effectiveness criterion was relaxed for the income-eligible programs since they are considered to have potential benefits that are not otherwise captured by the cost-effectiveness test.

The AEG additional DSM programs are shown in the tables below.

Table 3: Home Lighting Rebate

Objective	Increase the penetration of efficient lighting in customer homes by incentivizing the purchase of ENERGY STAR® qualified lighting.
Target Market	Residential customers as well as lighting manufacturers and local retailers.
Description	The Home Lighting Rebate Program incentivizes the purchase and installation of efficient lighting utilizing an upstream strategy to provide customers incentives on qualifying CFL and LED light bulbs at participating retailers. Customers receive an instant incentive at the point-of-purchase. The incentives vary depending upon the type of light bulb, manufacturer and the associated retail cost.
Implementation Strategy	GMO will engage a third-party implementation contractor to efficiently obtain the energy savings goals while adhering to the budget. The implementation contractor will: • Establish relationships with lighting manufacturers and retailers throughout GMO's service territory. • Provide in-store promotional materials and retail sales staff training. • Track program performance, including tracking sales data, reviewing sales data for accuracy and payment to retailers. • Periodically report progress towards program goals and opportunities for improvement. GMO will work with the implementation contractor to market the program to customers and educate retailer sales staff. Marketing efforts to increase customer awareness may include, but not be limited to: • Bill inserts • Newspaper advertisements • Internet placement • Point-of-Purchase materials (hang tags, posters)
Risk Management	Upstream programs simplify the participation process for residential customers, eliminating the need to complete and submit a rebate application. However, upstream programs typically have higher free ridership and leakage outside of the service territory. A number of steps will be taken to reduce free ridership and leakage while increasing spillover, including: • GMO will work with the implementation contractor to select retailers located well within GMO's service territory to reduce leakage outside of the service territory. • The Home Lighting Rebate Program will be cross-marketed with GMO's other Residential DSM Programs (e.g. bill inserts will promote multiple programs). • Incentives will be modified as needed to respond to the market price of qualifying light bulbs, with a goal of the incentive being no higher than 50% of the incremental cost. • GMO will work with the implementation contractor and third party evaluator to understand any market transformation elements that arise from this upstream program.

Measures & Incentives	Incentives were set for planning purposes and may be modified to reflect market conditions.

Measure	Unit	Average Incentive per Unit
CFL	per Bulb	$1.35
LED	per Bulb	$5.00

Table 4: Home Appliance Recycling Rebate

Objectives	Promote the removal and retirement of inefficient appliances.
Target Market	All residential customers.
Description	The program incentivizes residential customers to remove inefficient refrigerators and freezers from the electric system and dispose of them in an environmentally safe and responsible manner. The refrigerator/freezer must be in working conditioner, between 10 and 32 cubic feet in size, and a 2002 model or older. The refrigerators and freezers are picked-up at no cost to the customer. Room air conditioners and dehumidifiers may be picked-up free of charge during a scheduled trip for a qualifying refrigerator and/or freezer. Customers are limited to 2 refrigerator and/or freezer rebates and 3 room air conditioners and/or dehumidifiers per household per year.
Implementation Strategy	GMO will select an implementation contractor that demonstrates a record of providing the services offered and responsibly disposing the appliances. It is likely that a single provider will be engaged to perform, or subcontract for, all the services. The implementation contractor will be responsible for: • Scheduling pickups from customer homes, verification of appliance qualification, and appliance removal from customer homes. • Rebate processing. • Program tracking. • Periodically report progress towards program goals and opportunities for improvement. The implementation contractor will work with GMO to develop innovative and creative marketing strategies and materials. Marketing may include, but not be limited to, bill inserts, newspaper/community newsletter advertisements, community events, billboards, radio advertisements and the GMO website. The program will include an educational component that informs customers about the benefits of recycling their inefficient appliances and environmentally responsible disposal of appliances.
Risk Management	Experience at other utilities and discussions with implementation contractors suggest that program cost-effectiveness hinges on volume because unit disposal costs can be reduced by ensuring higher volumes. The implementation contractor will need to use extensive and effective marketing to obtain the volumes. There is a high probability that customers will buy a new appliance to replace the recycled unit. The planning energy and demand savings could be lowered if a customer that recycles a secondary appliance simply buys a new unit and begins utilizing their former primary unit as a secondary unit. The program will attempt to influence consumer behavior by encouraging residential customers to avoid replacing recycled secondary refrigerators or freezers. Appliance recycling programs typically have higher free ridership rates, primarily due to: (1) Customers that were planning to replace their appliance prior to participating in the program. (2) Customers that were not using their appliance prior to participating in the program. In an effort to reduce free ridership, the implementation contractor will emphasize and enforce the requirement that the appliance is plugged in and in operating condition at the time of pick-up. In an effort to increase spillover, the program will be cross-marketed with GMO's other Residential DSM Programs (e.g. bill inserts will promote multiple programs).
Measures & Incentives	Incentives were set for planning purposes and may be modified to reflect market conditions. The program will provide, on average, a $50 incentive for each refrigerator and/or freezer recycled. There will be no incentive for room air conditioners and dehumidifiers recycled. Customers are limited to 2 refrigerator and/or freezer rebates per household per program year and 3 room air conditioners and/or dehumidifiers

	recycled per household per year.

Table 5: Home Energy Report

Objectives	Reduce consumption via socially- and information-driven behavioral change and raise general awareness of energy efficiency and GMO's DSM programs.
Target Market	Residential single family homes.
Description	The Home Energy Report Program provides individualized energy use information to customers while simultaneously offering recommendations on how to save energy and money by making small changes to energy consuming behaviors. Energy reports are sent periodically to customer households to give them self-awareness and a peer comparison of their energy usage. Customers are also provided access to an online tool to track energy consumption and offer tips to reduce usage. Social competitiveness increases behavior to reduce energy consumption.
Implementation Strategy	GMO will select an implementation contractor that specializes in developing and issuing residential energy reports. The implementation contractor will utilize experimental design to select report recipients and a control group, design the reports and develop customized energy reduction tips with input from GMO. The program will cross-promote and market the GMO DSM portfolio.
Risk Management	Potential issues/risks to be aware of: • The program may undergo a meaningful change in customer responsiveness and evaluation paradigms in the coming years. • Research is being conducted on the persistence of savings after the program has ended. The program has been assumed to have a one year measure life and therefore has a relatively high-cost of energy savings on a lifetime or levelized cost basis. The program provides a significant opportunity to promote GMO's residential DSM programs via the customer reports and the online tool, thereby resulting in increased program spillover. However, the spillover impact will need to be carefully determined through an impact evaluation.
Measures & Incentives	Customers receive personalized energy reports, but there is no monetary incentive.

Table 6: Online Home Energy Audit

Objectives	Encourage energy education and conservation, as well as further engagement in the broader portfolio of DSM programs.
Target Market	Residential customers.
Description	The program provides customers access to a free online tool to analyze the energy efficiency of their home, educational materials regarding energy efficiency and conservation, and information on GMO DSM Programs. The program goals include: • Increase awareness of household energy consumption. • Educate residential customers about the benefits of energy efficiency and the opportunities to reduce energy consumption. • Increase awareness of and participation in other GMO DSM programs.
Implementation Strategy	GMO will engage a third-party contractor to develop and maintain the online tool(s).
Risk Management	The Online Home Energy Audit Program is an educational program that informs customers of household energy consumption and methods to reduce energy usage. GMO will need to strategize ways to highlight the audit tool on the GMO website and increase customer engagement.
Measures & Incentives	There are no monetary incentives.

Table 7: Whole House Efficiency

Objectives	Encourage whole-house improvements to existing homes by promoting home energy audits and comprehensive retrofit services.
Target Market	Residential customers that own or rent a residence as well as HVAC contractors for trade ally participation.
Description	The Whole House Efficiency Program consists of 3 Tiers: **Tier 1: Customer Audit**. Customer receives a home energy audit and direct installation of low-cost measures. The audit identifies potential efficiency improvements. The low-cost measures to be installed include: faucet aerator, low-flow showerhead, advanced power strip, water heater tank wrap, hot water pipe insulation and CFL/LEDs. **Tier 2: Infiltration Measures**. Customers that have completed Tier 1 are eligible to receive incentives for the purchase and installation of air sealing, insulation and ENERGY STAR® windows. **Tier 3. HVAC Equipment**. Customers are eligible to receive incentives for qualifying HVAC equipment installed by a participating contractor. Customers are not required to participate in Tier 1 or 2. Qualifying measures include heat pump water heaters, ECM furnace fans, heat pump ductless mini splits, central air conditioners and heat pumps. Early retirement incentives are provided to customers with central air conditioners and/or heat pumps in operable condition and at least 5 years of age. Residential customers that rent a residence must receive the written approval of the homeowner/landlord to participate in the program. The program goals include: • Demonstrate persistent energy savings. • Encourage energy saving behavior and whole house improvements. • Help residential customers reduce their electricity bills. • Educate customers about the benefits of installing high efficiency HVAC equipment. • Develop partnerships with HVAC contractors to bring efficient systems to market.
Implementation Strategy	GMO will engage a third-party implementation contractor to efficiently obtain the savings goals while adhering to the budget. The implementation contractor will: • Hire/sub-contract local staff to perform home audits and direct measure installation. • Engage customers and schedule home audit appointments. • Provide customer service support. • Establish relationships with local HVAC contractors to work with the program installing energy efficient HVAC equipment and infiltration measures. • Process rebate applications, including review and verification of applications and payment of customer rebates. • Track program performance, including customer and HVAC contractor participation as well as quality assurance/quality control (QA/QC). • Periodically report progress towards program goals. GMO will work with the implementation contractor to market the program to residential customers and HVAC contractors utilizing the following approaches: • Direct outreach to customers, including bill inserts, newspaper advertisements, email blasts, direct mail, bill messaging, and community events. • Engage contractors to promote awareness of and use rebates to help sell qualifying equipment.
Risk Management	It is important that the measures are properly installed and customer satisfaction is high. Therefore, it is crucial to engage experienced contractors. To enroll in the program, it is recommended that contractors provide GMO with (1) proof of insurance on an annual basis and (2) at least two customer references. GMO and/or the implementation contractor should

conduct QA/QC of a random group of completed projects by project type and contractor. The QA/QC process should include verification of the equipment installed and customer satisfaction with the contractor and the program.

A number of steps will be taken to reduce free ridership and increase spillover, including:

- Incentives will be modified as needed to respond to the market price of qualifying measures, with a goal of the incentive being no higher than 50% of the incremental cost.
- GMO will work with the implementation contractor to properly set the rebate levels to ensure customers have adequate buy-in to the program.
- Cross-market the program with GMO's other Residential DSM Programs
- Encourage customers to participate in all three tiers.

Measures & Incentives

Incentives were set for planning purposes and may be modified to reflect market conditions. Customers will pay $50 to receive the home energy audit and direct measure installation.

Tier 2 Incentive per Unit

Measure	Unit	Incentive per Unit
Air Sealing	per sq. ft.	$0.08, up to $300
Ceiling Insulation, R-38	per sq. ft.	$0.30, up to $500
Wall Insulation, R-5	per sq. ft.	$0.65, up to $150
ENERGY STAR® Windows	per Window	$75, up to $750

Central air conditioners and heat pumps are assumed to be 3-tons and the heat pump ductless mini split is assumed to be 1.5-tons.

Tier 3 Incentive per Unit

Measure	Unit	Replace/ New	Early Retirement	Replace Electric Resistance Heat
Heat Pump Water Heater	per Unit	$200	n/a	n/a
ECM Furnace Fan	per Unit	$50	n/a	n/a
Heat Pump Ductless Mini-Split	per Unit	$300	n/a	n/a
SEER 15 Central Air Conditioner	per Unit	$125	$250	n/a
SEER 16 Central Air Conditioner	per Unit	$200	$400	n/a
SEER 15, HSPF 8.5 Heat Pump	per Unit	$150	$300	$800
SEER 16, HSPF 8.5 Heat Pump	per Unit	$300	$600	$1,000
SEER 17, HSPF 8.6 Heat Pump	per Unit	$500	n/a	n/a

Table 8: Income-Eligible Multi-Family

Objective	Deliver long-term energy savings and bill reductions to low-income customers in multi-family housing and multi-family common area energy savings.
Target Market	Low-income residential homeowners and renters that meet the Federal guidelines for Weatherization Assistance and reside in multi-family housing as well as multi-family buildings with low-income residents.
Description	The program includes 2 tiers: **Tier 1. Multi-Family Kits.** Direct installation of low-cost measures for low-income homeowners and renters in multi-family housing, at no cost to the participant. The measures installed include: faucet aerator, low-flow showerhead, advanced power strip, hot water pipe insulation and CFL/LEDs. **Tier 2. Multi-Family Common Areas.** Installation of lighting measures in multi-family common areas, at no cost to the participant.
Implementation Strategy	GMO will engage a third-party implementation contractor to: • Identify and establish relationships with multi-family building owners that have a number of low-income residents. • Engage customers and schedule appointments. • Install measures and determine the insulation needed. • Track program performance. • Periodically report progress towards program goals. GMO will work with the implementation contractor to market the program to low-income customers and multi-family building owners utilizing the following approaches: • Direct outreach to customers, including bill inserts, direct mail, bill messaging, community events and community organizations. • Engage building owners to promote awareness of and use of the program.
Risk Management	The program focuses on providing energy efficiency services to low-income residents to ensure reduced consumption. There is little risk associated with this product.
Measures & Incentives	All measures are installed free of charge. There are no monetary incentives.

Table 9: Income-Eligible Weatherization

Objective	Deliver long-term energy savings and bill reductions to low-income customers.
Target Market	Low-income residential homeowners and renters that meet the Federal guidelines for Weatherization Assistance.
Description	The program includes 2 tiers: **Tier 1. Kits.** Direct installation of low-cost measures for low-income homeowners and renters, at no cost to the participant. The measures installed include: faucet aerator, low-flow showerhead, advanced power strip, hot water pipe insulation, hot water heater tank wrap and CFL/LEDs. **Tier 2. Weatherization.** Installation of ceiling, duct and/or wall insulation, at no cost to the participant. Customers work with local community action agency to participate.
Implementation Strategy	GMO will engage a third-party implementation contractor to: • Engage customers and schedule appointments. • Install measures and determine the insulation needed. • Track program performance. • Periodically report progress towards program goals. GMO will work with the implementation contractor to market the program to low-income customers utilizing bill inserts, direct mail, bill messaging, community events and community organizations.
Risk Management	The program focuses on providing energy efficiency services to low-income residents to ensure reduced consumption. There is little risk associated with this product.
Measures & Incentives	All measures are installed free of charge. There are no monetary incentives.

Table 10: Residential Programmable Thermostat

Objective	Decrease peak demand usage to provide system and grid relief during particularly high-load, high-congestion peak hours.
Target Market	Individually metered residential customers. Target primarily single family homeowners, expanding into multi-family as the single family market opportunities begin to saturate.
Description	The Residential Programmable Thermostat Program reduces peak demand by controlling participant cooling equipment during periods of system peak demand and when there may be delivery constraints within certain load zones. This is done by way of a remotely communicating, programmable thermostat. During a program event, the program operations center sends a radio frequency signal to the thermostat to adjust its set-point by 2 to 4 degrees F such that the system will consume less energy and run less frequently throughout the 3 to 6 hour event duration. One method of participation will be for customers to receive the thermostat and professional installation (a $150 value) for free upon qualification and enrollment in the program.
Implementation Strategy	GMO will engage a third-party implementation contractor to: • Hire/sub-contract local staff to install the programmable thermostats. • Engage customers, schedule installation appointments and process customer incentives. • Provide customer service support. • Track program performance and event data. • Periodically report progress towards program goals and opportunities for improvement. Events will typically occur between June 1 and September 30, Monday to Friday. Event duration is typically 3 to 6 hours per day. Customers may opt-out twice a year by calling GMO a day in advance. The program will be marketed through direct contact with consumers using bill inserts, newsletters, website, broadcast and print media, and direct mail.
Risk Management	The primary benefit of demand response programs is to mitigate the risks and costs associated with system peak loads. From a planning perspective, using demand response resources in the most valuable way would imply that system planners would include the peak impacts in the load forecast nominated to the RTO (regional transmission organization), thereby reducing the utility system peak, required capacity, and also the reserve requirements. This also implies that events would primarily be called when the day-ahead forecast projects a load in excess of that nominated peak, rather than using another event trigger mechanism, such as energy market prices above a certain threshold or weather above a certain temperature. Having the thermostats available as a resource year-round is potentially of value to system operations in the event of plant maintenance or other grid events. Curtailment in participating homes with electric heat could provide additional risk management capabilities in the future. Providing the opportunity for customers to opt-out or override a limited number of events provides choice and control to the customer, minimizing the risk of attrition and lost participants.
Measures & Incentives	Customers receive a free communicating, programmable thermostat with installation ($150 value) for joining the program. After this, no cash payment is required for continued participation, making this a very cost effective capacity resource. Incentives were set for planning purposes and may be modified to reflect market conditions.

Table 11: Business Energy Efficiency Rebate - Standard

Objective	Encourage purchase and installation of energy efficient equipment by providing incentives to lower the cost of purchasing efficient equipment for commercial and industrial facilities.
Target Market	All commercial and industrial customers.
Description	The Business Energy Efficiency Rebate – Standard is designed to help commercial and industrial customers save energy through a broad range of energy efficiency options that address all major end uses and processes. Pre-qualified rebates are available for measures, including lighting, HVAC equipment and motors. The measures are proven technologies that are readily available with known performance characteristics.
Implementation Strategy	GMO will engage a third-party implementation contractor to: • Process customer applications, verify eligibility and process customer rebates. • Conduct QA/QC to verify equipment installation. • Provide customer service support. • Track program performance. • Periodically report progress towards program goals and opportunities for improvement. Key pillars of the marketing strategy will include Trade Allies and direct customer marketing, including direct mail, newspaper advertisements, email blasts, bill inserts and HVAC trade publications. Additional marketing tactics will include: • Education. Train and educate Trade Allies on the programs and how to effectively sell the program to customers. • Trade Associations. Businesses rely on trade associations to represent industry's best interests in lobbying, growth, and identification of business opportunities. GMO will coordinate with specific associations to highlight suitable program offerings. • Highlight successfully completed projects. GMO will select projects to display the process and benefits of the program. This type of marketing will spur the customer's competitors to improve building performance and increase business process efficiency.
Risk Management	The key barriers are return on investment, decision timing and customer internal funding and approval processes. Many customers have internal return on investment hurdles that are quite aggressive, sometimes as short as a one year payback. Another barrier is ensuring that enough vendors are properly educated to allow them to actively engage customers by explaining the myriad benefits of efficiency improvements. Measure savings are expected to be updated annually. Potential changes to measure savings, costs, and other key assumptions could affect the measure's ability to pass cost-effectiveness tests. Therefore, the mix of measures that can be offered could change from year to year to reflect changes made to the original measure attributes. Incentives will be modified as needed to respond to market prices, with a goal of the incentive being no higher than 50% of the incremental cost. Proper incentives can reduce free ridership while still encouraging customers to participate in the program.

Measures & Incentives

Incentives were set for planning purposes and may be modified to reflect market conditions.

Measure	Unit	Incentive per Unit
Air Sourced A/C, <65 kBtuh	per ton	$50
Air Sourced A/C, ≥65 kBtuh	per ton	$40
Air Sourced HP, 65 < 135 kBtuh	per ton	$45
Ceramic Metal Halide	per fixture	$40
ENERGY STAR® Beverage Machines	per unit	$65
Heat Pump Water Heater	per unit	$200
High Bay T5	per fixture	$50
High Bay T8	per fixture	$40
LED Display Lighting	per door	$75
LED Exit Sign	per fixture	$6
Lo Flow Faucet Aerators	per unit	$5
Occupancy Sensors	per Watt	$0.80
Packaged Terminal AC/HP	per kBtuh	$150
Pipe Wrap/Insulation	per unit	$15
Pool Pump, High Efficiency	per unit	$100
Pool Pump, VSD	per unit	$200
Premium T8 Linear Fluorescent	per fixture	$5
Pre-Rinse Spray Valves	per unit	$50
Programmable Thermostat	per ton	$3
Pumps/Fans, VSD (HVAC only)	per HP	$130
Reach In Refrigerator/Freezer	per unit	$100
Reduced Lighting Power Density	per sq. ft.	$0.08, up to $750
Screw-In CFLs	per fixture	$1.00
Screw-In LEDs	per fixture	$8
Strip Curtains	per sq. ft.	$5
T8 Linear Fluorescent with Reflector/Delamping	per fixture	$5

Table 12: Business Energy Efficiency Rebate - Custom

Objective	Encourage purchase and installation of energy efficient equipment by providing incentives to lower the cost of purchasing efficient equipment for commercial and industrial facilities.
Target Market	All commercial and industrial customers.
Description	The Business Energy Efficiency Rebate – Custom Program is designed to help commercial and industrial customers save energy through a broad range of energy efficiency options that address all major end uses and processes. Equipment that does not qualify for a prescriptive rebate will be eligible for a custom rebate. Applications must be pre-approved by GMO before equipment is purchased and installed and must have a Total Resource Cost Test benefit-cost ratio of at least 1.0. Incentives, up to 50% of the project cost, were included as: • $0.07 per first-year-kWh saved for lighting incentives • $0.10 per first-year-kWh saved for non-lighting incentives A $500,000 incentive cap is imposed per facility per program year. Multiple rebate applications for different measures may be submitted. As a new addition for the 2016-2018 implementation cycle, combined heat and power (CHP) projects will be considered in the Business Energy Efficiency Rebate – Custom Program. GMO and the implementation contractor will work with customers interested in CHP to determine project costs, cost-effectiveness, tax credits, and financing options. For the purposes of the analysis, the incentive payment for CHP projects is determined to be $300 per kW of installed electric generation capacity and the $500,000 cap criteria will be reviewed and determined on a case-by-case basis and based upon available program funding.
Implementation Strategy	GMO will engage a third-party implementation contractor to: • Process customer applications, verify eligibility, review pre-approval applications, and process customer rebates. • Conduct QA/QC to verify equipment installation. Randomly inspect 10% of projects and all projects over a threshold determined by GMO (e.g. $10,000). • Provide customer service support. • Track program performance. • Periodically report progress towards program goals and opportunities for improvement. Key pillars of the marketing strategy will include Trade Allies and direct customer marketing, including direct mail, newspaper advertisements, email blasts, bill inserts and HVAC trade publications. Additional marketing tactics will include: • Education. Educate Trade Allies on how to effectively sell the program to customers. • Trade Associations. Businesses rely on trade associations to represent industry's best interests in lobbying, growth, and identification of business opportunities. GMO will coordinate with specific associations to highlight suitable program offerings. • Highlight successfully completed projects. GMO will select projects to display the process and benefits of the program. This type of marketing will spur the customer's competitors to improve building performance and increase business process efficiency.
Risk Management	The key barriers are return on investment, decision timing and customer internal funding and approval processes. Many customers have internal return on investment hurdles that are quite aggressive, sometimes as short as a one year payback. Another barrier is ensuring that enough vendors are properly educated to allow them to actively engage customers by explaining the myriad benefits of efficiency improvements.
Measures & Incentives	Incentives were set for planning purposes and may be modified to reflect market conditions. Incentives, up to 50% of the project cost and up to a maximum cap of $500,000, are:

	• $0.07 per kWh saved for lighting incentives • $0.10 per kWh saved for non-lighting incentives

Table 13: Strategic Energy Management

Objective	Provide energy education, technical assistance, and company-wide coaching to large commercial and industrial customers to drive behavioral change and transformation of company culture with respect to energy use and management.
Target Market	Customers with high energy use and operational sophistication. The best candidates are likely to have the following attributes: • Large manufacturing companies or commercial facilities with >300 kW peak demand. • Companies and institutional customers with multiple sites (i.e. operations/offices in another state or country). • Customers with commitment to sustainability and environmental stewardship. • Customers in regulated industries. • Companies that have well established management systems like quality/safety or those using continuous improvement practices. • Companies in a stable or rapid growth mode.
Description	The Strategic Energy Management (SEM) Program is a systematic approach to delivering persistent energy savings to organizations by integrating energy management into regular business practices. The program involves appointment of an energy liaison(s) and a team within participating organizations who regularly correspond with program representatives. The program includes two program tracks that use different delivery mechanisms: • One-on-One Consultative SEM provides the customer with access to an energy expert who works intensively with the customer to integrate energy management into the organization's business practices by helping the customer set up an energy management process and implement improvements. The participant receives frequent and personalized attention throughout the implementation period. Touch points and milestones are agreed upon between the two parties. • SEM Cohort places companies into groups that work alongside each other for one year or longer, coming together in periodic workshops, approximately quarterly, and working on their own between the sessions. The group setting enhances participant action as they strive to perform in front of their peers. Structured groups are composed of 5 to 12 participants that are often located in the same geographical area, sharing best practices and learning together. The group is typically filled with participants from non-competing industries; however, if mutual agreement is established, competitors may participate in the same group. A methodology is developed early in the engagement to forecast each participant's baseline energy consumption, from which savings goals are created and measured. To isolate energy savings attributable to SEM efforts, any savings from equipment measures installed under other programs in the portfolio can be netted out of these savings. SEM has been shown to produce larger and longer lasting energy savings when compared to other energy management offerings. Few customers, however, have the internal resources to pursue and sustain these initiatives on their own, without the support of a utility program.
Implementation Strategy	The design relies on a Program Administrator and Energy Management Providers. *Program Administrator:* GMO staff and a third-party implementation contractor to deliver the program and manage administrative functions, such as marketing, customer recruitment, and results tracking. *Energy Management Providers:* firms and personnel with specific knowledge and

expertise who work with customers to achieve savings. The Energy Management Provider must have a combination of the following:

- Experience in customer consulting and change management.
- Experience with continuous improvement methodologies.
- Experience engaging customer personnel at all levels, particularly executives.
- Experience using and deploying management systems such as quality, environmental impact, and safety.
- Technical expertise for understanding production process and operations to identify energy savings opportunities.
- Established track record deploying utility-based SEM programs, driving energy savings along with customer change and customer satisfaction.

Program delivery will be integrated with other programs. Customers that have already completed or are currently participating in the Business Energy Efficiency Rebate Programs can achieve additional efficiency gains. If capital measures are identified during the course of participation in SEM, they can be submitted for incentives under the appropriate Business Energy Efficiency Rebate Program.

The Program Administrator recruits customers through one-on-one contacts. To achieve goals, the program will likely need to target two- to three-times the participation goal. The recruitment process will build an SEM pipeline, wherein potential participants can be monitored as their priorities and business situations change over time. One-on-one recruiting builds familiarity and trust, providing the basis for successful engagements.

- *Recruit Customers*. Recruiting requires a two-prong approach at both the facility management level and executive level. GMO should leverage relationships with large customers and peer relationships that GMO executives have with customer executives.
- *Screen Customers*. Potential participants will be screened on the size of their connected load and on factors including history of implementing energy efficiency projects, experience with other continuous improvement programs, general responsiveness of plant personnel, etc. Screening will take place through discussions with account managers and preliminary conversations with prospective participants.
- *Gain Customer Commitment*. As part of the screening process, participating customers will commit to an on-site executive-level sponsor, dedicated program budget, access to key human resources, inclusion of an energy continuous improvement statement within existing corporate goals, and a training program for new and existing personnel.

An Energy Management Provider will be assigned to each participant and have primary responsibility for implementing the program and working with participant. The provider will have three roles:

- *Project Manager*. Coordinate customer communication and meetings, develop reports.
- *Organizational Facilitator(s)*. Conduct initial Energy Management Assessment, provide ongoing customer coaching, maintain customer satisfaction, and provide input to energy maps and savings models. Identify and cultivate an energy champion or team leader.
- *Savings Modeler*. Develop energy maps and savings models. Provide technical assistance to participating customers to understand current energy use, identify opportunities to reduce energy use, and to set energy-use reduction goals.

The key marketing message should be that GMO is supporting customers to more strategically manage energy and to invest in their future by building an organizational foundation for energy management, providing consultative resources and incentives. Marketing will rely heavily upon presentations and letters, supported by brochures, case studies and success stories. It is important for the marketing materials to:

- Provide a basic understanding of the concept of SEM and the program.
- Outline the compelling business case (benefits and costs) of participation.

	• Connect the SEM offering to the existing DSM portfolio.
Risk Management	The most challenging aspect of a SEM Program is maintaining long-term customer commitment because it directly affects savings persistence. To ensure commitment, the customer must clearly understand the following: • The level of staff time, management review, and other resources they are committing. • The services, such as consulting and training, they will receive. • The benefits, such as a more systematic and proactive approach to managing energy. Successful efforts involve setting rigorous expectations through ongoing meetings with the participant, Energy Management Providers, Program Administrator and GMO staff. • *Participating Customer and Program Administrator*. To ensure the customer maintains momentum and arrives at an agreed upon success point, a Stage-gate approach is recommended. This includes clearly defined stages based on progress indicators, such as the existence of an energy goal, consistent meetings of an energy team, and the engagement of employees in energy awareness. • *Program Administrator, Energy Management Provider(s) and GMO*. A periodic review meeting on a quarterly basis brings together GMO staff, the Program Administrator, and the Energy Management Provider(s) to discuss each participant with respect to successes, challenges, and overall progress. If it is determined that a customer's progress is lagging, they will agree to next steps, including increased engagement scope and discussions with the customer to ensure that they understand program support may be withdrawn if they do not improve performance. Working with customers' energy and production data is vital to the tracking of progress in this program. The data are frequently proprietary and competition-sensitive, so steps must be taken to establish a secure mechanism and procedure for sharing and storage of data.
Measures & Incentives	Behavioral and operational energy savings, as measured relative to the participant's personal baseline consumption, are paid incentives of $0.02 per first-year-kWh saved. These levels were set for planning purposes and may be modified to reflect market conditions. Separately, capital measures that are adopted due to participation in the SEM Program, and which are eligible for incentives under other programs such as the Business Standard and Custom initiatives, are routed through them and receive the applicable incentives as if they were regular projects. These savings are netted out of the SEM savings and recorded under the Standard or Custom programs. In this way, SEM also becomes a lead generator for other programs and further drives portfolio success.

Table 14: Block Bidding

Objective	Encourage high-volume energy savings projects from customers and third-party suppliers working on behalf of customers at lower cost than traditional programs. This program provides an opportunity to organize and procure non-conventional projects that may not be eligible or appropriately incentivized to participate in other programs.
Target Market	Any commercial, industrial or municipal customer as well as third-party suppliers, such as energy service companies, trade allies and performance contractors.
Description	The Block Bidding Program seeks to purchase blocks of electric savings by issuing a Request For Proposal (RFP) to eligible customers and third-party suppliers. The RFP details the proposal requirements as well as the electric savings that must be achieved. Customers and/or third parties submit proposals to deliver the requested block of cost-effective electric savings. The electric savings may be achieved in a variety of ways; for example, one customer facility installing energy efficiency equipment or a bundle of projects across multiple sites and/or customers. Bidder proposals are reviewed to: • Verify customer eligibility.

	• Ensure completeness and accuracy of proposed energy savings. • Screen the proposed measures for cost-effectiveness. All projects must have a Total Resource Cost Test benefit-cost ratio of greater than 1.0. Qualifying and cost-effective bidder proposals are ranked based upon the proposed cost per kWh saved ($/kWh). Program funds are awarded to bidders starting with the lowest $/kWh saved until the funding is depleted. GMO enters into contracts with the bidders that receive program funding. All projects must receive pre- and post-implementation inspections to verify the existing and upgraded equipment. The acquired savings may differ from the expected savings stated in the contract based upon actual performance and the post-implementation inspection.
Implementation Strategy	GMO staff will administer the Block Bidding Program with assistance from a third-party implementation contractor. Implementation contractor activities include: • Assist with outreach and education to potential bidders. • Review bidder proposals and recommend the bids to be funded. • Perform pre- and post-implementation inspections. • Provide customer service support. • Track program performance. • Periodically report progress towards program goals and opportunities for improvement. Marketing will be targeted to third-party suppliers and customers. Tactics will include: • Training sessions to educate third-party suppliers and customers on the program, proposal requirements and any associated paperwork requirements. • Direct outreach via GMO key account representatives, news releases, announcements, telephone calls and email. • Highlight successfully completed projects to display the benefits of the program. • Third-party suppliers will promote the program directly to eligible customers.
Risk Management	The most challenging aspect is engaging customers and the ability of customers to achieve the required blocks of electric savings. The implementation contractor and GMO staff must work closely to ensure that potential bidders understand the program requirements and work to correct any issues or concerns that arise in bidder proposals. Customers must be made aware of the ability to bundle projects and/or work with a third-party supplier to achieve the required blocks of electric savings. The implementation contractor and GMO staff must work closely with the contracted bidders to ensure projects are being completed in a timely fashion and issues are addressed in a timely fashion.
Measures & Incentives	Incentives of $0.06 per first-year-kWh saved were assumed for planning purposes, but the actual incentive payments will be a result of the individual project bids received during the RFP process. Program management can choose the threshold cost below which they are willing to pay based on the condition of budgets and energy and peak demand savings goals at the time the bids are received.

Table 15: Online Building Energy Audit

Objectives	Encourage energy education and conservation, as well as further engagement in the broader portfolio of DSM programs.
Target Market	Non-residential customers.
Description	The program provides customers access to a free online tool to analyze the energy efficiency of their businesses, educational materials regarding energy efficiency and conservation, and information on GMO DSM Programs. The program goals include: • Increase awareness of business and building energy consumption. • Educate commercial customers about the benefits of energy efficiency and the opportunities to reduce energy consumption. • Increase awareness of and participation in other GMO DSM programs.
Implementation Strategy	GMO will engage a third-party contractor to develop and maintain the online tool(s).
Risk Management	The Online Building Energy Audit Program is an educational program that informs customers of business energy consumption and methods to reduce energy usage. GMO will need to strategize ways to highlight the audit tool on the GMO website and increase customer engagement.
Measures & Incentives	There are no monetary incentives.

Table 16: Small Business Direct Install

Objective	Provide targeted, highly cost-effective measures to small business customers in a quickly deployable program delivery mechanism.
Target Market	Small business customers with an average electric demand of less than 30 kW per year.
Description	The Small Business Direct Install Program offers customers an energy assessment that includes information on potential energy savings and anticipated payback as well as incentives that cover up to 70% percent of the equipment and installation costs. Eligible measures include, but are not limited to, occupancy sensors, LED exit signs, and T5 lamps. The program works best if the assessment and applicable equipment/measure installations can be completed on the same day. GMO will select an implementation contractor that will provide the lighting audit and information on lighting incentives. Incentives will be assigned directly to the contractor, so that the value of utility incentives is reduced directly from the project cost. The program is part of a long-term strategy to raise awareness of energy savings opportunities among business customers and to help them take action using incentives offered by GMO.
Implementation Strategy	The implementation strategy will incorporate the following components: • *Walk-Through Audits.* Trained auditors complete a walk-through examination of the business using standard audit software, identifying specific energy saving opportunities. The auditor will review the anticipated costs and savings of the measures, along with information on financial resources available to help defray costs. Customers will be provided with a report and check list of recommendations from the audit. • *Direct Installation of Measures.* Upon customer approval of a job scope, the implementation contractor will install pertinent lighting measures identified during the audit on the same day as the audit, if possible. • *Customer Education.* Customers will be educated on energy efficient equipment and GMO's full suite of DSM programs. Particular attention will be paid to areas identified in the audit. GMO will hire an implementation contractor to: • Hire qualified, local individuals to conduct energy audits and install efficient lighting equipment. Provide training, ongoing as needed, to auditors. • Ensure that auditors are familiar with all GMO DSM programs available to customers. • Assist with program marketing and outreach. • Provide customer service support. • Track program performance, including audit requests, audit activities and customer actions. • Periodically report progress towards program goals and opportunities for improvement. The marketing and outreach strategies will include direct customer marketing such as bill inserts, newsletters, email, and on-bill messaging. The auditors will market the program directly to customers. GMO will highlight successfully completed projects to display the benefits of the program.
Risk Management	Small business customers are typically a hard-to-reach market without the time available to become educated on energy efficient equipment and the money available to upgrade to efficient equipment. One potential risk is a limited supply of qualified individuals with the skills to conduct audits and market energy efficiency improvements. A solution is the development of a local network of qualified professionals to provide audit and installation services and to promote the program to customers. The implementation contractor will: • Offer technical training to auditors, including classroom and field sessions. • Offer sales and business process training to help contractors succeed in selling and delivering energy efficiency services.
Measures &	Incentives were set for planning purposes and may be modified to reflect market

Incentives	conditions. Incentives cover up to 70% percent of the equipment and installation costs.

Table 17: Commercial Programmable Thermostat

Objective	Decrease peak demand usage to provide system and grid relief during particularly high-load, high-congestion peak hours.
Target Market	Small business customers with qualifying, applicable equipment. The type of customer that has HVAC units that are controlled by a single thermostat. It would not be possible for the Commercial Programmable Thermostat program, for example, to meaningfully control the HVAC system in a large hospital with a building energy management system and multiple control points.
Description	The Residential Programmable Thermostat Program reduces peak demand by controlling participant cooling equipment during periods of system peak demand and when there may be delivery constraints within certain load zones. This is done by way of a remotely communicating, programmable thermostat. During a program event, the program operations center sends a radio frequency signal to the thermostat to adjust its set-point by 2 to 4 degrees F such that the system will consume less energy and run less frequently throughout the 3 to 6 hour event duration. One method of participation will be for customers to receive the thermostat and professional installation (a $150 value) for free upon qualification and enrollment in the program.
Implementation Strategy	GMO will engage a third-party implementation contractor to: • Hire/sub-contract local staff to install the programmable thermostats. • Engage customers, schedule installation appointments and process incentives. • Provide customer service support. • Track program performance and event data. • Periodically report progress towards program goals and opportunities for improvement. Events will typically occur between June 1 and September 30, Monday to Friday. Event duration is typically 3 to 6 hours per day. Customers may opt-out twice a year by calling GMO a day in advance. The program will be marketed through direct contact with consumers using bill inserts, newsletters, website, broadcast and print media, and direct mail.
Risk Management	The primary benefit of demand response programs is to mitigate the risks and costs associated with system peak loads. From a planning perspective, using demand response resources in the most valuable way would imply that system planners would include the peak impacts in the load forecast nominated to the RTO, thereby reducing the utility system peak, required capacity, and also the reserve requirements. This also implies that events would primarily be called when the day-ahead forecast projects a load in excess of that nominated peak, rather than using another event trigger mechanism, such as energy market prices above a certain threshold or weather above a certain temperature. Having the thermostats available as a resource year-round is potentially of value to system operations in the event of plant maintenance or other grid events. Curtailment in participating homes with electric heat could provide additional risk management capabilities in the future. Providing the opportunity for customers to opt-out or override a limited number of events provides choice and control to the customer, minimizing the risk of attrition and lost participants.
Measures & Incentives	Customers receive a free communicating, programmable thermostat with installation ($150 value) for joining the program. After this, no cash payment is required for continued participation, making this a very cost effective capacity resource. Incentives were set for planning purposes and may be modified to reflect market conditions.

Table 18: Demand Response Incentive

Objective	Decrease peak demand usage to provide system and grid relief during particularly high-load, high-congestion peak hours.
Target Market	Large commercial and industrial customers with load curtailment capability of at least 25 kW.
Description	The Demand Response Incentive Program provides firm contractual arrangements with customers for periodic curtailments at times of system peak demand. Customers enter into a contract for a one-, three- or five-year term and receive a payment/bill credit based upon the curtailable load, the contract term and number of consecutive years under contract. Participants receive notification of an event at least 4 hours prior to the start time.
Implementation Strategy	Curtailment events may occur between June 1 through September 30, Monday through Friday between the hours of 12 pm and 10 pm (holidays are excluded). Event duration is typically 3 to 6 hours per day for a maximum of 15 events per year. GMO key account executives will be vital to coordinating with the largest customers and gaining their participation and collaboration. The program will also be marketed through direct contact with customers using bill inserts, newsletters, website, broadcast and print media, and direct mail.
Risk Management	The primary benefit of demand response programs is to mitigate the risks and costs associated with system peak loads. From a planning perspective, using demand response resources in the most valuable way would imply that system planners would include the peak impacts in the load forecast nominated to the RTO, thereby reducing the utility system peak, required capacity, and also the reserve requirements. This also implies that events would primarily be called when the day-ahead forecast projects a load in excess of that nominated peak, rather than using another event trigger mechanism, such as energy market prices above a certain threshold or weather above a certain temperature. Providing the opportunity for customers to opt-out or override a limited number of events provides choice and control to the customer, minimizing the risk of attrition and lost participants.
Measures & Incentives	Customers receive a fixed, capacity-reserve payment in terms of $/kW, based on the number of curtailable kW, the contract term, and number of consecutive years under contract. The fixed payment is supplemented by a performance payment on a $/kWh basis, calculated from the customer's actual load curtailment relative to their baseline load, as calculated by program management.

1.3 DEMAND-SIDE RATES

(C) To include demand-side rates for all customer market segments; —

GMO engaged Navigant to conduct a DSM Resource Potential Study. The study identified four major demand-side rate and demand response programs:

- *Pricing without Enabling Technology.* Customers manually curtail load in response to the pricing signals, communicated to via delivery mechanisms such as text message or email.
- *Pricing with Enabling Technology.* Customers have enabling technology for automatic load curtailment. These technologies include, but are not limited to, programmable thermostats, load switches, and automated demand response.
- *Interruptible Tariff* is a rate structure where customers agree to reduce demand to a pre-specified level/amount in exchange for an incentive payment. The tariff is limited to medium and large C&I customers and doesn't require advanced metering infrastructure (AMI) meters or equivalent equipment.
- *Direct Load Control.* Residential and small commercial customers allow specific equipment (e.g. central air conditioner) to be cycled to reduce system load. The program doesn't require AMI meters but does require equipment to remotely signal equipment (e.g. programmable thermostat).

1.4 MULTIPLE DESIGNS

(D) To consider and assess multiple designs for demand-side programs and demand-side rates, selecting the optimal designs for implementation, and modifying them as necessary to enhance their performance; and —

GMO engaged Navigant to conduct a DSM Resource Potential Study. Navigant considered multiple design scenarios including the realistic achievable potential (RAP) and maximum achievable potential (MAP) as well as three additional scenarios roughly equally spaced between the RAP and MAP scenarios.

Additionally, GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG updated measure inputs and incorporated additional measures on an as-needed basis to reflect more recent program developments, evaluations, and new technology developments. After a review of GMO's existing programs and the Navigant potential study as well as workshops with GMO program managers and staff, the programs were modified to enhance their performance and incorporate the updated measure characteristics. AEG performed industry standard cost-effectiveness tests in order to gauge the economic merits of the measures, programs and portfolio. The end-use measures most likely to achieve cost-effective savings were then selected and bundled into programs.

GMO also developed a fourth DSM scenario (Option E) that includes the same DSM levels as Option C for 2016-2018 and then transitions quickly to the adjusted Potential Study RAP level annual impacts for 2019-2034.

1.5 EFFECTS OF IMPROVED TECHNOLOGIES

(E) To include the effects of improved technologies expected over the planning horizon to —

1.5.1 REDUCE OR MANAGE ENERGY USE

***1. Reduce or manage energy use;* or —**

GMO engaged Navigant to conduct a DSM Resource Potential Study for the GMO service territory, which included the effects of improved technologies expected over the 20-year planning horizon. As a part of the scope of work, Navigant selected potential demand-side resources to fulfill the goal of achieving all cost-effective demand-side savings by designing highly effective potential demand-side programs. Navigant included the effects of improved technologies expected over the planning horizon to reduce or manage energy use and incorporate on-site CHP as a resource.

1.5.2 IMPROVE THE DELIVERY OF PROGRAMS

2. Improve the delivery of demand-side programs or demand-side rates. —

GMO engaged Navigant to conduct a DSM Resource Potential Study for the GMO service territory, which included the effects of improved technologies expected over the 20-year planning horizon. As a part of the scope of work, Navigant selected potential demand-side resources to fulfill the goal of achieving all cost-effective demand-side savings by designing highly effective potential demand-side programs. Navigant included the effects of improved technologies expected over the planning horizon to improve the delivery of demand-side programs or demand-side rates and include on-site CHP as a resource.

SECTION 2: DEMAND-SIDE RESEARCH

(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. —

GMO engaged Navigant to conduct a DSM Resource Potential Study. Navigant reviewed potential studies, technical reference manuals, and demand-side management program evaluations as well as regional and national sources. A comprehensive measure list was developed through a review of (a) DSM potential studies conducted for the state of Missouri and Missouri utilities,[2,3] (b) other Navigant potential, evaluation and program design work, and (c) existing GMO programs.

Navigant employed a variety of analytical approaches to estimate annual energy savings and coincident peak demand savings for each measure including: engineering algorithms, building energy computer simulation models, and secondary resources. The

[2] KEMA Consulting (March 04, 2011). Missouri Statewide DSM Potential Study – Final Report – Appendix.
[3] Global Energy Partners (January 2010). AmerenUE Demand-side Management Market Potential Study Volume 3: Analysis of Energy-Efficiency Potential.

majority of measures employed engineering algorithms and appropriate inputs from Technical Reference Manuals (TRM). When possible, Navigant utilized TRMs for Mid-Western states and utilities to capture effects of climate and regional similarities, including Ameren Missouri[4] and Illinois.[5]

Most building envelope measures were characterized through the use of building simulation models. Residential envelope measure savings were derived from BEopt™ software and calibrated to customer billing data. Commercial envelope measures were derived from simulations leveraging the *U.S. Department of Energy Commercial Reference Building Models of the National Building Stock* with a Kansas City, MO weather file.

Navigant conducted primary data collection of 139 non-residential customer sites across KPC&L's service territories. The 97 commercial and 42 industrial sites were randomly recruited by telephone according to a stratified sample design. Professionally trained surveyors collected a detailed inventory of energy-using equipment and building characteristics by inspection and, at some of the larger sites, customer-provided schedules of equipment. Surveyors also collected operation and power management behavior, including specifics on CHP (if present). Data collected covered all relevant energy aspects of customer facilities and businesses, including:

- Building size and orientation.
- Building envelope, such as insulation levels and wall and window sizes.
- Complete inventories of energy-using equipment covering all end uses, including lighting, HVAC, motors, water heating, commercial refrigeration, cooking, office equipment, air compressors, and other types of process equipment.
- Equipment and operation schedules and controls.

[4] *Appendix A, Technical Resource Manual, 2012 Energy Efficiency Filing.* Missouri Department of Natural Resources comments were considered and accounted for.
[5] State of Illinois Energy Efficiency Technical Reference Manual

Note that the evaluation and results for the commercial and industrial sectors do not reflect the fact that certain eligible customers may opt out of the program. This includes the energy and demand savings projections for the Realistic Achievable Potential (RAP) and Maximum Achievable Potential (MAP) scenarios.

Navigant conducted primary data collection of 69 residential customers across GMO's service territories. Customers were randomly recruited by telephone according to a stratified sample design. Surveyors conducted a brief interview with the customer, collecting a detailed inventory of energy-using equipment and building characteristics. The inspection covered all relevant energy aspects, including:

- Home size and orientation.
- Building envelope, such as insulation levels and wall and window sizes.
- Inventory of energy-using equipment covering all end uses.

Pursuant to 4 CSR 240-3.164 (2) (A), the current market potential study shall be updated no less frequently than every four (4) years. Therefore, in compliance with this requirement and as part of GMO's ongoing research efforts, GMO will conduct a new market potential study. GMO will initiate the next market potential study in 2015 with an estimated completion date of early 2017. GMO also recognizes that the current market potential study reflects a single data point and that a future market potential study may result in different energy and demand savings levels.

KCP&L SmartGrid Demonstration Project

The 2009 American Recovery and Reinvestment Act provided the United State Department of Energy with $600 million to fund Smart Grid Demonstration Projects. The KCP&L SmartGrid Demonstration Project (SGDP) was awarded a contract in August 2010. The operational testing and data collection phase of the SGDP concluded September 31, 2014. The analysis, evaluation, and documentation of findings for the twenty three operational demonstrations and tests conducted during the operational phase is ongoing and will be completed the first quarter of 2015. The SGDP Final Technical Report is due to the DOE May 1, 2015.

The SGDP is an end-to-end SmartGrid platform that includes advanced renewable generation, storage resources, leading-edge substation and distribution automation and control, energy management interfaces, and innovative customer programs and rate structures. The SGDP is focused on the geographic area served by the KCP&L Midtown Substation within Kansas City's urban core, an economic development region with a large number of customers living below the poverty line and/or in arrears with their utility bills.

The SGDP includes detailed analysis and testing to demonstrate the benefits of optimizing energy and information flows and utility operations across supply and demand resources, T&D operations, and customer end-use programs. Project components include:

Distribution Grid Management Infrastructure: The project will deploy a next generation end-to-end (or top-to-bottom) distribution grid management infrastructure based on distributed-hierarchical control concepts. The infrastructure will include:

- DR/DER Management System (DERM)
- Distribution Management System (DMS), including Distribution SCADA (D-SCADA), Dynamic Network Analysis (DNA), and Outage Management (OMS)
- AMI Head End
- Meter Data Management System (MDM)
- Distributed Control and Data Acquisition (DCADA)

SmartSubstation: develop and demonstrate a fully automated; next-generation distribution SmartSubstation with a local distributed control system based on IEC 61850 protocols.

SmartDistribution: develop and demonstrate a next generation DMS/D-SCADA system. The DMS/D-SCADA and Smart-Substation Controllers will provide the operational backbone of the system supporting significant levels of automation on the feeders,

complex and automated feeder reconfiguration decisions, and tightly integrated supervision with the Control Centers.

SmartDR/DERM : develop and demonstrate a next-generation, end-to-end DERM system that provides balancing of renewable and variable energy sources with controllable demand as it becomes integrated in the utility grid.

SmartGeneration: implement DER technologies and DR programs sufficient in quantity and diversity to support the DERM development and demonstration.

SmartMetering: develop and demonstrate state-of-the-art integrated AMI and meter data management (MDM) systems that support two-way communication with 14,000 SmartMeters in the demonstration area and provides the integration with CIS, DMS, OMS, and DERM.

SmartEnd-Use Program: achieve a sufficient number of consumers enrolled in a variety of consumer facing programs to 1) support the DERM development and demonstration and 2) measure, analyze, and evaluate the impact of consumer education, enhanced energy consumption information, energy cost and pricing programs and other consumer based programs have on end-use consumption.

SmartGrid Demonstration Project – 2014 Process Evaluation

Navigant conducted a process evaluation of the SGDP. The customer offerings evaluated included the following:

- *MySmart Portal:* An energy management web portal that displays energy usage and utility bill cost information in hourly, daily, and monthly configurations.
- *MySmartDisplay:* An in-home monitor that displays current energy usage and utility bill cost information.
- *MySmart Thermostat:* An advanced metering infrastructure (AMI) enabled programmable thermostat.

- *Home Area Network:* A home energy network consisting of AMI-enabled programmable thermostat and load control devices.
- *Time-of-Use Rates:* A rate structure that supports summer peak load shedding through higher costs on weekdays from 3:00 to 7:00 p.m. from May 16 to September 15.

Over the course of a number of years (2012-2014), Navigant conducted a process evaluation of each of these SGDP end-use components. The evaluation team used online and phone surveys to explore participant experience and satisfaction, conducted an analysis of the MySmart Portal's analytics to understand participant usage patterns, and interviewed project stakeholders to identify lessons learned about the program operations and technologies deployed throughout the program.

Navigant identified the following key overall findings from their evaluation of the SGDP customer programs.

- *Participant awareness of the overall SGDP varied by program component. For example, MySmart Portal participants did not seem to connect the portal with the SGDP, while MySmart Thermostat and TOU participants reported high levels of awareness of the SGDP.*
- *Participant motivations for signing up for their respective program components were consistently driven by a desire to understand and control their energy use, in many cases to save money. Less motivating was a desire to help the environment or assist KCP&L in managing its business risks, such as power outages or having to build new generation.*
- *Participants reported high levels of satisfaction with the SGDP program components, as well as high levels of satisfaction with KPC&L. When asked, most participants felt that the program improved or maintained their level of satisfaction with KCP&L as a utility.*

The final report can be found in Appendix 5D Navigant SGDP 2014 Process Evaluation Report.

ELECTRIC POWER RESEARCH INSTITUTE

GMO financially supports research conducted by the Electric Power Research Institute (EPRI). GMO has access to the EPRI library of energy efficiency and demand response research and data that is available to program participants.

The electric utility industry launched the Energy Efficiency Initiative in 2007 to investigate, demonstrate, and assess application of efficient end-use technologies and demand response systems. More than 40 utility companies collaborated to identify cost-effective technology and system options for increasing efficiency and enabling dynamic energy management. A key accomplishment includes the creation of a Living Laboratory to test energy efficiency and demand response technologies and their interoperability.

Research results are available as a significant collection of reports and data on technology and program potential, including material related to influencing factors such as greenhouse gas emissions and smart grid development. Through EPRI research, the industry has developed information on load growth (which could potentially offset efficiency benefits) and the potential cost/benefit of energy efficiency and demand response. Major converging factors that affect efficiency and load management are addressed, such as greenhouse gas effects and integration with advanced metering infrastructure and smart grid deployment.

More information about the EPRI energy efficiency and demand response program research can be found on their website, www.epri.com. Additional specific EPRI energy efficiency and demand response programs recently and/or currently supported by GMO are summarized below.

EPRI Program 170: Energy Efficiency and Demand Response

This program is focused on the assessment, testing, demonstration, and deployment of energy efficient and smart end-use technologies to accelerate their adoption into utility programs, which can influence the progress of codes and standards and ultimately lead to market transformation. The program also develops analytical frameworks essential to utility application of energy efficiency and demand response, including assessment of

resource potential, characterization of end-use load profiles, calculation of environmental impacts, and integration into utility resource planning.

The research has helped manage risk mitigation and avoided costs related to understanding and assessing emerging end use technologies, including:

- Assessment, testing, and demonstration of energy efficient and demand-responsive technologies and systems to determine efficacy prior to deployments in utility pilots or programs.
- Synthesis of end-use load research results and techniques to provide predictive insights into electricity use forecasts.

The program also provided significant input into standards development process, including use-case functional specifications of demand response–ready end-use devices through a multidisciplinary process involving utilities, equipment manufacturers, public agencies and other industry stakeholders.

The 2012 and 2013 Technology Readiness Guides provided a methodology for benchmarking the status of technologies with respect to the stages of EPRI's Energy Efficiency Technology Pipeline and included a comprehensive assessment encompassing required and scored criteria, criteria weighting, and an estimation of technical potential for energy efficiency.

EPRI Program 170 Supplemental: Evaluating Smart Thermostats' Impact on Energy Efficiency and Demand Response

Advances in technology have led to the development of a new generation of programmable communicating thermostats that hold the potential for energy and demand savings at a relatively low cost to electric and gas utilities. Industry experience has shown that customer acceptance and usability can be key drivers to a thermostat's energy or demand reduction potential. Given that smart thermostats may offer better customer usability due to their remote programming capability, the objective of this program is to evaluate their energy and demand savings impacts, as well as how customers perceive and use them.

New learning for the industry and the public will come about by addressing the program's key research question: Do smart thermostats result in energy and/or demand savings with residential customers? Other new learnings will be derived in answering secondary research questions relating to the technological characterization of various smart thermostats on the market, and customer interest and uptake. The program offers the opportunity to pool and compare data across different utility and technology contexts, therefore contributing a larger breadth of results than any single evaluation.

The program will inform natural gas and electric utilities and the public of the potential energy savings benefits of smart thermostats. For utilities, it may provide a measure of how these thermostats fit into their programs and key features that might promote energy efficiency and demand response. Demand response from residential air conditioners has been a target of many utility programs, but the cost of installation of load control devices and the perceived compromise in customer comfort have been large barriers. These thermostats, which are consumer-managed and possibly consumer-procured, may overcome these barriers at a relatively low cost. The knowledge gained about how customers perceive and interact with these types of devices may potentially inform future product designs and help bring about better thermostat choices for consumers.

EPRI Program 182: Understanding Electric Utility Customers

Electric utilities increasingly realize that they need to better understand and engage with customers. Overall, customer satisfaction is a key measure of how well a utility is meeting its customers' needs and expectations. However, engagement is taking on a new dimension. Technology advances along with the success of new electric service options, as demonstrated in pilots, make offering customers choices for how they buy electricity possible in almost any electricity market. Choices require more engagement because customers need confidence in the information that will help them make the right choice. Mutually beneficial results are the expectation, but are realized only if the choices offered customers jointly meet their needs and contribute to the utility fulfilling its obligation to provide reliable and affordable power.

Since customers have diverse electricity demands, it follows that a single service offering leaves some of those demands unfulfilled. Diversity of demands is advantageous because electricity supply is subject to temporal and spatial supply cost differences that are best managed if there are complementary demands. Some customers will use less when prices are high and more when they are low. Information about when they use electricity helps customers better allocate their budget to meet all their needs.

Fundamental research is required to identify the root drivers of utility customer behavior. Such drivers include the effects of rate structure, feedback, and control technologies on customer response, response variation by customer segment, and other pertinent research questions. Subsequent field tests are necessary to verify behavioral models and quantity their impact over a range of customer and market circumstances. This program employs two parallel and coordinated initiatives—original research and utilizing the research of others—to fill important knowledge gaps about how consumers and businesses use and value electricity. The program focuses on three categories of behavioral inducements: pricing structures, information provision (feedback), and control technologies.

EPRI Program 182 Supplemental: Matching Electric Service Plans to Utility Strategic Goals

GMO is collaborating with EPRI to evaluate the performance of its current residential rates in light of fundamental changes in its electricity supply costs and its desire to diversify its service offerings to engage customers. Important considerations in establishing a time-indexed plan for developing, testing and implementing Electric Service Plans (ESP) include: the success of existing dynamic pricing programs; expected impacts: the level of customer interest; metering and other service fulfillment requirements, and compatibility of GMO programs with ISO/RTO demand response offerings. ESP screening would contribute to defining the best path to achieve that objective.

EPRI Program 182 Supplemental: Characterizing Residential Customer Preferences for Electric Service Plans

Advances in metering, data management, and information technologies have reduced many of the barriers that limited the availability of dynamic electricity rates, especially to residential customers. For example, AMI enables electricity usage to be measured at almost any level of granularity, removing many of the barriers to offering pricing structures like time-of-use, peak-time rebates, critical peak pricing, real-time pricing, and variations thereof, to all customers on a self-selecting basis. Additionally, utilities and other retail providers can help customers plan and execute beneficial changes in usage under any rate structure by proving feedback and facilitating their use of control technologies. Considered together, these rate structures, feedback mechanisms, and control technologies can be combined into various types of service offerings (ESPs).

However, designing, marketing, implementing, and administering ESPs still involves additional costs, many of which are incurred up-front. The extent to which feedback is provided and incentives offered to promote adoption of control technologies is predicated on how and which ESPs customers elect to join. The cost of providing customer choice is substantial and driven by the scale and scope of ESP acceptance. In the absence of credible estimates of consumers' relative ESP preferences (market shares), justifying those expenditures is difficult. Recent pilots involving pricing, feedback, and control technology provide limited insight into why customers join ESPs (EPRI 1025856).

The program objective is to develop, test, and administer research methods that retail electric service providers can employ to gauge customer preferences for different types of ESPs. The results will provide initial insight into ESP preferences, and produce research tools that can be widely employed by utilities, on their own or collaboratively, to improve their understanding of customers' preferences for how they buy electricity.

EPRI Program 161: Information & Communication Technologies (IntelliGrid)

Utilities are increasingly deploying monitoring, communications, computing, and information technologies to enable grid modernization applications such as wide area

monitoring and control, integration of bulk or distributed renewable generation, distribution automation, and demand response. Companies face significant challenges when deploying these technologies. IntelliGrid addresses these challenges by:

- Promoting interoperable systems by leading an industry effort to develop open, interoperable AMI systems, contributing to the development of key standards (e.g. Common Information Model), assessing emerging standards (e.g. Open Automated Demand Response), conducting interoperability tests of products that implement key standards, and providing training and information to utilities on how to implement standards.

- Providing tracking and analysis of emerging communications technologies, investigating synchrophasor communications infrastructure to support grid control, conducting research on emerging technologies (e.g. TV white space and other lightly licensed spectrum), and conducting field demonstrations of 4G technologies for utility operations.

- Performing research into the nature and structure of utility data—where data is required, how data is turned into actionable information and effectively presented to a user—and understanding the cost of poor data quality to a utility.

- Capturing best practices and lessons learned from utility deployments of grid modernization technologies and applications.

- Tracking federal government and regulatory activities relating to standards and communications, and interpreting the impact these actions will have on the utility industry.

With the knowledge acquired through this program, members will be able to lower costs and reduce risks as they implement grid modernization technologies and applications. Specifically, members will have access to information that can help them:

- Implement standards-based approaches for achieving interoperability of devices and systems that make up a smart grid infrastructure.

- Understand the impact of new standards and communications technologies on utilities.
- Apply lessons learned from utility implementations of grid modernization technologies and systems.
- Understand communications and information system architecture requirements and technologies to support grid modernization applications.
- Understand the impact that federal government and regulatory activities related to standards and communications will have on the utility industry.

Research results will address near-term needs and make contributions that will advance the industry toward open, standards-based systems and devices that are interoperable and secure.

EPRI Program 161 Supplemental: Automated Demand Response and Ancillary Services Demonstration

This program will perform research associated with emerging energy price and product messaging-protocol standards to take advantage of ubiquitous low-cost communication infrastructures that may be able to reliably perform automated demand response (DR) and ancillary services or fast DR functions. Internationally recognized standards for DR and ancillary services are a key enabler for the development of commercially available products that have largely been proprietary over the last 30 years.

Emerging standards development from the Lawrence Berkeley National Lab, the Organization for the Advancement of Structured Information Standards, and the National Institute of Standards and Technology have advanced sufficiently so that demonstrations are feasible and products are beginning to become commercially available. However, research questions remain about the level of quality of service, reliability, security, and scalability. Other issues include the level of measurement and verification required and an understanding of the load characteristics and how it can meet the ancillary services requirements.

The program may help to accelerate development of standards that automatically manage loads and distributed energy resources (DER) for DR and ancillary services requiring faster response. The use of standardized communication protocols for these functions will benefit the public by enabling the use of multiple types of low-cost ubiquitous communication networks, crossing many utility boundaries from distributor to ISOs and facilitating access to ancillary markets.

This work is expected to increase market participation in the development of devices, eventually, with this functionality directly built in. Electric utilities are expected to gain an understanding of the performance capabilities load types, infrastructure requirements, product availability, and market opportunities associated with the advancement of this smart grid application.

EPRI Program D_SG: Smart Grid Demonstration

The Smart Grid Demonstration Initiative is a seven-year collaborative research effort to design, deploy, and evaluate how to integrate DER into utility grid and market operations. The Initiative leverages multi-million dollar investments in the smart grid by the electric utility industry, with the goal of sharing information and research results on a wide range of smart grid technologies and applications. Twenty-four collaborating and host utilities from Australia, Canada, France, Ireland, Japan and the United States have been designing and implementing demonstrations of smart grid technology and applications since 2008 as part of the Initiative.

SECTION 3: DEVELOPMENT OF POTENTIAL DEMAND-SIDE PROGRAMS

(3) The utility shall develop potential demand-side programs that are designed to deliver an appropriate selection of end-use measures to each market segment. The utility shall describe and document its potential demand-side program planning and design process which shall include at least the following activities and elements: —

GMO engaged Navigant to conduct a DSM Resource Potential Study. The potential study calculated four types of DSM resource potential:

Technical Potential: Assumes that all installed measures can immediately be replaced with an efficient technology, regardless of cost or market acceptance.

Economic Potential: A subset of technical potential that assumes that all installed measures can immediately be replaced with a cost-effective efficient technology. Cost-effectiveness is determined utilizing the total resource cost test.

Achievable Potential: Achievable potential estimates consider market acceptance, technology turn-over and diffusion of technology awareness and product adoption. The only difference between the scenarios is the assumed measure incentive.

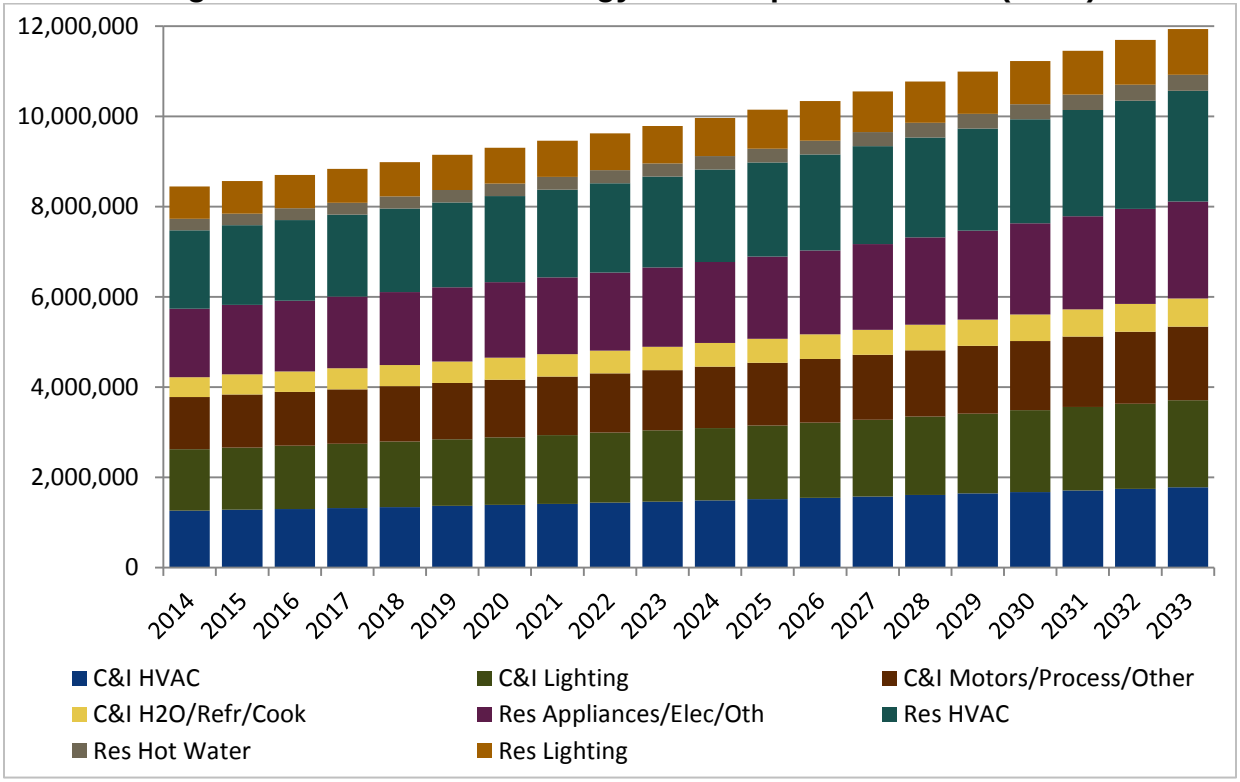
- *Maximum Achievable Potential (MAP):* incentive levels are set at 100% of the incremental cost of the measure. The scenario maximizes savings achieved, but also results in a portfolio cost that far exceeds that typically encountered in efficiency programs for a given level of energy saved.
- *Realistic Achievable Potential (RAP):* incentive levels are set based upon the efficiency supply curve by limiting the maximum $/kWh paid (calculated on a levelized cost basis) for any given measure.

A number of analytical steps were taken to produce potential estimates.

Step 1. Baseline Market Characterization and Historical Load Analysis[6]

Navigant conducted primary data collection, gathering detailed measure data and building characteristics from 208 buildings (69 residential and 139 commercial & industrial). Navigant also mapped the SIC code to historic energy usage, resulting into 11 commercial, 7 industrial, and 4 residential customer segments. The data were used to forecast building stock by customer segment, estimate market penetration of efficient measures, and develop measure-level savings estimates. The data, in combination with the measure characterization of the next task, were also used to estimate the forecast energy breakdown by end use category.

Figure 1. GMO End-Use Energy Consumption Forecast (MWh)



Note: Navigant's potential study analysis is conducted at the measure level and is disaggregated by customer segment. As a result, the potential study does not rely on a customer end-use forecast.

Step 2. Measure Identification and Characterization

Navigant developed a comprehensive measure list of conventional and emerging technologies. The initial measure list was identified through a review of a) previous

[6] At the time of the study, the list of opt-out customers was in flux due to changes in customer decision-making. Navigant and GMO decided they would not reduce the potential results of the study to exclude opt-out customers.

DSM potential studies conducted for the state of Missouri and other Missouri utilities, b) other Navigant potential, evaluation and program design work, and c) existing GMO program descriptions and custom applications. Navigant then modified the measure list to incorporate feedback from GMO and Missouri stakeholders. Overall, 500 measures were identified and 300[7] characterized for the final model.

Inputs from the baseline market characterization were used to develop measure-level savings estimates and initial technology densities. Navigant used a number of techniques to estimate measure-level savings, including calibrated building simulation and standard engineering algorithms. Navigant also estimated measure costs, accounting for regional cost differences using standard adjustment techniques. The measure characterization consisted of the following key parameters:

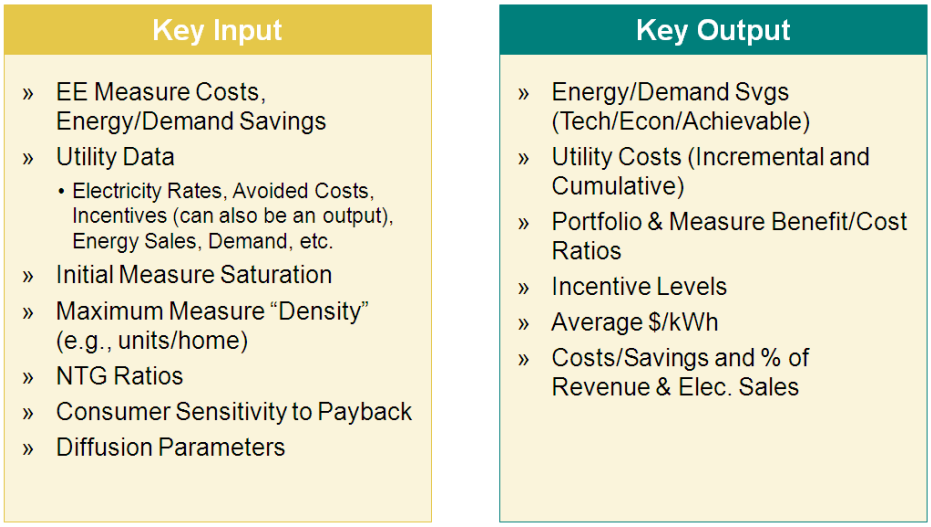
1) *Measure Definition*: the baseline and efficient equipment definitions, unit basis, and measure application.
2) *Energy Consumption*: annual energy consumption in kilowatt-hours (kWh).
3) *Coincident Electric Demand*: peak coincident demand in kilowatts (kW).
4) *Measure Lifetime*: the lifetime in years.
5) *Incremental Cost*: the difference in cost between the efficient equipment and the base or code equipment. Labor costs are only applied for retrofit measures.
6) *Net-to-Gross Ratio*: adjust savings and costs to account for free-ridership and spillover.
7) *Technology Density:* define the saturation of the baseline and efficient technologies in GMO territory. The values are on a “per home” basis for the residential sector and on a “per 1000 square feet of building space” for the commercial and industrial sectors.
8) *Technology Applicability:* the percentage of the base technology that can be reasonably and practically replaced with the specified efficient technology.

[7] Measures that were not characterized either had low or no density per the baseline data collection effort or were accounted for by other measures.

Step 3. Estimation of Technical and Economic Potential

Navigant estimated the technical, economic, and achievable potential using its proprietary Demand Side Management Simulator (DSMSim™) model. DSMSim is a bottom-up technology diffusion and stock tracking model implemented using a System Dynamics[8] framework. The figure below provides a high-level summary of the key input and output of DSMSim.

Figure 2. DSMSim Key Input and Output



Navigant also estimated combined heat and power (CHP) and demand response potential.

- CHP: Navigant considered a wide range of CHP technologies, fuel types and system sizes (e.g. fuel cells, micro-turbines, reciprocating engines, gas turbines, steam turbines), screened them for cost-effectiveness, and estimated adoption of technologies using a separate in-house CHP potential spreadsheet model.
- Demand Response: potential was estimated using the Demand Response Simulator (DRSim™) model, which follows the approach used in the FERC

[8] Sterman, John D. *Business Dynamics: Systems Thinking and Modeling for a Complex World*. 2000. Irwin McGraw-Hill. Also see http://en.wikipedia.org/wiki/System_dynamics for a high-level overview.

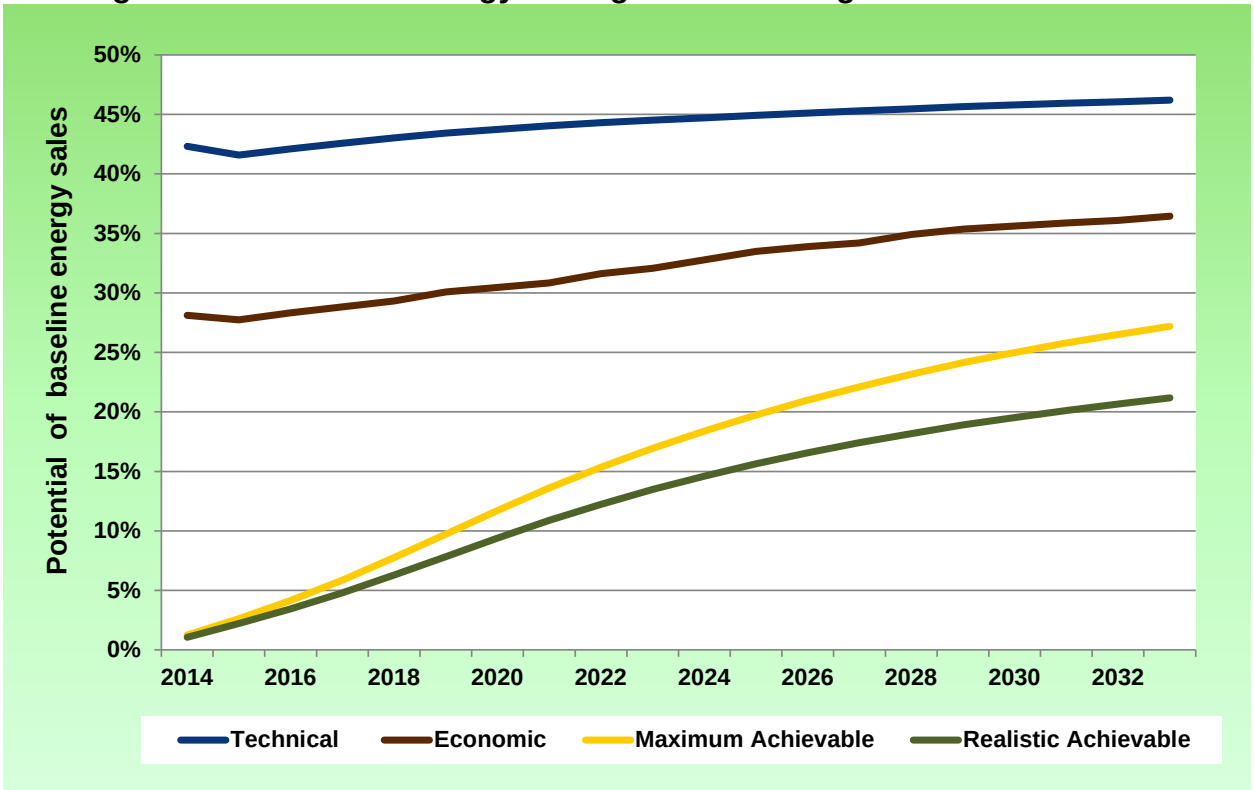
National Assessment of Demand Response Potential.[9] Consistent with the FERC approach, Navigant estimated demand response potential for five categories, including interruptible tariffs, direct load control, pricing without enabling technology, pricing with enabling technology, and other.

Navigant developed a suite of DSM programs consistent with the RAP scenario and ran scenario analysis between the RAP and MAP scenarios to understand how increasing savings targets would likely increase total costs.

The figure below illustrates the potential for energy savings as a percentage of the baseline energy forecast. Technical potential represents 41 to 46% of baseline energy sales over the 20-year forecast horizon, whereas economic potential ranges from 27 to 36% over the forecast horizon. Maximum achievable potential reaches 16.9% after 10 years and 27.2% by 2033. Realistic achievable potential is 13.5% of baseline energy sales by 2023 and 21.2% by 2033, which is roughly 58% the economic potential in that year. Note that these figures do not reflect the roll-off of measures at the end of the measures' life, C&I opt outs nor other required adjustments.

[9] Federal Energy Regulatory Commission, *A National Assessment of Demand Response Potential*. Prepared by The Brattle Group, June 2009.

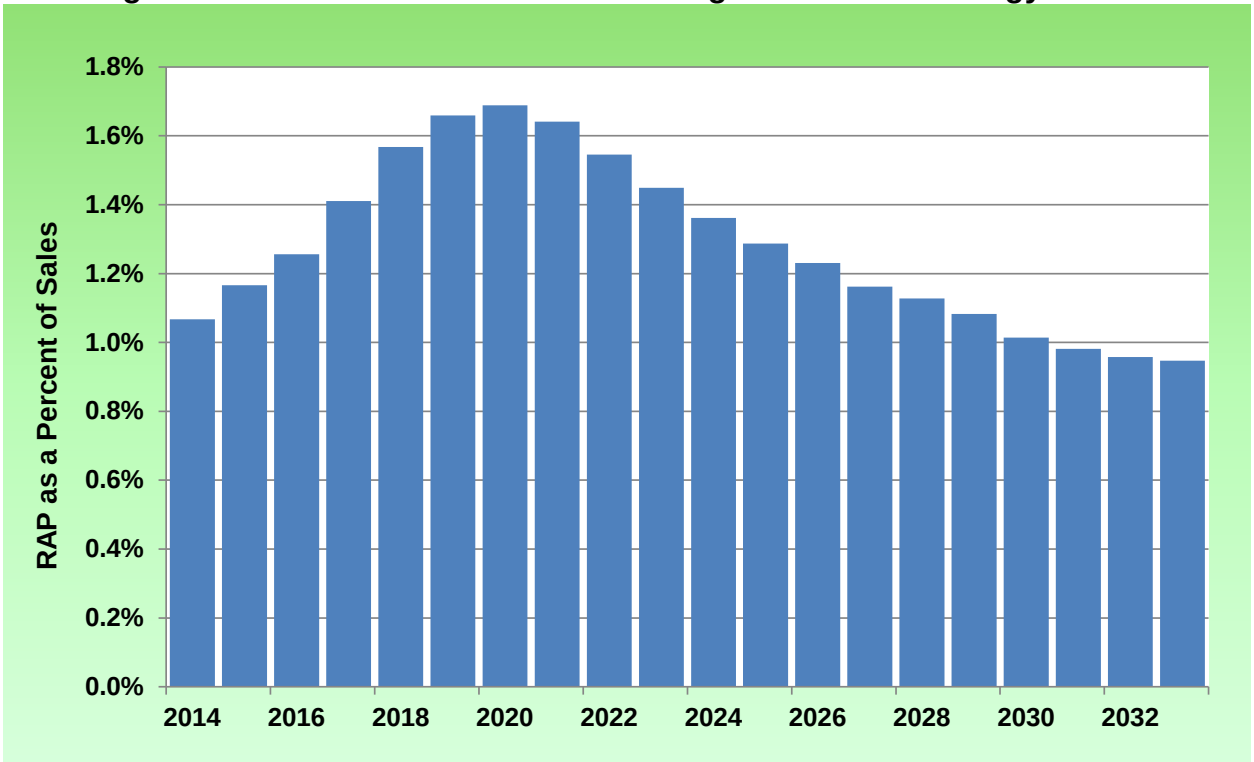
Figure 3. Cumulative Energy Savings as Percentage of Baseline Sales[10]



The figure below presents the annual incremental realistic achievable potential as a percentage of baseline forecast energy sales. The table shows the cumulative energy and demand savings from energy efficiency measures.

[10] Note that this chart does not reflect roll-off of measures at the end of the measures' life, C&I opt outs nor other required adjustments.

Figure 4. Incremental RAP as a Percentage of Baseline Energy Sales[11]



[11] [11] Note that this chart does not reflect roll-off of measures at the end of the measures' life, C&I opt outs nor other required adjustments.

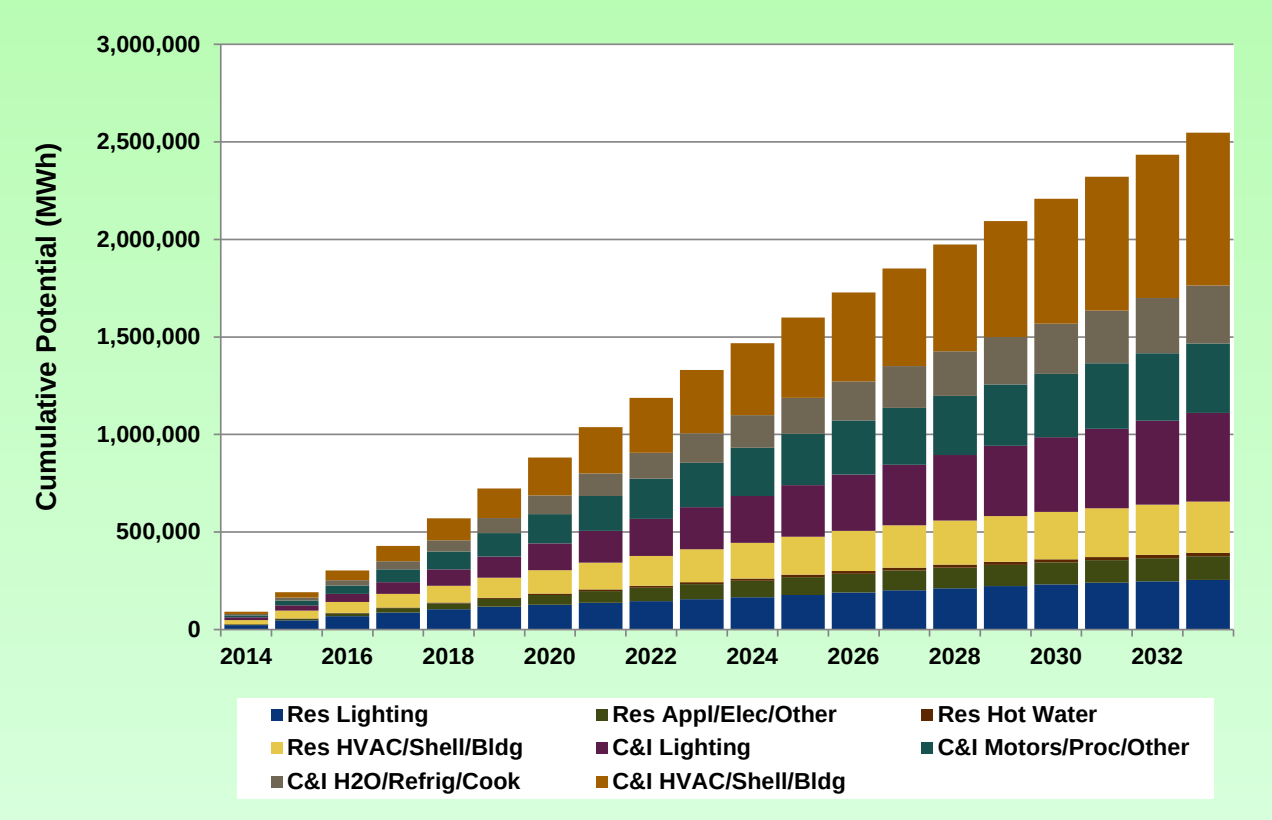
Table 19. Cumulative Energy and Demand Savings[12]

Year	Cumulative Energy Savings (MWh)				Cumulative Demand Savings (MW)			
	Technical	Economic	MAP	RAP	Technical	Economic	MAP	RAP
2014	3,604,097	2,394,376	106,150	90,895	1,018	602	26	20
2015	3,595,117	2,398,790	227,510	191,727	1,016	606	57	44
2016	3,697,376	2,486,081	364,356	302,033	1,039	624	93	71
2017	3,796,243	2,570,081	523,176	427,785	1,061	642	135	102
2018	3,899,798	2,658,253	703,168	569,884	1,085	661	183	137
2019	4,005,157	2,773,474	897,225	722,942	1,109	684	237	176
2020	4,103,282	2,857,034	1,098,957	881,328	1,133	703	292	217
2021	4,203,193	2,942,518	1,298,414	1,037,947	1,156	721	347	257
2022	4,299,936	3,068,068	1,490,214	1,187,910	1,179	771	400	295
2023	4,393,587	3,164,818	1,672,037	1,330,940	1,201	790	450	331
2024	4,492,172	3,292,540	1,847,554	1,467,700	1,224	821	498	364
2025	4,594,538	3,425,606	2,018,670	1,599,381	1,248	846	543	395
2026	4,700,944	3,531,512	2,187,097	1,727,665	1,273	872	587	424
2027	4,816,489	3,635,284	2,350,357	1,851,215	1,301	895	629	452
2028	4,933,979	3,788,766	2,513,766	1,973,566	1,328	922	670	479
2029	5,055,552	3,915,775	2,673,904	2,093,452	1,357	951	710	506
2030	5,180,364	4,028,017	2,826,627	2,208,148	1,386	976	748	530
2031	5,300,992	4,140,064	2,976,165	2,321,418	1,414	1,001	784	555
2032	5,425,181	4,251,923	3,123,259	2,434,251	1,443	1,026	819	579
2033	5,554,149	4,383,342	3,270,051	2,548,082	1,473	1,053	853	603

Residential single family homes offer the largest potential for energy savings, accounting for 19% of the realistic achievable potential by 2033. The figure below presents the cumulative energy savings by end-use. As seen in the figure, C&I HVAC/Shell/Whole Building measures provide the largest savings opportunity by 2033, driven largely by new construction measures that reduce savings greater than 30% relative to a baseline building. This end use category accounts for between 25% and 32% of total realistic achievable potential over the 20-year forecast horizon. Residential and C&I Lighting still account for substantial savings notwithstanding new federal lighting standards that reduce opportunity relative to past achievement. Residential and C&I lighting combined account for between 28% and 30% of realistic achievable savings over the 20-year forecast horizon.

[12] [12] Note that this table does not reflect roll-off of measures at the end of the measures' life, C&I opt outs nor other required adjustments.

Figure 5. Cumulative RAP Energy Savings (MWh) by End Use Category[13]



GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG took the following steps:

1. **Review Existing GMO DSM Portfolio**. AEG reviewed program descriptions and evaluations as well as program tracking data, including program participation, budgets versus expenditures and program savings. AEG held two collaborative program design workshops with GMO program managers and staff to discuss the program design process and gain insight into the existing DSM programs.

2. **Review DSM Potential Study**. AEG reviewed the *Demand-Side Resource Potential Study Report* and the *Demand-Side Resource Potential Study Report – Demand Response* completed by Navigant in August 2013. AEG compared the existing GMO portfolios with the potential study and best practice programs from industry research, primarily using information from utilities that are similar in size and customer

[13] Note that this chart does not reflect roll-off of measures at the end of the measures' life, C&I opt outs nor other required adjustments.

composition as GMO. AEG updated measure inputs and incorporated additional measures on an as-needed basis to reflect more recent program developments, evaluations, and new technology developments (for example the dramatic cost and efficacy improvements occurring in the LED lighting market).

3. **Review Stakeholder Input and Regulatory Requirements**. AEG reviewed GMO stakeholder input on the DSM programs provided through written comments and prior collaborative workshops. Similarly, AEG reviewed reporting and filing requirements, as well as the Stipulation and Agreement, which specified items to be considered in the design of future DSM programs. AEG attempted to design the portfolio and programs in such a way to address and satisfy all of these concerns.

4. **Develop DSM Program Plan**. AEG constructed program design for the 20-year period from 2016 through 2034. With the existing GMO DSM programs and the Navigant potential study as a starting point, the programs were modified to enhance their performance and incorporate the updated measure characteristics. AEG analyzed cost-effectiveness in order to gauge the economic merits of the measures, programs and portfolio. Cost-effectiveness was measured using four of the industry standard cost-effectiveness tests; total resource cost test, utility cost test, participant cost test, and rate impact measure test. As required in 22.050 (5) (B) the total resource cost test was used as the final determination of cost-effectiveness. As permitted in 22.050 (5) (D), the cost-effectiveness criterion was relaxed for the income-eligible programs since they are considered to have potential benefits that are not otherwise captured by the cost-effectiveness test.

5. **Adjust Potential Study RAP and MAP**. In the Navigant potential study report, the reported energy and demand savings did not account for the roll-off of measures at the end of the measures' life nor did it factor in the opt-out of commercial and industrial customers. At GMO's request, Navigant provided additional spreadsheets that take measure roll-off into account. GMO then used the new energy and demand savings and factored in an estimated 15% opt-out of commercial and industrial customers. In addition, GMO adjusted the Navigant

potential study RAP and MAP scenarios to match the time period needed for the IRP. The potential study included the years 2014 through 2033. GMO already has existing programs through 2015. Thus, the effects of programs in 2014 and 2015 were removed and the savings were extended to 2034. The impacts of these adjustments are shown in Table 48, Table 49, and Table 50. These calculations and adjustments can be found in the GMO workpapers[14].

3.1 PREVIOUSLY IMPLEMENTED DEMAND-SIDE PROGRAMS FROM OTHER UTILITIES

***(A) Review demand-side programs that have been implemented by other utilities with similar characteristics and identify programs that would be applicable for the utility*; —**

GMO engaged Navigant to conduct a DSM Resource Potential Study. Navigant conducted a benchmarking assessment of similar utility programs and top-performing utilities to (1) ensure the potential estimates developed were reasonable and appropriate and (2) identify best practices.

The benchmarking analysis included residential and C&I DSM programs at GMO in Kansas and Missouri as well as the following 14 utilities/program administrators: Pacific Gas & Electric (California), Interstate Power & Light (Iowa), MidAmerican (Iowa), Ameren Illinois, Commonwealth Edison (Illinois), Westar (Kansas), AEP Ohio, Consumer's Energy (Michigan), Detroit Edison (Michigan), Minnesota Power, Otter Tail Power (Minnesota), Xcel Energy (Minnesota), Efficiency Vermont, and Wisconsin Focus on Energy.

For sector comparison purposes, Navigant focused on the following high performing utility portfolios:

- C&I sector: Interstate Power & Light, Minnesota Power, Otter Tail Power and Xcel Energy.

[14] GMO IRP Output - Maximum, FINAL - Program Totals IRP HC.xlsx
GMO IRP Output - Realistic, FINAL - Program Totals IRP HC.xlsx

- Residential sector: Commonwealth Edison, Detroit Edison, MidAmerican, Minnesota Power and Xcel Energy.

3.2 MARKET SEGMENT IDENTIFICATION

(B) Identify, describe, and document market segments that are numerous and diverse enough to provide relatively complete coverage of the major classes and decision-makers identified in subsection (1)(A) and that are specifically defined to reflect the primary market imperfections that are common to the members of the market segment; —

GMO engaged Navigant to conduct a DSM Resource Potential Study. Navigant identified GMO's market segments by categorizing historic customer energy usage by SIC code. The residential, commercial and industrial sector market segments included:

- Residential: Single Family, Single Family Low-Income, Multi-Family, Multi-Family Low Income
- Commercial: Grocery, Healthcare, Lodging, Office – Large, Office – Small, Restaurants, Retail, Schools, Warehouses, Other Commercial
- Industrial: Chemicals, Electronics, Food, Rubber-Plastics, Stone-Clay-Glass, Motor Freight Transportation, Other Industrial

Table 20. Market Segments (2014), MWh

	GMO
Industrial-Chemicals	161,806
Industrial-Electronics	238,731
Industrial-Food	308,581
Industrial-Motor Freight	80,461
Industrial-Other Industrial	705,581
Industrial-Rubber-Plastics	101,682
Industrial-Stone-Clay-Glass	90,187
Commercial-College	82,229
Commercial-Grocery	186,563
Commercial-Healthcare	284,708
Commercial-Lodging	76,924
Commercial-Office - Large	580,911
Commercial-Office - Small	363,401
Commercial-Other Commercial	366,053
Commercial-Restaurant	209,552
Commercial-Retail	404,073
Commercial-School	388,158
Commercial-Warehouse	159,154
Residential-Single Family	2,438,300
Residential-SF Low Income	1,044,986
Residential-Multi-Family	122,334
Residential-MF Low Income	52,429
Total	**8,446,806**

3.3 DEVELOPMENT OF END USE MEASURES

(C) Identify a comprehensive list of end-use measures and demand-side programs considered by the utility and develop menus of end-use measures for each demand-side program. The demand-side programs shall be appropriate to the shared characteristics of each market segment. The end-use measures shall reflect technological changes in end-uses that may be reasonably anticipated to occur during the planning horizon; —

GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG began with the *Demand-Side Resource Potential Study Report* and the *Demand-Side Resource Potential Study Report – Demand Response* completed by Navigant in August 2013. Navigant developed a comprehensive measure list through a review of (a) DSM potential studies conducted for the state of Missouri and Missouri utilities,[15,16] (b) other Navigant potential, evaluation and program design work, and (c) existing GMO programs. Navigant then modified the measure list to incorporate feedback from GMO and Missouri stakeholders. Overall, 500 measures were identified and 300 were characterized for the final model.

Navigant employed a variety of analytical approaches to estimate measure-level energy savings and coincident peak demand savings, including standard engineering algorithms, calibrated simulation models, and secondary resources. The majority of measures employed engineering algorithms and appropriate inputs from TRMs. When possible, Navigant utilized TRMs for Mid-Western states and utilities to capture effects of climate and regional similarities, including Ameren Missouri[17] and Illinois.[18] Most building envelope measures were characterized through the use of building simulation models. Residential envelope measure savings were derived from BEopt™ software and calibrated to customer billing data. Commercial envelope measures were derived from simulations leveraging the *U.S. Department of Energy Commercial Reference Building Models of the National Buildin*g *Stock* with a Kansas City, MO weather file.

Navigant also estimated measure costs, accounting for regional cost differences using standard adjustment techniques. Material and labor costs were derived from a variety of resources including TRMs, online research, the California Database for Energy Efficiency Resources, and RS Means cost work.

[15] KEMA Consulting (March 04, 2011). Missouri Statewide DSM Potential Study – Final Report – Appendix.
[16] Global Energy Partners (January 2010). AmerenUE Demand-side Management Market Potential Study Volume 3: Analysis of Energy-Efficiency Potential.
[17] *Appendix A, Technical Resource Manual, 2012 Energy Efficiency Filing.* Missouri Department of Natural Resources comments were considered and accounted for.
[18] State of Illinois Energy Efficiency Technical Reference Manual

AEG reviewed the end-use measures developed in the Navigant potential study and the measures in GMO's MEEIA portfolio. Based on research and industry best practices, AEG updated the measure inputs and added additional end-use measures to reflect changes in technology that have emerged since the potential study was completed.

Table 21. Residential End-Use Measures

End-Use	Efficient Description	Base Description
Appliance	Combination Oven	Standard Oven
Appliance	Convection Oven	Standard Oven
Appliance	Efficient Ceiling Fan	Standard Ceiling Fan
Appliance	ENERGY STAR Dehumidifier	Standard Dehumidifier
Appliance	ENERGY STAR Dishwasher	Standard Dishwasher
Appliance	ENERGY STAR Dual Speed Pool Pump	Standard Pool Pump
Appliance	ENERGY STAR Freezer	Standard Freezer
Appliance	ENERGY STAR Refrigerator	Standard Refrigerator
Appliance	ENERGY STAR Variable Speed Pool Pump	Standard Pool Pump
Appliance	Heat Pump Clothes Dryer	Standard Clothes Dryer
Appliance	High Efficiency Clothes Dryer	Standard Clothes Dryer
Appliance	High Efficiency Clothes Washer	Standard Clothes Washer
Appliance	High Efficiency Pool Pump	Standard Pool Pump
Appliance	Induction Stove	Standard Stove
Appliance	Pool Pump Timer	Standard Pool Pump
Appliance	Pool Pump VSD	Standard Pool Pump
Appliances	ENERGY STAR Air Purifier	Standard Air Purifier
Behavioral	Home Energy Display	No Home Energy Displays
Behavioral	Home Energy Reports	No Home Energy Report
Electronics	80 Plus Power Supplies	Standard Power Supplies
Electronics	ENERGY STAR Copier/Printer	Standard Copier/Printer
Electronics	ENERGY STAR Desktop PC	Standard Desktop PC
Electronics	ENERGY STAR DVD/VCR	Standard DVD/VCR
Electronics	ENERGY STAR Laptop Computer	Standard Laptop Computer
Electronics	ENERGY STAR LCD TV	Standard LCD TV
Electronics	ENERGY STAR LED TV	Standard LED TV
Electronics	ENERGY STAR Plasma TV	Standard Plasma TV
Electronics	Smart Power Strip	Standard Power Strip
Hot Water	Drain Water Heat Recovery	No Drain Water Heat Recovery
Hot Water	Efficient Water Heater	Standard Water Heater
Hot Water	Heat Pump Integrated on Existing Water Heater	Standard Water Heater
Hot Water	Heat Pump Water Heater	Standard Water Heater
Hot Water	Heat Pump Water Heater, Early Retirement	Standard Water Heater
Hot Water	Heat Recovery from Heat Pump Water Heater	Standard Water Heater
Hot Water	Low Flow Faucet Aerator	Standard Faucet Aerator
Hot Water	Low Flow Showerhead	Standard Showerhead
Hot Water	Pipe Insulated	No Pipe Insulation
Hot Water	Solar Water Heater	Standard Water Heater
Hot Water	Tankless Water Heater	Standard Water Heater
Hot Water	Water Heater Tank Wrap	No Blanket
HVAC	AC DLC Switch	No Switch
HVAC	Air Conditioner SEER 15	Standard Air Conditioner

End-Use	Efficient Description	Base Description
HVAC	Air Conditioner SEER 15, Early Retirement	Standard Air Conditioner
HVAC	Air Conditioner SEER 16	Standard Air Conditioner
HVAC	Air Conditioner SEER 16, Early Retirement	Standard Air Conditioner
HVAC	Air Conditioner SEER 17	Standard Air Conditioner
HVAC	Air Conditioner SEER 17, Early Retirement	Standard Air Conditioner
HVAC	Attic Venting	No Attic Venting
HVAC	Efficient ECM Fan	Standard AC/Furnace Fan
HVAC	ENERGY STAR Ventilation Fan	Standard Ventilation Fan
HVAC	Geothermal Heat Pump	Standard Heat Pump
HVAC	Heat Pump Ductless Mini Split	Standard AC/Heat Pump
HVAC	Heat Pump SEER 15	Standard Heat Pump
HVAC	Heat Pump SEER 15, Early Retirement	Standard Heat Pump
HVAC	Heat Pump SEER 15, Replace Electric Resistance Heat	Electric Resistance Heat & CAC
HVAC	Heat Pump SEER 16	Standard Heat Pump
HVAC	Heat Pump SEER 16, Early Retirement	Standard Heat Pump
HVAC	Heat Pump SEER 16, Replace Electric Resistance Heat	Electric Resistance Heat & CAC
HVAC	Heat Pump SEER 17	Standard Heat Pump
HVAC	Heat Pump SEER 17, Early Retirement	Standard Heat Pump
HVAC	Heat Pump SEER 17, Replace Electric Resistance Heat	Electric Resistance Heat & CAC
HVAC	Heat/Energy Recovery Ventilation	No Heat/Energy Recovery Ventilation
HVAC	High Efficiency Room A/C	Standard Room A/C
HVAC	High Efficiency Room A/C, Early Retirement	Standard Room A/C
HVAC	HVAC Diagnostics and Tune-Up	Standard AC/Heat Pump
HVAC	Sizing, Refrigerant Charge & Airflow Correction	Standard AC/Heat Pump
Lighting	Linear Fluorescent - Premium T8	Linear Fluorescent - T12
Lighting	Linear Fluorescent - T5	Linear Fluorescent - T12
Lighting	Linear Fluorescent - T8	Linear Fluorescent - T12
Lighting	Occupancy Sensors	No Occupancy Sensors
Lighting	Photocell/Time-Clock Controls	No Outdoor Controls
Lighting	Screw In - CFLs	Screw In - Halogen
Lighting	Screw In - LEDs	Screw In - Halogen
Other	Major Renovation (Shell + HVAC)	Baseline Home
Recycle	Dehumidifier Recycle	Standard Dehumidifier
Recycle	Freezer Recycle	Standard Freezer
Recycle	Refrigerator Recycle	Standard Refrigerator
Recycle	Room A/C Recycle	Standard Room Air Conditioner
Shell	Add Storm Window	Standard Window
Shell	Air Sealing	Base Infiltration
Shell	Cool Roof	Standard Roof
Shell	Crawlspace/Basement Wall Insulation	No Crawlspace/Basement Wall Insulation
Shell	Duct Sealing/Repair	Standard Duct Leakage
Shell	ENERGY STAR Windows	Standard Window
Shell	Increased Ceiling Insulation	Base Ceiling Insulation
Shell	Increased Duct Insulation	No/Low Duct Insulation
Shell	Increased Floor Insulation	Base Floor Insulation
Shell	Increased Wall Insulation	Base Wall Insulation
Shell	Self-Install Weatherization	Base Infiltration
Shell	Sunscreen	Standard Window
Shell	Window Film	Standard Window

Table 22. Business End-Use Measures

End-Use	Efficient Description	Base Description
Behavioral	Building Operator Certification	No BOC training
Behavioral	Energy Feedback Device	No Energy Feedback Device

End-Use	Efficient Description	Base Description
Compressed Air	Comp Air - ASD	Comp Air - No ASD
Compressed Air	Comp Air - Controls	Comp Air - No Controls
Compressed Air	Comp Air - Dryer Cycling	Comp Air - Base System
Compressed Air	Comp Air - Eliminate In-Efficient Uses	Comp Air - Base System
Compressed Air	Comp Air - Leaks Repaired	Comp Air - Leaks
Compressed Air	Comp Air - Motor Practices	Comp Air - Standard Practice
Compressed Air	Comp Air - No Loss Drains	Comp Air - Standard Drains
Compressed Air	Comp Air - O&M	Comp Air - No O&M
Compressed Air	Comp Air - Power Recovery	Comp Air - No Power Recovery
Compressed Air	Comp Air - Pressure Reduction	Comp Air - Base System
Compressed Air	Comp Air - Replace Motor	Comp Air - Standard Efficiency
Compressed Air	Comp Air - Sizing	Comp Air - Oversized
Compressed Air	Comp Air - Storage/Air Receivers	Comp Air - No Storage
Cooking	Combination Oven	Standard Oven
Cooking	Convection Oven	Standard Oven
Cooking	ENERGY STAR Fryer	Standard Fryer
Cooking	ENERGY STAR Hot Food Holding Cabinet	Standard Hot Food Holding Cabinet
Cooking	ENERGY STAR Steamer	Standard Steamer
Drives	Drive - Custom	Standard Drive
Drives	Drive - Direct Drive	Base Drive - V Belt
Drives	Drive - Motor	Standard Motor
Drives	Drive - O&M	Standard Drive
Drives	Drive - VFD (Other)	Constant Speed
Fans	Fans - ASD	No ASD
Fans	Fans - Controls	No Controls
Fans	Fans - Improve Components	Standard Components
Fans	Fans - Motor Practices	Standard Practice
Fans	Fans - O&M	No O&M
Fans	Fans - Power Recovery	No Power Recovery
Fans	Fans - Replace Motor	Standard Efficiency
Fans	Fans - System Optimization	Standard
Hot Water	Demand Controlled Circulation	Standard Water Heater
Hot Water	Efficient Water Heater	Standard Water Heater
Hot Water	Heat Pump Water Heater	Standard Water Heater
Hot Water	Heat Trap	Standard Water Heater
Hot Water	Laundry Waste Water Recovery	No Waste Water Recovery
Hot Water	Low Flow Faucet Aerator	Standard Faucet Aerator
Hot Water	Low Flow Showerhead	Standard Showerhead
Hot Water	Pipe Wrap/Insulation	Standard Water Heater
Hot Water	Pre-Rinse Spray Valves	No Pre-Rinse Spray Valves
Hot Water	Solar Water Heater	Standard Water Heater
Hot Water	Tank Blanket	Standard Water Heater
Hot Water	Tankless Water Heater	Standard Water Heater
Hot Water	Water Heater - Heat Recovery from Air Source HP	Standard Water Heater
Hot Water	Water Heater - Heat Recovery from Geothermal HP	Standard Water Heater
Hot Water	Water Heater - Heat Recovery from Refrigeration	Standard Water Heater
HVAC	Absorption Chiller	Standard Chiller
HVAC	AC DLC Switch	No Switch
HVAC	AC/HP Coil Cleaning	Standard AC/HP
HVAC	AC/HP Ductless Mini Split	Standard AC/HP
HVAC	AC/HP Ductless Mini Split VRF	Standard AC/HP
HVAC	AC/HP Evaporative Pre-Cooling	No Pre-Cooling
HVAC	Air Source Heat Pump	Standard Heat Pump
HVAC	Air Sourced Air Conditioner	Standard Air Conditioner

End-Use	Efficient Description	Base Description
HVAC	Chilled/Hot Water Temp Reset	No Reset
HVAC	Demand Control Ventilation - CO Sensors (Parking)	No Demand Control Ventilation
HVAC	Demand Control Ventilation - CO2 Sensors (Occupancy)	No Demand Control Ventilation
HVAC	Economizer Controls	No Economizer
HVAC	Efficient Air Cooled Chiller	Standard Chiller
HVAC	Efficient Water Cooled Chiller	Standard Chiller
HVAC	EMS Controls	No EMS
HVAC	Geothermal Heat Pump	Standard AC/HP
HVAC	Heat/Energy Recovery Ventilation	No Heat/Energy Recovery Ventilation
HVAC	High Efficiency PTAC/PTHP	Standard PTAC/PTHP
HVAC	High Efficiency Room AC/HP	Standard Room AC/HP
HVAC	Hotel Occupancy Sensor Controls	No Occupancy Sensor
HVAC	HVAC O&M	HVAC - NO O&M
HVAC	Make Up/Exhaust - Separate/Optimized	Standard Make Up/Exhaust
HVAC	Programmable Thermostat Controls	Standard Thermostat
HVAC	Retrocommissioning/Optimization	No Retrocommissioning
HVAC	Tune Up/Diagnostics	No Tune Up/Diagnostics
HVAC	Water Side Economizer w/Efficient Tower	Efficient Water Cooled Chiller
HVAC	Water Source Heat Pump	Standard Heat Pump
Lighting	Ceramic Metal Halide	High Intensity Discharge
Lighting	Continuous Dimming Controls	No Dimming
Lighting	High Bay Premium T8	High Intensity Discharge
Lighting	High Bay T5	High Intensity Discharge
Lighting	High Bay T8	High Intensity Discharge
Lighting	Hotel Room Occupancy Controls	No Controls
Lighting	Induction Lighting	High Intensity Discharge
Lighting	Induction Street Lighting	Standard Street Lighting
Lighting	LED Exit Sign	CFL/Incandescent Exit Sign
Lighting	LED Flood Light	25% 50W MH
Lighting	LED Linear Fluorescent	T12 Linear Fluorescent
Lighting	LED Outdoor Pole/Arm Mounted Parking/Roadway	100W MH
Lighting	LED Parking Garage/Canopy	175W MH
Lighting	LED Parking Lot Lighting	Standard Parking Lot Lighting
Lighting	LED Wall-Mounted Area Lights	100W MH
Lighting	Occupancy Sensors	No Occupancy Sensor
Lighting	Outdoor Bi-Level LED Lighting	Outdoor Mercury Vapor
Lighting	Outdoor LED Lighting	Outdoor Mercury Vapor
Lighting	Photocell/Time-Clock Controls	No Outdoor Controls
Lighting	Premium T8 Linear Fluorescent	T12 Linear Fluorescent
Lighting	Premium T8 Linear Fluorescent with Reflector/Delamping	T12 Linear Fluorescent
Lighting	Reduced Lighting Power Density	Standard Lighting Power Density
Lighting	Screw In - CFLs	Screw In - Halogen
Lighting	Screw In - LEDs	Screw In - Halogen
Lighting	T5 Linear Fluorescent	T12 Linear Fluorescent
Lighting	T8 Linear Fluorescent	T12 Linear Fluorescent
Lighting	T8 Linear Fluorescent with Reflector/Delamping	T12 Linear Fluorescent
Motor	ECM Motor	PSC Motor
New Construction	High Performance - 30% savings	Code Minimum
New Construction	High Performance - 50% savings	Code Minimum
New Construction	High Performance - 70% savings	Code Minimum
Office Equipment	80 PLUS Power Supply Desktop Derived Server	Standard Power Supply
Office Equipment	80 PLUS Power Supply Desktop PC	Standard Power Supply
Office Equipment	Data Center Best Practices	Standard Data Center
Office Equipment	ENERGY STAR Copier	Standard Copier

End-Use	Efficient Description	Base Description
Office Equipment	ENERGY STAR CRT Monitor	Standard CRT Monitor
Office Equipment	ENERGY STAR Desktop PC	Standard Desktop PC
Office Equipment	ENERGY STAR LCD Monitor	Standard CRT Monitor
Office Equipment	LCD Manual Power Management Enabling	Standard CRT Monitor
Office Equipment	Power Management Enabling - Manual	Standard Copier
Office Equipment	Power Management Enabling - Networked	Standard Copier
Office Equipment	Work Station Plug Load Occupancy Sensor	No Work Station Occupancy Sensor
Other	Block Bidding	No Block Bidding
Other	CT w/ Heat Recovery	No CHP
Other	Curtailable Rate	Normal Rate
Other	Efficient Transformers	Standard Transformer
Other	Fuel Cell w/ Heat Recovery	No CHP
Other	Heating - O&M	No O&M
Other	Heating - Process Control	No Controls
Other	Injection Molding - Barrel Wrap	No Barrel Wrap
Other	Reciprocating Engine w/ Heat Recovery	No CHP
Other	Retro-Commissioning	No Program
Other	Strategic Energy Management	No Program
Pools	High Efficiency Pool Pump	Standard Pool Pump
Pools	Pool Pump Timer	Standard Pool Pump
Pools	Pool Pump VSD	Standard Pool Pump
Pumps	Efficient Pumps/Fan	Standard Pumps/Fans
Pumps	Pumps - ASD	No ASD
Pumps	Pumps - Controls	No Controls
Pumps	Pumps - Motor Practices	Standard Practice
Pumps	Pumps - O&M	No O&M
Pumps	Pumps - Power Recovery	No Power Recovery
Pumps	Pumps - Replace Motor	Standard Efficiency
Pumps	Pumps - Sizing	Oversized
Pumps	Pumps - System Optimization	Standard
Pumps	VSD Pumps/Fan	No VSD
Refrigeration	Commissioning/Re-Commissioning	Standard Refrigeration
Refrigeration	Demand Defrost	Standard Refrigeration
Refrigeration	Efficient Compressor	Standard Refrigeration
Refrigeration	Efficient Motor	Standard Motor
Refrigeration	Efficient Refrigeration - O&M	Standard Refrigeration
Refrigeration	Efficient Refrigeration - System Optimization	Standard Refrigeration
Refrigeration	ENERGY STAR Beverage Machine	Standard Beverage Machine
Refrigeration	ENERGY STAR Refrigerator	Standard Refrigerator
Refrigeration	Evaporator Fan Controller on Med Temp Walk-Ins	Standard Refrigeration
Refrigeration	Fiber Optic Display Lighting	Standard Refrigeration
Refrigeration	Floating Head Pressure Controls	Standard Refrigeration
Refrigeration	Freezer/Cooler Replacement Gaskets	Standard Refrigeration
Refrigeration	High Efficiency Ice Maker	Standard Ice Maker
Refrigeration	High Efficiency Reach-In Refrigerator/Freezer	Standard Reach In Refrigerator/Freezer
Refrigeration	High Efficiency Walk-In Refrigerator/Freezer	Standard Walk-In Refrigerator/Freezer
Refrigeration	High R-Value Glass Doors	Standard Refrigeration
Refrigeration	Humidistat Controls	Standard Refrigeration
Refrigeration	LED Display Lighting	Standard Refrigeration
Refrigeration	Multiplex Compressor System	Standard Refrigeration
Refrigeration	Night Covers	Standard Refrigeration
Refrigeration	Oversized Air Cooled Condenser	Standard Refrigeration
Refrigeration	Strip Curtains	Standard Refrigeration
Refrigeration	Vending Miser Beverage Machine	Beverage Machines - Standard

End-Use	Efficient Description	Base Description
Refrigeration	VSD Compressor	Standard Refrigeration
Shell	Cool Roof	Standard Roof
Shell	Duct Insulation	No Duct Insulation
Shell	Duct Sealing/Repair	Standard Duct Leakage
Shell	External Shading/Overhangs	No Shading
Shell	High Performance Glazing	Standard Glazing
Shell	Increase Ceiling Insulation	No/Low Ceiling Insulation
Shell	Increase Wall Insulation	No/Low Wall Insulation
Shell	Solar Shades	No Solar Shades
Shell	Window Film	No Window Film

3.4 ADVANCED METERING AND DISTRIBUTION ASSESSMENT

(D) Assess how advancements in metering and distribution technologies that may be reasonably anticipated to occur during the planning horizon affect the ability to implement or deliver potential demand-side programs; —

GMO engaged Navigant to conduct a DSM Resource Potential Study for the GMO service territory. The analysis assumed that a customer must have access to an advanced metering infrastructure (AMI) meter integrated with GMO's backend system to participate in a demand-side program. To support the analysis, Navigant developed a forecast for AMI deployment in each service territory as well as an estimate of when GMO might install a Meter Data Management (MDM) system to support enhanced pricing programs. The AMI deployment forecast used in the Navigant study was based on the company's best estimates at the time.

Subsequent to the Navigant study, GMO developed a IT technology roadmap that includes the following elements;

- *AMI Metro (2014-2016)*. GMO initiated an upgrade of the legacy AMR meters with new AMI meters and technology in the entire Kansas City Metro service area.
- *MDM (2015)*. GMO will deploy an enterprise MDM system to manage all meter reading data.
- *CIS (2017)*. GMO has a project underway to deploy a new CIS that will upgrade and consolidate the existing KCP&L-MO and GMO systems. AMI deployments

will be suspended in 2017 to facilitate the CIS implementation, migration and testing.

- *AMI Rural (2018-2020)*. While not yet approved, GMO projects that after the new CIS project, AMI meters will be deployed in all service territories outside of the Kansas City.

The table below provides a revised forecast for AMI meter deployments based on the current and projected system implementation schedules.

Table 23. AMI Deployment Forecast

2014	2015	2016	2017	2018	2019	2020
0%	0%	60%	60%	75%	93%	95%

Currently, AMI meters are projected to be deployed to 95% of customers recognizing the fact that deploying AMI communications in sparse, rural areas may not be cost-effective. However, GMO continues to work with the AMI communications network provider to develop and deploy a 100% solution. If AMI deployment throughout the entire service territory is not cost-effective, individual customers could potentially be provided an AMI meter that communicates via public (e.g. ATT or Verizon) carrier. This alternative to the AMI communications network is currently under development by the AMI vendor and should be market ready by the time the CIS upgrade project completes.

3.5 END-USE MEASURES MARKETING PLAN

(E) Design a marketing plan and delivery process to present the menu of end-use measures to the members of each market segment and to persuade decision-makers to implement as many of these measures as may be appropriate to their situation. When appropriate, consider multiple approaches such as rebates, financing, and direct installations for the same menu of end-use measures; —

The marketing plan and delivery process will be designed to inform customers of the DSM programs, the benefits of each program and how they can participate in a program. The plan will include a combination of strategies to reach all market segments

and decision-makers. The GMO website content and functionality will be a crucial component of the marketing plan, as the website directs customers to information about the DSM programs.

A strategy will be developed to move customers along the marketing funnel from awareness to education to conversion to engagement. Key points of the strategy and ensuing marketing campaigns will be to:

1. Develop a set of campaigns driven by seasonal timeliness and opportunities during and immediately after customers' engagement with each product to generate leads for the portfolio, especially the priority programs.

2. Drive customers from awareness to conversion by matching campaign elements to customers' informational needs at various points within the marketing funnel. Continue supporting customers through the engagement portion of the funnel via cross-promotion.

3. Ensure planned campaigns remain flexible and responsive to shifts in program strategy based on current unknowns becoming clearer, the need to balance costs versus participation through the year, and other unanticipated variables.

4. Craft malleable and creative approaches for planned campaigns, preserving our ability to complement and roll up to new creative strategy that will be developed for the general awareness advertising campaign.

5. Develop quarterly GMO employee communications campaigns that will increase employee awareness of products so they can help tell our story to customers, and encourage participation among eligible employees.

Tactics that can help move customers to participation include the following:

- KCP&L website content providing program information resources, contact information, and links to other relevant service and information resources.
- Program brochures that describe the benefits and features of the program.

- Bill inserts, on-bill messages and targeted email messages.
- Print and radio advertisements.
- Direct customer outreach (e.g. GMO customer representatives and/or an implementation contractor).
- Presence at conferences and public events used to increase general awareness of the program and distribute promotional materials.
- Partnerships with local contractors/businesses.
- Customized newsletters.

3.6 STATEWIDE MARKETING AND OUTREACH PROGRAM EVALUATION

***(F) Evaluate, describe, and document the feasibility, cost-reduction potential, and potential benefits of statewide marketing and outreach programs, joint programs with natural gas utilities, upstream market transformation programs, and other activities. In the event that statewide marketing and outreach programs are preferred, the utilities shall develop joint programs in consultation with the stakeholder group*; —**

Challenges definitely exist with an overall statewide marketing plan considering the variety of program offerings across the state and within service territories. GMO has seen this in the degree of effort and diligence needed to properly educate customers and promote programs in the KCP&L-Missouri territory vs. the GMO territory based on slightly different vintages of the programs. That being said, we continue to engage with peer utilities across the state at least once per year to identify opportunities with programs that are similar to evaluate the effectiveness in delivery.

Some areas of cooperation thus far include efforts GMO has undertaken to cooperatively market programs jointly run with outside organizations, such as non-profit organizations and state agencies involved with the Income Eligible Weatherization Program. Additionally, GMO partners with Laclede Gas on the Home Performance with Energy Star program. The multi-family housing sector also seems like a promising area

to partner with various interested parties across the state to promote and convert customers into energy efficient participants.

3.7 COST-EFFECTIVENESS

(G)Estimate the characteristics needed for the twenty (20)-year planning horizon to assess the cost effectiveness of each potential demand-side program, including: —

3.7.1 STAND-ALONE DEMAND AND ENERGY REDUCTION IMPACTS

1. An assessment of the demand and energy reduction impacts of each stand-alone end-use measure contained in each potential demand-side program; —

GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG began with the *Demand-Side Resource Potential Study Report* and the *Demand-Side Resource Potential Study Report – Demand Response* completed by Navigant in August 2013. Navigant developed a comprehensive measure list through a review of (a) DSM potential studies conducted for the state of Missouri and Missouri utilities,[19,20] (b) other Navigant potential, evaluation and program design work, and (c) existing GMO programs. Navigant then modified the measure list to incorporate feedback from GMO and Missouri stakeholders. Overall, 500 measures were identified and 300 were characterized for the final model.

Navigant employed a variety of analytical approaches to estimate measure-level energy savings and coincident peak demand savings, including standard engineering algorithms, calibrated simulation models, and secondary resources. The majority of measures employed engineering algorithms and appropriate inputs from TRMs. When possible, Navigant utilized TRMs for Mid-Western states and utilities to capture effects of climate and regional similarities, including Ameren Missouri[21] and Illinois.[22] Most

[19] KEMA Consulting (March 04, 2011). Missouri Statewide DSM Potential Study – Final Report – Appendix.
[20] Global Energy Partners (January 2010). AmerenUE Demand-side Management Market Potential Study Volume 3: Analysis of Energy-Efficiency Potential.
[21] *Appendix A, Technical Resource Manual, 2012 Energy Efficiency Filing.* Missouri Department of Natural Resources comments were considered and accounted for.

building envelope measures were characterized through the use of building simulation models. Residential envelope measure savings were derived from BEopt™ software and calibrated to customer billing data. Commercial envelope measures were derived from simulations leveraging the *U.S. Department of Energy Commercial Reference Building Models of the National Building Stock* with a Kansas City, MO weather file.

Navigant also estimated measure costs, accounting for regional cost differences using standard adjustment techniques. Material and labor costs were derived from a variety of resources including TRMs, online research, the California Database for Energy Efficiency Resources, and RS Means cost work.

AEG reviewed the end-use measures developed in the Navigant potential study and the measures in GMO's MEEIA portfolio. Based on research and industry best practices, AEG updated the measure inputs and added additional end-use measures to reflect changes in technology that have emerged since the potential study was completed.

The demand and energy reduction impacts of each end-use measure included in the additional DSM portfolio (Option C) are presented below.

Residential Measures

In 2007, the United States Congress passed the Energy Independence and Security Act (EISA) which set efficiency standards for 'general service' light bulbs, implemented in two phases. From 2012 to 2014, standard light bulbs manufactured were be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. By 2020, there must be a 60 percent reduction in light bulb energy use.[23] The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock.

[22] State of Illinois Energy Efficiency Technical Reference Manual
[23] See Database of State Incentives for Renewables & Efficiency (DSIRE). *Federal Appliance Standards*. Available at: www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US04R&re=1&ee=1

Table 24. Residential Lighting Measures

Measure	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
CFL pre-2020	5	28	0.003	$1.70
CFL 2020	5	6	0.001	$1.00
LED pre-2020	20	31	0.003	$15
LED 2020	20	9	0.001	$10

GMO proposes to offer measures to multi-family and single family customers. The energy and demand savings vary for low-flow faucet aerator or hot water pipe insulation depending on whether the customer resides in a multi-family or single family residence.

Table 25. Residential Low-Flow Faucet Aerator & Pipe Insulation

Measure	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
Faucet Aerator – Multi-Family	9	42	0.005	$3
Family	9	65	0.010	$3
Pipe Insulated – Multi-Family	10	236	0.017	$15
Pipe Insulated – Single Family	10	273	0.024	$15

The remaining residential measure inputs are presented in the table below.

Table 26. Residential Measures

Measure	Unit	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
A/C SEER 15	per ton	18	69	0.016	$93
A/C SEER 15, Early Retirement	per ton	6	486	0.234	$642
A/C SEER 16	per ton	18	130	0.016	$185
A/C SEER 16, Early Retirement	per ton	6	547	0.234	$642
A/C SEER 17	per ton	18	184	0.041	$278
A/C SEER 17, Early Retirement	per ton	6	600	0.259	$642
Air Sealing	per sq. ft.	15	0	0.000	$0.12
Dehumidifier Recycle	per unit	4	139	0.035	$49
Efficient ECM Fan	per unit	20	644	0.360	$97
ENERGY STAR Windows	per sq. ft.	25	2	0.001	$1.50
Freezer Recycle	per unit	8	1,201	0.191	$93
Heat Pump Ductless Mini Split	per ton	18	1,285	0.817	$716
HP SEER 15	per ton	18	173	0.054	$98
HP SEER 15, Early Retirement	per ton	6	1,195	0.502	$729
HP SEER 15, Replace Electric Resistance Heat	per ton	6	4,838	1.765	$729
HP SEER 16	per ton	18	234	0.054	$196
HP SEER 16, Early Retirement	per ton	6	1,256	0.502	$729
HP SEER 16, Replace Electric Resistance Heat	per ton	6	4,891	1.765	$729
HP SEER 17	per ton	18	321	0.093	$294
HP SEER 17, Early Retirement	per ton	6	1,342	0.540	$729
Heat Pump Water Heater	per unit	13	1,766	0.084	$1,000
Home Energy Reports	per home	1	145	0.028	$0
Increased Ceiling Insulation	per sq. ft.	25	1	0.000	$0.76
Increased Duct Insulation	per home	20	210	0.118	$720
Increased Wall Insulation	per sq. ft.	25	1	0.000	$1.32
Pipe Insulated	per unit	15	74	0.008	$2.81
Refrigerator Recycle	per unit	8	1,190	0.190	$93
Room A/C Recycle	per unit	4	121	0.114	$49
Smart Power Strip	per unit	5	74	0.005	$15
Water Heater Tank Wrap	per unit	5	131	0.015	$18

C&I End-Use Measures

In 2007, the United States Congress passed EISA which set efficiency standards for 'general service' light bulbs, implemented in two phases. From 2012 to 2014, standard light bulbs manufactured were be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. By 2020, there must be a 60 percent reduction in light bulb energy use. The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock.

Table 27. C&I Lighting Measures

Measure	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
CFL pre-2020	5	188	0.006	$3.30
CFL 2020	5	82	0.003	$1.00
LED pre-2020	20	200	0.006	$25
LED 2020	20	94	0.003	$39

The remaining C&I measures are presented in the table below.

Table 28. C&I Measures

Efficient Description	Unit	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
80 PLUS Power Supply Desktop Derived Server	per unit	5	334	0.038	$2.00
Air Source Heat Pump 65<135 kBtuh	per ton	15	91	0.124	$100
Air Sourced Air Conditioner <65 kBtuh	per ton	15	82	0.066	$120
Air Sourced Air Conditioner >240 kBtuh	per ton	15	71	0.057	$100
Air Sourced Air Conditioner 135<240 kBtuh	per ton	15	81	0.065	$100
Air Sourced Air Conditioner 65<135 kBtuh	per ton	15	57	0.046	$100
Block Bidding	per Bid	10	2,514,850	436	$496,331
Ceramic Metal Halide (replace HID HPS)	per unit	15	712	0.024	$104
Ceramic Metal Halide (replace HID MH)	per unit	15	697	0.023	$106
Chilled/Hot Water Temp Reset	per ton	5	82	0.003	$2.06
Comp Air - ASD (100+ HP)	per HP	6	693	0.167	$132
Comp Air - ASD (1-5 HP)	per HP	14	693	0.167	$385
Comp Air - ASD (6-100 HP)	per HP	10	693	0.167	$147
Comp Air - Controls	per HP	10	454	0.160	$20
Comp Air - Dryer Cycling	per HP	10	47	0.011	$11
Comp Air - Eliminate In-Efficient Uses	per HP	8	333	0.080	$67
Comp Air - Leaks Repaired	per HP	10	666	0.160	$133
Comp Air - Motor Practices (100+ HP)	per HP	6	56	0.010	$7.86
Comp Air - Motor Practices (1-5 HP)	per HP	14	180	0.034	$79
Comp Air - Motor Practices (6-100 HP)	per HP	10	90	0.017	$20
Comp Air - No Loss Drains	per HP	5	13	0.003	$3
Comp Air - Pressure Reduction	per HP	6	100	0.024	$1
Comp Air - Replace Motor (100+ HP)	per HP	15	31	0.007	$8
Comp Air - Replace Motor (6-100 HP)	per HP	15	46	0.011	$8
Comp Air - Sizing	per HP	10	100	0.024	$15
Comp Air - Storage/Air Receivers	per HP	10	292	0.070	$20
Curtailable Rate	per kW	1	-	1.000	$1.00
Drive - Custom	per HP	15	29	0.006	$10

Efficient Description	Unit	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
Drive - Direct Drive	per HP	15	146	0.031	$25
Drive - VFD (Other)	per HP	15	512	0.082	$355
Efficient Pumps/Fan	per HP	15	3	0.002	$1.77
Efficient Transformers	per kVA	25	14	0.002	$2.06
ENERGY STAR Beverage Machine	per unit	14	1,754	0.116	$140
Fans - ASD (100+ HP)	per HP	15	948	0.147	$133
Fans - ASD (1-5 HP)	per HP	15	1,037	0.161	$460
Fans - ASD (6-100 HP)	per HP	15	973	0	$155
Fans - Controls	per HP	15	57	0.012	$20
Fans - Improve Components	per HP	15	142	0.030	$49
Fans - Motor Practices (100+ HP)	per HP	15	62	0.013	$21
Fans - Motor Practices (1-5 HP)	per HP	15	67	0.014	$23
Fans - Motor Practices (6-100 HP)	per HP	15	63	0.013	$22
Fans - Power Recovery	per HP	15	283	0.060	$98
Fans - System Optimization	per HP	15	283	0.060	$98
Geothermal Heat Pump	per ton	15	443	0.781	$379
Heat Pump Water Heater	per unit	10	1,993	0.298	$925
High Bay T5 (replace HID HPS)	per unit	15	443	0.032	$104
High Bay T5 (replace HID MH)	per unit	15	390	0.028	$102
High Bay T8 (replace HID HPS)	per unit	15	325	0.023	$100
High Efficiency PTAC/PTHP	per kBtuh	15	30	0.012	$12
High Efficiency Reach-In Refrigerator/Freezer	per unit	12	3,026	0.129	$263
LED Display Lighting	per unit	8	731	0.071	$256
LED Exit Sign (replace CFL)	per unit	13	65	0.008	$23
LED Exit Sign (replace Incandescent)	per unit	13	258	0.031	$30
LED Linear Fluorescent	per unit	15	225	0.062	$45
Low Flow Faucet Aerator	per unit	9	131	0.196	$8.35
Make Up/Exhaust - Separate/Optimized	per HP	15	568	0.285	$116
Occupancy Sensors	per Watt	8	2	0.001	$0.12
Pipe Wrap/Insulation	per unit	6	224	0.278	$47
Pool Pump - High Efficiency	per unit	10	1,301	0.149	$273
Pool Pump - VSD	per unit	10	2,461	0.281	$579
Premium T8 Linear Fluorescent	per unit	15	55	0.004	$10
Pre-Rinse Spray Valves	per unit	5	2,671	-	$100
Programmable Thermostat Controls	per ton	8	126	-	$6
Pumps - ASD (100+ HP)	per HP	15	1,002	0.085	$133
Pumps - ASD (1-5 HP)	per HP	15	1,096	0.092	$460
Pumps - ASD (6-100 HP)	per HP	15	1,028	0.087	$155
Pumps - Controls	per HP	15	239	0.062	$85
Pumps - Motor Practices (100+ HP)	per HP	15	87	0.022	$31
Pumps - Motor Practices (1-5 HP)	per HP	15	95	0.024	$34

Efficient Description	Unit	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
Pumps - Motor Practices (6-100 HP)	per HP	15	89	0.023	$32
Pumps - Power Recovery	per HP	15	227	0.059	$81
Pumps - Replace Motor (1-5 HP)	per HP	15	33	0.008	$19
Pumps - Sizing	per HP	15	162	0.042	$58
Reduced Lighting Power Density	per sq. ft.	13	0	0.000	$0.14
Screw In - CFLs	per unit	5	188	0.006	$3.33
Screw In - LEDs	per unit	25	200	0.006	$25
Strategic Energy Management	per Customer	3	150,454	33.690	$3,009
Strip Curtains	per sq. ft.	6	129	0.015	$10
T8 Linear Fluorescent with Reflector/Delamping	per unit	15	67	0.005	$8
VSD Compressor	per HP	10	234	0.038	$78
VSD Pumps/Fan	per HP	15	478	0.145	$305
Water Heater - Heat Recovery from Air Source HP	per unit	18	1,923	0.133	$900
Water Heater - Heat Recovery from Geothermal HP	per unit	18	1,923	0.127	$900

3.7.2 IMPACT OF BUNDLING END-USE MEASURES

2. An assessment of how the interactions between end-use measures, when bundled with other end-use measures in the potential demand-side program, would affect the stand-alone end-use measure impact estimates; —

Navigant modeled the end-use interactions through application of HVAC interaction factors for lighting measures, which account for increased heating and/or decreased cooling loads resulting from reduced lighting wattages. In addition, impacts for New Construction/Major Rehab projects account for bundles of end-use measures needed to meet targeted energy efficiency levels.

GMO also engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG reviewed the end-use measures developed in the Navigant potential study and the measures in GMO's MEEIA portfolio. Based on research and industry best practices, AEG updated the measure inputs and added additional end-use measures to reflect changes in technology that have emerged since the potential study was completed.

The end-use measures identified were screened for cost-effectiveness on a stand-alone basis. Measures that were cost-effective on a stand-alone basis were bundled into

programs and re-screened for cost-effectiveness. Except for the low-income programs, the DSM programs were designed to be cost-effective. Measures were bundled based on end-use and implementation. For example, space cooling and heating end-use measures benefit from being installed by an experienced HVAC contractor.

Table 29. DSM Program Measure Offerings

Residential Programs	
Home Lighting Rebate	CFL and LED Bulbs
Appliance Recycling	Recycle inefficient refrigerators, freezers, dehumidifiers or room air conditioners.
Home Energy Report	Behavior program utilizing customized energy reports sent periodically to households.
Online Home Energy Audit	Online energy audit tool.
Whole House Efficiency	The program has three tiers. To participate in Tier 2, customers must complete Tier 1. - Tier 1. Audit and direct install of CFL/LED bulbs, low flow faucet aerators, low flow showerheads, hot water pipe insulation, water heater tank wrap, and smart power strips. - Tier 2. Air Sealing, Insulation (ceiling/wall) and ENERGY STAR Windows - Tier 3. HVAC Equipment - Heat Pump Water Heater - Efficient ECM Fan - Central Air Conditioners (SEER 15, 16) - Central Air Conditioner Early Retirement (SEER 15, 16) - Heat Pump (SEER 15, 16 and 17) - Heat Pump Early Retirement (SEER 15, 16) - Heat Pump Replace Electric Resistance Heat (SEER 15, 16)
Income-Eligible Multi-Family	The program is comprised of two tiers. - Tier 1. Home Kit (includes CFL/LED bulbs, low flow faucet aerators, low flow showerheads, pipe insulation, water heater tank wrap, and smart power strip). - Tier 2. Common Area Lighting
Income-Eligible Weatherization	The program is comprised of two tiers. - Tier 1. Home Kit (includes CFL/LED bulbs, low flow faucet aerators, low flow showerheads, pipe insulation, water heater tank wrap, and smart power strip). - Tier 2. Weatherization (ceiling, duct or wall insulation)
Residential Programmable Thermostat	Direct load control program that cycles and curtails central air conditioners by way of a remote-controlled switch.

Commercial Programs	
Business Energy Efficiency Rebate – Standard	Customers may receive incentives by installing efficient measures from a pre-qualified list of options.
Business Energy Efficiency Rebate – Custom	Customers may receive incentives for non-prescriptive measures.
Strategic Energy Management	Provides education, technical assistance, and coaching for large customers to drive behavioral change and transform company culture.
Block Bidding	Purchase blocks of electricity savings representing reduced electric usage from eligible customers or third parties working with eligible customers.
Online Building Energy Audit	Online energy audit tool.
Small Business Direct Install	Small customers receive 70% of the full cost of qualifying measures.
Commercial Programmable Thermostat	Direct load control program that cycles and curtails central air conditioners by way of a remote-controlled switch.
Demand Response Incentive	Interruptible tariff program for customers that can reduce load by at least 25 kW during times of system peak congestion.

3.7.3 CHANGE IN PARTICIPANTS AND INSTALLATIONS

3. An estimate of the incremental and cumulative number of program participants and end-use measure installations due to the potential demand-side program; —

An estimate of the potential DSM Program incremental and cumulative end-use measure installations and participants can be found in the work paper "GMO IRP Filing Tables.xlsx." Cumulative participants does not equal the sum of all incremental participants because some customers will participate in multiple programs. The analysis assumes that there will be a 25% overlap.

3.7.4 DEMAND REDUCTION AND ENERGY SAVINGS

***4. For each year of the planning horizon, an estimate of the incremental and cumulative demand reduction and energy savings due to the potential demand-side program;* and —**

An estimate of the incremental and cumulative demand reduction and energy savings due to the potential DSM programs can be found in the work paper “GMO IRP Filing Tables.xlsx.”

3.7.5 COST ESTIMATES

***5. For each year of the planning horizon, an estimate of the costs, including*: —**

A. The incremental cost of each stand-alone end-use measure; —

The incremental cost of each stand-alone energy use measure can be found in the work paper “GMO IRP Filing Tables.xlsx.”

B. The cost of incentives paid by the utility to customers or utility financing to encourage participation in the potential demand-side program. The utility shall consider multiple levels of incentives paid by the utility for each end-use measure within a potential demand-side program, with corresponding adjustments to the maximum achievable potential and the realistic achievable potential of that potential demand-side program; —

Navigant considered multiple levels of incentives in the development of the RAP and MAP scenarios. MAP scenario incentives were set at 100% of the incremental cost, with some exceptions for certain measures such as CFLs. RAP scenario incentives varied based on a methodology using the energy efficiency supply curve, with some exceptions for certain measures. AEG also considered other incentive levels in the development of the additional DSM portfolio (Option C), varying incentives by end-use measure and program.

Customer incentives paid by the utility can be found in the work paper “GMO IRP Filing Tables.xlsx.”

C. ***The cost of incentives to customers to participate in the potential demand-side program paid by the entities other than the utility; —***

No assumption was made that any incentives would be paid by entities other than the utility.

D. The cost to the customer and to the utility of technology to implement a potential demand–side program; —

The cost to the customer and the utility to implement the potential DSM programs can be found in the work paper "GMO IRP Filing Tables.xlsx."

E. ***The utility's cost to administer the potential demand-side program; and —***

The utility's cost to administer the potential DSM programs can be found in the work paper "GMO IRP Filing Tables.xlsx."

***F. Other costs identified by the utility*; —**

AEG did not identify other utility costs.

3.8 TABULATION OF PARTICIPANTS, IMPACT, & COSTS

G. A tabulation of the incremental and cumulative number of participants, load impacts, utility costs, and program participant costs in each year of the planning horizon for each potential demand-side program; and —

The incremental and cumulative participations, load impacts, utility costs and program participant costs in each year for the potential DSM programs can be found in the work paper "GMO IRP Filing Tables.xlsx." Cumulative participants does not equal the sum of all incremental participants because some customers will participate in multiple programs. The analysis assumes that there will be a 25% overlap.

3.9 SOURCES AND QUALITY OF INFORMATION

H. The utility shall describe and document how it performed the assessments and developed the estimates pursuant to subsection (3)(G) and shall provide documentation of its sources and quality of information. —

GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG began with the *Demand-Side Resource Potential Study Report* and the *Demand-Side Resource Potential Study Report – Demand Response* completed by Navigant in August 2013. Navigant developed a comprehensive measure list through a review of (a) DSM potential studies conducted for the state of Missouri and Missouri utilities,[24,25] (b) other Navigant potential, evaluation and program design work, and (c) existing GMO programs. Navigant then modified the measure list to incorporate feedback from GMO and Missouri stakeholders. Overall, 500 measures were identified and 300 were characterized for the final model.

Navigant employed a variety of analytical approaches to estimate measure-level energy savings and coincident peak demand savings, including standard engineering algorithms, calibrated simulation models, and secondary resources. The majority of measures employed engineering algorithms and appropriate inputs from TRMs. When possible, Navigant utilized TRMs for Mid-Western states and utilities to capture effects of climate and regional similarities, including Ameren Missouri[26] and Illinois.[27] Most building envelope measures were characterized through the use of building simulation models. Residential envelope measure savings were derived from BEopt™ software and calibrated to customer billing data. Commercial envelope measures were derived from simulations leveraging the *U.S. Department of Energy Commercial Reference Building Models of the National Building Stock* with a Kansas City, MO weather file.

[24] KEMA Consulting (March 04, 2011). Missouri Statewide DSM Potential Study – Final Report – Appendix.
[25] Global Energy Partners (January 2010). AmerenUE Demand-side Management Market Potential Study Volume 3: Analysis of Energy-Efficiency Potential.
[26] *Appendix A, Technical Resource Manual, 2012 Energy Efficiency Filing.* Missouri Department of Natural Resources comments were considered and accounted for.
[27] State of Illinois Energy Efficiency Technical Reference Manual

Navigant also estimated measure costs, accounting for regional cost differences using standard adjustment techniques. Material and labor costs were derived from a variety of resources including TRMs, online research, the California Database for Energy Efficiency Resources, and RS Means cost work.

AEG reviewed the end-use measures developed in the Navigant potential study and the measures in GMO's MEEIA portfolio. Based on research and industry best practices, AEG updated the measure inputs and added additional end-use measures to reflect changes in technology that have emerged since the potential study was completed.

In addition to the Navigant potential study, AEG gathered the end-use measure data from multiple sources including:

- Southwest Energy Efficiency Project (March 2013). Utility Strategic Energy Management Programs.
- United States Energy Information Administration. Form EIA-826. Monthly Electric Utility Sales and Revenue Report with State Distributions.
- State of Illinois. (2012). Energy Efficiency Technical Reference Manual.
- U.S. Department of Energy. Building Technologies Program: Residential Products.
- Michigan Public Service Commission (2013). Michigan Energy Measures Database. Prepared by Morgan Marketing Partners.
- Northeast Energy Efficiency Partnerships (June 2014). Mid-Atlantic Technical Reference Manual. Version 4. Prepared by Shelter Analytics.
- Navigant Consulting, Inc. (July 2014). GMO Evaluation, Measurement, & Verification Report – Final Draft. Program Year 2013. Highly Confidential. Prepared for GMO.

– The Cadmus Group, Inc. (August 2013). Nonresidential Block Bidding Program Evaluation Report. Prepared for New York State Electric & Gas and Rochester Gas and Electric Corporations.

The table below presents the source documentation by measure.

Table 30. DSM Measure Documentation

Sector	Measure	Source(s)
Residential	Screw In - CFLs	Illinois/Mid-Atlantic
Residential	Screw In - LEDs	Illinois/Mid-Atlantic
Residential	Low Flow Faucet Aerator	Navigant Potential Study
Residential	Low Flow Showerhead	Navigant Potential Study
Residential	AC DLC Switch	KCP&L Inputs
Residential	Air Conditioner	DOE/Illinois/Michigan
Residential	Air Sealing	Illinois/Michigan
Residential	Dehumidifier Recycle	Navigant Evaluation
Residential	Efficient ECM Fan	Illinois
Residential	ENERGY STAR Windows	Mid-Atlantic
Residential	Freezer Recycle	Navigant Evaluation
Residential	Heat Pump Ductless Mini Split	DOE/Energy Star/Illinois/Michigan
Residential	Heat Pump	DOE/Illinois/Michigan
Residential	Heat Pump Water Heater	Illinois
Residential	Home Energy Reports	Opower

Sector	Measure	Source(s)
Residential	Increased Ceiling Insulation	Illinois/Michigan
Residential	Increased Duct Insulation	Illinois/Michigan
Residential	Increased Wall Insulation	Illinois/Michigan
Residential	Pipe Insulated	Navigant Potential Study
Residential	Refrigerator Recycle	Navigant Evaluation
Residential	Room A/C Recycle	Navigant Evaluation
Residential	Smart Power Strip	Navigant Potential Study
Residential	Water Heater Tank Wrap	Navigant Potential Study
C&I	80 PLUS Power Supply Desktop Derived Server	Navigant Potential Study
C&I	AC DLC Switch	KCP&L Inputs
C&I	Air Source Heat Pump 65<135 kBtuh	Illinois/Mid-Atlantic/CEE
C&I	Block Bidding	NYSEG/RGE
C&I	Ceramic Metal Halide	Navigant Potential Study
C&I	Chilled/Hot Water Temp Reset	Navigant Potential Study
C&I	Comp Air	Navigant Potential Study
C&I	Curtailable Rate	KCP&L Inputs
C&I	Drive	Navigant Potential Study
C&I	Efficient Pumps/Fan	Navigant Potential Study
C&I	Efficient Transformers	Navigant Potential Study
C&I	ENERGY STAR Beverage Machine	Navigant Potential Study
C&I	Fans	Navigant Potential Study
C&I	Geothermal Heat Pump	Navigant Potential Study
C&I	Heat Pump Water Heater	Navigant Potential Study/Mid-Atlantic
C&I	High Bay T5	Navigant Potential Study
C&I	High Bay T8	Navigant Potential Study
C&I	High Efficiency PTAC/PTHP	Navigant Potential Study
C&I	High Efficiency Reach-In Refrigerator/Freezer	Navigant Potential Study
C&I	LED Display Lighting	Navigant Potential Study
C&I	LED Exit Sign (replace CFL)	Navigant Potential Study/Mid-Atlantic
C&I	LED Exit Sign (replace Incandescent)	Navigant Potential Study/Illinois
C&I	LED Linear Fluorescent	Navigant Potential Study/EIA
C&I	Low Flow Faucet Aerator	Navigant Potential Study
C&I	Make Up/Exhaust - Separate/Optimized	Navigant Potential Study
C&I	Occupancy Sensors	Illinois
C&I	Pipe Wrap/Insulation	Navigant Potential Study
C&I	Pool Pump	Navigant Potential Study
C&I	Premium T8 Linear Fluorescent	Navigant Potential Study
C&I	Pre-Rinse Spray Valves	Illinois
C&I	Programmable Thermostat Controls	Navigant Potential Study
C&I	Pumps	Navigant Potential Study
C&I	Reduced Lighting Power Density	Navigant Potential Study

Sector	Measure	Source(s)
C&I	Screw In - CFLs	Navigant Potential Study
C&I	Screw In - LEDs	Navigant Potential Study
C&I	Strategic Energy Management	SWEEP/EIA
C&I	Strip Curtains	Navigant Potential Study
C&I	T8 Linear Fluorescent with Reflector/Delamping	Navigant Potential Study
C&I	VSD Compressor	Navigant Potential Study
C&I	VSD Pumps/Fan	Navigant Potential Study
C&I	Water Heater - Heat Recovery	Navigant Potential Study

SECTION 4: DEMAND-SIDE RATE DEVELOPMENT

(4) 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 and shall include at least the following activities and elements: —

4.1 DEMAND-SIDE RATE REVIEW

(A) Review demand-side rates that have been implemented by other utilities and identify whether similar demand-side rates would be applicable for the utility taking into account factors such as similarity in electric prices and customer makeup; —

GMO engaged Navigant to conduct a DSM Resource Potential Study for the GMO service territory. Navigant reviewed utility demand-side rates and third-party research, including:

- KEMA Consulting (March 4, 2011). Missouri Statewide DSM Potential Study – Final Report.
- Global Energy Partners (January 2010). AmerenUE Demand-side Management (DSM) market Potential Study, Volume 3.
- Electric Power Research Institute (October 2012). Understanding Electric Utility Customers – Summary Report. Report #1025856.
- Federal Energy Regulatory Commission (December 2012). 2012 Survey on Demand Response and Advanced Metering. Demand Response Survey Data.
- The Brattle Group (June 2009). A National Assessment of Demand Response Potential. Prepared for Federal Energy Regulatory Commission.
- The Brattle Group (June 2009). National Demand Response Potential Model Guide. Prepared for Federal Energy Regulatory Commission.

4.2 IDENTIFY DEMAND SIDE RATES

(B) Identify demand-side rates applicable to the major classes and decision-makers identified in subsection (1)(A). When appropriate, consider multiple demand-side rate designs for the same major classes; —

GMO engaged Navigant to conduct a DSM Resource Potential Study. The study identified four major demand-side rate and demand response programs: Pricing without Enabling Technology, Pricing with Enabling Technology, Interruptible Tariffs, and Direct Load Control.

- *Pricing without Enabling Technology.* Customers manually curtail load in response to the pricing signals, communicated to via delivery mechanisms such as text messages or email.
- *Pricing with Enabling Technology.* Customers have enabling technology for automatic load curtailment. These technologies include, but are not limited to, programmable thermostats, load switches, and automated demand response.
- *Interruptible Tariff* is a rate structure where customers agree to reduce demand to a pre-specified level/amount in exchange for an incentive payment. These tariffs are limited to medium and large C&I customers and do not require AMI meters or equivalent equipment.
- *Direct Load Control.* Residential and small commercial customers allow HVAC equipment (e.g. central air conditioner) to be cycled to reduce system load. The program does not require AMI meters but does require equipment to remotely signal the HVAC equipment, such as a programmable thermostat.

As shown in the table below, Navigant considered multiple demand response programs for each of the major classes.

Table 31. Program Types and Rate Classes Assessed

	Rate Classes			
	Residential	Small C&I	Medium C&I	Large C&I
Interruptible/Curtailable Tariffs			X	X
Direct Load Control	X	X		
Pricing without Enabling Technology	X	X	X	X
Pricing with Enabling Technology	X	X	X	X
Other Demand Response		X	X	

4.3 ASSESS TECHNOLOGICAL ADVANCEMENTS

(C) Assess how technological advancements that may be reasonably anticipated to occur during the planning horizon, including advanced metering and distribution systems, affect the ability to implement demand-side rates; —

GMO engaged Navigant to conduct a DSM Resource Potential Study. An important consideration in the deployment of the demand-side rates is that most require investment in AMI meters and MDM systems to integrate the time-based rate structures with the billing system. Navigant assessed the impact that AMI meters would have on the ability to implement demand-side rates. AMI metering will make it possible to collect detailed data on whether or not participants changed their behavior after opting in to a time of use rate and to measure differences between participant behavior with and without various types of enabling technology.

Subsequent to the Navigant study, GMO developed a IT technology roadmap that includes the following elements;

- *AMI Metro (2014-2016)*. GMO initiated an upgrade of the legacy AMR meters with new AMI meters and technology in the entire Kansas City Metro service area.
- *MDM (2015)*. GMO will deploy an enterprise MDM system to manage all meter reading data.

- *CIS (2017)*. GMO has a project underway to deploy a new CIS that will upgrade and consolidate the existing KCP&L-MO and GMO systems. AMI deployments will be suspended in 2017 to facilitate the CIS implementation, migration and testing.
- *AMI Rural (2018-2020)*. While not yet approved, GMO projects that after the new CIS project, AMI meters will be deployed in all service territories outside of the Kansas City.

4.4 ESTIMATE INPUT DATA AND OTHER CHARACTERISTICS

(D) Estimate the input data and other characteristics needed for the twenty (20)-year planning horizon to assess the cost effectiveness of each potential demand-side rate, including: —

4.4.1 DEMAND AND ENERGY REDUCTION IMPACT

1. An assessment of the demand and energy reduction impacts of each potential demand-side rate; —

GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG began with the *Demand-Side Resource Potential Study Report – Demand Response* completed by Navigant in August 2013. Navigant estimated the participant peak reduction as a percentage of the average load profile for that rate class.

Table 32. Program Type and Potential Peak Savings

Program Type	Potential Peak Savings
Pricing without Enabling Technology	7%
Pricing with Enabling Technology	18%

Source: Based on the averaged load reductions for Residential pricing pilots with and without enabling technology. Electric Power Research Institute (October 2012). Understanding Electric Utility Customers - Summary Report. Report #1025856.

For Interruptible Tariffs and Direct Load Control, Navigant used actual 2012 peak demand reduction values from the GMO programs. Navigant conservatively assumed there were no significant energy savings.

AEG updated the measure inputs to reflect GMO's 2014 Residential and Commercial Programmable Thermostat Programs. There are no energy savings currently assumed with the programs as designed, although studies are currently underway to evaluate this potential. The AC DLC Switch incremental cost is applied to new customers only for the purchase and installation of the programmable thermostat.

Table 33. Demand-Side Rate Measure Inputs

Sector	Measure	Unit	Measure Life	Per Unit Gross Peak kW Savings	Per Unit Incremental Cost
Residential	AC DLC Switch	per unit	10	0.970	$150
C&I	AC DLC Switch	per unit	10	1.000	$150
C&I	Curtailable Rate	per kW	1	1.000	$1.00

4.4.2 INTERACTION OF MULTIPLE DEMAND-SIDE RATES

2. An assessment of how the interactions between multiple potential demand-side rates, if offered simultaneously, would affect the impact estimates; —

GMO engaged Navigant to conduct a DSM Resource Potential. In the study, demand-side rates were bundled and assessed by customer class and type such that multiple demand-side rates would not be offered simultaneously to the same customer. Navigant modeled the end-use interactions through application of HVAC interaction factors for lighting measures, which account for increased heating and/or decreased cooling loads resulting from reduced lighting wattages. In addition, impacts for New Construction/Major Rehab projects account for bundles of end-use measures needed to meet targeted energy efficiency levels.

4.4.3 INTERACTION OF POTENTIAL DEMAND-SIDE RATES AND PROGRAMS

3. 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; —

Navigant modeled the end-use interactions through application of HVAC interaction factors for lighting measures, which account for increased heating and/or decreased

cooling loads resulting from reduced lighting wattages. In addition, impacts for New Construction/Major Rehab projects account for bundles of end-use measures needed to meet targeted energy efficiency levels.

GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG reviewed the end-use measures developed in the Navigant potential study and the measures in GMO's MEEIA portfolio. Based on research and industry best practices, AEG updated the measure inputs and added additional end-use measures to reflect changes in technology that have emerged since the potential study was completed.

The end-use measures identified were screened for cost-effectiveness on a stand-alone basis. Measures that were cost-effective on a stand-alone basis were bundled into programs and re-screened for cost-effectiveness. Except for the low-income programs, the DSM programs were designed to be cost-effective. Measures were bundled based on end-use and implementation.

4.4.4 DEMAND AND REDUCTION ENERGY SAVINGS

4. For each year of the planning horizon, an estimate of the incremental and cumulative demand reduction and energy savings due to the potential demand-side rate; and —

There are no energy savings currently assumed with the programs as designed, although studies are currently underway to evaluate this potential. The estimated incremental and cumulative demand reduction savings due to the potential demand-side rates can be found in the work paper "GMO IRP Filing Tables.xlsx."

4.4.5 COST OF DEMAND-SIDE RATES

5. For each year of the planning horizon, an estimate of the costs of each potential demand-side rate, including: —

A. The cost of incentives to customers to participate in the potential demand side rate paid by the utility. The utility shall consider multiple levels of incentives to achieve customer participation in each potential demand-side rate, with corresponding adjustments to the maximum achievable potential and the realistic achievable potentials of that potential demand-side rate; —

The cost of incentives to customers can be found in the work paper "GMO IRP Filing Tables.xlsx." The Residential and Commercial Programmable Thermostat incentives apply only to new customers.

B. The cost to the customer and to the utility of technology to implement the potential demand-side rate; —

The cost to the customer and the utility to implement the potential demand-side rates can be found in the work paper "GMO IRP Filing Tables.xlsx." The Residential and Commercial Programmable Thermostat participant incremental costs apply only to new customers.

C. The utility's cost to administer the potential demand-side rate; and —

The utility's cost to administer the potential demand-side rates can be found in the work paper "GMO IRP Filing Tables.xlsx."

D. Other costs identified by the utility; —

No other costs were identified.

4.5 TABULATION OF NUMBER OF PARTICIPANTS

(E) A tabulation of the incremental and cumulative number of participants, load impacts, utility costs, and program participant costs in each year of the planning horizon for each potential demand-side program; —

The incremental and cumulative participants, load impacts, utility costs and program participant costs for each potential demand-side rate can be found in the work paper "GMO IRP Filing Tables.xlsx." Cumulative participants does not equal the sum of all incremental participants because some customers will participate in multiple programs. The analysis assumes that there will be a 25% overlap.

4.6 SPP DR ELIGIBILITY

(F) Evaluate how each demand-side rate would be considered by the utility's Regional Transmission Organization (RTO) in resource adequacy determinations, eligibility to participate as a demand response resource in RTO markets for energy, capacity, and ancillary services; and —

On March 1, 2014, the Southwest Power Pool (SPP) launched its new Integrated Marketplace. Included in SPP's new market design is the enabling of demand response resources to compete with traditional generators in the energy market. To offer a Demand Response Resource (DRR) into the SPP market, market participants must register as either a Dispatchable Demand Response (DDR) Resource or a Block Demand Response (BDR) Resource. As a part of this registration, the Asset Owner must also identify a corresponding Demand Response Load Asset and the associated PNode or APNode at which the load will be reduced. The Demand Response Load Asset is used by SPP to identify the actual load reduction to verify DDR and BDR compliance with Dispatch Instructions and Operating Reserve deployment instructions.

A DDR resource is a special type of resource created to model demand reduction associated with controllable load and/or a behind-the-meter generator that is dispatchable on a 5-minute basis and must have a corresponding Demand Response Load (DRL). DRL is a measurable load capable of being increased or reduced at the

instruction of the SPP operator identified in the registration and must have telemetering installed. A DDR must submit the real-time value of the DRL to SPP via SCADA on a 10-second basis. A DDR resource has two alternatives for reporting its output; Submitted Resource Production Option or Calculated Production Option.

For DDR resources utilizing the Submitted Resource Option, the Market Participant must determine the real-time resource production and submit the value to SPP via SCADA on a 10-second basis. The meter agent will submit after-the-act integrated meter values directly to SPP.

For DDR resources utilizing the Calculated Resource Production Option, a baseline hourly load profile must be submitted for the DRL prior to the hour for which the DDR resource has been committed that represents the forecast consumption for the hour assuming no load reduction. SPP will take a snapshot of the demand MW at the start of the operating hour. The Real-Time Resource output is calculated as the difference between 1) the minimum of (hourly Load Profile of the DRL, Snapshot of the DRL SCADA interval prior to deployment) and 2) the Real-Time SCADA value for the DRL.

DDR resources must submit energy offer curves similar to generators. The offer curve represents how much the DDR resource can reduce load by in a given hour and at what price. DDR resources specify the maximum and minimum amount of demand reduction that can be achieved. DDR resources would also submit all associated costs no-load costs, start-up costs, etc. A DDR resource can also be compensated for some but not all ancillary services. DDR resources have the opportunity to be compensated for spinning and supplemental reserves but not for regulation up or regulation down.

A BDR is a special type of resource that is not dispatchable on a 5-minute basis but can be dispatched and committed in hourly blocks. A BDR resource must also have a corresponding DRL. The DRL must have telemetering installed and have the real-time load consumption sent to SPP SCADA via ICCP on a 10-second basis. A BDR resource is required to submit an hourly load profile prior to the hour for which the BDR resource has been committed which represents the forecast assuming no load

reduction. SPP will take a snapshot of the demand MW at the start of the operating hour.

There are certain operational differences that apply to BDR resources. First, a BDR resource will only use two operating limits, minimum economic capacity operating limit and maximum economic capacity operating limit. The minimum economic operating limit represents the MW amount of demand reduction associated with the first price block identified in the energy price offer curve. The maximum economic capacity limit represents the maximum amount of demand reduction that can be achieved. Second, in the Real Time Balancing Market (RTBM), if the BDR is committed and dispatched in the Day-Ahead market or Reliability Unit Commitment (RUC), the BDR resource minimum economic capacity operating limit will be increased to match the dispatched amount.

A limiting factor for the use of DRRs in the SPP market are the metering requirements. SPPs requirements stipulate that the DRRs must be metered at the individual meter level. Therefore, the company cannot register a DR program as a whole, but would have to register each individual participating customer as a separate resource, because each customer has their own meter. This would greatly increase the amount of work required to manage the program and would also increase the cost, with unclear benefits.

Further, SPP does not have a capacity market and thus the DRRs only receive compensation for the energy and ancillary provided and do not receive capacity payments. This potentially reduces the value of the DRRs because the utility does not control the dispatch of the resource. DRRs are included in the must offer requirements of the SPP market, meaning that the company is required to offer all available resources into the market. The utility does retain some capability to self-commit the resource, but if there are a limited number of times we can call on a particular DR program and SPP has already utilized all those times, then we will have nothing left to use.

Finally, SPP does not recognize demand response as a resource equal to a generator in the capacity margin requirements. If the DRR does not get dispatched, the utility

does not realize a reduction in its peak demand and therefore does not avoid the capacity need. For the time being, it would appear that the company may have greater ability to control and manage its peak demand by self-dispatching its DRRs rather than submitting demand response offers into the SPP market. This will help to maximize the value of DRR by capturing the value of avoided capacity by reducing its overall system load from SPP's perspective. At the time of this writing, GMO is not aware of any registered DRRs in the SPP market. The company will continue to evaluate and monitor SPPs DR market options for the best way to maximize the value of DRRs.

4.7 DOCUMENT HOW ASSESMENTS WERE PERFORMED

(G)The utility shall describe and document how it performed the assessments and developed the estimates pursuant to subsection (4)(D) and shall document its sources and quality of information. —

GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG began with the *Demand-Side Resource Potential Study Report – Demand Response* completed by Navigant in August 2013. Navigant conducted the analysis using its DRSim™ model. The model is designed to identify the critical component variables of peak demand impact, avoided cost estimates, program administration and evaluation costs, one-time startup costs, any incentive costs, and the appropriate population of potential participants. Navigant mirrored the model's approach after the methodology that the Federal Energy Regulatory Commission used in its *National Assessment of Demand Response Potential,*[28] with a number of customizations added to specifically tailor the framework and inputs to KPC&L.

Navigant estimated the participant peak reduction as a percentage of the average load profile for that rate class. For Interruptible Tariffs and Direct Load Control, Navigant used actual 2012 peak demand reduction values from the GMO programs. Navigant conservatively assumed there were no significant energy savings. Demand-side rate resources referenced by Navigant include:

[28] Federal Energy Regulatory Commission, *A National Assessment of Demand Response Potential*. Prepared by The Brattle Group, June 2009.

- KEMA Consulting (March 4, 2011). Missouri Statewide DSM Potential Study – Final Report.
- Global Energy Partners (January 2010). AmerenUE Demand-side Management (DSM) market Potential Study, Volume 3.
- Electric Power Research Institute (October 2012). Understanding Electric Utility Customers – Summary Report. Report #1025856.
- Federal Energy Regulatory Commission (December 2012). 2012 Survey on Demand Response and Advanced Metering. Demand Response Survey Data.
- The Brattle Group (June 2009). A National Assessment of Demand Response Potential. Prepared for Federal Energy Regulatory Commission.
- The Brattle Group (June 2009). National Demand Response Potential Model Guide. Prepared for Federal Energy Regulatory Commission.

AEG updated the measure inputs to reflect GMO's 2014 Residential and Commercial Programmable Thermostat Programs. There are no energy savings currently assumed with the programs as designed, although studies are currently underway to evaluate this potential. The AC DLC Switch incremental cost is applied to new customers only for the purchase and installation of the programmable thermostat.

SECTION 5: DEMAND-SIDE PROGRAM COST EFFECTIVENESS

(5) The utility shall describe and document its evaluation of the cost effectiveness of each potential demand-side program developed pursuant to section (3) and each potential demand-side rate developed pursuant to section (4). All costs and benefits shall be expressed in nominal dollars. —

GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG began with the *Demand-Side Resource Potential Study Report* and the *Demand-Side Resource Potential Study Report – Demand Response* completed by Navigant in August 2013. Navigant developed a comprehensive measure list of 500 measures, 300 of which were characterized for the final model. Navigant employed a variety of analytical approaches to estimate measure-level energy savings and coincident peak demand savings, including standard engineering algorithms, calibrated simulation models, and secondary resources. AEG reviewed the end-use measures developed in the Navigant potential study and the measures in GMO's MEEIA portfolio. Based on research and industry best practices, AEG updated the measure inputs and added additional end-use measures to reflect changes in technology that have emerged since the potential study was completed.

AEG performed the industry standard cost-effectiveness tests to gauge the economic merits of the measures, programs and portfolio. Each test compares the benefits of a DSM program to its costs using its own unique perspectives and definitions. The definitions for the four standard tests most commonly used are described below.

- *Total Resource Cost Test (TRC).* The benefits include the lifetime avoided energy costs and avoided capacity costs while the costs include the participant and utility administrative costs associated with the program. The TRC test represents the combination of the effects of a program on both participating and non-participating customers.

- *Utility Cost Test (UCT).* The benefits include the lifetime avoided energy costs and avoided capacity costs while the costs include the utility's incentive and administrative costs.
- *Participant Cost Test (PCT).* The benefits include lost utility revenues (i.e. the lifetime value of retail rate savings). The costs include the participant incremental measure costs minus the value of incentives.
- *Rate Impact Measure Test (RIM).* The test measures what happens to customer's rates due to changes in utility revenues and operating costs. Therefore, if the benefits are greater than the costs, rates will decrease on average and subsidies will be minimized or avoided. The benefits are the same as the TRC benefits and the costs include all utility costs associated with the program, including lost utility revenue as well as incentive and administrative costs.

The software used to perform the cost-effectiveness has been adapted from Minnesota Office of Energy Security "BenCost" software and is consistent with the California Standard Practice Manual. The input data gathered for the model included:

Table 34. Cost-Effectiveness Model Inputs

General Inputs	Specific-Project Inputs
Retail Rate ($/kWh)	Utility Project Costs (Administrative & Incentives)
Commodity Cost ($/kWh)	Direct Participant Project Costs ($/Participant)
Demand Cost ($/kW-Year)	Project Life (Years)
Environmental Damage Cost ($/kWh)	kWh/Participant Saved (Net and Gross)
Discount Rate (%)	kW/Participant Saved (Net and Gross)
Growth Rate (%)	Number of Participants
Line Losses (%)	

Measures that were cost-effective on a stand-alone basis were bundled into programs and re-screened for cost-effectiveness. Except for the low-income programs, the DSM programs were designed to be cost-effective. Measures were bundled based on end-use and implementation.

Table 35. DSM Program Measure Offerings

Residential Programs	
Home Lighting Rebate	CFL and LED Bulbs
Appliance Recycling	Recycle inefficient refrigerators, freezers, dehumidifiers or room air conditioners.
Home Energy Report	Behavior program utilizing customized energy reports sent periodically to households.
Online Home Energy Audit	Online energy audit tool.
Whole House Efficiency	The program has three tiers. To participate in Tier 2, customers must complete Tier 1. – Tier 1. Audit and direct install of CFL/LED bulbs, low flow faucet aerators, low flow showerheads, hot water pipe insulation, water heater tank wrap, and smart power strips. – Tier 2. Air Sealing, Insulation (ceiling/wall) and ENERGY STAR Windows – Tier 3. HVAC Equipment – Heat Pump Water Heater – Efficient ECM Fan – Central Air Conditioners (SEER 15, 16) – Central Air Conditioner Early Retirement (SEER 15, 16) – Air Source Heat Pump (SEER 15, 16 and 17) – Air Source Heat Pump Early Retirement (SEER 15, 16) – Air Source Heat Pump Replace Electric Resistance Heat (SEER 15, 16)
Income-Eligible Multi-Family	The program is comprised of two tiers. – Tier 1. Home Kit (includes CFL/LED bulbs, low flow faucet aerators, low flow showerheads, hot water pipe insulation, water heater tank wrap, and smart power strip). – Tier 2. Common Area Lighting
Income-Eligible Weatherization	The program is comprised of two tiers. – Tier 1. Home Kit (includes CFL/LED bulbs, low flow faucet aerators, low flow showerheads, hot water pipe insulation, water heater tank wrap, and smart power strip). Tier 2. Weatherization (ceiling, duct or wall insulation)
Residential Programmable Thermostat	Direct load control program that cycles and curtails central air conditioners by way of a remote-controlled switch.
Commercial Programs	
Business Energy Efficiency Rebate – Standard	Customers may receive incentives by installing efficient measures from a pre-qualified list of options.
Business Energy Efficiency Rebate – Custom	Customers may receive incentives for non-prescriptive measures.
Strategic Energy Management	Provides energy education, technical assistance, and coaching for large commercial and industrial customers in order to drive behavioral change and transformation of the company culture.
Block Bidding	Purchase blocks of electricity savings representing reduced electric usage from eligible customers or third parties working with eligible customers.
Online Building Energy Audit	Online energy audit tool.
Small Business Direct Install	Small customers receive 70% of the full cost of qualifying measures.
Commercial Programmable Thermostat	Direct load control program that cycles and curtails central air conditioners by way of a remote-controlled switch.
Demand Response Incentive	Interruptible tariff program for customers that can reduce load by at least 25 kW during times of system peak congestion.

5.1 CUMULATIVE BENEFITS

(A) In each year of the planning horizon, the benefits of each potential demand-side program and each potential demand-side rate shall be calculated as the cumulative demand reduction multiplied by the avoided demand cost plus the cumulative energy savings multiplied by the avoided energy cost. These calculations shall be performed both with and without the avoided probable environmental costs. The utility shall describe and document the methods, data, and assumptions it used to develop the avoided costs. —

5.1.1 AVOIDED DEMAND COST

1. The utility avoided demand cost shall include the capacity cost of generation, transmission, and distribution facilities, adjusted to reflect reliability reserve margins and capacity losses on the transmission and distribution systems, or the corresponding market-based equivalents of those costs. The utility shall describe and document how it developed its avoided demand cost, and the capacity cost chosen shall be consistent throughout the triennial compliance filing. —

The calculation of avoided demand cost is provided in the table below.

Table 36. Avoided Demand Cost Development **Highly Confidential**

Technology Type	CT (F-Class)
Capital Cost Source	[redacted]
Net Capacity (MW)	
Capacity Factor	
Fixed O&M ($/kW-Yr)	
Var O&M ($/MWh)	
Technology Cost ($/kW)	
AFUDC	
Technology Cost w AFUDC	
Technology Capital (w AFUDC)	
Levelized FCR for construction projects	
Annual Technology Carrying Cost	
Transmission Cost ($/kW)	
Transmission Capital	
Transmission FCR	
Annual Transmission Carrying Cost	
Total Annual Carrying Cost	
Total Fixed O&M	
Total Variable O&M	
Total Fixed Cost Per Year	
Total Fixed Cost Per Year ($/MWh) {1}	
Ht Rt (Btu/KWh)	
Fuel Cost $/mmbtu	
Fuel Cost $/MWh	
All-In ($/MWh)	
All-in $/kW-year (2012$)	
Annual Inflation Rate	
All-In $/MWh (2015$)	
All-in $/kW-year (2015$)	

At the outset of the time horizon considered by the analysis, all avoided demand costs are set at $20 per kW to reflect the prevailing price of short-term capacity contracts available on the market. The avoided demand cost is then assumed to ramp up to $152.22 linearly over the intervening years. For this particular input of the DSM analysis, we assume the year in which capacity needs are anticipated for GMO is 2018, based on a holistic assessment of current and prior information. This, of course, is an output of the current IRP's multiple cases, but the above represents a reasonable, simplifying assumption based on the best available information in order to avoid

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circularity in the analysis. The corresponding values of avoided demand costs by year are provided in the table below.

Table 37. Avoided Demand Costs by Year **Highly Confidential**

Year	Capacity Cost ($/kW)
2016	[redacted]
2017	
2018	
2019	
2020	
2021	
2022	
2023	
2024	
2025	
2026	
2027	
2029	
2030	
2031	
2032	
2033	
2034	

5.1.2 AVOIDED ENERGY COST

2. The utility avoided energy cost shall include the fuel costs, emission allowance costs, and other variable operation and maintenance costs of generation facilities, adjusted to reflect energy losses on the transmission and distribution systems, or the corresponding market-based equivalents of those costs. The utility shall describe and document how it developed its avoided energy cost, and the energy costs shall be consistent throughout the triennial compliance filing. —

The avoided energy costs are market-based equivalents that account for all of these costs and are provided by the MIDAS Market Model. The corresponding values by year are provided in the table below.

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Table 38. Avoided Energy Costs by Year **Highly Confidential**

Year	Avoided Cost ($/MWh)
2016	[redacted]
2017	
2018	
2019	
2020	
2021	
2022	
2023	
2024	
2025	
2026	
2027	
2029	
2030	
2031	
2032	
2033	
2034	

5.1.3 AVOIDED ENVIRONMENTAL COST

3. The avoided probable environmental costs include the effects of the probable environmental costs calculated pursuant to 4 CSR 240-22.040(2)(B) on the utility avoided demand cost and the utility avoided energy cost. The utility shall describe and document how it developed its avoided probable environmental cost. —

The probable environmental costs were developed as described in the response to 4 CSR 240-22.040(2)(B) and included in the calculation of avoided energy costs.

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5.2 TOTAL RESOURCE COST TEST (TRC)

(B) The total resource cost test shall be used to evaluate the cost effectiveness of the potential demand-side programs and potential demand-side rates. In each year of the planning horizon —

5.2.1 DEMAND-SIDE PROGRAM COSTS

1. The costs of each potential demand-side program shall be calculated as the sum of all incremental costs of end-use measures that are implemented due to the program (including both utility and participant contributions) plus utility costs to administer, deliver, and evaluate each potential demand-side program; —

The TRC costs include the incremental participant cost and utility administrative costs associated with the program.

5.2.2 DEMAND-SIDE RATE COSTS

2. The costs of each potential demand-side rate shall be calculated as the sum of all incremental costs that are due to the rate (including both utility and participant contributions) plus utility costs to administer, deliver, and evaluate each potential demand-side rate; and —

The TRC costs include the incremental participant cost and the utility administrative costs associated with the program.

5.2.3 COSTS NOT TO INCLUDE

3. For purposes of this test, the costs of potential demand-side programs and potential demand-side rates shall not include lost revenues or utility incentive payments to customers. —

The TRC costs do not include lost revenues or incentive payments.

5.3 UTILITY COST TEST (UCT)

(C) The utility cost test shall also be performed for purposes of comparison. In each year of the planning horizon —

5.3.1 TEST COSTS

1. The costs of each potential demand-side program and potential demand-side rate shall be calculated as the sum of all utility incentive payments plus utility costs to administer, deliver, and evaluate each potential demand-side program or potential demand-side rate; —

The UCT costs include the utility's incentive and administrative costs.

5.3.2 COSTS NOT TO INCLUDE

2. For purposes of this test, the costs of potential demand-side programs and potential demand-side rates shall not include lost revenues; and —

The UCT costs do not include lost revenues.

5.3.3 RATE OF RETURN OR INCENTIVE COSTS

3. The costs shall include, but separately identify, the costs of any rate of return or incentive included in the utility's recovery of demand-side program costs. —

The analysis did not assume a rate of return or utility incentive.

5.4 TRC MUST BE GREATER THAN ONE

(D) The present value of program benefits minus the present value of program costs over the planning horizon must be positive or the ratio of annualized benefits to annualized costs must be greater than one (1) for a potential demand-side program or potential demand-side rate to pass the utility cost test or the total resource cost test. The utility may relax this criterion for programs that are judged to have potential benefits that are not captured by the estimated load

impacts or avoided costs, including programs required to comply with legal mandates. —

Except for the low-income programs, the DSM programs were designed to be cost-effective.

5.5 TRC AND UCT TEST RESULTS

(E) The utility shall provide results of the total resource cost test and the utility cost test for each potential demand-side program evaluated pursuant to subsection (5)(B) and for each potential demand–side rate evaluated pursuant to subsection (5)(C) of this rule, including a tabulation of the benefits (avoided costs), demand-side resource costs, and net benefits or costs. —

The TRC and UCT results for each potential DSM program and demand side rate are presented in the work paper "GMO IRP Filing Tables.xlsx."

5.6 OTHER COST BENEFIT TEST RESULTS

(F) If the utility calculates values for other tests to assist in the design of demand-side programs or demand-side rates, the utility shall describe and document the tests and provide the results of those tests. —

AEG also analyzed cost-effectiveness for the following two standard tests:

- *Participant Cost Test (PCT).* The benefits include lost utility revenues (i.e. the lifetime value of retail rate savings). The costs include the participant incremental measure costs minus the value of incentives.
- *Rate Impact Measure Test (RIM).* The test measures what happens to customer's rates due to changes in utility revenues and operating costs. Therefore, if the benefits are greater than the costs, rates will decrease on average and subsidies will be minimized or avoided. The benefits are the same as the TRC benefits and the costs include all utility costs associated with the

program, including lost utility revenue as well as incentive and administrative costs.

The PCT and RIM results for each potential DSM program and demand side rate are presented in the work paper "GMO IRP Filing Tables.xlsx."

5.7 DESCRIBE AND DOCUMENT COST EFFECTIVENESS TESTS

(G)The utility shall describe and document how it performed the cost effectiveness assessments pursuant to section (5) and shall describe and document its methods and its sources and quality of information. —

GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. AEG began with the *Demand-Side Resource Potential Study Report* and the *Demand-Side Resource Potential Study Report – Demand Response* completed by Navigant in August 2013. Navigant developed a comprehensive measure list of 500 measures, 300 of which were characterized for the final model. Navigant employed a variety of analytical approaches to estimate measure-level energy savings and coincident peak demand savings, including standard engineering algorithms, calibrated simulation models, and secondary resources.

AEG reviewed the end-use measures developed in the Navigant potential study and the measures in GMO's MEEIA portfolio. Based on research and industry best practices, AEG updated the measure inputs and added additional end-use measures to reflect changes in technology that have emerged since the potential study was completed.

In addition to the Navigant potential study, AEG gathered the end-use measure data from multiple sources including:

- Southwest Energy Efficiency Project (March 2013). Utility Strategic Energy Management Programs.
- United States Energy Information Administration. Form EIA-826. Monthly Electric Utility Sales and Revenue Report with State Distributions.

- State of Illinois. (2012). Energy Efficiency Technical Reference Manual.
- U.S. Department of Energy. Building Technologies Program: Residential Products.
- Michigan Public Service Commission (2013). Michigan Energy Measures Database. Prepared by Morgan Marketing Partners.
- Northeast Energy Efficiency Partnerships (June 2014). Mid-Atlantic Technical Reference Manual. Version 4. Prepared by Shelter Analytics.
- Navigant Consulting, Inc. (July 2014). GMO Evaluation, Measurement, & Verification Report – Final Draft. Program Year 2013. Highly Confidential. Prepared for GMO.
- The Cadmus Group, Inc. (August 2013). Nonresidential Block Bidding Program Evaluation Report. Prepared for New York State Electric & Gas and Rochester Gas and Electric Corporations.

The table below presents the source documentation by measure.

Table 39. DSM Measure Documentation

Sector	Measure	Source(s)
Residential	Screw In - CFLs	Illinois/Mid-Atlantic
Residential	Screw In - LEDs	Illinois/Mid-Atlantic
Residential	Low Flow Faucet Aerator	Navigant Potential Study
Residential	Low Flow Showerhead	Navigant Potential Study
Residential	AC DLC Switch	KCP&L Inputs
Residential	Air Conditioner	DOE/Illinois/Michigan
Residential	Air Sealing	Illinois/Michigan
Residential	Dehumidifier Recycle	Navigant Evaluation
Residential	Efficient ECM Fan	Illinois
Residential	ENERGY STAR Windows	Mid-Atlantic
Residential	Freezer Recycle	Navigant Evaluation
Residential	Heat Pump Ductless Mini Split	DOE/Energy Star/Illinois/Michigan
Residential	Heat Pump	DOE/Illinois/Michigan
Residential	Heat Pump Water Heater	Illinois
Residential	Home Energy Reports	Opower

Sector	Measure	Source(s)
Residential	Increased Ceiling Insulation	Illinois/Michigan
Residential	Increased Duct Insulation	Illinois/Michigan
Residential	Increased Wall Insulation	Illinois/Michigan
Residential	Pipe Insulated	Navigant Potential Study
Residential	Refrigerator Recycle	Navigant Evaluation
Residential	Room A/C Recycle	Navigant Evaluation
Residential	Smart Power Strip	Navigant Potential Study
Residential	Water Heater Tank Wrap	Navigant Potential Study
C&I	80 PLUS Power Supply Desktop Derived Server	Navigant Potential Study
C&I	AC DLC Switch	KCP&L Inputs
C&I	Air Source Heat Pump 65<135 kBtuh	Illinois/Mid-Atlantic/CEE
C&I	Block Bidding	NYSEG/RGE
C&I	Ceramic Metal Halide	Navigant Potential Study
C&I	Chilled/Hot Water Temp Reset	Navigant Potential Study
C&I	Comp Air	Navigant Potential Study
C&I	Curtailable Rate	KCP&L Inputs
C&I	Drive	Navigant Potential Study
C&I	Efficient Pumps/Fan	Navigant Potential Study
C&I	Efficient Transformers	Navigant Potential Study
C&I	ENERGY STAR Beverage Machine	Navigant Potential Study
C&I	Fans	Navigant Potential Study
C&I	Geothermal Heat Pump	Navigant Potential Study
C&I	Heat Pump Water Heater	Navigant Potential Study/Mid-Atlantic
C&I	High Bay T5	Navigant Potential Study
C&I	High Bay T8	Navigant Potential Study
C&I	High Efficiency PTAC/PTHP	Navigant Potential Study
C&I	High Efficiency Reach-In Refrigerator/Freezer	Navigant Potential Study
C&I	LED Display Lighting	Navigant Potential Study
C&I	LED Exit Sign (replace CFL)	Navigant Potential Study/Mid-Atlantic
C&I	LED Exit Sign (replace Incandescent)	Navigant Potential Study/Illinois
C&I	LED Linear Fluorescent	Navigant Potential Study/EIA
C&I	Low Flow Faucet Aerator	Navigant Potential Study
C&I	Make Up/Exhaust - Separate/Optimized	Navigant Potential Study
C&I	Occupancy Sensors	Illinois
C&I	Pipe Wrap/Insulation	Navigant Potential Study
C&I	Pool Pump	Navigant Potential Study
C&I	Premium T8 Linear Fluorescent	Navigant Potential Study
C&I	Pre-Rinse Spray Valves	Illinois
C&I	Programmable Thermostat Controls	Navigant Potential Study
C&I	Pumps	Navigant Potential Study
C&I	Reduced Lighting Power Density	Navigant Potential Study

Sector	Measure	Source(s)
C&I	Screw In - CFLs	Navigant Potential Study
C&I	Screw In - LEDs	Navigant Potential Study
C&I	Strategic Energy Management	SWEEP/EIA
C&I	Strip Curtains	Navigant Potential Study
C&I	T8 Linear Fluorescent with Reflector/Delamping	Navigant Potential Study
C&I	VSD Compressor	Navigant Potential Study
C&I	VSD Pumps/Fan	Navigant Potential Study
C&I	Water Heater - Heat Recovery	Navigant Potential Study

The demand and energy reduction impacts of each end-use measure included in the additional DSM portfolio (Option C) are presented below.

Residential Measures

In 2007, the United States Congress passed the Energy Independence and Security Act (EISA) which set efficiency standards for 'general service' light bulbs, implemented in two phases. From 2012 to 2014, standard light bulbs manufactured were be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. By 2020, there must be a 60 percent reduction in light bulb energy use.[29] The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock.

Table 40. Residential Lighting Measures

Measure	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
CFL pre-2020	5	28	0.003	$1.70
CFL 2020	5	6	0.001	$1.00
LED pre-2020	20	31	0.003	$15.00
LED 2020	20	9	0.001	$10.00

GMO proposes to offer measures to multi-family and single family customers. The energy and demand savings vary for low-flow faucet aerator or hot water pipe insulation depending on whether the customer resides in a multi-family or single family residence.

[29] See Database of State Incentives for Renewables & Efficiency (DSIRE). *Federal Appliance Standards*. Available at: www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US04R&re=1&ee=1

Table 41. Residential Low-Flow Faucet Aerator & Pipe Insulation

Measure	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
Faucet Aerator – Multi-Family	9	42	0.005	$3
Family	9	65	0.010	$3
Pipe Insulated – Multi-Family	10	236	0.017	$15
Pipe Insulated – Single Family	10	273	0.024	$15

The remaining residential measure inputs are presented in the table below.

Table 42. Residential Measures

Measure	Unit	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
A/C SEER 15	per ton	18	69	0.016	$93
A/C SEER 15, Early Retirement	per ton	6	486	0.234	$642
A/C SEER 16	per ton	18	130	0.016	$185
A/C SEER 16, Early Retirement	per ton	6	547	0.234	$642
A/C SEER 17	per ton	18	184	0.041	$278
A/C SEER 17, Early Retirement	per ton	6	600	0.259	$642
Air Sealing	per sq. ft.	15	0	0.000	$0.12
Dehumidifier Recycle	per unit	4	139	0.035	$49
Efficient ECM Fan	per unit	20	644	0.360	$97
ENERGY STAR Windows	per sq. ft.	25	2	0.001	$1.50
Freezer Recycle	per unit	8	1,201	0.191	$93
Heat Pump Ductless Mini Split	per ton	18	1,285	0.817	$716
HP SEER 15	per ton	18	173	0.054	$98
HP SEER 15, Early Retirement	per ton	6	1,195	0.502	$729
HP SEER 15, Replace Electric Resistance Heat	per ton	6	4,838	1.765	$729
HP SEER 16	per ton	18	234	0.054	$196
HP SEER 16, Early Retirement	per ton	6	1,256	0.502	$729
HP SEER 16, Replace Electric Resistance Heat	per ton	6	4,891	1.765	$729
HP SEER 17	per ton	18	321	0.093	$294
HP SEER 17, Early Retirement	per ton	6	1,342	0.540	$729
Heat Pump Water Heater	per unit	13	1,766	0.084	$1,000
Home Energy Reports	per home	1	145	0.028	$0
Increased Ceiling Insulation	per sq. ft.	25	1	0.000	$0.76
Increased Duct Insulation	per home	20	210	0.118	$720
Increased Wall Insulation	per sq. ft.	25	1	0.000	$1.32
Pipe Insulated	per unit	15	74	0.008	$2.81
Refrigerator Recycle	per unit	8	1,190	0.190	$93
Room A/C Recycle	per unit	4	121	0.114	$49
Smart Power Strip	per unit	5	74	0.005	$15
Water Heater Tank Wrap	per unit	5	131	0.015	$18

C&I End-Use Measures

In 2007, the United States Congress passed EISA which set efficiency standards for 'general service' light bulbs, implemented in two phases. From 2012 to 2014, standard light bulbs manufactured were be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. By 2020, there must be a 60 percent reduction in light bulb energy use. The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock.

Table 43. C&I Lighting Measures

Measure	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
CFL pre-2020	5	188	0.006	$3.30
CFL 2020	5	82	0.003	$1.00
LED pre-2020	20	200	0.006	$25
LED 2020	20	94	0.003	$39

The remaining C&I measures are presented in the table below.

Table 44. C&I Measures

Efficient Description	Unit	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
80 PLUS Power Supply Desktop Derived Server	per unit	5	334	0.038	$2
AC DLC Switch	per unit	10	-	1.000	$0
Air Source Heat Pump 65<135 kBtuh	per ton	15	91	0.124	$100
Air Sourced Air Conditioner <65 kBtuh	per ton	15	82	0.066	$120
Air Sourced Air Conditioner >240 kBtuh	per ton	15	71	0.057	$100
Air Sourced Air Conditioner 135<240 kBtuh	per ton	15	81	0.065	$100
Air Sourced Air Conditioner 65<135 kBtuh	per ton	15	57	0.046	$100
Block Bidding	per Bid	10	2,514,850	436	$496,331
Ceramic Metal Halide (replace HID HPS)	per unit	15	712	0.024	$104
Ceramic Metal Halide (replace HID MH)	per unit	15	697	0.023	$106
Chilled/Hot Water Temp Reset	per ton	5	82	0.003	$2.06
Comp Air - ASD (100+ HP)	per HP	6	693	0.167	$132
Comp Air - ASD (1-5 HP)	per HP	14	693	0.167	$385
Comp Air - ASD (6-100 HP)	per HP	10	693	0.167	$147
Comp Air - Controls	per HP	10	454	0.160	$20
Comp Air - Dryer Cycling	per HP	10	47	0.011	$11
Comp Air - Eliminate In-Efficient Uses	per HP	8	333	0.080	$67
Comp Air - Leaks Repaired	per HP	10	666	0.160	$133
Comp Air - Motor Practices (100+ HP)	per HP	6	56	0.010	$7.86
Comp Air - Motor Practices (1-5 HP)	per HP	14	180	0.034	$79
Comp Air - Motor Practices (6-100 HP)	per HP	10	90	0.017	$20
Comp Air - No Loss Drains	per HP	5	13	0.003	$3
Comp Air - Pressure Reduction	per HP	6	100	0.024	$1
Comp Air - Replace Motor (100+ HP)	per HP	15	31	0.007	$8
Comp Air - Replace Motor (6-100 HP)	per HP	15	46	0.011	$8
Comp Air - Sizing	per HP	10	100	0.024	$15
Comp Air - Storage/Air Receivers	per HP	10	292	0.070	$20
Curtailable Rate	per kW	1	-	1.000	$1
Drive - Custom	per HP	15	29	0.006	$10

Efficient Description	Unit	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
Drive - Direct Drive	per HP	15	146	0.031	$25
Drive - VFD (Other)	per HP	15	512	0.082	$355
Efficient Pumps/Fan	per HP	15	3	0.002	$1.77
Efficient Transformers	per kVA	25	14	0.002	$2.06
ENERGY STAR Beverage Machine	per unit	14	1754	0.116	$140
Fans - ASD (100+ HP)	per HP	15	948	0.147	$133
Fans - ASD (1-5 HP)	per HP	15	1037	0.161	$460
Fans - ASD (6-100 HP)	per HP	15	973	0	$155
Fans - Controls	per HP	15	57	0.012	$20
Fans - Improve Components	per HP	15	142	0.030	$49
Fans - Motor Practices (100+ HP)	per HP	15	62	0.013	$21
Fans - Motor Practices (1-5 HP)	per HP	15	67	0.014	$23
Fans - Motor Practices (6-100 HP)	per HP	15	63	0.013	$22
Fans - Power Recovery	per HP	15	283	0.060	$98
Fans - System Optimization	per HP	15	283	0.060	$98
Geothermal Heat Pump	per ton	15	443	0.781	$379
Heat Pump Water Heater	per unit	10	1993	0.298	$925
High Bay T5 (replace HID HPS)	per unit	15	443	0.032	$104
High Bay T5 (replace HID MH)	per unit	15	390	0.028	$102
High Bay T8 (replace HID HPS)	per unit	15	325	0.023	$100
High Efficiency PTAC/PTHP	per kBtuh	15	30	0.012	$12
High Efficiency Reach-In Refrigerator/Freezer	per unit	12	3026	0.129	$263
LED Display Lighting	per unit	8	731	0.071	$256
LED Exit Sign (replace CFL)	per unit	13	65	0.008	$23
LED Exit Sign (replace Incandescent)	per unit	13	258	0.031	$30
LED Linear Fluorescent	per unit	15	225	0.062	$45
Low Flow Faucet Aerator	per unit	9	131	0.196	$8.35
Make Up/Exhaust - Separate/Optimized	per HP	15	568	0.285	$116
Occupancy Sensors	per Watt	8	2	0.001	$0.12
Pipe Wrap/Insulation	per unit	6	224	0.278	$47
Pool Pump - High Efficiency	per unit	10	1301	0.149	$273
Pool Pump - VSD	per unit	10	2461	0.281	$579
Premium T8 Linear Fluorescent	per unit	15	55	0.004	$10
Pre-Rinse Spray Valves	per unit	5	2671	-	$100
Programmable Thermostat Controls	per ton	8	126	-	$6
Pumps - ASD (100+ HP)	per HP	15	1002	0.085	$133
Pumps - ASD (1-5 HP)	per HP	15	1096	0.092	$460
Pumps - ASD (6-100 HP)	per HP	15	1028	0.087	$155
Pumps - Controls	per HP	15	239	0.062	$85
Pumps - Motor Practices (100+ HP)	per HP	15	87	0.022	$31
Pumps - Motor Practices (1-5 HP)	per HP	15	95	0.024	$34

Efficient Description	Unit	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
Pumps - Motor Practices (6-100 HP)	per HP	15	89	0.023	$32
Pumps - Power Recovery	per HP	15	227	0.059	$81
Pumps - Replace Motor (1-5 HP)	per HP	15	33	0.008	$19
Pumps - Sizing	per HP	15	162	0.042	$58
Reduced Lighting Power Density	per sq. ft.	13	0.46	0.000	$0.14
Screw In - CFLs	per unit	5	188	0.006	$3.33
Screw In - LEDs	per unit	25	200	0.006	$25
Strategic Energy Management	per Customer	3	150,454	34	$3,009
Strip Curtains	per sq. ft.	6	129	0.015	$10
T8 Linear Fluorescent with Reflector/Delamping	per unit	15	67	0.005	$8
VSD Compressor	per HP	10	234	0.038	$78
VSD Pumps/Fan	per HP	15	478	0.145	$305
Water Heater - Heat Recovery from Air Source HP	per unit	18	1923	0.133	$900
Water Heater - Heat Recovery from Geothermal HP	per unit	18	1923	0.127	$900

AEG performed the industry standard cost-effectiveness tests in order to gauge the economic merits of the measures, programs and portfolio. Each test compares the benefits of a DSM program to its costs using its own unique perspectives and definitions. The definitions for the four standard tests most commonly used are described below.

- *TRC*. The benefits include the lifetime avoided energy costs and avoided capacity costs while the costs include the participant and utility administrative costs associated with the program. The TRC test represents the combination of the effects of a program on both participating and non-participating customers.

- *UCT*. The benefits include the lifetime avoided energy costs and avoided capacity costs while the costs include the utility's incentive and administrative costs.

- *PCT*. The benefits include lost utility revenues (i.e. the lifetime value of retail rate savings). The costs include the participant incremental measure costs minus the value of incentives.

- *RIM*. The test measures what happens to customer's rates due to changes in utility revenues and operating costs. Therefore, if the benefits are greater than

the costs, rates will decrease on average and subsidies will be minimized or avoided. The benefits are the same as the TRC benefits and the costs include all utility costs associated with the program, including lost utility revenue as well as incentive and administrative costs.

The software used to perform the cost-effectiveness has been adapted from Minnesota Office of Energy Security "BenCost" software and is consistent with the California Standard Practice Manual. The input data gathered for the model included:

Table 45. Cost-Effectiveness Model Inputs

General Inputs	Specific-Project Inputs
Retail Rate ($/kWh)	Utility Project Costs (Administrative & Incentives)
Commodity Cost ($/kWh)	Direct Participant Project Costs ($/Participant)
Demand Cost ($/kW-Year)	Project Life (Years)
Environmental Damage Cost ($/kWh)	kWh/Participant Saved (Net and Gross)
Discount Rate (%)	kW/Participant Saved (Net and Gross)
Growth Rate (%)	Number of Participants
Line Losses (%)	

Measures that were cost-effective on a stand-alone basis were bundled into programs and re-screened for cost-effectiveness. Except for the low-income programs, the programs were designed to be cost-effective. Measures were bundled based on the end-use, sector and implementation.

SECTION 6: TOTAL RESOURCE COST TEST

(6) Potential demand-side programs and potential demand-side rates that pass the total resource cost test including probable environmental costs shall be considered as demand side candidate resource options and must be included in at least one (1) alternative resource plan developed pursuant to 4 CSR 240-22.060(3). —

Potential demand-side programs and demand-side rates that passed the total resource cost test (a benefit-cost ratio of at least 1.0) were considered as a demand-side candidate resource option.

6.1 BUNDLING OF PORTFOLIOS

(A) The utility may bundle demand-side candidate resource options into portfolios, as long as the requirements pursuant to section (1) are met and as long as multiple demand side candidate resource options and portfolios advance for consideration in the integrated resource analysis in 4 CSR 240-22.060. The utility shall describe and document how its demand-side candidate resource options and portfolios satisfy these requirements. —

GMO engaged Navigant to conduct a DSM Resource Potential Study and AEG to design an additional DSM portfolio (Option C) for the GMO service territory.

Navigant developed a set of efficiency programs designed to deliver the savings in the realistic achievable potential scenario. While the potential model is run at the level of the measure and customer segment, Navigant mapped measures and customer segments to programs, thereby allocating the realistic achievable potential to a suite of efficiency programs. The potential model is therefore effectively an integrated potential and program design model, as the results are internally consistent.

AEG took a number of steps to prepare Option C, these included:

Review Existing DSM Portfolio. AEG reviewed the existing DSM portfolio and held two collaborative DSM program design workshops with GMO program managers and staff to discuss the program design process and gain insight into the existing DSM programs. The insights included, but were not limited to, the following:

- How are the programs implemented? What program modifications are anticipated for 2015?
- What is working well? What is not working well? What is missing?

- How well are the current programs suited to address the portfolio objectives?
- What are the implications of the potential study on existing programs?

Review DSM Potential Study . AEG reviewed the *Demand-Side Resource Potential Study Report* and the *Demand-Side Resource Potential Study Report – Demand Response* completed by Navigant Consulting, Inc. in August 2013. AEG compared the existing GMO portfolios with the potential study and best practice programs from industry research, primarily using information from utilities that are similar in size and customer composition as GMO. At this stage, AEG updated measure inputs and incorporated additional measures on an as-needed basis to reflect more recent program developments, evaluations, and new technology developments.

Review Stakeholder Input and Regulatory Requirements. AEG reviewed GMO stakeholder input on the DSM programs provided through written comments and prior collaborative workshops. Similarly, AEG reviewed reporting and filing requirements. AEG attempted to design the portfolio and programs in such a way to address and satisfy all of these concerns.

AEG screened the measures identified. Measures that were cost-effective on a stand-alone basis were bundled into programs and re-screened for cost-effectiveness. Except for the low-income programs, the programs were designed to be cost-effective. Measures were bundled based on end-use, sector and implementation while considering stakeholder input and regulatory requirements.

6.2 LOAD IMPACT ESTIMATES

(B) For each demand-side candidate resource option or portfolio, the utility shall describe and document the time-differentiated load impact estimates over the planning horizon at the level of detail required by the supply system simulation model that is used in the integrated resource analysis, including a tabulation of the estimated annual change in energy usage and in diversified demand for each year in the planning horizon due to the implementation of the candidate demand-side resource option or portfolio. —

GMO engaged Navigant to conduct a DSM Resource Potential Study and AEG to design an additional DSM portfolio (Option C) for the GMO service territory.

Navigant developed a comprehensive measure list through a review of potential studies, technical reference manuals, and demand-side management program evaluations as well as regional and national sources. Navigant employed a variety of analytical approaches to estimate annual energy savings and coincident peak demand savings for each measure including: engineering algorithms, building energy computer simulation models, and secondary resources. The measure characterization values are aligned with national codes and standards assumptions for 2013. To accurately assess future impacts and cost effectiveness from these measures, both the energy/demand and costs of certain measures must be adjusted to account for codes and standards changes. Navigant identified the following measures as affected by future codes and standards: The adjustments to the baseline and efficient annual energy and demand savings as well as costs can be found in Appendix 5A Navigant Demand Side Resource Potential Study Report.

AEG updated measure inputs and incorporated additional measures on an as-needed basis to reflect more recent program developments, evaluations, and new technology developments. Measure assumptions were updated to reflect the most recent national codes and standards.

Lighting measures will experience a federal code change in 2020. In 2007, the United States Congress passed the Energy Independence and Security Act (EISA) which set efficiency standards for 'general service' light bulbs, implemented in two phases. From 2012 to 2014, standard light bulbs manufactured were be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. By 2020, there must be a 60 percent reduction in light bulb energy use.[30] The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock.

[30] See Database of State Incentives for Renewables & Efficiency (DSIRE). *Federal Appliance Standards*. Available at: www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US04R&re=1&ee=1

Table 46. Residential Lighting Measures

Measure	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
CFL pre-2020	5	28	0.003	$1.70
CFL 2020	5	6	0.001	$1.00
LED pre-2020	20	31	0.003	$15
LED 2020	20	9	0.001	$10

Table 47. C&I Lighting Measures

Measure	Measure Life	Gross kWh Savings	Gross kW Savings	Incremental Cost
CFL pre-2020	5	188	0.006	$3.30
CFL 2020	5	82	0.003	$1.00
LED pre-2020	20	200	0.006	$25
LED 2020	20	94	0.003	$39

6.3 UNCERTAINTY OF LOAD IMPACT ESTIMATES

(C) The utility shall describe and document its assessment of the potential uncertainty associated with the load impact estimates of the demand-side candidate resource options or portfolios. The utility shall estimate —

1. The impact of the uncertainty concerning the customer participation levels by estimating and comparing the maximum achievable potential and realistic achievable potential of each demand-side candidate resource option or portfolio; and —

The potential uncertainty associated with the load impact estimates of the demand-side candidate resource options was accounted for with the 5 scenarios developed by Navigant.

The achievable potential estimates consider market acceptance, technology turn-over and diffusion of technology awareness and product adoption. The only difference between the scenarios is the assumed measure incentive.

- *Maximum Achievable Potential (MAP)*: incentive levels are set at 100% of the incremental cost of the measure. The scenario maximizes savings achieved, but also results in a portfolio cost that far exceeds that typically encountered in efficiency programs for a given level of energy saved.
- *Realistic Achievable Potential (RAP)*: incentive levels are set based upon the efficiency supply curve by limiting the maximum $/kWh paid (calculated on a levelized cost basis) for any given measure.

Additionally, GMO engaged AEG to design an additional DSM portfolio (Option C) for the GMO service territory. After a review of GMO's existing programs and the Navigant potential study and industry research as well as workshops with GMO program managers and staff, AEG updated measure inputs and incorporated additional measures on an as-needed basis to reflect more recent program developments, evaluations, and new technology developments. With the existing GMO DSM programs and the Navigant potential study as a starting point, the programs were modified to enhance their performance and incorporate the updated measure characteristics. AEG performed the industry standard cost-effectiveness tests in order to gauge the economic merits of the measures, programs and portfolio. The end-use measures most likely to achieve cost-effective savings were then selected and bundled into programs. GMO also developed a fourth DSM scenario (Option E) that includes the same DSM levels as Option C for 2016-2018 and then transitions quickly to the adjusted Potential Study RAP level annual impacts for 2019-2034.

2. The impact of uncertainty concerning the cost effectiveness by identifying uncertain factors affecting which end-use resources are cost effective. The utility shall identify how the menu of cost-effective end-use measures changes with these uncertain factors and shall estimate how these changes affect the load impact estimates associated with the demand-side candidate resource options. —

In the Navigant potential study report, the reported energy and demand savings did not account for the roll-off of measures at the end of the measures' life nor did it factor in the opt-out of commercial and industrial customers. At GMO's request, Navigant

provided additional spreadsheets that take measure roll-off into account. GMO then used the new energy and demand savings and factored in an estimated 15% opt-out of commercial and industrial customers. In addition, GMO adjusted the Navigant potential study RAP and MAP scenarios to match the time period needed for the IRP. The potential study included the years 2014 through 2033. GMO already has existing programs through 2015. Thus, the effects of programs in 2014 and 2015 were removed and the savings were extended to 2034. The impacts of these adjustments are shown in Table 48, Table 49, and Table 50. These calculations and adjustments can be found in the GMO workpapers[31].

The tables below present the cumulative energy and demand savings for the combined energy efficiency and demand response programs for the adjusted Navigant MAP and RAP scenarios as well as Option C and Option E.[32]

[31] GMO IRP Output - Maximum, FINAL - Program Totals IRP HC.xlsx, GMO IRP Output - Realistic, FINAL - Program Totals IRP HC.xlsx

[32] The Navigant potential study runs from 2014 through 2033. The AEG additional DSM portfolio runs from 2016 through 2034.

Table 48. Cumulative Energy Savings Potential (MWh) – GMO[33]

Year	Option C	Option E	RAP	MAP
2016	67,893	67,893	122,662	150,012
2017	120,614	120,614	263,509	326,990
2018	170,903	170,903	414,286	519,842
2019	217,205	257,293	544,941	696,541
2020	253,004	356,179	678,816	876,877
2021	279,655	465,701	810,173	1,053,877
2022	305,186	582,825	932,894	1,220,960
2023	331,849	701,185	1,046,344	1,376,114
2024	357,485	806,317	1,143,970	1,515,351
2025	396,482	903,724	1,232,988	1,644,978
2026	428,112	994,465	1,313,448	1,765,078
2027	461,371	1,071,166	1,379,974	1,864,516
2028	495,063	1,141,761	1,440,144	1,956,609
2029	529,765	1,195,111	1,482,956	2,026,476
2030	566,062	1,235,872	1,513,138	2,078,292
2031	591,767	1,267,762	1,535,297	2,117,443
2032	619,058	1,291,132	1,549,558	2,144,029
2033	647,573	1,310,001	1,560,146	2,163,508
2034	675,265	1,327,858	1,570,733	2,182,987

[33] Note that the RAP and MAP estimates reflect the adjustments for measure roll-off, commercial and industrial opt-outs, and the shift in the time period to meet the IRP needs.[34] Note that the RAP and MAP estimates reflect the adjustments for measure roll-off, commercial and industrial opt-outs, and the shift in the time period to meet the IRP needs. [35] Note that the RAP and MAP estimates reflect the adjustments for measure roll-off, commercial and industrial opt-outs, and the shift in the time period to meet the IRP needs.

Table 49. Cumulative Peak Demand Potential (MW) – GMO[34]

Year	Option C	Option E	RAP	MAP
2016	47	47	59	77
2017	85	85	122	160
2018	108	108	188	274
2019	116	142	252	385
2020	143	194	314	493
2021	164	246	374	597
2022	179	300	431	698
2023	188	353	484	794
2024	194	405	533	886
2025	201	429	552	940
2026	207	450	568	993
2027	213	471	584	1,045
2028	220	491	598	1,066
2029	227	509	612	1,091
2030	234	525	623	1,112
2031	239	540	633	1,133
2032	244	555	644	1,153
2033	250	568	654	1,172
2034	255	582	654	1,174

[34] Note that the RAP and MAP estimates reflect the adjustments for measure roll-off, commercial and industrial opt-outs, and the shift in the time period to meet the IRP needs. [35] Note that the RAP and MAP estimates reflect the adjustments for measure roll-off, commercial and industrial opt-outs, and the shift in the time period to meet the IRP needs.

Table 50. Cumulative Budget – GMO **Highly Confidential**[35]

Year	Option C	Option E	RAP	MAP
2016				
2017				
2018				
2019				
2020				
2021				
2022				
2023				
2024				
2025				
2026				
2027				
2028				
2029				
2030				
2031				
2032				
2033				
2034				

[35] Note that the RAP and MAP estimates reflect the adjustments for measure roll-off, commercial and industrial opt-outs, and the shift in the time period to meet the IRP needs.

HC

SECTION 7: DEVELOPMENT OF EVALUATION PLANS

(7) For each demand-side candidate resource option identified in section (6), the utility shall describe and document the general principles it will use to develop evaluation plans pursuant to 4 CSR 240-22.070(8). The utility shall verify that the evaluation costs in subsections (5)(B) and (5)(C) are appropriate and commensurate with these evaluation plans and principles. —

Program evaluation supports the need for public accountability, oversight, validation of program performance and cost-effective program improvements. The performance of DSM portfolios in regulated jurisdictions is almost universally evaluated by third-party independent contractors. GMO has designated approximately 5% of its portfolio budget for Evaluation, Measurement and Verification (EM&V) activities.

GMO will engage an EM&V contractor(s) to conduct process and impact evaluations of the DSM programs. The EM&V Contractor will meet with GMO program staff to discuss evaluation objectives, establish a schedule of deliverables and set up a communications protocol. The EM&V Contractor will develop a high level timeline of evaluation strategies and objectives.

Process Evaluations

Process evaluations ensure that a program is operating as intended and provides information that can enable improvements in both the program design and implementation. Process evaluations are typically conducted within six months to a year from a program's implementation.

A good process evaluation will:

- Assist KPC&L staff and implementation contractors structure programs to achieve cost-effective savings while maintaining high levels of customer satisfaction.
- Determine awareness levels to refine marketing strategies and reduce barriers to participation.

- Provide recommendations for changing the program's structure, management, administration, design, delivery, operations or targets.
- Determine if specific best practices should be incorporated.

Process evaluations assess customer understanding, attitudes about, and satisfaction with the program and other educational activities. The EM&V contractor will assess the effectiveness of the marketing and outreach, trade ally involvement, and whether implementation milestones are met adequately and on schedule. These evaluations will use sales and promotion data maintained by the tracking system as well as customer survey data.

Evaluation Plans

The EM&V Contractor will develop evaluation plans for each program, identifying the program objectives, key researchable issues, data collection requirements, sampling plan, budget and timeline. The sampling plan will describe the sample design, interview methodology and stratification. The interview methodology will range depending on the market actor being interviewed, from on-site interviews, in-depth interviews or telephone interviews. The EM&V Contractor will identify key market actors, such as GMO staff, third-party implementation contractors, participation trade allies, and participation customers. The sample size of each group will be calculated at a 90% confidence interval with an error margin of +/- 10%. GMO will review and approve the evaluation plans and subsequent data collection instruments.

Document Review

The EM&V Contractor will collect program materials, including, but not limited to, process flowcharts, third-party implementation contractor agreements (redacted as necessary), trade ally agreements, rebate applications, and marketing and outreach materials.

The EM&V Contractor will also evaluate the program tracking system(s), including initial data validation (application processing, measure and savings capture and validation, audit trail, and system location), security, and data granularity (types of data being

captured, QA/QC processes, data thresholds and back-up data capture, refresh rate and automated validations).

Market Actor Interviews

Interviews with key market actors will focus on understanding the program history and objectives as well as program implementation, including, but not limited to:

- Marketing and outreach activities
- Third-party implementation contractor responsibilities and management, if applicable
- Customer acquisition and participation process
- Trade Ally participation
- Rebate application processing
- Program tracking and reporting

Interview questions will be based on portfolio- and program-level activities and achievements to identify process improvements to improve program efficiency.

Customer Surveys

Participating customer surveys will seek to understand the customer experience with the program and awareness of the KPC&L portfolio. The surveys will identify barriers to participation, spillover, and areas of improvement.

Trade Ally Surveys/Interviews

Trade allies will be asked about clarity of program rules, support from KPC&L staff and/or third-party implementation contractor, marketing efforts, and rebate applications. The surveys/interviews will identify barriers to participation, free-ridership, spillover, and opportunities to improve program processes.

Non-Participating Customer and Trade Ally Interviews/Surveys

Where appropriate, interviews with non-participating customers and trade allies will be conducted to better understand the free ridership, spillover, barriers to participation and marketing messages.

Impact Evaluations

Impact evaluations estimate gross and net demand, energy savings and the cost-effectiveness of installed systems. They are used to verify measure installations, identify key energy assumptions and provide the research necessary to calculate defensible and accurate savings attributable to the program. Impact evaluations are typically conducted one year after the program is implemented because program results may not be accessible or apparent before then.

The EM&V Contractor will develop evaluation plans that ensure the appropriate measurement of savings in compliance with the appropriate International Performance Measurement and Verification Protocol as well as the State of Missouri EM&V protocols. The evaluation will verify measure installations and identify key assumptions for equipment life, incremental equipment cost, free ridership and spillover. The evaluation will also provide the necessary research to calculate defensible and accurate savings attributable to the program.

The EM&V Contractor will evaluate program cost-effectiveness using the standard tests including Total Resource Cost, Societal Cost Test, Participant Test, Utility Test and Rate Impact Measure Test.

SECTION 8: DEMAND-SIDE RESOURCES AND LOAD-BUILDING PROGRAMS

(8) Demand-side resources and load-building programs shall be separately designed and administered, and all costs shall be separately classified to permit a clear distinction between demand-side resource costs and the costs of load-building programs. The costs of demand-side resource development that also serve other functions shall be allocated between the functions served. —

GMO did not include load-building programs.