Advanced Metering Infrastructure (AMI)

Cost / Benefit Analysis

March 30, 2012

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1. Executive Summary

This document expands on the AMI Plan for Ameren Illinois Corporation (Ameren Illinois) to implement cost-beneficial advanced metering infrastructure (AMI). These pages describe how Ameren Illinois evaluated and prioritized technologies to create value for our customers, our company, and the State of Illinois via AMI.

To develop the cost/benefit analysis for the AMI deployment, Ameren Illinois used the guiding principles outlined in Section 16-108.6(a) of the Illinois Public Utilities Act which provides as follows:

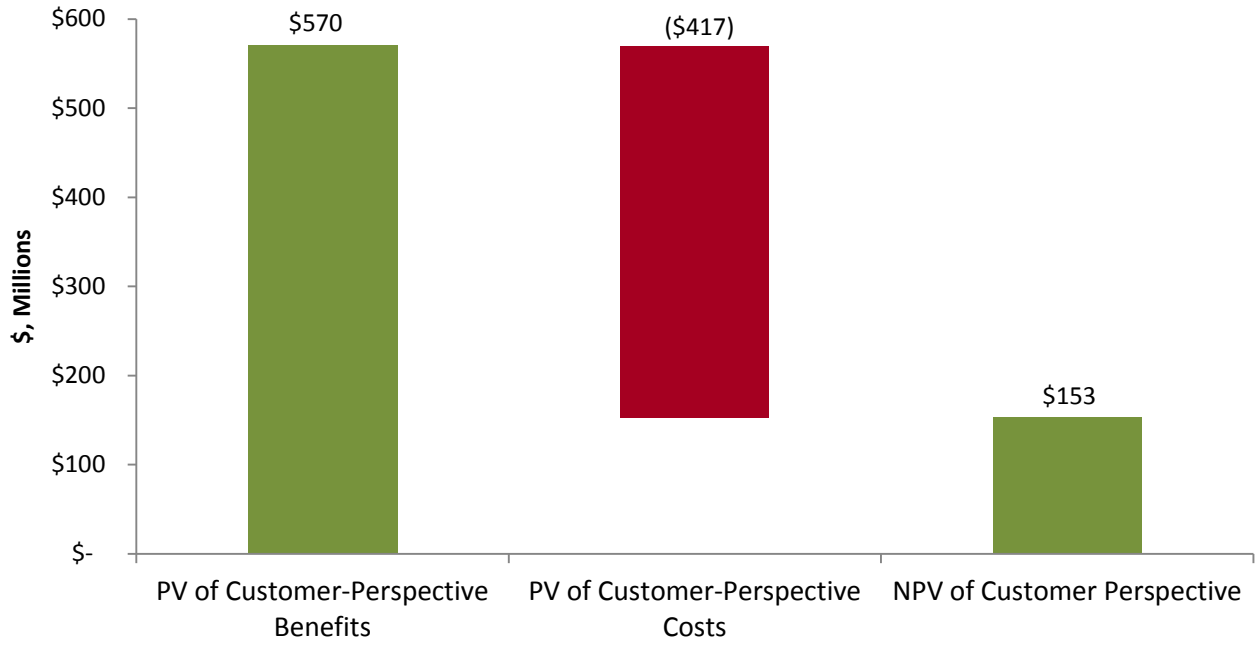
> "Cost beneficial" means a determination that the benefits of a participating utility's Smart Grid AMI Deployment Plan exceed the costs of the Smart Grid AMI Deployment plan as initially filed with the Commission or as subsequently modified by the modified by the Commission. This standard is met if the present value of the total benefits of the Smart Grid AMI Deployment Plan exceeds the present value of the total costs of the Smart Grid AMI Deployment Plan. The total cost shall include all utility costs reasonably associated with the Smart Grid AMI Deployment Plan. The total benefits shall include the sum of avoided electricity costs, including avoided utility operational costs, avoided consumer power, capacity, and energy costs, and avoided societal costs associated with the production and consumption of electricity, as well as other societal benefits, including the greater integration of renewable and distributed power sources, reductions in the emissions of harmful pollutants and associated avoided health-related costs, other benefits associated with energy efficiency measures, demand-response activities, and the enabling of greater penetration of alternative fuel vehicles."

As support for the AMI Plan, Ameren Illinois has developed a cost/benefit analysis of implementing AMI within the Ameren Illinois service territory. In conducting this evaluation, the project team worked closely with business managers over an 8-month period (August 2011 – March 2012) to refine the scope of the AMI investment, research industry AMI initiatives, develop operational data and projections, identify and resolve key business case formation questions, and construct the AMI business case. Figure 1 summarizes the specific benefits of this implementation.

Figure 1: AMI Implementation Benefits Summary

The overall results of the evaluation are positive. Taking into account all costs and benefits, and assuming adjustments to customer rates, the Net Present Value (NPV) is $153 million over the 20-year cost/benefit evaluation term (including terminal value) as seen in Figure 2. This is the value of the AMI program to Ameren Illinois customers. This does not include other indirect societal benefits of AMI outlined subsequently in this evaluation.

Figure 2: NPV of Ameren Illinois AMI Business Case Summary



On the cost side, Ameren Illinois will incur new costs for AMI meters and communications infrastructure, IT systems, implementation services, and on-going operational expenses. During the 20-year evaluation period, Ameren Illinois expects the Present Value total cost of ownership to reach $417 million.

The Present Value of benefits over the 20-year evaluation period are estimated at $570 million, and exceed the Present Value of costs by $153 million. Benefits result from meter reading automation, reduction in unaccounted for energy, operational efficiencies in field & meter services, billing and customer management, improved capital spend efficiency, as well as customer benefits such as reduction in consumption on inactive meters and demand response benefits and the others listed in Figure 1.

2. Ameren Illinois AMI Context and Background

As a utility serving the State of Illinois, Ameren Illinois is a leading energy provider that serves more than 1,200 communities. Every day, Ameren Illinois delivers energy to 1.2 million electric and 840,000 natural gas customers in central and southern Illinois. Ameren Illinois is also an early adopter of Automated Meter Reading (AMR), having introduced this technology to parts of the utility's 43,700-mile service territory in 1998. Upon completion of the automated meter deployment in 2010, Ameren Illinois had installed 678,000 electric and 476,000 gas one-way-communication-enabled AMR meters covering more than half of its gas and electric customers.

Taking advantage of advancements in metering technology and leveraging two-way radio frequency (RF) networks that were installed during the AMR project, Ameren Illinois strives to promote "green" technologies and ensure high-quality service in a cost-effective manner through the AMI initiative. As such, and in order to fulfill the provisions required as part of the AMI Plan, our AMI cost/benefit analysis evaluates a 20-year investment and outlines the determination that the benefits exceed all costs reasonably associated with this initiative.

A number of key assumptions were formed as Ameren Illinois analyzed variables and scenarios to identify impacts to customers from implementing AMI in its service territory. Additional detailed assumptions are contained in the Appendix.

2.1. Key Deployment Assumptions

2.1.1. Ownership/Operation of AMI Network

Ameren Illinois plans to own and operate the AMI communications network (as opposed to paying an outside vendor to own and/or operate the network).

2.1.2. Coincident Installation of Electric and Gas Meters

Ameren Illinois understands that there will be costs and benefits to customers from implementing AMI within its gas service territory in conjunction with AMI electric. Ameren Illinois plans on a simultaneous rollout of gas AMI along with the electric AMI rollout, provided the Company has (i) a clear path to full and complete cost recovery (i.e. return of and on investments and operating costs) and (ii) a strong and healthy financial position to provide the financing needed to install and maintain the infrastructure. This business case is an electric-only view of costs and benefits, but includes electric allocations for infrastructure shared across both electric and gas.

2.1.3. Implementation Schedule

The timing of meter deployment drives different costs and benefits for Ameren Illinois customers. Ameren Illinois is committed to serving 62% of its electric customers with AMI in 10 years, and plans to continue rollout of AMI meters to 100% of its customer base over 15 years, provided the Company has (i) a clear path to full and complete cost recovery (i.e. return of and on investments and operating costs) and (ii) a strong and healthy financial position to provide the financing needed to install and maintain the infrastructure. Furthermore, Ameren Illinois assumes a roll out to its non-AMR served operating centers first, followed by AMR operating centers.

2.2. Vendor Pricing

Ameren Illinois issued two Requests for Information (RFI) to a base of AMI and Meter Data Management (MDM) System vendors asking for indicative pricing on an AMI Network deployment, and MDM implementation. This cost/benefit analysis uses an average pricing methodology across the responses to the RFI.

2.3. Business Case Approach

During the period from August 2011 through March 2012, the Ameren Illinois AMI project team has worked closely with:

- Ameren Illinois business executives to understand the strategic imperatives and refine the scope of the AMI investment
- Ameren Illinois function leaders to project operational activities and associated costs and benefits
- External vendors and industry experts to obtain metering, communication and IT infrastructure cost estimates, research industry AMI initiatives, identify and resolve key business case formation questions, and construct the AMI business case

2.3.1. Cost Estimates Approach

The Ameren Illinois AMI project team worked through a formal RFI process to engage with multiple external metering vendors to obtain cost estimates for AMI field hardware (meters and communications infrastructure), installation, and administration costs. The team also engaged with both external IT vendors and internal IT and Corporate Planning teams to assess the costs associated with hardware procurement, software purchasing and licensing, IT development and integration, and overall support and maintenance of the IT systems and infrastructure needed during AMI deployment. Moreover, department leaders helped identify resource requirements and cost estimates for program management and associated operational activities such as customer education, customer management, and technical support.

With respect to meter depreciation, Ameren Illinois has reviewed some of the largest AMI deployment plans in the United States, such as those by Duke Energy, Southern California Edison, DTE, and PG&E to base its AMI deployment on a useful life of 20 years for the AMI meter. As with any complex system, individual components may fail early or last longer than the overall useful life. The AMI meter's useful life does not depend on when the first component fails or how long the last meter-module functions. Instead, its life depends on the system as a whole operating correctly and reliably**.** Moreover, Southern California Edison conducted product testing that concluded that the meter useful life would be 20 years or more[1].

2.3.2. Benefit Estimates Approach

The Ameren Illinois AMI project team relied heavily on both internal and external AMI and metering experts to identify AMI benefit areas and detail cost reductions and loss prevention associated with each benefit area commensurate with the meter deployment schedule. While direct operational and customer benefits in several areas such as meter reading, field and meter services, unaccounted for energy, billing accuracy, consumption on inactive meters, and demand response were quantified, numerous indirect customer and societal benefits have also been evaluated and included in the business case.

2.3.3. Cost/Benefit Analysis Approach

A rigorous approach to the AMI cost / benefit analysis was conducted by using several different evaluation methodologies, including Payback Period, Net Present Value (NPV) analysis, as well as Total Resource Cost (TRC) analysis. The time horizon used for the business case was 20 years. However, a terminal value was also calculated to take into account the costs and benefits associated with the un-depreciated AMI infrastructure remaining beyond the 20 year period. The cost benefit analysis is taken from the customer perspective, with costs and benefits modeled as revenue requirement adjustments.

As such, the discount rate that is used for the NPV analysis should also reflect a customer-perspective discount rate. This is consistent with the Illinois Statewide Smart Grid Collaborative (ISSGC) recommendation of “using an appropriate discount rate.” Therefore, a customer-relevant discount rate was used for this analysis as the 20-Year Treasury Bill rate (3.62% currently). This approach is consistent with the ComEd AMI pilot evaluation and the Ameren Illlinois Cost/Benefit Analysis timeframe.

[1] SCE Cost Benefit Analysis, Vol 3., December 21, 2006

2.4. Alignment with Illinois Statewide Smart Grid Collaborative Recommendations

Ameren Illinois adhered to the guidelines of the Illinois Statewide Smart Grid Collaborative (ISSGC) when developing the cost and benefit estimates. The table below summarizes how Ameren Illinois complied with these guidelines.

Table 1: Alignment with ISSGC Cost-Benefit Filing Requirements

Requirement (from ISSGC report)	Sub-Requirement (from ISSGC report)	Ameren Illinois Business Case Alignment
1. Provide cost-benefit analyses of the investment(s), including a Total Resource Cost test:	The analysis should include any factor (i.e., cost or benefit) that meets the following criteria: • They can be expected to have a meaningful economic impact on the utility's investment decision or are relevant to the Commission's approval decisions • They can be reasonably and transparently quantified and monetized • They are relevant to the analysis, specifically including the costs of achieving claimed benefits.	✓ Requirement Met
	Costs and benefits should only be counted once; there can be no double-counting of benefits.	✓ Requirement Met
	All costs and benefits used in the analysis should be incremental to the investment when compared with a baseline or "business as usual" scenario. The baseline scenario should reflect the related costs or benefits that would be anticipated if the investment were not made.	✓ Requirement Met (Costs and benefits were analyzed to ensure only incremental values were used)
	The cost-benefit analysis should recognize as a separate line item any stranded costs that would result from the smart grid investment.	✓ Requirement Met

Requirement (from ISSGC report)	Sub-Requirement (from ISSGC report)	Ameren Illinois Business Case Alignment
1. Provide cost-benefit analyses of the investment(s), including a Total Resource Cost test: (cont'd)	The utility should be required to present multiple views, or perspectives, as part of their cost-benefit analysis to be filed with the Commission. • A Total Resource Cost perspective for investments should be presented by the utilities – both with societal costs and benefits and without societal costs and benefits • Other perspectives that should be presented include a Ratepayer Impact view (depicting how rates would be impacted) and a Customer/Participant view (depicting the impacts of customer-specific costs and benefits) As appropriate to each test, the cost-benefit analysis should separately identify: 1) Those costs and benefits that will be directly incurred or realized by ratepayers through the traditional ratemaking structure 2) Those costs that can be expected to be incurred by non-utility parties 3) Those benefits that will flow, if at all, through the wholesale price of energy or other markets 4) Those benefits associated with broader societal objectives or results that are not necessarily reflected in regulated customer rates.	✓ Requirement Met (Both a customer/ratepayer impact and Total Resource Cost views are included in this analysis)
	Cost-benefit analysis may bundle or package together investments in several applications if those applications are needed to function together or provide otherwise unachievable synergies, or if they are reliant on a common infrastructure investment. To the extent that it is feasible to separate underlying platforms from individual applications, smart grid applications contained within a package should still be subject to individual cost-benefit analysis based on their stand-alone incremental costs and benefits.	✓ Requirement Met (Ameren Illinois views the AMI investment as a comprehensive capability that is considered as a whole)
	Cost-benefit analysis should provide a calculation of a payback period based on the present value of the annual cash flows of the smart grid investment or package	✓ Requirement Met
	Potential non-regulated, third party, or incidental revenue from smart grid infrastructure investments should be reflected in the cost-benefit analysis.	N/A (This analysis does not include non-regulated or third-party/incidental revenue)

Requirement (from ISSGC report)	Sub-Requirement (from ISSGC report)	Ameren Illinois Business Case Alignment
2. Provide documentation supporting the cost-benefit analyses	Documentation of key assumptions underlying the analyses, particularly of those factors that may have a high degree of variability and/or uncertainty	✓ Requirement Met
	Discussion of the uncertainties associated with estimates of costs and benefits over the term of the payback period	✓ Requirement Met (Included a sensitivity analysis – see section 7)
	Discussion of the potential change in benefits and costs that may occur over time assuming various implementation schedules	✓ Requirement Met (Considered both a 10-year and 15-year rollout schedule as later described in the sensitivity analysis)
	Identification and discussion of other investments or approaches (if any) that reasonably might achieve similar or better results	✓ Requirement Met (Multiple AMI and MDM vendor solutions will be evaluated as a part of the project to identify the best-fit solution)
	Documentation of the discount rates used in the analyses and a discussion of the rationale for their use	✓ Requirement Met
	Documentation of a sensitivity analysis of the projected costs and benefits of the investment to variables and assumptions. While reasonable discretion should be provided in terms of the variables and assumptions to be included, the sensitivity analysis should: – Identify the key variables from the cost-benefit analysis that merit sensitivity analysis. The degree of participation, assumed behavioral impacts, and persistence of customer behavior changes should be among the variables included in sensitivity analyses. Other candidates for inclusion are variables (such as emission costs and reliability) that have a wide range of potential values and/or are more subjective in nature. – Produce cost-benefit results using alternate values for the variables in order to demonstrate the sensitivity/impact various scenarios might have on the economic profile of the smart grid investments.	✓ Requirement Met

Requirement (from ISSGC report)	Sub-Requirement (from ISSGC report)	Ameren Illinois Business Case Alignment
	Discussion of the rationale behind the packaging or bundling of applications in the analyses	✓ Requirement Met (Ameren Illinois views the AMI investment as a comprehensive capability that is considered as a whole)
	Documentation of the investment's useful life and the basis for its determination	✓ Requirement Met
2. Provide documentation supporting the cost-benefit analyses (cont'd)	Documentation of the length of time over which reasonable customer benefits can be reliably estimated	✓ Requirement Met
	Documentation of assumptions regarding any environmental benefits incorporated in the analysis (e.g., emissions reduced, values of emissions/allowances)	N/A (This analysis does not include any quantified environmental benefits)
	Discussion of the methodology and assumptions used in deriving the estimated benefits from load shape changes. This discussion should describe the model(s) used, model inputs and outputs, model logic (at a high level), scenarios performed, and how model results are to be interpreted.	✓ Requirement Met (This analysis includes a high-level summary of the demand response benefit methodology, which is based on peak load shifting)

3. Ameren Illinois AMI Program Costs

Ameren Illinois has conducted detailed cost assessments to determine the life cycle cost of AMI ownership, as well as the capital and operations and maintenance (O&M) costs associated with AMI deployment. AMI deployment is expected to be completed within 15 years. Operations of the AMI infrastructure will commence prior to the AMI system installation and continue through the timeframe of the business case.

The major cost components of the AMI deployment are summarized in the table below.

Table 2: Key Cost Components (in $ millions, over 20 years)

Key Cost Components	Capital	O&M	Total
AMI Meter and Communications Infrastructure and Implementation	[redacted]	[redacted]	[redacted]
IT Systems and Integration	[redacted]	[redacted]	[redacted]
Project Management	[redacted]	[redacted]	[redacted]
AMI Operations	[redacted]	[redacted]	[redacted]
TOTAL	[redacted]	[redacted]	[redacted]

3.1. AMI Metering Equipment and Communications Infrastructure Implementation

This cost category includes the capital costs associated with the installation, configuration and customization of the AMI metering and communications systems. This also includes O&M costs associated with accelerated depreciation of existing meters.

Ameren Illinois estimates that the 20-year capital costs incurred as a result of full AMI deployment within 15 years will be approximately [redacted]. Below is a summary of the main components of these costs.

Table 3: AMI Metering Equipment & Communications Infrastructure Cost Breakout (in $ millions, over 20 years)

AMI Metering Equipment and Communications Infrastructure Cost Drivers	Capital	O&M	Total
AMI Meters	[redacted]	[redacted]	[redacted]
AMI Meter Installation	[redacted]	[redacted]	[redacted]
AMI Communications Network Hardware & Installation	[redacted]	[redacted]	[redacted]
Accelerated Depreciation for Existing Meters	[redacted]	[redacted]	[redacted]
TOTAL	[redacted]	[redacted]	[redacted]

Capital costs include costs of AMI meters and communications, as well as installation and project management costs. The cost estimates were derived from the AMI vendor RFI that was issued in September 2011.

AMI meter costs include the costs for the physical AMI meter for single-phase and three-phase meters having RF radio communicators. All self-contained meters that are 200 Amps or less will also have an internal switch for remote connect / disconnect applications. This is based on an annual meter growth rate of 0.25% to determine the total number (approximately 1.3 million) of AMI meters that will be deployed after 100% roll-out within 15 years.

Installation of meters is a complex activity involving pre-installation preparations and field deployment. During pre-installation, facilities are prepared for AMI meter processing, field surveys are completed, and plans are developed for meter deployment. Network preparation, including right of ways and interagency permissions are obtained. During field deployment, the meters are actually installed at the customer premises (and the existing meter is taken out of service).

Meter deployment is major activity. It involves setting up cross-dock facilities as a logistical hubs for meter deployment. Meters are checked for performance and accuracy before deployment. The workforce is trained and deployed to cross-dock facilities. Deployment is scheduled based on route plan. Meters are installed, and clean-up is performed to complete the installation process. Tests of meter communication and data accuracy are performed as a part of commissioning.

The AMI communications network hardware and installation phase involves the physical roll-out of the communications infrastructure (collection points, wide area network (WAN) hardware) in the field and within Ameren Illinois facilities (head-end communications equipment). First, the communications network is installed in each operating center area to provide immediate visibility to the meters that will be installed. Network communication implementation includes field survey, installation of communication equipment and testing of communication equipment. It is estimated that there will be 1,252 collection points across the Ameren Illinois service territory.

The final cost driver related to the AMI Metering Equipment implementation is the accelerated depreciation for the existing non-AMR meters and AMR meters & infrastructure. Since the AMI meters will be rolled out to all customers over the 15 year deployment period, all existing meters (both non-AMR and AMR) will be replaced during that timeframe. Many of these meters will still have a depreciable life remaining at the point they are replaced. Therefore, the costs for accelerating the remaining depreciation for these meters are included in this analysis, which is consistent with the guidelines recommended by the Illinois Statewide Smart Grid Collaborative.

The existing depreciation schedule calls for depreciation on existing meters (both AMR and non-AMR) to total $87 million in 2012-2031 and $4 million in 2031 and beyond. The accelerated depreciation schedule for the existing meters based on AMI implementation totals $91 million in 2012-2025. While the total depreciated is the same for the existing & accelerated schedules (including years after 2031), the difference between the existing & accelerated depreciation for each year is included in the cost estimates. The total of the accelerated depreciation is $4M over the 20-year timeframe of this analysis.

3.2. IT Systems and Integration

This cost category includes the implementations costs associated with the IT systems and integration hardware, software, development, security and project management, as well as the ongoing maintenance of these systems. Ameren Illinois estimates that the 20-year capital and O&M costs incurred as a result of full AMI deployment within 15 years will be approximately [redacted].

Key components of AMI-related IT systems:

- AMI IT systems include head-end systems to communicate with the AMI network, capture meter data and send control commands to the meter.
- Head-end systems transfer data to a Meter Data Management System (MDMS) where it's validated against acceptance rules to ensure data quality. Estimations are done for missing data and edits are made to some data elements.
- Storage systems are needed, as meter data increases exponentially over current needs, increasing the importance of systematic data management.
- Data will need to be shared by several systems, and it requires an integration platform to allow sharing of the information between various enterprise systems (e.g. providing data of various applications such as billing, customer service and customer analytics).
- Security of the AMI network, including planning and implementation of security architecture to protect customer and operational data, is required.

Table 4: IT Systems and Integration Cost Breakout (in $ millions, over 20 years)

IT Systems and Integration Cost Drivers	Capital	O&M	Total
Hardware	[redacted]	[redacted]	[redacted]
Software	[redacted]	[redacted]	[redacted]
Labor	[redacted]	[redacted]	[redacted]
Security and planning	[redacted]	[redacted]	[redacted]
Project Management	[redacted]	[redacted]	[redacted]
Operations	[redacted]	[redacted]	[redacted]
TOTAL	[redacted]	[redacted]	[redacted]

Ameren Illinois estimates capital costs for IT systems and integration to be approximately [redacted] over 20 years.

Outlined below are further details on the key elements of Ameren Illinois' anticipated AMI IT infrastructure:

- Hardware
  - Servers for Enterprise Service Bus (ESB) and Business Process Management (BPM)
  - Network Operations Hardware
- Software
  - AMI Head End
  - Application Servers & Database Servers
  - Meter Data Management System
  - Data Analytics Software
  - ESB Tools
- Labor
  - Key activities include:
    - MDMS Design and Implementation
    - MDMS Integration
    - AMI Integration
    - ESB Integration
    - Environment Set Up, Installs, etc.
    - Data Analytics Support
- Security and Planning
  - Costs have been estimated for the planning, designing, and building of security systems and protocols to securely transmit data within the network.
  - On-going IT system security administration will incur additional costs
- Project Management
  - Key activities include centralized training, personnel recruiting, employee communications, and miscellaneous start-up related activities
  - Vendor oversight of the Request for Proposals (RFP) process and contracts supervision will also bear additional costs
  - Other management overhead costs spanning two or more functional cost categories, such as project management and the administration of job skills training, are also included in this cost category
- Operations
  - Costs have been allocated for on-going application support, post production support / transition, upgrade, and maintenance for AMI-related IT systems

Both Ameren Illinois resources and contractor resources will be employed for support and maintenance of IT systems. Furthermore, fees will need to be paid to vendors for product support and servicing.

3.3. Program Management

A long-term strategic initiative such as AMI deployment requires a substantial amount of resources for program delivery activities. Ameren Illinois estimates that [redacted] will be needed to fund program management activities.

Table 5: Program Management Cost Breakout (in $ millions, over 20 years)

Program Management Cost Drivers	Capital	O&M	TOTAL
Program Management	[redacted]	[redacted]	[redacted]

Program Management activities include

- **Governance:** Oversight, program prioritization and approval, establishing program sponsorship and accountability,
- **Quality Management:** The development and management of standard processes and practices to manage quality across the program
- **Program Scheduling and Staffing**: The management of integrated timelines and dependencies; securing and allocating resources to satisfy demand in a timely manner
- **Issue and Risk Management:** A standard methodology and tool for reporting, prioritizing, and escalating issues to ensure timely resolution; the development and management of standard risk identification and response capabilities to manage risk across the program
- **Project Communications and Reporting**
- **Financial/Benefits Realization and Regulatory Management:** The management and production of financial planning and reporting; management of benefits realization and business cases to ensure business benefits are measured and achieved; single point of contact to manage compliance with requirements of Commission
- **Change Control Process:** The management and prioritization of new projects or new requirements, including change orders
- **Release Management:** The management of an integrated release strategy to support organization-wide prioritization, dependencies and risk
- **Sourcing Strategy and Management:** Single point of contact to manage compliance with requirements of legal department
- **Vendor/Contract Management:** Integrated management of key vendors, including contractual, administrative and communication functions
- **Employee communications:** Managing communications with internal audiences, external audiences, and executives to ensure common messages, executive sponsorship and appropriate stakeholder involvement

The program management work will be performed by a combination of internal and external resources.

3.4. AMI Operations (Start-up and On-going)

This category of costs represents the costs of start-up and on-going operations for supporting AMI operational activities throughout the business case evaluation period of 20 years. As outlined in Table 6, AMI operational costs include costs for metering operations, communications operations and consumer education. The 20-year total cost in this area is [redacted], of which [redacted] is capital and [redacted] is O&M.

Table 6: AMI Operations Cost Breakout (in $ millions, over 20 years)

AMI Operations Cost Drivers	Capital	O&M	TOTAL
Metering Operations	[redacted]	[redacted]	[redacted]
Communications Operations	[redacted]	[redacted]	[redacted]
Consumer Education	[redacted]	[redacted]	[redacted]
TOTAL	[redacted]	[redacted]	[redacted]

3.4.1. Metering Operations

Metering operations includes all costs related to managing Ameren Illinois' AMI metering operations during implementation and on an on-going basis. Included in this are the following areas:

- **Meter Inventory Management:** Managing the inventory for 1.3 million meters over the 15-year rollout
- **Meter Maintenance:** Performing routine maintenance and repairs to meters that fail
- **Meter Warehousing:** Facilities costs for housing the meter inventory, especially during the initial rollout
- **Meter Testing and Make-ready:** Initial testing of meters before installation to ensure the meters are fully operational
- **Meter Technical Support**: Diagnosing problems when meters experience issues
- **Meter Field Services:** Implementation-related service calls after AMI meters are installed

3.4.2. Communications Operations

Communications operations include all aspects of maintaining and operating the AMI communications network. This includes WAN backhaul charges, as well as costs for maintaining the AMI communication networks to ensure availability for continuous AMI operation. Also included are rent/charges for using shared facilities in some places, such as communication towers and repeaters. FTEs include network operations engineers, field / telecom operations technicians and supervisors, as well as NOC infrastructure specialists.

3.4.3. Consumer Education

Finally, the success of AMI program is contingent on the ability of Ameren Illinois to communicate with customers, with a specific focus on educating them on the safety and capabilities of the AMI system. The focus is to enable the customer so that customer direct benefits are maximized. This also includes both broad public education and specific customer education on the positive impacts of AMI technology, implementation success stories, and/or how AMI creates value in energy conservation.

Ameren Illinois estimates that [redacted] of annual customer education costs will be incurred in the first five years of the implementation, with [redacted] in each remaining year of the meter rollout schedule.

4. Ameren Illinois AMI Direct Program Benefits

Ameren Illinois has conducted a thorough assessment of all the direct economic benefits that it expects to accrue through 100% AMI implementation within 15 years. These benefits are evaluated over a 20 year period and are expressed in incremental terms over the "business as usual" case.

Included in this analysis are both direct operational benefits (financial benefits realized by the utility and passed along to customer rates) and direct customer benefits (financial benefits realized by customers directly).

The following methodology was utilized to calculate steady-state benefits associated with the AMI implementation:

(1) Define the value drivers of the AMI solution components
(2) Identify and isolate the affected baseline costs and revenues that will be impacted
(3) Research and identify relevant cost savings and/or loss prevention percentages to be applied to the affected baseline

Over 20 years, Ameren Illinois expects financial benefits of approximately [redacted]. The following table outlines a summary of the major quantifiable benefits expected out of the AMI implementation.

Table 7: Key Benefit Drivers (in $ millions, over 20 years)

Benefit Category	Cumulative Benefits
Direct Operational Benefits – Reduction in Meter Reading Costs	[redacted]
Direct Operational Benefits – Reduction in Field & Meter Services	[redacted]
Direct Operational Benefits – Reduction in Unaccounted for Energy	$48
Direct Operational Benefits – Efficiency Improvement in Billing and Customer Management	$1
Direct Operational Benefits – IT Cost Savings	$4
Direct Operational Benefits – Improved Capital Spend Efficiency	$27
Direct Customer Benefits	$275
TOTAL	[redacted]

4.1. Direct Operational Benefits – Reduction in Meter Reading Costs

Ameren Illinois has been an early adopter of automated meter reading, with its Illinois program starting in the 1990s and aggressively expanding throughout the state from 2006 through 2010. Today, approximately 680,000 electric meters and 476,000 gas meters are automated – representing more than half of Ameren Illinois' customers. As a result of this automated meter reading, many of the meter reading labor benefits have been previously realized. Reduction in meter reading costs from the remaining 574,000 manual electric meters represents the largest area of benefits expected from Ameren Illinois' AMI implementation plan. Meter reads that are traditionally conducted through physical site visits to the customer premise can instead be done remotely through the AMI system. Benefits associated with reduction in meter reads represent the reduction in manual meter reading labor costs, associated IT costs, as well as vehicle / transportation costs.

Ameren Illinois estimates that full deployment of AMI over 15 years will result in meter reading cost savings of [redacted] over a 20 year period.

Table 8: Meter Reading Cost Savings Breakdown (in $ millions, over 20 years)

Reduction in Meter Reading Costs	Cumulative Benefits
Reduction in Manual Meter Reading Expenses	[redacted]
Reduction in AMR Meter Reading Expenses	[redacted]
Reduction in Manual and AMR Meter IT Costs	[redacted]
Reduction in On-Cycle Meter Reading Vehicle Expense	[redacted]
TOTAL	[redacted]

4.1.1. Reduction in Manual Meter Reading Expenses

Of the 574,000 electric meters that are manually read, 45% of on-cycle reads are performed utilizing internal Ameren Illinois labor while the remaining reads are performed by contractors. Cost savings through the reduction in manual meter reads will be realized through a reduction in both in-house and contractor labor costs.

Meter reader workforce reductions are planned over the course of the 15-year AMI implementation, and Ameren Illinois is planning to realize these workforce reductions through natural attrition and work re-assignment over time.

Quantifiable benefits related to manual meter reading savings are expected to be [redacted] over a 20 year business case time horizon. These cost savings take into account meter reads conducted by both internal meter readers as well as external contractors.

4.1.2. Reduction in AMR Meter Reading Expenses

Ameren Illinois currently has approximately 680,000 AMR meters that it expects to begin replacing with AMI meters starting in year 2019. All costs associated with AMR meter reading in the form of fees paid to external vendors will be eliminated as AMI meters replace existing AMR meters.

By eliminating these AMR costs over the AMI implementation time frame, Ameren Illinois expects to realize cost savings related to AMR meter reading of approximately [redacted] over a 20 year business case time horizon.

4.1.3. Reduction in Manual and AMR Meter IT Costs

O&M costs associated with the IT systems that support existing manual and AMR meter reads will be eliminated with the deployment of AMI meters. Benefits include cost savings associated with the support and upgrade of meter reading devices as well as software licensing and maintenance.

The current cost to support the existing MVRS hardware and software is roughly [redacted] per year. Ameren Illinois expects to be able to save 100% of these costs after full deployment.

Ameren Illinois estimates reduction in manual and AMR meter IT costs to be approximately [redacted] over the 20 year business case time horizon.

4.1.4. Reduction in On-Cycle Meter Reading Vehicle Expense

As non-AMR meters get replaced by AMI smart meters, the reduction in the need for manual meter reads will result in a reduction in associated vehicle costs for Ameren Illinois. Vehicle-related benefits include cost savings from fewer vehicles, fuel costs, vehicle insurance, and vehicle maintenance.

The current annual cost to operate and maintain vehicles for meter reading purposes is approximately [redacted]. With AMI, Ameren Illinois expects reduction in manual and special meter reads to reduce vehicle costs by approximately [redacted] over the 20-year business case time horizon.

4.2. Direct Operational Benefits – Reduction in Field and Meter Services

AMI's smart metering and communication infrastructure enables utilities to perform several functions remotely that would otherwise require a field visit to the customer premise. As a result, significant cost savings through the reduction in the number of personnel and vehicles for field and meter services can be achieved. Benefits in this area can be seen in the reduction in manual disconnect / reconnect of meters, single light outages, need for manual re-reads, as well as customer equipment problem outages.

Ameren Illinois estimates that full deployment of AMI over 15 years will result in meter reading cost savings of [redacted] over the 20 year business case time horizon.

Table 9: Field and Meter Savings Breakdown (in $ millions, over 20 years)

Reduction in Field & Meter Services	Cumulative Benefits
Reduction in Manual Disconnect / Reconnect of Meters	[redacted]
Reduction in Manual Off-Cycle / Special Meter Reads	[redacted]
Reduction in Field Services Vehicle Expense	[redacted]
Reduction in Single Light-out Field Trips	[redacted]
Reduction in Customer Equipment Problem Outages	[redacted]
Salvage Value of Replaced Meters	[redacted]
Reduction in Nuisance Stopped Meter Orders	[redacted]
TOTAL	[redacted]

4.2.1. Reduction in Manual Disconnect / Reconnect of Meters

The remote connect / disconnect feature of AMI smart meters enables utilities to turn on and off services for new and cancelled accounts remotely without a field trip. This benefit not only applies to the ability to turn on and off services for regular move-in / move-out of customers, but also provides the ability to cancel service for non-paying customers. As a result, significant cost savings can be realized through the reduction in need for personnel and transportation costs to turn on / off services. Cost savings will also be seen through the time saved due to reduction in meter access challenges as a result of AMI.

From 2009 to 2011, Ameren Illinois received about 247,000 orders for electric disconnect / re-connect per year, of which about 89,000 per year were disconnects for non pay. The labor cost for manual disconnect / reconnect is approximately [redacted] per year currently. Ameren Illinois expects cost savings of approximately [redacted] from reduced labor associated with the ability to remotely turn on/off energy service over 20 years.

4.2.2. Reduction in Manual Off-Cycle / Special Meter Reads

Ameren Illinois currently incurs significant costs to conduct manual off-cycle special meter reads. These reads are conducted for tenant changes, re-reads, high bill inquiries, and other instances when a reading is needed off the normal read cycle reads etc. Labor cost savings will be realized through reduction in off-cycle / special meter reads as a result of AMI.

In 2011, Ameren Illinois conducted approximately 100,000 off-cycle reads. Quantifiable benefits related to off-cycle meter reading savings are expected to be approximately [redacted] over a 20 year business case time horizon.

4.2.3. Reduction in Field Services Vehicle Expense

With the reduction in field service visits to customer premises due to the above factors, there will also be a reduction in associated vehicle costs for Ameren Illinois. Vehicle-related benefits include cost savings from fewer vehicles, fuel costs, vehicle insurance, and vehicle maintenance.

The total benefit Ameren Illinois expects to realize through reduction in off cycle field services vehicle expense will be approximately [redacted] over the 20-year business case time horizon.

4.2.4. Reduction in "OK on Arrival" Outage Field Trips

AMI implementation is expected to result in cost savings associated with reduced outage "OK on Arrival" field trips to customer premises. With the ability to provide near real-time power and outage status information, AMI systems are able to test for loss of voltage at the service point and both detect outage conditions as well as obtain restoration status indication. As a result, "OK on Arrival" field trips will be virtually eliminated, thereby leading to cost savings.

Ameren Illinois currently works about 7,600 orders for outages (both storm and non-storm related) that upon investigation are found to be "OK on Arrival". Ameren Illinois estimates that it will realize financial benefits related to reduction in "OK on Arrival" field trips of approximately [redacted] over the 20-year business case time horizon.

4.2.5. Reduction in "Customer Equipment Problem" Outage Field Trips

With AMI, Ameren Illinois will be able to determine whether the cause of an outage is the result of an electrical problem with the customer's equipment. This automated determination will help save dispatch labor and transportation costs for customer incidents that involve equipment failure.

Ameren Illinois estimates that while approximately 90% of "Customer Equipment Problem" related field trips can be eliminated as a result of AMI, 10% of orders will still require a field trip due to problems inside the meter base. Cost savings of approximately [redacted] are expected over a period of 20 years.

4.2.6. Salvage Value of Replaced Meters

A small financial benefit of replacing electro-mechanical and AMR meters as part of Ameren Illinois' AMI deployment plan is the salvage value of meters that have remaining useful life.

Ameren Illinois has estimated a conservative salvage value of [redacted] per meter, thereby leading to benefits of approximately [redacted] for the utility over the 20-year business case time horizon.

4.2.7. Reduction in Nuisance Stopped Meter Orders

Currently, Ameren Illinois receives approximately 34,700 orders for stuck / stopped electric meters annually. Of these, approximately 30% of the orders are found to be invalid / nuisance by the field & meter services personnel. With AMI, Ameren Illinois will be able to remotely detect whether the meter is stopped or malfunctioning, thereby eliminating the need for a premise visit to address an invalid stopped meter order.

Over the 20-year business case time horizon, Ameren Illinois expects benefits of approximately [redacted] related to reduction in nuisance stopped meter orders.

4.3. Direct Operational Benefits – Reduction in Unaccounted for Energy

Unaccounted for Energy (UFE) in the areas of meter tampering, energy theft, meter inaccuracy, and dead / stopped meters results in significant revenue loss for utilities. Through the use of smart meters and sophisticated MDM systems, UFE can be detected early and revenue losses related to unmetered energy can be reduced.

Ameren Illinois estimates that full 100% AMI implementation in 15 years will help increase revenue from reduction in UFE by $48 million over a 20 year period.

Table 10: Field and Meter Savings Breakdown (in $ millions, over 20 years)

Reduction in Unaccounted for Energy	Cumulative Benefits
Theft / Tamper Detection & Reduction	$42
Faster Identification of Dead Meters	$6
TOTAL	**$48**

4.3.1. Theft / Tamper Detection & Reduction

AMI systems significantly aid in the early detection of meter tampering and energy theft. Through the use of analytics software and AMI functionality that enables frequent recording of smart meter energy consumption, the detection of anomalous patterns of energy resulting from theft and tampering can be discovered. According to Chartwell, a market research company for utility customer care, marketing and smart grid, theft is estimated at 1% of a utilities' revenue.[2] Thus, the use of AMI can significantly reduce energy and revenue losses associated with energy theft.

In reviewing various public utility AMI filings, Ameren Illinois observed that other utilities estimated savings in the range of 0.5% - 1% of revenue associated with each AMI meter. Ameren Illinois conservatively estimates that AMI will help the utility save 0.25% of theft / tamper-associated revenue. This will result in cutting existing residential line losses by about 2.9%. Over a 20 year period, Ameren Illinois expects financial benefits from reduction in energy theft for residential customers to be approximately $42 million.

4.3.2. Faster Identification of Dead Meters

The implementation of AMI systems helps utilities more quickly identify dead and/or stopped meters that can no longer measure electricity due to meter failure. This early identification helps utilities quickly take steps towards repairing or replacing the dead meter, thereby reducing potential revenue losses.

Ameren Illinois currently receives approximately 3,470 valid orders annually for dead residential meters with average residential consumption of about 1,000 kWh per month. With the use of AMI and a charge back period of 60 days, Ameren Illinois expects to realize financial benefits associated with the early identification of dead meters of approximately $6 million over a 20 year time period.

4.4. Direct Operational Benefits – Efficiency Improvement in Billing Functions

An important benefit of AMI is the cost savings realized through efficiency improvement in billing functions and customer management. Meter reading errors are expected to be virtually eliminated and the need for calculation of estimated bills due to access issues will be significantly reduced. However, more complicated billing problems may increase due to expanded dynamic pricing. The potential to reduce float between meter read and customer billing will drive greater benefits for Ameren Illinois.

Over a 20 year period, Ameren Illinois estimates $1 million in cost savings through efficiency improvement in billing and customer management as a result of AMI.

[2] Chartwell Report, 11th Edition on AMI/AMR

Table 11: Efficiency in Billing Breakout (in $ millions, over 20 years)

Efficiency Improvement in Billing and Customer Management	Cumulative Benefits
Reduction in Estimated Bills	-
Reduction in Bill Inquiry Calls	$0.5
Reduction in Float between Meter Read and Customer Billing	$0.5
TOTAL	**$1**

4.4.1. Reduction in Estimated Bills

The ability to remotely read meters on a frequent basis greatly reduces estimated bills that often result from meter access issues that currently prevent meter readers from obtaining reads in hard to access areas at the customer premise. Fewer customer service resources are thus expected to review exception reports, resolve billing errors and process adjustments.

Ameren Illinois has already received these benefits in its existing AMR areas. While it is believed that a reduction in estimated bills from its non-AMR areas will result in reduced workload for Ameren Illinois' Customer Accounting Department, there is likely to be an increase in more complicated billing problems due to expanded dynamic pricing. At this point, Ameren Illinois is taking a conservative approach and assuming that AMI will have a neutral effect on its Customer Accounting Department.

4.4.2. Reduction in Bill Inquiry Calls

Detailed customer interval consumption data will allow call center associates to accurately identify when a customer had higher than normal energy consumption. Moreover, the availability of more energy use data is expected to drive down call durations.

Ameren Illinois currently receives about 250,000 calls annually related to billing questions. Since Ameren Illinois already has some of this capability in its existing AMR areas, this incremental benefit only applies in its non-AMR areas. As non-AMR meters are replaced with AMI, the utility expects benefits 11% reduction in bill inquiry calls, thereby resulting in approximately $500,000 in cost savings.

4.4.3. Reduction in Float between Meter Read and Customer Billing

Ameren Illinois expects AMI to enable all accounts to be billed on the second day of the billing window. As a result of AMR implementation, Ameren Illinois is already able to receive a majority of its meter readings on the second day within the window. However, the remaining bills (about 20%) that are currently produced during the third and fourth days will now be generated during the second day as a result of AMI. This will accelerate Ameren Illinois' revenue stream and improve its cash flow.

Over the 20 year business case time horizon, Ameren Illinois expects benefits related to reduction in float between meter read and customer billing of approximately $500,000.

4.5. Direct Operational Benefits – IT Cost Savings

Ameren Illinois currently spends on 1.5 FTEs to support its existing Meter Data Management (MDM). Furthermore, in addition to the $36,000 it pays in annual software maintenance fees, it has also budgeted associated hardware purchase and upgrade costs. These costs will thus not be incurred for the AMI project, resulting in a benefit of $4 million over the 20 year evaluation period

Table 12: IT Cost Savings (in $ millions, over 20 years)

IT Cost Savings	Cumulative Benefits
IT Cost Savings	$4

4.6. Operational Benefits – Improved Capital Spend Efficiency

Ameren Illinois also expects AMI to enable improvements in the distribution system planning efforts. AMI will provide detailed information across the distribution network that can be used to optimize investments in infrastructure improvements. Examples of data available by AMI that can be used in asset management are:

- Interval (time-based) consumption data at the customer level (and ability to aggregate up to transformer and circuit levels)
- Voltage information collected at each premise
- Momentary outage information

The total benefit from Improved Capital Spend Efficiency over the 20-year business case timeframe is $27 million.

Table 13: Asset Management Benefit Breakout (in $ millions, over 20 years)

Improved Capital Spend Efficiency	Capital	O&M	Cumulative Benefits
Distribution System Management	$15	$1	$16
Avoided Meter Purchases	$11	$0	$11
TOTAL	**$26**	**$1**	**$27**

4.6.1. Distribution System Management

Interval consumption data can be aggregated at the transformer level to help identify under-used and over-loaded transformers, as well as to properly size replacement transformers.

From 2006 through 2011, the average capital investment by Ameren Illinois in the low voltage distribution system was approximately $81 million per year, while the average O&M expense for the maintenance of overhead lines, underground lines, and line transformers was $75 million per year.

At full AMI deployment, Ameren Illinois expects 1% capital savings and 0.1% reduction in O&M expenses related to low voltage distributed system management. Over the 20-year business case time horizon, this results in total benefits of approximately $16 million, which is comprised of $15 million in capital savings and $1 million in O&M avoided cost.

4.6.2. Avoided Meter Purchases

This benefit category represents the cost savings realized by not having to replace existing non-AMR and AMR meters on an annual basis without AMI implementation. These include cost savings from reduced additions (meter costs), reduced replacements (meter costs), as well as reduced meter testing and installation costs (labor and material). The benefit from avoided meter purchases, however, is partially offset by the cost of on-going replacement of AMI meters due to normal failure rates.

With an expected meter replacement rate of 3% and a meter addition rate of 0.25% annually, Ameren Illinois estimates cost savings from avoided meter replacements at approximately $11 million over 20 years.

4.7. Direct Customer Benefits

While the above benefits are largely operational in nature and will be directly captured by Ameren Illinois and its operations, many of the benefits will be directly or indirectly captured by Ameren Illinois customers. These will be captured by customers in the form of reduced electric rates due to the avoidance of shared and pass-through costs, all things being equal.

Table 14 outlines a summary of the major quantifiable customer benefits expected out of the AMI implementation.

Table 14: Direct Customer Benefit Breakout (in $ millions, over 20 years)

Direct Customer Benefits	Cumulative Benefits
Reduced Consumption on Inactive Meters	$14
Reduced Uncollectible / Bad Debt Expense	$90
Demand Response Financial Benefit	$171
TOTAL	**$275**

4.7.1. Consumption on Inactive Meters(CIM)

Ameren Illinois assigns electric meters to customer accounts and bills for usage on those meters to the assigned customer accounts. When a customer disconnects electric service at a premise (most often when they are vacating the premise), the customer account is disassociated with that electric meter. In the vast majority of cases, there is a corresponding connect request of electric service to the same premise (most often when a new occupant takes possession of a premise) on a date very close to the disconnect date.

Ameren Illinois does not physically disconnect electric service on the premise when a disconnect occurs in its existing AMR areas, and in some instances in its existing non-AMR areas. Rather, a “soft disconnect” usually occurs whereby a customer account is not associated with an electric meter during the gap between disconnect and connect. During the same gap, electric usage may still occur in some cases. Since there is not a customer account associated with the electric meter, no customer is billed for this usage.

A key feature of the AMI meters and infrastructure is the provision of a remote disconnect feature that will physically disconnect power to a premise when a disconnect request occurs. This will provide a significant decrease in unaccounted for consumption when meters are inactive.

Ameren Illinois estimates that approximately 12.1 GWh of electric energy is consumed on inactive meters on an annual basis. Ameren Illinois estimates it can reduce at least 90% of this CIM with the full implementation of AMI.

Over the 20 year business case time horizon, cumulative benefits associated with reduced consumption on inactive meters are estimated at $14 million.

Table 15: Reduced Consumption Breakout (in $ million, over 20 years)

4.7.2. Consumption on Inactive Meters	Cumulative Benefits
Reduced Consumption on Inactive Meters (GWh)	98.3 GWh
Reduced Consumption on Inactive Meters ($, millions)	$14 M

4.7.3. Uncollectible Expense / Bad Debt

Ameren Illinois incurs write-off expenses of approximately $17.8 million per year for electric customer accounts that are deemed to be uncollectible. Due to the manual nature of the existing disconnect for non-pay process, timing of disconnect for non-pay orders, and the existing workload, Ameren Illinois is not able to complete all the physical disconnect for non-pay orders issued in a given year.

AMI meters and infrastructure will be used to perform a remote disconnect and re-connect based on the regulatory timeframe allowed. Ameren Illinois estimates that AMI will help it recover uncollectible expenses through both 1) completing remote disconnects for all non-pay disconnect orders typically issued, and 2) revising collection processes within existing regulations to increase the number of disconnect for non-pay orders issued. Approximately $5.8 million annual reduction in uncollectible expense is estimated after 100% AMI rollout.

Over the 20 year business case time horizon, cumulative benefits associated with reduced uncollectible expense / bad debt are estimated at approximately $90 million.

Table 16: Reduced Uncollectible Expense Breakout (in $ million, over 20 years)

Uncollectible Expense / Bad Debt	Cumulative Benefits
Reduced Uncollectible Expense / Bad Debt	$90

4.7.4. Demand Benefits

Another advantage of the AMI meters and infrastructure rollout is the ability to impact customer usage by aligning rates more closely with the real-time costs of energy. It is estimated that this will result in the shifting of a portion of the electric usage from peak times to off-peak times. This, in turn, will decrease the potential aggregate electricity demand during peak times.

Since the dynamic pricing programs (the current Real Time Pricing / Power Smart Pricing, and the new required peak-time rebate program) are planned to be voluntary, the amount of benefits achieved largely depends on the customer opt-in rate. Based on an estimated coincident peak demand of 7835 MW in 2012, Ameren Illinois estimates the customer participation in dynamic pricing programs and achievable demand response potential as:

Table 17: Customer Type Breakout (in $ million, over 20 years)

Customer Type	Achievable Demand Response Potential (from FERC study*)	% of Customers on Dynamic Pricing by 2031 (from FERC** study)	Estimated % of Ameren Illinois Customers on Dynamic Pricing Program by 2031	Estimated Ameren Illinois Achievable Demand Response Potential	Estimated Annual Demand Response Potential (2031)
Residential	3.1%	67.5%	30%	1.38%	108 MW
Small Commercial & Industrial	0.0%	67.5%	10%	0.0%	0 MW
Medium Commercial & Industrial	0.1%	67.5%	10%	0.01%	1 MW
Large Commercial & Industrial	1.0%	67.5%	10%	0.15%	12 MW

** A National Assessment of Demand Response Potential" issued by FERC in June 2009*
*** The achievable scenario in the FERC study assumes 60% - 75% of customers remain on dynamic pricing. 67.5% is the average between 60% and 75%*

The potential financial benefit for this peak demand response reduction is largely dependent on the dollar-value assigned to each MW in peak demand reduction. Ameren Illinois has estimated this using a combination of external (MISO Annual Cost of New Entry 2011 report) and internal Ameren estimates. The table below shows the total $ per MW estimates:

Table 18: Demand Response Breakout

Year	Total Estimated Incremental Demand Response (in MW)	$ per MW Demand Response Factor	Annual Savings (in $ millions)
2012	0	$29,881	$0
2013	0	$30,921	$0
2014	0	$35,438	$0
2015	0	$56,381	$0
2016	1	$77,353	$0
2017	3	$98,354	$0
2018	6	$119,384	$1
2019	11	$140,446	$2
2020	17	$161,540	$3
2021	24	$166,386	$4
2022	33	$171,378	$6
2023	42	$176,519	$7
2024	53	$181,815	$10
2025	65	$187,269	$12

Year	Total Estimated Incremental Demand Response (in MW)	$ per MW Demand Response Factor	Annual Savings (in $ millions)
2026	78	$192,887	$15
2027	91	$198,674	$18
2028	98	$204,634	$20
2029	106	$210,773	$22
2030	113	$217,096	$25
2031	121	$223,609	$27

The total financial benefit for demand response is $27 million once the target customer participation rate is achieved in 2031. This results in a 20-year total benefit of $171 million.

Table 19: Demand Response Breakout (over 20 years)

Demand Response	Cumulative Benefits
Demand Response Reduction (MW)	861 MW
Demand Response Financial Benefit ($, millions)	$171

5. Ameren Illinois AMI Cost / Benefit Analysis

For the purposes of comparing the benefits against the costs for the AMI program, Ameren Illinois has developed a robust approach that uses several different evaluation methodologies, including:

- Calculation of Terminal Value
- Payback period
- NPV analysis
- Total Resource Cost (TRC) analysis

The timeframe of the primary business case is 20 years for both benefits and costs, which aligns with the estimated useful life for the AMI-related investments.

Terminal value (continuation of benefits and costs beyond 20 years) was also included to reflect the useful life of AMI infrastructure remaining after the 20-year period (due to the staggered rollout schedule). In fact, approximately 40% of the installed meters in 2031 will still have at least 10 years of useful life remaining after the 20 year investment evaluation ends.

The cost/benefit analysis is taken from the customer perspective, with costs and benefits modeled as revenue requirement adjustments.

In general, costs are estimated and attributed to the year in which the cost is incurred. Benefits are attributed to the year in which they will be realized, which generally trails the occurrence of the related cost by one year to three years (e.g. customer benefits will be realized the year following the installation of the AMI meters for that portion of the customers).

Included in this analysis are all the benefits and costs across the categories in sections 3 and 4, summarized in the table below:

Table 20: Cash-Basis Benefit & Cost Summary ($ in millions, over 20 years, non-discounted)

Key Cost / Benefit Drivers	Total
Benefits	
Direct Utility O&M Benefits	[redacted]
Direct Utility Capital Benefits	$27
Direct Customer Benefits	$275
Total (nominal)	[redacted]
Costs	
AMI Meter & Communications Infrastructure	[redacted]
IT Systems & Integration	[redacted]
AMI Operations	[redacted]
Project Management & Associated Costs	[redacted]
Total (nominal)	[redacted]
Terminal Value in Year 2031	**$156**

From a customer perspective, the impacts of the benefits and costs will take the form of changes to rates and direct customer benefits. Changes to rates are driven by O&M, depreciation, tax and revenue-requirement changes. The following table summarizes the customer benefits.

Table 21: Customer Impact Summary Table ($ in millions, over 20 years, non-discounted)

Net Customer Impact	TOTAL
O&M Expenses Net Change	$325
Depreciation Net Change (including stranded investment in existing meters)	($221)
Taxes Net Change	($48)
Return Requirements Net Change	($111)
Direct Customer Benefits	$431
Total (nominal)	**$376**

5.1 Calculation of Terminal Value

As Ameren Illinois is planning on a 15-year rollout of AMI meters across its service territory, it is estimating an overall useful life of more than 20 years for the entire AMI system. While it is common practice for AMI business cases to have a 20-year timeframe, Ameren Illinois feels it is prudent to include an estimate of the business case beyond the 20-year window. As stated previously, in 2031 (the last year of the 20-year business case timeframe) approximately 40% of the installed meters will still have a remaining useful life of at least 10 years.

To capture the business case impacts of the remaining useful life of the AMI-related assets beyond the 20-year business case timeframe, a terminal value analysis was used. This involves using benefit and costs from the final years of the NPV analysis and projecting the future years based on that.

Several key steps are involved in the Terminal Value analysis:

1. Identify the average fixed annual costs for operating and maintaining the AMI system – $14 million was calculated by averaging the AMI-related O&M expense for 2027 through 2031
2. Identify the average variable annual net benefit per meter (total benefits - variable costs) – $52.14 was calculated by averaging the net benefit for 2027 through 2031. This value is reduced to a 50% level on a straight-line basis during the 15 years of the TV analysis.
3. Calculate the net impact by year for each year remaining on useful life of meters (declining from 1.3 million meters in 2031 to 13,000 meters in 2046)
4. Calculate the NPV of these net impacts using the customer-relevant discount rate of 3.62% (20-year Treasury Rate) to get the Terminal Value in 2031
5. Discount the 2031 Terminal Value to 2012 using the same discount rate

This results in a terminal value in 2031 of $156 million. By discounting this back to 2012, the terminal value yields an additional present value $77 million:

Table 25: Terminal value result ($ in millions)

Result	Total
NPV of Terminal Value in 2031	$156
NPV of Terminal Value in 2012	$77

5.2 Payback Period

The first business case methodology used by Ameren Illinois is the payback period analysis. This involves calculating when the cumulative customer benefits equals and begins to exceed the cumulative customer cost stream. This is useful in understanding to what extent the realization of the benefits lag the incurrence of the costs.

Below is a summary of the benefit & cost cash flows along with the cumulative cash flow:

Table 22: Annual & Cumulative Cost / Benefit Cash Flow (in $ millions, non-discounted)

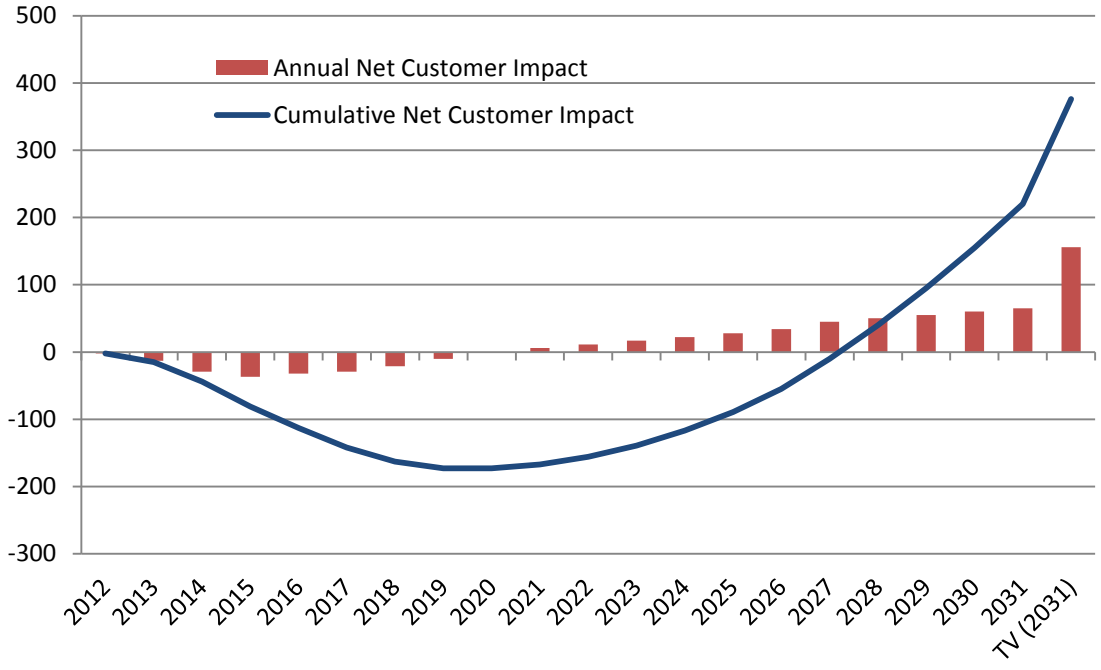
Year	Annual Net Customer Impact	Cumulative Net Customer Impact
2012	(2)	(2)
2013	(13)	(15)
2014	(29)	(44)
2015	(37)	(81)
2016	(32)	(113)
2017	(29)	(142)
2018	(21)	(163)
2019	(10)	(173)
2020	0	(173)
2021	6	(167)
2022	11	(156)

Year	Annual Net Customer Impact	Cumulative Net Customer Impact
2023	17	(139)
2024	22	(117)
2025	28	(89)
2026	34	(55)
2027	45	(10)
2028	50	40
2029	55	95
2030	60	155
2031	65	220
Terminal Value (2031)	156	376

As can be seen in the table above, the payback period for the AMI business case is 16 years. In other words, the cumulative benefits will begin to exceed the cumulative costs in early 2028. This payback period is reasonable, especially given the following factors:

- The bulk of the capital investment is in the first six years of the project duration
- The need to maintain multiple meter reading capabilities (processes & technologies) during the rollout period (manual read, AMR, and AMI during first seven years; AMR and AMI during next seven years)
- The rollout of the meters is over a 15 year period, with 50% of the meters deployed by 2020

Figure 3: Payback Summary ($ millions)



5.3 Net Present Value

The second methodology used to evaluate the AMI business case is a Net Present Value (NPV) analysis. In this analysis, the annual costs and benefits cash flows of the AMI program are discounted by a customer-relevant discount rate. Here, the 20-year Treasury Bill rate of 3.62% is used. This results in an estimate of the economic value of the investment.

In this analysis, any NPV of greater than zero signifies an investment that earns a positive financial return after accounting for the time-value of money.

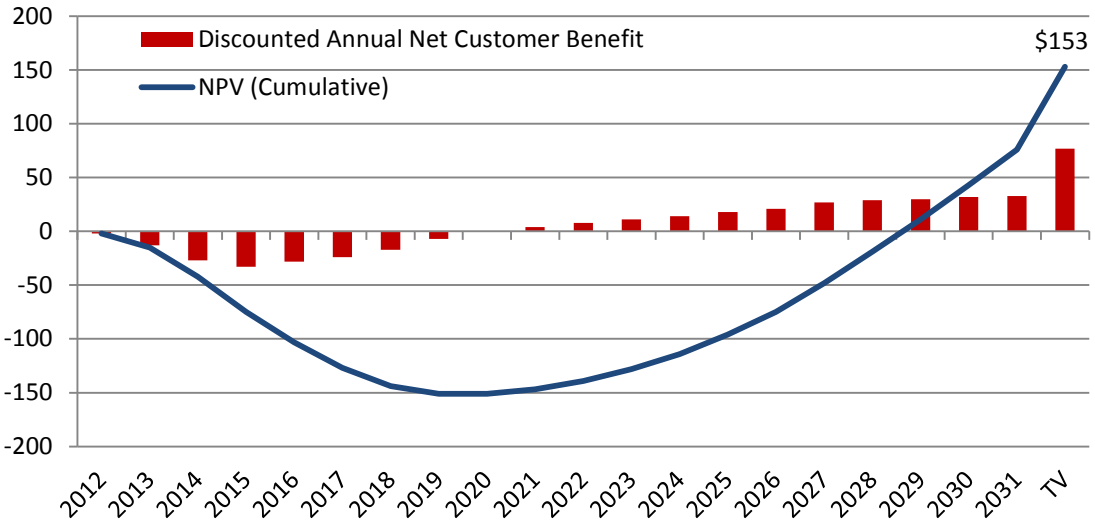
Below is a summary of the discounted net benefit/cost per year:

Table 23: Annual Discounted Net Customer Benefit (in $ millions, discounted)

Year	Net Customer Benefit
2012	(2)
2013	(13)
2014	(27)
2015	(33)
2016	(28)
2017	(24)
2018	(17)
2019	(7)
2020	0
2021	4
2022	8
2023	11
2024	14
2025	18
2026	21
2027	27
2028	29
2029	30
2030	32
2031	33
TV (Terminal Value)	$77
TOTAL (NPV)	**$153**

As seen above, the NPV for the AMI business case is $153 million.

Figure 4: NPV Summary ($ millions)



5.4 Total Resource Costs (TRC)

Ameren Illinois also used a Total Resource Costs (TRC) analysis, which is a comparison of the total costs of the project (from both the utility and customer perspective) with the total benefits of the project (again, from both the utilty and customer perspective).

Similar to the NPV analysis, both the benefits and costs are discounted to a net present value using a customer-relevant discount rate. Again, the 20-year Treasury Rate of 3.62% is used. The TRC is then calculated as ratio of the present value of benefits to the present value of costs.

For the purposes of this analysis, several simplifying assumptions were used in calculating the TRC. Specifically, Ameren Illinois used the net O&M and capital impacts as inputs into this analysis. Ameren Illinois considered net impacts that are negative as costs and net impacts that are positive as benefits. For example, net O&M is negative in the period of 2012-2016, so those were considered as costs for the TRC analysis. The positive net O&M values in years 2017-2031 were considered as benefits. Terminal value was included as a net benefit in the Gross Resource Benefits.

The results of the TRC analysis is a TRC of 1.37, which is summarized in the table below.

Table 24: Total Resource Costs Analysis Summary ($ in millions, over 20 years)

Category	TOTAL
Gross Resource Benefits (nominal)	$988
PV of Gross Resource Benefits	$570
Gross Resource Costs (nominal)	$607
PV of Gross Resource Costs	$417
Total Resource Costs (ratio of PV of Gross Resource Benefits to PV of Gross Resource Costs)	**1.37**

6. Indirect Benefits

The AMI business case directly captures and quantifies all the direct benefits tied to the AMI implementation, including utility and customer benefits. This section focuses on indirect benefits that were not modeled in the business case; however, AIC believes it would be remiss in not identifying them in this discussion. The indirect benefits fall into two categories: Indirect Customer Benefits and Indirect Societal/Environmental Benefits.

6.1. Indirect Customer Benefits

Indirect Customer Benefits are benefits that impact Ameren Illinois customers, but are not strictly or wholly tied to the AMI implementation. In other words, these are customer-impacting benefits that are enabled but not directly delivered by the AMI solution.

6.1.1. Reliability

AMI can enhance reliability through multiple mechanisms. Among them, it shortens recovery time when outages occur by providing last-gasp messages from affected meters and geo-visual information on where the outage occurred. AMI also gives utilities visibility beyond the substation, where today's utility monitoring generally stops, and this provides more detailed information that can be used to monitor distribution assets, such as distribution transformers. These capabilities will have a downward impact on the System Average Interruption Duration Index (SAIDI). The estimates of the economic costs of outages and power quality issues vary widely, with various reports citing sums between $25 and $150 billion per year on an industry-wide basis.[3]

In addition, momentary outage information provided by an AMI system can be evaluated to determine line locations that have a high probability of tree limbs hitting the lines during wind storms. Over time this phenomena can cause two lines to contact each other, thereby causing a fault on the line and a customer outage. AMI information can proactively identify this scenario prior to the system fault and allow vegetation management crews to trim the overgrown trees.

[3] "*Grid Modernization 101", "The Smart Grid: An Introduction," "Overview of the Electric Grid," "Building the smart grid,"* The Economist Technology Quarterly, June 6, 2009

6.1.2. Distributed Generation

Today, two meters are utilized at a residential level for distributed generation to measure when energy is being consumed from the grid versus when energy is being put out on the grid. With the new AMI meters, one single meter can be utilized in these situations. Called net metering, AMI meters record when consumers are using power versus supplying it. This reduces the costs for both the utility and the customer. Furthermore, with this added net metering functionality, utilities can ubiquitously offer customers new programs for renewable integration without having to add or change equipment. For example, utilities can offer programs around roof-top solar or solar hot water heaters.

6.1.3. New Services

AMI is a foundational infrastructure that may allow for services that expand into the home for smart appliances. Whirlpool and GE are among some of the leading brands working to integrate smart appliances with AMI. Whirlpool received $19 million in U.S. Department of Energy stimulus funding to support the manufacturing and commercialization of smart appliances that would communicate with AMI over the home area network (HAN). Ameren intends to purchase AMI meters that are capable of implementing the industry-embraced standard called Smart Energy Profile that governs how third parties interact with the metered information.

Furthermore, utilities can enable programs with customers to reduce load and will now have the capability of monitoring individual customer actions, such as verification that requested load reduction actually takes place.

6.1.4. Enabling PHEVs

As utilities begin to provide infrastructure and charging stations for plug-in-hybrid electric vehicles (PHEVs) and electric vehicles (EVs), the use of AMI to communicate with these charging stations, facilitate rates for residential customers to charge cars at certain times of the day, and the ability to track outages of key charging stations are added benefits provided by AMI. Furthermore, as battery technology continues to evolve and mature, many believe that the PHEVs can be utilized at certain times to provide energy back into the electric grid. AMI's net metering capabilities will be needed to measure the flow of energy in both directions. This is referred to as net metering to determine when the consumer is using power versus supplying.

6.1.5. Customer Convenience

With the rollout of AMI, utilities will be able to provide better customer service, especially around customer-directed shut-off and reconnection dates. These improvements in service represent a non-monetary value to the customer, but they generally result in increased levels of customer satisfaction.

Also, for those customers with indoor meters, utilities will no longer have to make arrangements to get access to the building or home to read the meters.

6.2. Indirect Societal / Environmental Benefits

Indirect Societal and Environmental Benefits are benefits that the broader communities that Ameren serves, but these benefits are not strictly or wholly tied to the AMI implementation.

6.2.1. Safety and Emergency Response

With the implementation of AMI, utilities can more rapidly cooperate with fire departments and other agencies to respond to emergencies. For example, when the local fire department calls to shut down power to a burning home, the utility can quickly respond by remotely disconnecting power via the disconnect switch in the meter.

Furthermore, AMI will also impact employee and vendor safety by eliminating or reducing physical customer premises trips for meter reading, disconnections and other reasons. Safety incidents by field/meters services and meter readers are often a large portion of the overall safety incidents for utilities.

6.2.2. Local Economy

With the rollout of AMI, several jobs will be created during the 15-year field deployment, as well as new skills needed for the back office, communications and IT systems development/maintenance. This will provide a non-trivial impact to the local workforce. Macroeconomic benefits that can enhance the local economy may arise from changes in the expenditure patterns of these workers/consumers.

6.2.3. Market Competition

Competition is fostered on two levels: from a market level and from a supplier component level. With AMI, greater information on energy usage will be available. It is a common belief that the expanded service choices enabled by advanced metering and communication technology are essential if consumers are to realize the full benefits of wholesale competition.[4]

In addition, Ameren is specifying the use of standards in choosing the AMI vendor. At the endpoint, Smart Energy Profile is a key standard to foster interoperability among vendors wanting to offer services in the home energy management area. Using a non-proprietary standard-based HAN solution for the AMI system will prevent vendor "lock-in" and enable more competition for parties desiring to provide solutions.

6.2.4. Environment

Electricity generation creates the majority of the U.S. sulfur dioxide (SO_2) pollution (primarily from burning coal) and is the second-largest emitter of nitrogen oxides (NOx) after vehicles. As AMI enables utilities to obtain more information and as utilities educate their customers on energy use and choice about using energy, it is expected that more customers will subscribe to various demand management programs. With the AMI-enabled pricing programs, price signals produced via the AMI devices could motivate customers to shift their energy consumption or lower it. This action would smooth out the utility's load curve, thereby reducing the need for high-emission peaking plants in some cases. As customers reduce their peak usage, SO_2 reductions can be achieved thereby eliminating pollution and helping to preserve our environment. Emmissions are further reduced by the reduction in vehicle miles driven due to the elimination of manual meter reading and field visits for disconnect / reconnect , stopped meter, and outage investigations.

[4] *Characterizing and Quantifying the Societal Benefits Attributable to Smart Metering Investments,* EPRI report, July 2008

7. Sensitivity Analysis

Ameren Illinois acknowledges that despite a meticulous and data-driven approach to conducting the cost / benefit analysis, the longer-term nature of the business case implies inherent uncertainties in the estimates of several AMI cost and benefit drivers. Ameren Illinois has thus conducted sensitivity analysis to identify the impact of changes to certain drivers on the base case.

7.1. Approach and Assumptions

Outlined in Table 25 is a summary of all the cost and benefit drivers that were subjected to sensitivity analysis. The table also highlights the range of values that each sensitivity parameters was subjected to, the resulting NPV, and the change in NPV from the base case.

Table 25: Sensitivity Analysis Variables, Assumptions, and Impact on NPV

Sensitivity Variable	Base Case Value	Sensitivity Range / Assumptions	Description / Rationale	New NPV
AMI Implementation Type	100% Electric & Associated Gas Implementation over 15 years (62% Electric Allocated)	100% Electric Standalone Implementation over 15 years	Ameren Illinois' cost / benefit analysis is prepared for an Electric and associated Gas AMI implementation over 15 years. For the purpose of sensitivity analysis, Ameren Illinois assumed an Electric Standalone (no Gas) AMI implementation over 15 years.	$56 million
AMI Implementation Period	100% Electric & Associated Gas Implementation over 15 years	62% Electric & Associated Gas Implementation over 10 years (then stop)	Ameren Illinois' cost / benefit analysis is prepared for a 100% Electric and associated Gas AMI implementation over 15 years. For the purpose of sensitivity analysis, Ameren Illinois also assumed a 62% Electric & Associated Gas implementation over 10 years. No further AMI implementation would take place after the first 10 years in this case.	$47 million

Sensitivity Variable	Base Case Value	Sensitivity Range / Assumptions	Description / Rationale	New NPV
O&M Benefits	$557 million	-30% to +15%[5]	Ameren Illinois' projected O&M benefits are driven by a data-focused and rigorous approach to estimations around cost reductions and loss prevention in numerous areas such as meter reading, field & meter services, UFE, billing and customer management etc. However, despite the analytical approach, unforeseen circumstances may cause the projected O&M benefits to vary. In order to calculate a range for the O&M benefits, Ameren Illinois assumes a 30% decrease and a 15% increase in O&M benefits over the 20-year business case time horizon.	[$13 million, $224 million]
O&M Costs	$236 million	-15% to +30%[5]	Ameren Illinois' projected O&M costs are based on a comprehensive assessment of the various drivers and associated yearly costs to operate and maintain the AMI infrastructure. However, due to the long-term nature of the AMI deployment, certain costs such as those to operate and maintain the AMI Communications Network as well as IT-related labor software maintenance costs may vary. Thus, Ameren Illinois assumes a 30% increase and a 15% decrease in O&M costs for purposes of sensitivity analysis	[$95 million, $183 million]

[5] Based on the Association for the Advancement of Cost Engineering (AACE) *Cost Estimate Classification System*, using Class 3 estimate and Expected Accuracy Range of 3 (i.e. 3x multiplier of +10%/-5% for costs). Benefits use the same ranges with inverse values.

Sensitivity Variable	Base Case Value	Sensitivity Range / Assumptions	Description / Rationale	New NPV
Capital Costs	$314 million	-15% to +30%[5]	Ameren Illinois' projected capital costs for meters and communications network hardware are based on average pricing obtained in response to RFIs. Capital costs for IT systems and labor, and management labor, while highly data driven and based on estimates from internal and external experts, contain a level of uncertainty given the long-term nature and scale of AMI deployment. Ameren Illinois thus assumes a 30% increase and a 15% decrease in capital costs for the purposes of sensitivity analysis	[$98 million, $251 million]
CIM Benefits ($ per KWH Recovery)	10.29 cents / KWH	5.3 cents / KWH	In the base case, Ameren Illinois assumes that it will be able to bill for and thereby recover the full 10.29 cents / KWH for consumption on inactive meters once AMI is implemented For purposes of sensitivity analysis, Ameren Illinois assumes that even if there is no tenant to bill for the entire lost energy consumption, it could still save energy supply cost of 5.3 cents / KWH	$147 million
Uncollectible Benefits	$3.5 million per year after 10 years of AMI rollout	-30% to +15%[5]	For the base case, Ameren Illinois assumes that at 100% AMI rollout, it will be able to reduce uncollectible electric expense by approximately 32% ($5.75 million per year). Since the ability to reduce bad debt expense depends on a multitude of factors including recovery rate after disconnect and increase in recoverable amount through revised collection process, Ameren Illinois estimates a 30% decrease ($4 million per year at 100% rollout) and a 15% increase ($6.6 million per year at 100% rollout) in uncollectible benefits for the purposes of sensitivity analysis	[$130 million, $165 million]

Sensitivity Variable	Base Case Value	Sensitivity Range / Assumptions	Description / Rationale	New NPV
Customer Opt-Out	0%	0.5% - 2.5%	The base case presented in this document assumes that 100% of the customers will participate in Ameren Illinois' AMI plan. However, Ameren Illinois is conducting sensitivity analysis to determine the impact of 0.5% and 2.5% customer opt-out. The effect of the customer opt-out is modeled assuming the additional costs of a one-time meter change and system set-up fee, a monthly off-cycle read fee, and the loss of potential AMI related benefits. If a Customer opt-out option is determined as necessary, it is recommended for fairness to those customers who do not opt-out, the associated costs and reduction in potential AMI related benefits should be born by those customers that are allowed to Opt-out.	[$133 million, $149 million]
Disconnects for Non-Pay	No premise visits needed for disconnect of non-paying customers	Premise visits needed for disconnect of non-paying customers	In the base case, Ameren Illinois assumes that it will realize cost savings from reduced visits as a result of remote disconnects for non-paying customers. For purposes of sensitivity analysis, Ameren Illinois assumes that disconnects for non-paying customers will still require a site visit. Thus, all the operational savings from automating the orders for non-pay disconnects and the Uncollectible benefits will be eliminated.	$35 million
Energy Theft Reduction	0.25%	0.1% - 0.4%	The model estimates that AMI will help Ameren Illinois save 0.25% of revenue associated with each AMI meter that is currently lost due to energy theft. Ameren Illinois has observed that other utilities have seen energy theft reduction benefits in the range of 0.5% - 1% of revenue. For the purposes of the sensitivity analysis, Ameren Illinois estimates (again, conservatively) that between 0.1% and 0.4% of revenue associated with each AMI meter can be saved as a result of AMI.	$132 million - $174 million

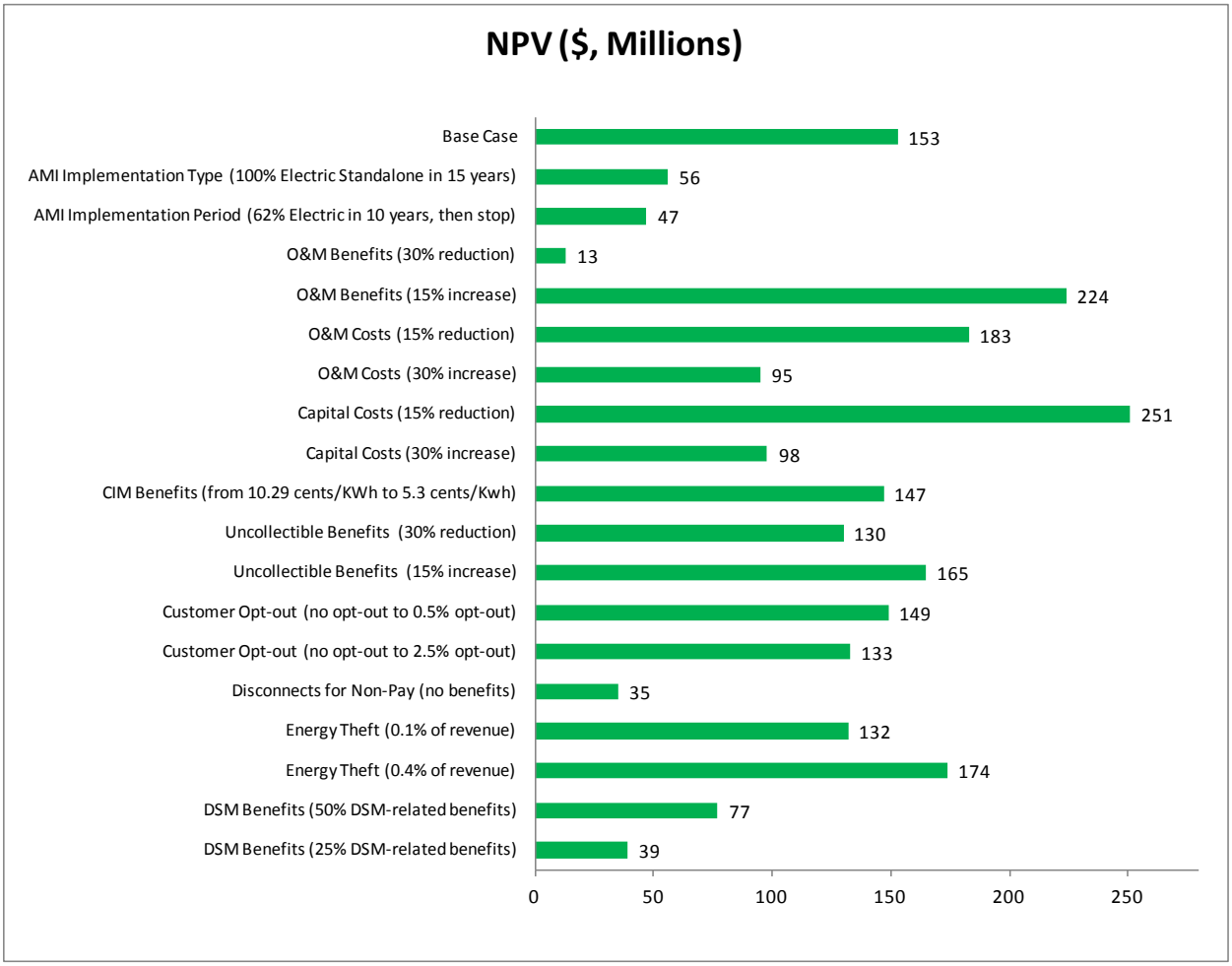
Sensitivity Variable	Base Case Value	Sensitivity Range / Assumptions	Description / Rationale	New NPV
DSM Benefits	$171 million	25% - 50% of projected DSM benefits	Ameren Illinois has conducted sensitivity around DSM benefits by assuming that it will only be able to realize 50% of the DSM benefits projected in the base case of the cost / benefit analysis. Positive NPV is still achieved with 25% DSM benefit.	$39 million - $77 million

7.2. Sensitivity Analysis Results

Figure 6 shown below graphically illustrates how Ameren Illinois' AMI NPV changes with respect to changes in the cost and benefit assumptions for the major drivers of the AMI business case.

It can be noted that barring an overall O&M benefit reduction or capital cost increase of 40%, the business case NPV remains positive despite conservative assumptions around certain cost and benefit drivers.

Figure 6: Sensitivity Analysis Results – Revised NPVs ($ millions)



8. Appendix

8.1. General Assumptions

- The business case assumes 100% deployment of AMI electric and associated gas meters over a period of 15 years
- The model analysis period is 20 years from 2012 through 2031, with AMI meter deployment commencing in year 2013
- Meter depreciation time (useful life) period used in the model is 20 years
- Meter growth rate is estimated at 0.25% annually

- Salvage cost per meter is assumed to be $1.00

- The following escalation rates over the 20-year business case time horizon are assumed:
  - General: 2.5%
  - Labor: 3.0%
  - Transportation: 4.75%
  - Meters: 0.0%

- Financial Assumptions
  - AIC composite tax rate of 41.2% is used to calculate Net Customer Impact
  - Discount Rate of 3.62% (20-year Treasury Rate) is used to calculate NPV

- 80% IT costs are allocated to electric meter deployment while the remaining 20% are allocated to gas meter deployment

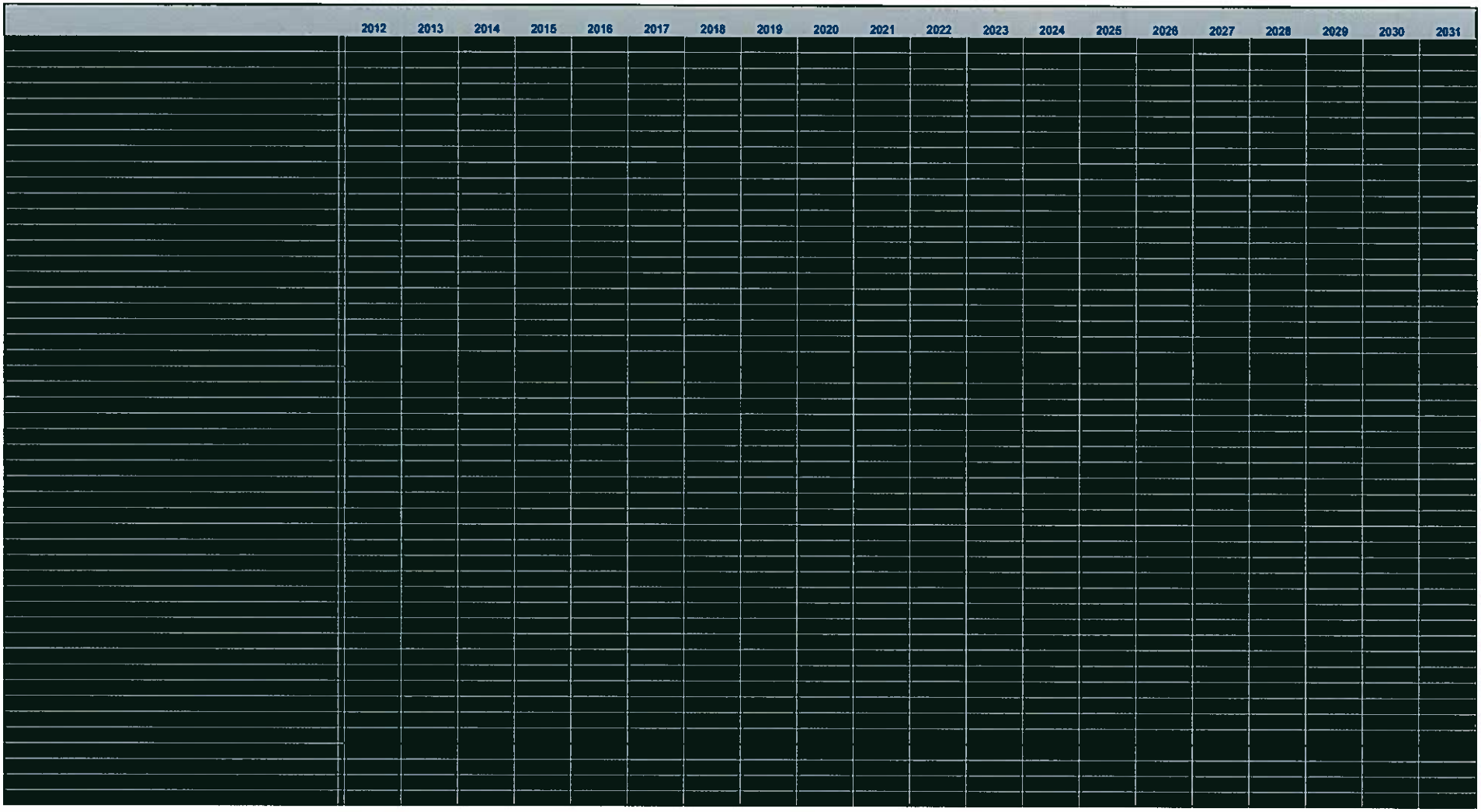
- 60% of AMI network costs are allocated to electric meter deployment and 40% are allocated to gas deployment

- Assumes full implementation of AMI technologies to all electric customers
  - No customer opt-out is assumed for the cost / benefit analysis
  - No personal on-site notification is required for disconnects for non-pay

Prepared by Ameren Illinois

8.2. Cost Summary by Year

(in $ millions)

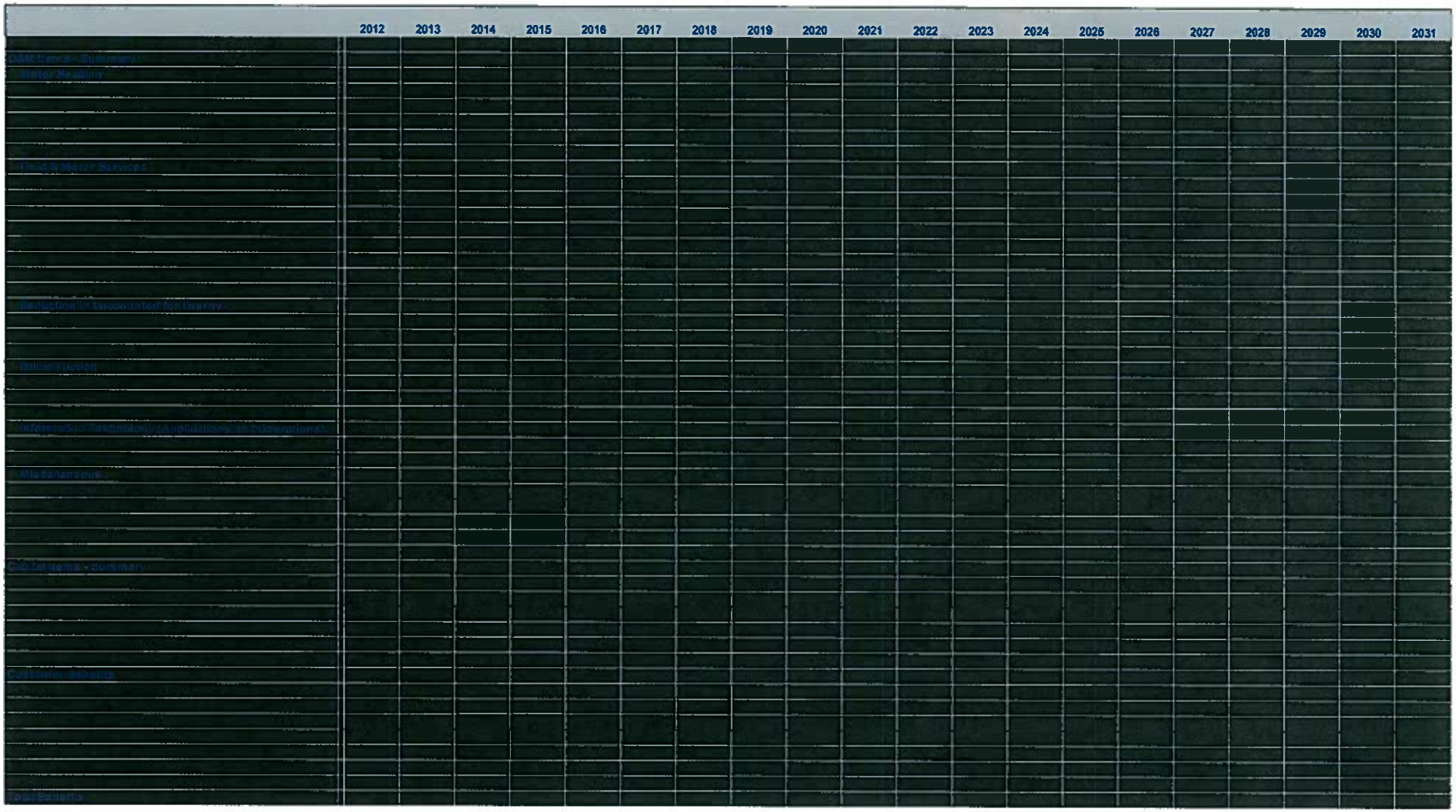


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
[redacted]																				

Prepared by Ameren Illinois

8.3. Benefits Summary by Year

(in $ millions)



Prepared by Ameren Illinois

8.4. Net Customer Impacts Summary by Year

(in $ millions)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
[redacted]																				
[redacted]																				
[redacted]																				
[redacted]																				
[redacted]																				

Prepared by Ameren Illinois

8.5. Total Resource Costs (TRC) Analysis by Year

(in $ millions)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031

Prepared by Ameren Illinois

8.6. Terminal Value Summary

(in $ millions)

	5 Year Average 2027 - 2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
[redacted]																