Deployment Map

Ameren ILLINOIS

Ameren Illinois Advanced Metering

Percent of Total Upgrades by Year

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Annual Deployment by Meter

Year	Approved AMI Plan	100% Deployment
2014	40,419	46,972*
2015	148,000	161,567*
2016	148,000	179,000
2017	148,000	305,800
2018	148,000	305,800
2019	148,000	250,200
Total	780,419	1,249,339
*Actual Deployed Electric Meters		

Operating Center	Division	Deployment Sequence	# of Electric Meters
2014			
Hillsboro	5	1	40,419
North Pana	4	2	6,553
2014 Total			46,972
2015			
North Pana	4		13,814
Effingham	4	3	14,121
Robinson	4	4	13,461
Olney	4	5	13,158
Centralia	6	6	16,719
Mount Vernon	6	7	21,886
Benton	6	8	17,856
Harrisburg	6	9	9,378
Marion	6	10	27,558
Anna	6	11	10,579
Sparta	6	12	8,576
Jerseyville	2	13	3,317
Incomplete Exchanges			(8,856)
2015 Total			161,567
2016			
Sparta	6		16,500
Jerseyville	2		12,400
Virden	2	14	11,500
Pittsfield	2	15	5,900
Quincy	2	16	26,900
Jacksonville	2	17	13,400
Petersburg	2	18	10,800
Beardstown	2	19	13,700
Carthage	2	20	8,200
Macomb	2	21	11,300
Canton	2	22	11,600
Lincoln CILCO	3	23	17,200
Western	1	24	10,700
Carryover from 2015			8,900
2016 Total			179,000

Operating Center	Division	Deployment Sequence	# of Electric Meters
2017			
Western	1		2,000
Lacon	1	25	16,500
Galesburg	1	26	44,000
Kewanee	1	27	15,200
LaSalle	1	28	37,800
Gilman	4	29	14,100
Paxton	4	30	15,600
Tuscola	4	31	14,100
Tuscola CILCO	4	32	9,000
Springfld CILCO	3	33	13,500
Champaign	4	34	83,400
Danville	4	35	32,200
Bloomington	3	36	12,400
Forecasted Incomplete Exchanges			(4,000)
2017 Total			305,800
2018			
Bloomington	3		49,900
Eastern	1	37	32,100
Pekin	1	38	25,000
Peoria	1	39	93,000
Decatur	3	40	63,500
Mattoon	4	41	21,300
Paris	4	42	8,600
Carbondale	6	43	16,400
Forecasted Incomplete Exchanges			(4,000)
2018 Total			305,800
2019			
Carbondale	6		4,500
East St. Louis	5	44	33,600
E St Louis - IP	5	45	200
Belleville	6	46	90,900
Maryville	5	47	46,000
Granite City	6	48	22,100
River Bend	5	49	17,700
Alton	5	50	27,200
Finish All Incomplete Meter Exchanges			8,000
2019 Total			250,200
6 Year Total (2014-2019)			1,249,339

Advanced Metering Infrastructure (AMI)

Cost / Benefit Analysis

May 2016

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1. Executive Summary

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:

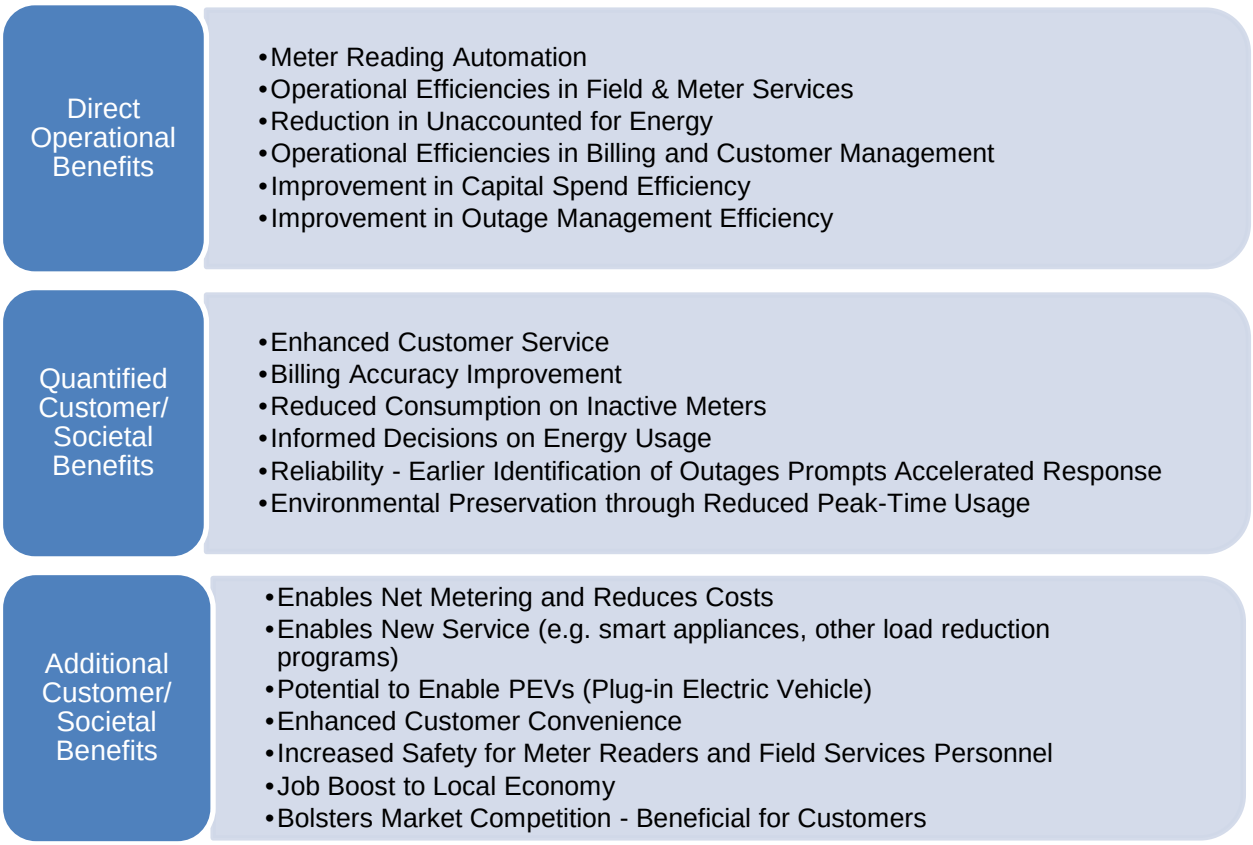
> "Cost beneficial" means a determination that the benefits of a participating utility's Smart Grid AMI Deployment Plan exceed the costs of the Smart Grid AMI Deployment plan as initially filed with the Commission or as subsequently modified by the Commission. This standard is met if the present value 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 developed a cost/benefit analysis of implementing AMI within the Ameren Illinois service territory and submitted this filing to the Illinois Commerce Commission (ICC) on March 30, 2012. In June 2012, after a ruling by the ICC on the initial filing, Ameren Illinois submitted a modified cost/benefit analysis, refocusing the base case to an 8 year, 62%, electric-only AMI meter deployment plan, adding additional benefits in key areas, and refining cost estimates. The Commission approved the modified AMI Plan in Docket No. 12-0244 in December 2012.

In April 2016, Ameren Illinois proposed an acceleration of its AMI deployment in its annual AMI Update to the ICC. The ICC directed Ameren Illinois to re-open its approved AMI Plan for review. In this filing, Ameren Illinois presents a cost/benefit analysis for an 8 year, 100% electric allocated AMI meter deployment. As demonstrated here, this further modified AMI Plan to deploy AMI to 100% of AIC’s electric delivery customers remains cost beneficial.

Figure 1 summarizes the specific benefits of this implementation.

Figure 1: AMI Implementation Benefits Summary



The table below summarizes the Internal Rates of Return (IRR) for the three different AMI meter deployment scenarios analyzed:

Table 1: AMI Deployment Internal Rates of Return

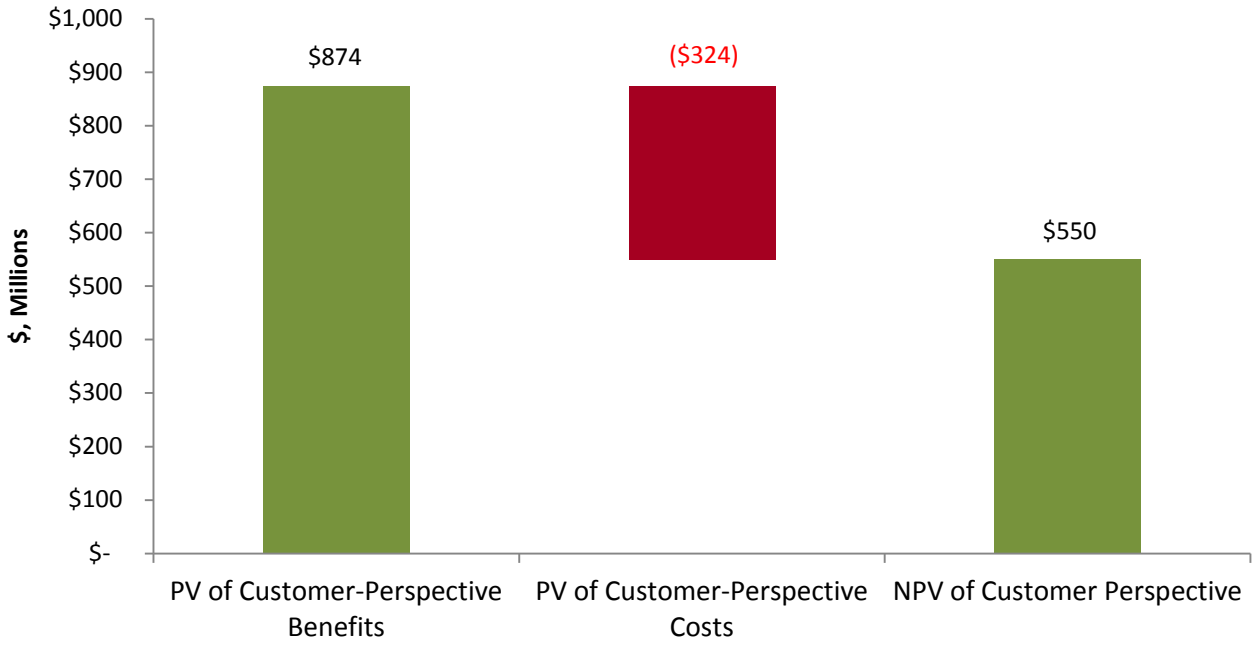
Deployment Scenario	IRR
62% Electric Only by 2019 (Approved by the ICC in December 2012)	14.6%
62% Electric Allocated by 2019 (Current Forecast)	22.4%
100% Electric Allocated by 2019	28.4%

Each scenario above significantly exceeds Ameren Illinois' current cost of capital of 5.58% with the most benefit accruing to customers from the 8 year, 100% AMI deployment. The allocated scenarios analyzed were updated from the original 8 year, 62% AMI meter deployment plan approved by the ICC with the following:

- Actual capital costs for 2012 through 2015 and updated capital expenditure forecasts for 2016 through 2031
- Allocated costs shared by gas and electric AMI based on ICC approved allocation factors
- Actual O&M benefits realized through an AMR meter read discount from 2014 through 2020
- Additional O&M costs for an AMR termination fee
- Scaled costs and benefits for 100% of customers receiving AMI.
- Revised model sensitivities to a tighter range now that Ameren Illinois has more experience with the AMI technology.

The following figure summarizes the present value of the benefits and costs of the 100% deployment of AMI in Ameren Illinois' service territory.

Figure 2: NPV of Ameren Illinois 100% AMI Business Case Summary



On the cost side, Ameren Illinois has incurred and 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 $324 million.

The Present Value of benefits over the 20-year evaluation period is estimated at $874 million, and exceeds the Present Value of costs by $550 million. Benefits result from meter reading automation, reduction in unaccounted for energy, operational efficiencies in field & meter services, billing and customer management, improved distribution system spend efficiency, as well as customer benefits such as reduction in consumption on inactive meters, Demand Response benefits, etc. as listed in Figure 1. The Net Present Value calculation for the 100% electric AMI deployment was determined using Ameren Illinois' weighted average cost of capital (WACC) set in the 2015 formula rate update filing of 5.583% as the discount rate.

Ameren Illinois' 100% AMI meter deployment provides significantly more benefits to the electric customer than was originally proposed in the June 2012 AMI Plan.

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 approximately 1.25 million electric and 830,000 natural gas customers in central and southern Illinois. Ameren Illinois also was 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, 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, 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. **Allocated Electric Base Case**

For the purposes of this business case, it is assumed that AMI is implemented for the benefit of Ameren Illinois' electric and gas customers. Investments that are shared by both gas and electric AMI customers are allocated based on existing allocation methodologies approved by the ICC. The business case captures all costs specific to the electric customer (for instance, an electric meter) and the allocated portion of the shared costs (for instance, the AMI network equipment.)

2.1.3. **Implementation Schedule**

Ameren Illinois has revised its original deployment plan from an 8 year, 62% AMI deployment plan to an 8 year, 100% AMI deployment, ending in 2019.

2.1.4. **Vendor Pricing**

Ameren Illinois' successfully contracted with all of its major vendors for the program. Each contract contains the provisions for expansion to 100% electric AMI deployment. The major contracts for the AMI program include:

- AMI Meters, Network, and Deployment

- Meter Data Management System
- System Integration, Change Management, and Customer Communication
- Software Development Staffing
- Residential Web Presentation of Customer AMI Data
- Information Technology Hardware and Software
- Cloud Based AMI Data Analytics

2.1.5. **Cost Estimates Approach**

The Ameren Illinois AMI project team worked through formal RFI and RFP processes to engage with multiple external vendors and internal stakeholders to obtain vendor contracts and internal staffing forecasts to successfully deploy an AMI solution.. The team also engaged with internal IT, Customer Service, Field Operations, and Corporate Planning teams to assess the costs of integrating an AMI solution into Ameren Illinois' business processes. 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.

In 2013, Ameren Illinois successfully contracted with all of its major vendors for the AMI program. For this cost/benefit analysis, Ameren Illinois has included the costs as contracted.

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].

2.1.6. **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. 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, Demand Response, Energy Efficiency, and PEV were quantified. Ameren Illinois has also included numerous additional customer and societal benefits which were not quantified in the business case.

2.1.7. **Cost/Benefit Analysis Approach**

A rigorous approach to the AMI cost / benefit analysis was conducted by using several different evaluation methodologies, including Internal Rate of Return, Net Present Value (NPV) analysis, a Ratepayer Impact Test, as well as Total Resource Cost (TRC) analysis. The time horizon used for the business case was 20 years. 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.

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

In Ameren Illinois' approved AMI Plan, the discount rate that was used for the NPV analysis reflected 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% in 2012). This approach was consistent with the ComEd AMI pilot evaluation.

With the revision to the cost/benefit analysis expanding AMI to 100%, Ameren Illinois took a more conservative approach to the NPV analysis by using its current weighted average cost of capital of set in the 2015 formula rate update filing of 5.583% as the discount rate.

2.2. 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 2: 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
	Identification and discussion of other investments or approaches (if any) that reasonably might achieve similar or better results	N/A
	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
	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

Requirement (from ISSGC report)	Sub-Requirement (from ISSGC report)	Ameren Illinois Business Case Alignment
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)	✓ Requirement Met
	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 to 100% is expected to be completed within 8 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 3: Key Cost Components (in $ millions, over 20 years)

Key Cost Components	Total
Capital	
AMI Meters	$196
Communication Network	$29
Information Technology	$55
Program Management	$10
AMI Operations Support of Deployment	$23
Subtotal of Capital Expenditures	**$313**
O&M	
Meter Reading	$16
Information Technology	$115
Management and Other Costs	$76
Subtotal of O&M	**$207**
TOTAL OF CAPITAL AND O&M	**$520**

3.1. AMI Meters Capital

This cost category includes the capital costs associated with the installation and configuration of the AMI meters.

Ameren Illinois estimates that the 20-year capital costs incurred as a result of full AMI deployment within 8 years will be approximately $196 million. Below is a summary of the main components of these costs.

Table 4: AMI Meters Cost (in $ millions, over 20 years)

AMI Meters Cost Drivers	Capital
AMI Meters	$158
AMI Meter Installation	$38
TOTAL	**$196**

The costs were derived from the AMI vendor's contract that was signed in April 2013 which included provisions for Ameren Illinois' to extend to 100% of its service territory.

AMI meter costs include the costs for the physical AMI meter for single-phase and three-phase meters having embedded two-way RF radio communicators. All self-contained meters that are 200 Amps or less will also have an internal switch for remote connect / disconnect applications. Each meter also includes a capitalized software license cost for the AMI Head End and Meter Data Management Software applications. This cost is based on a 100% deployment over 8 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.

Meter deployment is a major activity. It involves setting up cross-dock facilities as logistical hubs. Meters for electric services that are 200 amps or less are sample tested and meters for electric services greater than 320 amps are 100% tested for performance and accuracy before deployment. The meter installation 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.

3.2. Communications Network Capital

The AMI communications network hardware and installation phase involves the physical roll-out of the communications infrastructure (collection points and wide area network (WAN) hardware) in the field. 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 approximately 20,000 network devices (routers and collectors) across the Ameren Illinois' service territory.

Table 5: Communication Network Costs (in $ millions, over 20 years)

Communication Network Cost Drivers	Capital
AMI Communications Equipment	$17
AMI Communications Equipment Installation	$4
Make Ready Distribution Work	$8
TOTAL	**$29**

3.3. Information Technology (Applications and Operations) Capital

This cost category includes the capital implementation costs associated with the IT systems and integration hardware, software, development, security and IT project management.

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 meter data is 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 for 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 6: Information Technology (Applications and Operations) Costs (in $ millions, over 20 years)

Information Technology (Applications and Operations) Cost Drivers	Capital
Hardware	$12
Software	$5
Labor	$35
Integrated Operations Center	$3
TOTAL	**$55**

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

- Hardware
  - Servers for Enterprise Service Bus (ESB), the middleware applications that moves data between applications
  - Network Operations Hardware
  - Servers for AMI Applications
  - Servers for Database Applications
  - Data Storage

- Software
  - AMI Head End
  - Application Software for Data Transmission
  - Meter Data Management System
  - Data Analytics Software
  - ESB Tools
  - Integrated Operations Center AMI Network Monitoring and Work Management tools

- Labor
  - Business Process Review and Design
  - Requirements Definition
  - AMI Head End & MDMS Design and Integration
  - ESB Implementation
  - IT Environment Set Up, Installs, etc.
  - Development and Integration
  - Testing and Test Support
  - Data Analytics Support
  - Security and Event Planning

- Integrated Operations Center (IOC)
  - Design and construction of the Integrated Operations Center facility in Decatur, IL
  - Business process design and implementation for the IOC

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

3.4. Program Management Capital

A long-term strategic initiative such as AMI deployment requires a substantial amount of resources for program delivery activities. Ameren Illinois estimates that $10 million will be needed to fund program management activities for the 100% deployment of AMI

Table 7: Program Management Costs (in $ millions, over 20 years)

Program Cost Drivers	Capital
Program Management	$10

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

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

3.5. AMI Operations Support of Deployment Capital

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 the following table, AMI operational costs include costs for metering operations, communications operations and consumer education. The 20-year total cost in this area is $23 million in capital.

Table 8: AMI Operations Costs (in $ millions, over 20 years)

AMI Operations Cost Drivers	Capital
Metering	$5
Communications	$2
Miscellaneous (Contingency)	$16
TOTAL	**$23**

3.5.1. Metering Operations

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

- **Meter Inventory Management:** Managing the inventory for 100% deployment of meters over the 8-year rollout
- **Meter Warehousing:** Facility 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 functional

3.5.2. Communications Operations

Communications operations include all aspects supporting the deployment of the AMI communications network. Personnel includes network operations engineers, field / telecom operations technicians and supervisors, as well as Network Operations Center infrastructure specialists.

3.5.3. Miscellaneous (Contingency)

Ameren Illinois' project management best practices require a risk based contingency to be included as part of authorized project costs. Ameren Illinois' AMI project team has done an analysis on the remaining risk items for the expansion of AMI to 100% of its customers to develop the contingency amount carried in the business case.

3.6. Meter Reading Operations and Maintenance Costs

Meter Reading Costs are the manual methods required to supplement the AMI delivered benefits in order to meet Ameren Illinois' AMI-related performance metrics as established in Illinois Public Acts 97-616 and 97-646.

Table 9: Meter Reading Costs (in $ millions, over 20 years)

Meter Reading Cost Drivers	O&M
Manual Disconnect & Read to Meet Metrics	$1
AMI Communications Network	$12
Accelerated Depreciation for Existing Meters	$1
Electric Meter Failures	$2
TOTAL	**$16**

3.6.1. **Manual Disconnect & Read to Meet Metrics**

Ameren Illinois estimates that, since the deployment of AMI meters didn't begin until 2014 and will end in 2019, the AMI system won't be fully operational and deployed in time to meet the performance metrics, specifically in the areas of disconnects to reduce Consumption on Inactive Meters (CIM) and estimated bills. In order to reduce consumption on inactive meters, Ameren Illinois estimates that additional physical disconnects will need to occur to prevent usage on accounts that have had their service stopped. The AMI system will ultimately provide the capability to remotely physically disconnect electrical service to customers that have stopped service on their account. Until the AMI system is fully deployed and operational, additional manual disconnects will need to occur to meet the performance targets.

In order to reduce the amount of uncollectible revenue that is written off each year, Ameren Illinois estimates that additional physical disconnects will need to occur to prevent additional usage on accounts that are overdue. The AMI system will provide a remote disconnect capability that will address this need once the AMI system is fully implemented.

To date, Ameren Illinois has not spent any addition O&M to do additional manual reads to meet the estimated reads metric.

3.6.2. **AMI Communications Network**

Ameren Illinois has included O&M costs over the life of the project for make ready of the poles to receive the network equipment. Typically, this work is considered capital, except in situations where Ameren Illinois needs to add a new pole but keep the same conductors. Ameren Illinois' Plant Accounting has determined the labor to temporarily suspend the conductors and then rehang them on the new pole is considered O&M. Additionally, the ongoing cellular modem licenses for the AMI network's backhaul communication channel from the Wide Area Network (WAN) to Ameren Illinois' data center is considered O&M.

3.6.3. **Accelerated Depreciation for Existing Meters**

The final cost driver related to the AMI Metering Equipment implementation is the accelerated depreciation for the existing non-AMR meters and applicable AMR meters & infrastructure. Since the AMI meters will be rolled out to 100% of customers over the 8 year deployment period, all existing non-AMR meters and AMR meters 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 $85 million in 2012-2031 and $3 million in 2032 and beyond. The accelerated depreciation schedule for the existing meters based on AMI implementation totals $88 million in 2012-2031. While the total depreciated is the same for the existing & accelerated schedules (including years after 2031), the difference between the existing and accelerated depreciation for each year is included in the cost estimates.

3.6.4. **Electric Meter Failures**

Ameren Illinois has included the labor cost to remove and replace electric meters that fail after installation during the five year warranty period. If the meter fails after the five year warranty period, Ameren Illinois replaces the meter as a capital expenditure, which is included in our AMI Meters Capital cost item. Ameren Illinois has assumed a 0.5% failure rate of AMI meters during the warranty period.

3.7. Information Technology (Applications and Operations) Operations and Maintenance Costs

Table 10: Information Technology Costs (in $ millions, over 20 years)

Information Technology (Applications and Operations) Cost Drivers	O&M
Hardware	$4
Software	$28
Labor	$59
Integrated Operations Center	$22
Asset Management	$2
TOTAL	**$115**

3.7.1. **Hardware**

The hardware O&M consists of annual license fees for the various equipment used by the AMI solution to move data from the Wide Area Network through the various applications that use AMI data in Ameren Illinois' data center.

3.7.2. **Software**

The software O&M are the annual software maintenance fees for each application that Ameren Illinois uses to support the AMI solution. Examples of applications used on the AMI program that require annual software maintenance fees include:

- AMI Head End (manages the AMI Field Area Network)
- Meter Data Management System
- Enterprise Service Bus
- Meter Asset Management System
- Data Warehouse
- File Transfer Applications
- Residential Customer Web Portal
- Cloud Based Meter Data Analytics
- Integrated Operations Center Work Management System

3.7.3. **Labor**

Information Technology O&M labor includes application development specialists, infrastructure specialists, network communication technicians, RF engineers, business analysts, and application testers who are responsible for ensuring the AMI solution has high availability and is routinely upgraded as new functionality requests are received from Ameren Illinois Customer Service and Division Operations. Also included is each AMI IT organization's supervision.

3.7.4. **Integrated Operations Center**

Ameren Illinois' Integrated Operations Center (IOC) monitors the AMI network to ensure the smooth flow of AMI data from the endpoint through the field area network into the data center to the appropriate application that uses the AMI data for daily utility operations. The IOC is co-located with Ameren Illinois' dispatch center for

synergies in identifying and remotely troubleshooting communication and electric network issues. After the project team disbands, the IOC will serve as the center of Ameren Illinois' expertise on AMI operations.

3.7.5. **Asset Management**

Asset Management Planning Support costs include the development of enhanced asset planning analysis tools and software to enable better forecasting and planning. Additionally, there is an on-going maintenance cost for the tools and software that will be developed.

3.8. Management and Other Costs (Operations and Maintenance)

Table 11: Management and Other Costs (in $ millions, over 20 years)

Management and Other Cost Drivers	O&M
Program Management	$1
Metering Operations	$0
Change Management	$2
AMR Termination Fee	$7
Miscellaneous	$0
Customer Education – Deployment & Initial Functionality	$8
Demand Response	$5
Energy Efficiency	$5
Electric Vehicle Enhancement	$25
Customer Technology Interface & Support	$23
TOTAL	**$76**

3.8.1. **Program Management**

Subsequent to the full functionality integration of the AMI solution into Ameren Illinois' Energy Delivery Business Suite of Applications, the AMI project team will continue to oversee not only the capital investment required for the additional deployment of meters, modules, and network, but will also retain accountability for the ongoing operations and maintenance of the AMI solution. Thus, a portion of the AMI project team's program management staff will be apportioned to O&M as the AMI project team fixes new defects, performs upgrades, and maintains the AMI solution infrastructure.

3.8.2. **Metering Operations**

The Metering Operations O&M is for the ongoing software licenses for the AMI endpoint deployment software known as ProField. ProField is the work management application used by the deployment subcontractor to handle all aspects of the electric meter installation. ProField allows an installer to capture meter data at the install, take pictures of the installation, perform pre-job safety checks, and capture GPS coordinates.

3.8.3. **Change Management**

Ameren Illinois determined at the outset of the program to implement a robust internal change management program due to the large amount of people, process, and technology changes an AMI solution drives in an organization. The tasks performed by the change management team include:

- Creating a Change Management Strategy to identify an overarching plan to ensure the organization fully adopts the changes brought about by AMI
- Organizational Impact Analysis to determine the amount of change and the criticality of the change due to AMI on specific organizational positions
- Development of training materials, instructor led training, and computer based training for new AMI functionality
- Establishment of multiple internal communications channels (meetings, websites, change champions, etc) to allow co-workers to receive change information at the right time in their preferred method of learning
- Organizational surveys to determine the effectiveness of the change management tactics.

3.8.4. **AMR Termination Fee**

Expansion of the AMI deployment to 100% will result in a termination fee associated with the existing AMR contract.

3.8.5. **Miscellaneous**

The O&M costs in this category are for AMI Project Team office supplies, ongoing maintenance of the AMI Test Lab in Collinsville, and Mobile Data Terminals for Meter Specialists.

3.8.6. **Customer Education – Deployment and Initial Functionality**

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, how AMI creates value in energy conservation, and/or specific details on participation in Demand Response/Energy Efficiency programs. In addition, customer education efforts will include instruction on how to use customer self-service and web portal tools. Ameren Illinois has begun and will continue to execute its customer education plan outlined in its approved AMI Plan. The goals of the plan are to help our customers and stakeholders:

- Understand AMI to be an integral component of the Modernization Action Plan (MAP).
- Understand and be able to communicate the benefits of AMI to their families, friends, neighbors, constituents and others.
- Understand the benefits of advanced meters and pricing programs (such as Peak Time Rewards).
- Understand AMI is a “normal” course of doing business with Ameren Illinois.
- Use an effective “two-way” communication channel to provide feedback, ask questions and gather information.

As part of the communication to customers, Ameren Illinois has performed a customer segmentation study to determine what messaging themes resonates with the different customer segments. Ameren Illinois has used these customer segments in developing its communication collateral along its different communication channels and self-service options.

3.8.7. **Demand Response**

Customers, in the future, will have the choice to opt-in to a variety of pricing programs such as Peak Time Rewards (PTR), Critical Peak pricing rate, Direct Load Control program, or Time of Use program enabled by the

AMI solution. Costs associated with this program include technology such as in-home displays, programmable control thermostats, and home energy management systems. The AMI solution currently enables the use of in-home devices using the Home Area Network Zigbee Protocol standard. Ameren Illinois believes these programs will be provided through regulatory driven initiatives provided by the utility, such as Peak Time Rewards, and through Retail Electric Suppliers as they develop programs to differentiate themselves in the energy supply market.

3.8.8. **Energy Efficiency**

As customers are more aware of their energy use, there is a natural learning that takes place and results in overall usage reduction. The costs associated with the Energy Efficiency program include the home energy devices such as in-home displays or home energy monitors or messages customized to one's personal mobile devices. As stated previously, Ameren Illinois believes it will be the Retail Electric Suppliers who develop these types of programs.

3.8.9. **Electric Vehicle (EV) Enhancement**

AMI combined with smart charging technologies will allow EV owners to charge their vehicles at non-peak times when electricity rates are cheapest. The costs associated in this model are driven by the incremental cost of electric vehicles relative to conventional vehicles. It is assumed that the PEV premium is $9,500 in 2012 and declining at a rate of 16% in the first ten years of the forecast and 8% in the last ten years.

3.8.10. **Customer Technology Interface & Support**

AMI when used in conjunction with Demand Response technology is an enabler to provide new options for customers who choose to opt-in to Demand Response and Energy Efficiency programs. The IT costs associated with integrating to these new systems is estimated in these costs. The integration interfaces would leverage industry standard interfaces where applicable such as NIST standards for integrating to new head-end Demand Response system (DRMS), Green Button interfaces for customer web portals, and interfaces to third-party vendors providing additional enabling technologies that may be leveraged by Ameren Illinois customers in the future.

4. Ameren Illinois AMI Program Operational Benefits

Ameren Illinois has conducted a thorough assessment of all the operational benefits that it expects to accrue through the 100% AMI implementation within 8 years. Included in this analysis are direct operational benefits realized by Ameren Illinois and passed along to customer rates. These benefits are evaluated over a 20 year period and are expressed in incremental terms over the "business as usual" case.

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 $1.6 billion. The following table outlines a summary of the major quantifiable benefits expected out of the AMI implementation.

Table 12: Key Benefit Drivers (in $ millions, over 20 years)

Key Benefit Components	Total
O&M	
Meter Reading	$263
Field & Meter Services	$242
Unaccounted for Energy	$35
Customer Care Improvements	$13
Information Technology (Applications and Operations)	$3
Distribution System Management	$14
Subtotal of O&M Benefits	**$570**
Capital	
Distribution System Management	$13
Outage Management	$12
Asset Management Planning	$9
Avoided Meter Purchases	$26
Subtotal of Capital Benefits	**$60**
Customer	
Consumption on Inactive Meters	$22
Uncollectible Expense	$67
Demand Response	$590
Energy Efficiency	$35
Electric Vehicle Enhancement	$221
Carbon Reduction	$16
Value of Reduced Outage Duration	$35
Subtotal of Customer Benefits	**$986**

TOTAL OF O&M, Capital, and Customer Benefits	**$1,616**

4.1. Meter Reading Benefits

Ameren Illinois has been an early adopter of automated meter reading (AMR). Approximately 680,000 electric meters were converted to AMR – representing more than half of Ameren Illinois' electric 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 100% deployment of AMI over 8 years will result in meter reading cost savings of $263 million over a 20 year period.

Table 13: Meter Reading Cost Savings Breakdown (in $ millions, over 20 years)

Reduction in Meter Reading Costs	Cumulative Benefits
Reduction in Manual Meter Reading Expenses	$120
Reduction in AMR Meter Reading Expenses	$140
Reduction in Manual and AMR Meter IT Costs	$2
Reduction in On-Cycle Meter Reading Vehicle Expense	$1
TOTAL	**$263**

4.1.1. **Reduction in Manual Meter Reading Expenses**

Of the 574,000 electric meters that are manually read, 20% 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 8-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 $120 million 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 will replace all of its AMR meters with AMI meters starting in 2017. 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 $140 million over a 20 year business case time horizon.

4.1.3. **Reduction in Manual Meter IT Costs**

O&M costs associated with the IT systems that support existing manual 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 $175,000 per year. Ameren Illinois expects to be able to save 60% of these costs after deployment.

Ameren Illinois estimates reduction in manual meter IT costs to be approximately $2 million 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 $500,000. With AMI, Ameren Illinois expects reduction in manual and special meter reads to reduce vehicle costs by approximately $1 million over the 20-year business case time horizon.

4.2. Field and Meter Services Benefits

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 100% deployment of AMI over 8 years will result in field and meter services cost savings of $242 million over the 20 year business case time horizon.

Table 14: Field and Meter Savings Breakdown (in $ millions, over 20 years)

Field & Meter Services	O&M Benefits
Reduction in Manual Disconnect / Reconnect of Meters	$147
Reduction in Manual Off-Cycle / Special Meter Reads	$40
Reduction in Nuisance Stopped Meter Orders	$3
Reduction in Field Services Vehicle Expense	$30
Reduction in Customer Equipment Problem Outages	$3
Reduction in "OK on Arrival" Outage Field Trips	$18
Salvage Value of Replaced Meters	$1
TOTAL	**$242**

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 2010 to 2014, Ameren Illinois annually received about 245,000 orders for electric disconnect / re-connect per year, of which about 84,000 per year were disconnects for non-pay. Ameren Illinois expects cost savings of approximately $147 million 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.

Ameren Illinois annually conducts approximately 121,000 off-cycle reads. Quantifiable benefits related to off-cycle meter reading savings are expected to be approximately $40 million over a 20 year business case time horizon.

4.2.3. Reduction in Nuisance Stopped Meter Orders

Currently, Ameren Illinois receives approximately 22,200 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 $3 million related to reduction in nuisance stopped meter orders.

4.2.4. 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 $30 million 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 $3 million are expected over a period of 20 years.

4.2.6. 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, in AMI areas, thereby leading to cost savings.

Ameren Illinois currently works about 8,200 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 $18 million over the 20-year business case time horizon.

4.2.7. 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 $0.65 per meter, thereby leading to benefits of approximately $1 million for the utility over the 20-year business case time horizon.

4.3. Unaccounted for Energy Benefits

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 data analytics algorithms, UFE can be detected early and revenue losses related to unmetered energy can be reduced.

Ameren Illinois estimates that 100% AMI implementation in 8 years will help increase revenue from reduction in UFE by $35 million over a 20 year period.

Table 15: Field and Meter Savings Breakdown (in $ millions, over 20 years)

Reduction in Unaccounted for Energy	Cumulative Benefits
Theft / Tamper Detection & Reduction	$32
Faster Identification of Dead Meters	$3
TOTAL	**$35**

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 $32 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 2,200 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 $3 million over a 20 year time period.

4.4. Customer Care Improvement Benefits

An important benefit of AMI is the cost savings realized through efficiency improvements in customer call volume and 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. Efforts to raise awareness regarding AMI through marketing campaigns and customer education will increase customer adoption of self-service leading to an overall reduction in call volume. However, more complicated billing problems may increase due to expanded dynamic pricing. The potential to reduce float between meter read and customer billing will also drive greater benefits for Ameren Illinois.

Over a 20 year period, Ameren Illinois estimates $13 million in cost savings through efficiency improvements in customer call volume and management as a result of AMI.

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

Table 16: Efficiency in Billing Breakout (in $ millions, over 20 years)

Customer Care Improvements	O&M Benefits
Customer Service Support of AMI Implementation	$1
Reduction in Estimated Bills	$0
Reduction in Call Volume	$10
Reduction in Float between Meter Read and Customer Billing	$1
Reduction in Customer Accounts Management	$1
TOTAL	**$13**

4.4.1. Customer Service Service Support of AMI Implementation

Ameren Illinois' actual benefits realized to date include customer service personnel assigned as capital resources to the AMI program for business process design and testing of AMI functionality. These resources are included in the AMI program's capital costs.

4.4.2. 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 Accounts Department due to estimated bill issues.

4.4.3. Reduction in Customer Call Volume

Comprehensive marketing campaigns and customer awareness programs will educate customers about the self-service options available to them from Ameren Illinois throughout the AMI roll-out.

Ameren Illinois receives approximately 5 million calls annually related to customer inquiries. Ameren Illinois is currently planning on further developing its customer self-service capabilities, including web and IVR enhancements channels. Ameren Illinois plan to increase the self-service marketing efforts during the AMI roll-out, encouraging portal use and promoting self-service within AMI communications. Ameren Illinois estimates it will see approximately a 5% reduction in call volume as a result of greater self-service adoption. This will also be driven by lower bill inquiry call volume due to reductions in estimated bills. The reduction in call volume over the 20 year business case time horizon will produce $10 million in cost savings.

4.4.4. Reduction in Float between Meter Read and Customer Billing

Ameren Illinois expects AMI to enable all accounts within AMI territories 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 $1 million dollars.

4.4.5. **Reduction in Customer Accounts Management Costs**

Detailed information regarding the status of each AMI meter will allow Ameren Illinois to detect stopped or faulty meters on a real-time basis. Currently, meters that have stopped or are not registering an accurate reading as a result of device failure require a manual intervention to investigate the issue. Also, AMI will provide data to resolve billing exceptions faster, either through automation of the exception management process or through quicker access to data in the customer's meter. Through the implementation of AMI, Ameren Illinois expects to be able to reduce the customer accounts effort required to intervene on a stopped meter incident.

Over the 20 year period, the reduction in customer accounts back-office costs is estimated at $1 million dollars through a reduction in effort required to address stopped meters.

4.5. Information Technology (Applications and Operations) Benefits

Ameren Illinois currently uses 1.5 FTEs to support its existing Meter Data Management (MDM) for Power Smart Pricing / Real Time Pricing programs. Furthermore, in addition to the $36,000 it pays in annual software maintenance fees, it has also budgeted associated hardware purchase and upgrade costs. The new Meter Data Management System implemented with AMI will handle the data processing for these accounts. Thus, these costs will not be incurred after the implementation of the AMI project, resulting in a benefit of $3 million over the 20 year evaluation period

4.6. Distribution Network Efficiency Benefits

Ameren Illinois expects AMI to enable improvements in operating and maintaining the electrical distribution grid.

Over a 20 year period, Ameren Illinois estimates $14 million in cost savings through distribution network efficiency benefits as a result of AMI.

Table 17: Distribution Network Efficiency (in $ millions, over 20 years)

Distribution Network Efficiency	O&M Benefits
Distribution System Management	$1
Outage Management	$8
Asset Management Planning	$5
TOTAL	**$14**

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 2010 through 2014, the average O&M expense for the maintenance of overhead lines, underground lines, and line transformers was $84 million per year.

At 100% AMI deployment, Ameren Illinois expects 0.1% reduction in O&M expenses related to low voltage distributed system management. Over the 20-year business case time horizon, this results $1 million in O&M avoided cost.

4.6.2. **Outage Management**

AMI will enable Ameren Illinois to obtain automated outage notification from the smart meters, receive specific location information as well as verify when power has been restored. These features will allow crews to be deployed more efficiently to outage areas further improving crew management efficiency. Additional truck rolls will also be eliminated by verifying, remotely, that all customers in an area have been restored before dispatching the crew to the next location.

With the implementation of AMI, outage restoration spend will improve by 10% of cost savings, $8 million in O&M.

4.6.3. **Asset Management Planning**

Information received through AMI will provide more granular level system health and performance details. Using more detailed information from AMI enables Ameren Illinois to more accurately forecast load growth and evaluate system investments resulting in improved asset planning and strategies.

Over the 20 year business case time horizon improved asset planning and strategies will enable resource leveling and result in a total benefit of $5 million in O&M.

4.7. Capital Benefits

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 $60 million.

Table 18: Capital Benefits Breakout (in $ millions, over 20 years)

Capital Expenditures	Capital Benefits
Distribution System Management	$13
Outage Management	$12
Asset Management Planning	$9
Avoided Meter Purchases	$26
TOTAL	**$60**

4.7.1. **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 2010through 2014, the average capital investment by Ameren Illinois in the low voltage distribution system was approximately $72 million per year.

At 100% AMI deployment, Ameren Illinois expects 1% capital savings related to low voltage distributed system management. Over the 20-year business case time horizon, this results in capital benefits of approximately $13 million.

4.7.2. **Outage Management**

AMI will enable Ameren Illinois to obtain automated outage notification from the smart meters, receive specific location information as well as verify when power has been restored. These features will allow crews to be deployed more efficiently to outage areas further improving crew management efficiency. Additional truck rolls will also be eliminated by verifying, remotely, that all customers in an area have been restored before dispatching the crew to the next location.

With the implementation of AMI, outage restoration spend will improve by 10% resulting in $12 million in Capital savings.

4.7.3. **Asset Management Planning**

Information received through AMI will provide more granular level system health and performance details. Using more detailed information from AMI enables Ameren Illinois to more accurately forecast load growth and evaluate system investments resulting in improved asset planning and strategies.

Over the 20 year business case time horizon improved asset planning and strategies will enable resource leveling and result in a total benefit of $9 million in Capital.

4.7.4. **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% annually, Ameren Illinois estimates cost savings from avoided meter replacements at approximately $26 million over 20 years.

4.8. Ameren Illinois AMI Customer/Societal Benefits

While the above benefits are largely operational in nature and will flow to customers through Ameren Illinois and its operations and rates, other benefits from AMI will be flow directly to Ameren Illinois customers. These will be captured by customers in the form of reduced energy usage and the potential for special rate plans in which Ameren Illinois' customers can engage.

Quantified Customer/Societal Benefits are benefits that impact Ameren Illinois customers and are realized by those customers or by society as a whole, not by Ameren Illinois.

Table 19: Quantified Customer Benefit Breakout (in $ millions, over 20 years)

Quantified Customer Benefits	Cumulative Benefits
Reduced Consumption on Inactive Meters	$22
Reduced Uncollectible / Bad Debt Expense	$67
Customer Engagement Benefits	
Demand Response	$590
Energy Efficiency	$35
Electric Vehicle Enhancement	$221
Carbon Reduction	$16
Customer Outage Reduction Benefit	$35
TOTAL	**$986**

4.8.1. **Reduced Consumption on Inactive Meters**

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 residential CIM with the 100% implementation of AMI and associated manual methods.

Over the 20 year business case time horizon, cumulative benefits associated with reduced consumption on inactive meters are estimated at $22 million.

4.8.2. **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 $3.5 million annual reduction in uncollectible expense is estimated after 62% AMI rollout with associated manual methods.

Over the 20 year business case time horizon, cumulative benefits associated with reduced uncollectible expense / bad debt are estimated at approximately $67 million.

4.8.3. **Customer Engagement Benefits**

For the next four customer benefits (Demand Response, Energy Efficiency, Electric Vehicle Enhancement, and Carbon Reduction), Ameren Illinois has scaled the benefits that requires customers to engage in a energy reduction program from the 62% AMI deployment to the 100% deployment, but has not updated the analysis with new baseline assumptions.

4.8.4. **Demand Response**

Once AMI is in place, retail rates can be aligned more closely with the real-time costs of energy. Dynamic pricing and other customer programs are designed to incentivize customers to reduce load during the most expensive hours of the day, thus decreasing the aggregate electricity demand during peak times.

To quantify the potential benefits of Demand Response, Ameren Illinois expects that all Residential customers will be eligible to participate in a Peak Time Rebate program for electricity curtailed during critical peak hours. Residential customers will also have opportunities to opt-in to a Critical Peak Pricing rate with and without enabling technologies, and Direct Load Control or Time-of-Use with smart charging for electric vehicles. Commercial and Industrial customers may be on a Critical Peak Pricing Program, with or without Automated Demand Response. Additionally, certain C&I customers may qualify to participate in a Direct Load Control program. These programs may be provided by the utility or by third party service providers.

The benefits of these programs are largely driven by participation rates in the programs and the change in peak load usage per customer, valued at the appropriate avoided capacity and energy costs and avoided carbon emissions. The cost/benefit analysis assumes a likely participation scenario in which 40% of the residential customers who receive AMI will be on some type of Demand Response (mentioned previously) and 3-6% participation among Commercial and Industrial customers with AMI.

Over the 20 year Business Case time horizon the combined benefits from Demand Response are estimated at $590 million.

4.8.5. **Energy Efficiency**

AMI-enabled Energy Efficiency programs and technologies can contribute to increased Energy Efficiency throughout the day. When customers are more aware of their usage either by using their in-home displays or via the web, they often adjust their behavior and overall energy usage is reduced.

Over the 20 year Business Case time horizon the combined benefits from Energy Efficiency are estimated at $35 million.

4.8.6. **Electric Vehicle Enhancement**

AMI combined with smart charging technologies will allow PEV owners to charge their vehicles at non-peak times when electricity rates are cheapest. This will lower the PEV cost per mile driven and encourage additional consumers to switch to PEVs (compared to the flat-rate case). Society will benefit from this switch since electricity is cheaper and produces less carbon dioxide per mile driven than gasoline. Assuming that 0.7 percent of vehicles among customers with AMI in the Ameren Illinois territory are PEVs (and assuming furthermore that these PEVS would not have been purchased but for AMI and time-of-use rates that lower the cost of operating these vehicles), the total 20 year Business Case nominal benefit from PEVs is $221 million.

4.8.7. **Carbon Reduction**

When energy emissions are lowered due to the Energy Efficiency (EE) programs described above, less carbon is emitted. Due to the smart charging of electric vehicles, there would be an increase in off-peak energy usage, emitting more carbon. However, this increase is more than offset by the reduced carbon emissions from avoided gasoline usage in conventional cars. The change in carbon emissions is monetized using the expected price of carbon in the future. Ameren Illinois assumes that the price of carbon will be zero until 2025, at which point it is $30 per metric ton in nominal terms and by 2032 it rises to $51 per metric ton.

The total 20 year Business Case benefits from reduced carbon emissions are $16 million.

4.8.8. **Customer Outage Reduction Benefit**

AMI facilitates restoring power quicker through the use of the last gasp feature of the meter and the system's ability to ping a meter. Benefits flow to customers in the form of the avoided economic losses they experience due to unreliability. For the purposes of this estimate, various industry reports were reviewed. While the value per customer class did vary slightly and different methods were found in how to value the reliability benefit, there was general consensus that the reliability benefit is an item to be considered when making smart grid investments.

Ameren Illinois utilized the ICE (interruption cost estimation) calculator, which was funded by Lawrence Berkley National Lab and DOE in conjunction with Freeman, Sullivan and Company. The methodology[3] for calculating reliability benefits involved using Ameren Illinois' SAIFI and CAIDI information, survey data from the ICE calculator, and information regarding the number of residential and small commercial customers. Large Commercial and Industrial customers were excluded from the analysis since many of these customers have backup strategies for reliability purposes.

The total 20-year customer value for outage reduction is $35 million.

4.8.9. **Additional Customer/Societal Benefits**

Additional Customer/Societal Benefits are benefits realized by the broader communities that Ameren Illinois serves. Ameren Illinois has not quantified these benefits at this time.

[3] *The 2011 NARUC report, "Evaluating Smart Grid Reliability Benefits for Illinois"*, January 2011

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.

Local Economy

With the rollout of AMI, several jobs will be created during the 8 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.

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 Illinois specified the use of standards in choosing its AMI vendor. First, Ameren Illinois' AMI vendor will provide a standards based network that will, in the future, allow other vendors to provide endpoint and network device products that work with the standards based network. 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.

Other Environmental Benefits

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. Emissions 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

Electric Vehicles

Only the benefits to society of AMI for the additional PEV ownership attributable to AMI were quantified. However, there are still several benefits from AMI that arise from those customers who would have purchased PEVs in the absence of AMI. By incentivizing these PEV owners to charge their vehicles during off-peak periods, AMI will reduce the amount of generation, transmission and distribution capacity needed by Ameren. Furthermore, as battery technology continues to evolve and mature, many believe that the PEVs 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. This can potentially be a very valuable resource in integrating more renewable generation resources into the grid.

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. Net Metering with AMI meters records 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.

Variable Generation

AMI allows for dynamic prices that reflect shifting supply conditions. In doing so, AMI creates an additional tool in managing this variable generation - customer demand response. For example, a smart-charging PEV can help balance the grid at night by charging when the wind gusts and putting additional electricity back on the grid when it does not.

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 Illinois 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

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.

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
- Ratepayer Impact

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, a signicant portion of Ameren Illinois' AMI meters will have useful life beyond the 20 year investment evaluation.

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 Table 20:

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

Key Cost / Benefit Drivers	Total
Benefits	
Utility O&M Benefits	$570
Utility Capital Benefits	$60
Customer/Societal Benefits	$986
Total (nominal)	**$1,616**
Costs	
Capital	$313
Operations & Maintenance	$207
Total (nominal)	**$510**
Terminal Value in Year 2031	**$456**

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	$362
Depreciation Net Change (including stranded investment in existing meters)	($226)
Taxes Net Change	($39)
Return Requirements Net Change	($84)
Direct Customer Benefits	$1,441
Total (nominal)	**$1,454**

5.1. Calculation of Terminal Value

As Ameren Illinois is planning on an 8 year rollout of AMI meters across 100% of its customers, 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 69% of the installed meters will still have a remaining useful life of at least 5 years. It is assumed that the AMI system will still be at critical mass and operating until the number of active meters with remaining depreciable life dips below 100,000.

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. Determine when there is no longer critical mass of active meters with remaining depreciable life (at least 100,000 active meters) – 2038
2. Identify the average fixed annual costs for operating and maintaining the AMI system – $7 million
3. Identify the average variable annual net benefit per meter (total benefits - variable costs) – $103.56
4. Calculate the net impact by year for each year remaining on useful life of meters up to the point where there is not critical mass of the AMI system (from 1.2M meters in service in 2032 to 250,000 meters in service in 2038)
5. Calculate the NPV of these net impacts using the customer-relevant discount rate of 5.583% (Weighted Average Cost of Capital) to get the Terminal Value in 2032
6. Discount the 2032 Terminal Value to 2012 using the same discount rate

This results in a terminal value in 2032 of $456 million. By discounting this back to 2012, the terminal value yields an additional present value $154 million:

Table 22: Terminal value result ($ in millions)

Result	Total
NPV of Terminal Value in 2031	$456
NPV of Terminal Value in 2012	$154

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:

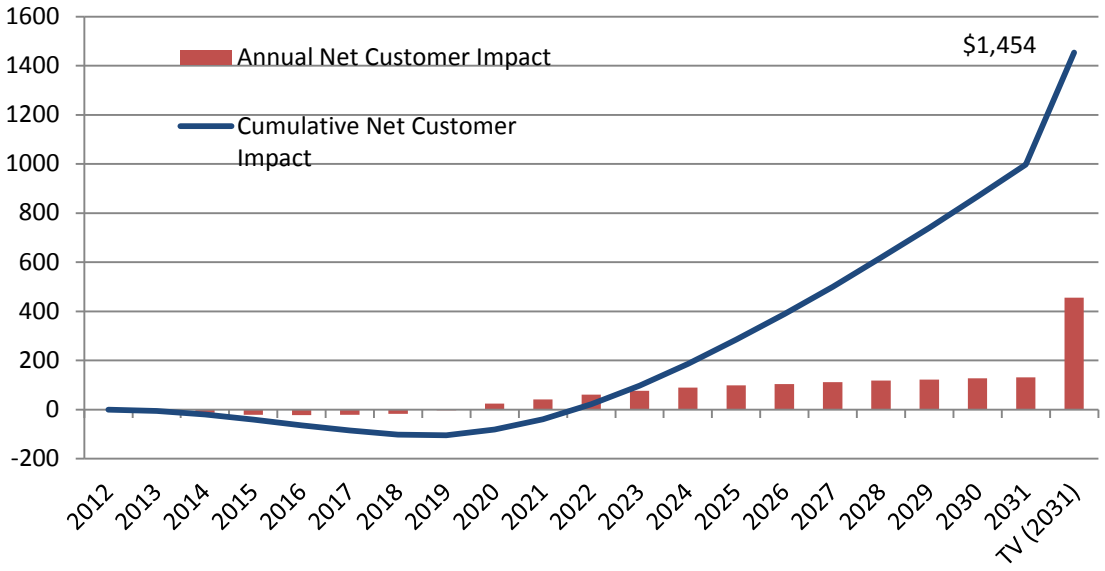
Table 23: Annual & Cumulative Cost / Benefit Cash Flow (in $ millions, non-discounted)

Year	Annual Net Customer Impact	Cumulative Net Customer Impact
2012	(1)	(1)
2013	(5)	(6)
2014	(14)	(20)
2015	(21)	(41)
2016	(23)	(64)
2017	(21)	(85)
2018	(17)	(102)
2019	(3)	(105)
2020	24	(81)
2021	41	(40)
2022	61	21
2023	76	97
2024	89	186
2025	99	285
2026	104	389
2027	111	500
2028	118	618
2029	122	740
2030	127	867
2031	131	998
Terminal Value (2031)	456	1,454

As can be seen in the table above, the payback period for the AMI business case is 11 years. In other words, the cumulative benefits will begin to exceed the cumulative costs in 2022. 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 the remaining years)
- The rollout of the meters is over an 8 year period, with 100% of the meters deployed by 2019.

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. Ameren Illinois has taken a conservative approach to the relevant discount rate and used its current Weighted Average Cost of Capital (WACC) as the discount rate. 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:

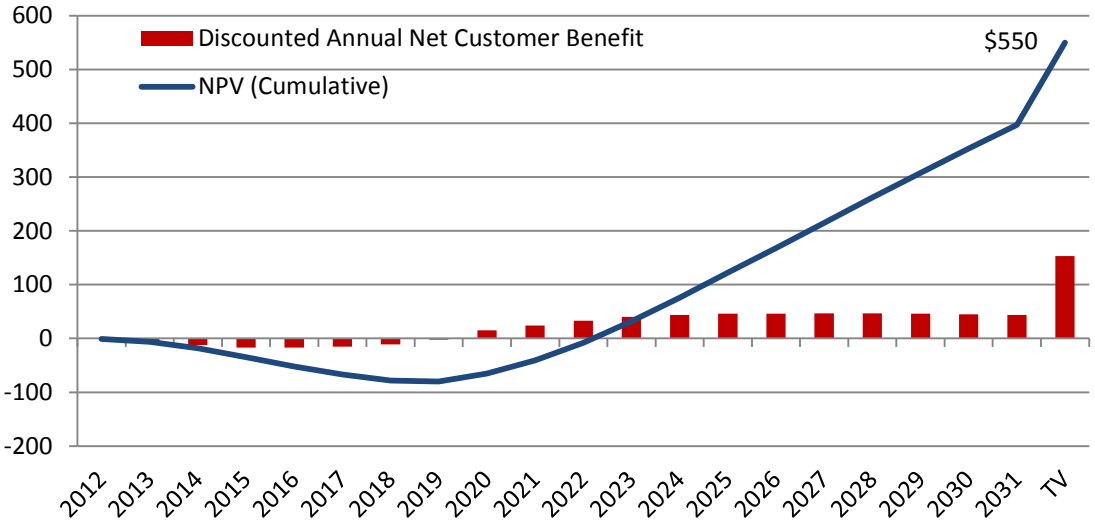
Table 24: Annual Discounted Net Customer Benefit (in $ millions, discounted)

Year	Net Customer Benefit
2012	(1)
2013	(5)
2014	(12)
2015	(17)
2016	(17)
2017	(15)
2018	(11)
2019	(2)
2020	15
2021	24
2022	33
2023	40

Year	Net Customer Benefit
2024	44
2025	46
2026	46
2027	47
2028	47
2029	46
2030	45
2031	44
TV (Terminal Value)	154
TOTAL (NPV)	**550**

As seen above, the NPV for the AMI business case is $550 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 utility 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. Ameren Illinois has taken a conservative approach to the societal cost of money and used its current Weighted Average Cost of Capital (WACC) as the discount rate. 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. Terminal value was included as a net benefit in the Gross Resource Benefits.

The result of the TRC analysis is a TRC of 2.70, which is summarized in Table 25.

Table 25: Total Resource Costs Analysis Summary ($ in millions, over 20 years)

Category	TOTAL
Gross Resource Benefits (nominal)	$2,011
PV of Gross Resource Benefits	$874
Gross Resource Costs (nominal)	$548
PV of Gross Resource Costs	$324
Total Resource Costs (ratio of PV of Gross Resource Benefits to PV of Gross Resource Costs)	**2.70**

5.5. Ratepayer Impact

The final methodology used to analyze the costs and benefits of Ameren Illinois' 100% AMI deployment is the ratepayer impact test. The ratepayer impact test takes the net Total Cost to Customers and multiplies it by the number of annual bills for a rate class and the percentage of the revenue requirement that customer class receives. The ratepayer impact test assumes that the AMI investment will impact revenue requirement in relative proportion to "customer-related" costs in the electric class cost of service study (ECOSS) today. The "customer-related" costs Ameren Illinois included in this analysis are all costs and the O&M and Capital benefits that flow through the revenue requirement as well as the consumption on inactive meter and uncollectible benefits under the Customer benefits classification. From the latest ECOSS study, 73.6% of the incremental revenue requirement is within the residential class, and 22.3% is within the DS-2 small non-residential class.

The result of the AMI investment's impact on a customer's monthly delivery services bills is summarized in the following table.

Table 26: Ratepayer Impact Test Summary ($ in millions, over 20 years)

Year	DS-1 Residential Customer	DS-2 Small Non-Residential Customer
2012	$ 0.03	$ 0.07
2013	$ 0.31	$ 0.67
2014	$ 0.80	$ 1.74
2015	$ 1.21	$ 2.63
2016	$ 1.37	$ 2.98
2017	$ 1.37	$ 2.98
2018	$ 1.36	$ 2.95
2019	$ 1.08	$ 2.35
2020	$ 0.23	$ 0.50

Year	DS-1 Residential Customer	DS-2 Small Non-Residential Customer
2021	$(0.10)	$(0.22)
2022	$(0.47)	$(1.01)
2023	$(0.77)	$(1.67)
2024	$(1.06)	$(2.30)
2025	$(1.17)	$(2.54)
2026	$(1.21)	$(2.64)
2027	$(1.54)	$(3.34)
2028	$(1.70)	$(3.69)
2029	$(1.82)	$(3.95)
2030	$(1.90)	$(4.13)
2031	$(1.97)	$(4.28)

The ratepayer impact analysis includes two of the seven Customer benefits listed in Table12 (Consumption on Inactive Meter - $22 million and Uncollectibles - $67 million). The Customer Engagement benefits (Demand Response - $590 million, Energy Efficiency - $35 millioin , Electric Vehicle Enhancement - $221 million, and Carbon Reduction - $16 million) plus the Value of Reduced Outage Duration - $35 million are not included since they would flow to customers from energy usage reductions or economic loss avoided and not through a customer's delivery services rate.

6. 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.

6.1. Approach and Assumptions

Outlined in Table 27 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 and the change in Internal Rate of Return (IRR) from the base case. The base case Internal Rate of Return is 28.4%.

Table 27: Sensitivity Analysis Variables, Assumptions, and Impact on IRR

Sensitivity Variable	Base Case Value	Sensitivity Range / Assumptions	Description / Rationale	New IRR
Customer Engagement in AMI Enabled Programs	Included	Excluded	Ameren Illinois has included benefits that requires the customer to engage in an energy saving program enable by AMI such as energy efficiency, demand response, or electric vehicle charging.	12.7%
Customer/ Societal (DR,EE,& PEV)	40% participation rate	20% - 60% participation rates	Ameren Illinois has conducted analysis around Customer/Societal benefits and assumed 40% participation rate by customers in the base case. For the purposes of the sensitivity analysis, Ameren Illinois has taken 50% to 150% of this value.	22.5% - 32.8%
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.	28.0% - 28.9%
CIM Benefits ($ per KWH Recovery)	9.79 cents / KWH	5.39 cents / KWH	In the base case, Ameren Illinois assumes that it will be able to bill for and thereby recover the full 9.79 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 5.39 cents / KWH.	28.2%

Sensitivity Variable	Base Case Value	Sensitivity Range / Assumptions	Description / Rationale	New IRR
Uncollectible Benefits	$3.75 million per year after 10 years of AMI rollout	-15% 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 20%. 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 and a 15% increase in uncollectible benefits for the purposes of sensitivity analysis.	28.2% - 28.7%
O&M Benefits	$557 million	-10% to +10%	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 10% decrease and a 10% increase in O&M benefits over the 20-year business case time horizon.	27.0% - 29.8%
O&M Costs	$236 million	10% Increase	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 10% increase in O&M costs for purposes of sensitivity analysis	27.4%

Sensitivity Variable	Base Case Value	Sensitivity Range / Assumptions	Description / Rationale	New IRR
Capital Costs	$314 million	5% Increase	Ameren Illinois' projected capital costs for meters and communications network hardware are based on contracted pricing obtained in a rigorous vendor sourcing process. Capital costs for IT systems and labor, and management labor for the most part have already been deployed. Ameren Illinois thus assumes a 5% increase in capital costs for the purposes of sensitivity analysis	27.8%

6.2. Sensitivity Analysis Results

If all of the sensitivities are adjusted to the most conservative view, the AMI implementation still returns a 6.62% internal rate of return to Ameren Illinois' customers. The most conservative view still exceeds the weighted average cost of capital of 5.583%.

7. Appendix

7.1. General Assumptions

- The business case assumes 100% deployment of AMI electric meters over a period of 8 years
- The model analysis period is 20 years starting in 2012, ending in 2031, with AMI meter deployment commencing in year 2014
- Meter depreciation time (useful life) period used in the model is 20 years
- Meter growth rate is estimated at 0.0% annually
- Salvage cost per meter is assumed to be $0.65
- The following escalation rates over the 20-year business case time horizon are assumed:
  - General: 2.0%
  - Labor: 2.5%
  - Transportation: 2.0%
- Financial Assumptions
  - AIC composite tax rate of 40.0% is used to calculate Net Customer Impact
  - Discount Rate of 5.563% (Ameren Illinois' Weighted Average Cost of Capital) is used to calculate NPV and TRC

7.2. Cost Summary by Year (in $ millions)

	20-Year Total	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Capital Items - Summary																					
Meters																					
AMI Electric Meters	157.9	-	-	8.0	25.2	18.5	39.0	36.4	30.8	-	-	-	-	-	-	-	-	-	-	-	-
AMI Electric Meter Installation	37.8	-	-	1.1	3.8	5.4	9.6	9.7	8.2	-	-	-	-	-	-	-	-	-	-	-	-
Communication Network																					
AMI Communications Equipment	17.7	-	1.0	4.1	3.1	5.5	0.9	-	-	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
AMI Communications Equipment Installation	4.2	-	-	0.3	0.7	1.7	0.7	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Make Ready Distribution Work	7.7	-	-	1.4	0.9	2.3	1.6	1.5	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Information Technology (Applications and Operations)																					
Hardware	11.8	-	2.1	0.2	0.2	0.0	0.1	0.1	1.0	3.7	-	-	-	-	-	4.4	-	-	-	-	-
Software	4.8	-	3.2	1.1	0.2	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Labor	35.6	-	10.2	14.3	10.5	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Integrated Operations Center	2.8	-	0.8	1.0	0.2	0.2	0.2	0.2	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Program Management																					
Program Management	9.7	2.9	0.4	0.7	1.1	1.2	1.1	1.1	1.2	-	-	-	-	-	-	-	-	-	-	-	-
AMI Operations Support of Deployment																					
Metering	4.6	-	-	-	0.1	1.1	1.2	1.2	1.0	-	-	-	-	-	-	-	-	-	-	-	-
Communications	2.6	-	-	0.0	0.1	0.7	0.7	0.6	0.4	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous (Contingency)	16.0	-	0.3	0.8	0.0	0.0	4.9	5.1	4.8	-	-	-	-	-	-	-	-	-	-	-	-
Total Capital	313.2	2.9	18.1	32.9	46.1	37.4	60.0	56.5	47.9	3.8	0.1	0.3	0.3	0.3	0.3	4.7	0.3	0.3	0.3	0.3	0.3
O&M Items - Summary																					
Meter Reading Costs																					
Manual Disconnect & Read to Meet Metrics	1.4	-	-	0.5	0.3	0.3	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AMI Communications Network	12.3	-	-	0.2	0.3	0.8	0.6	0.6	0.7	0.8	1.6	0.4	0.1	0.1	0.9	1.7	0.4	0.1	0.1	0.9	1.9
Accelerated Depreciation for Existing Meters	1.0	-	-	0.4	1.4	2.5	4.1	5.0	5.3	3.4	1.7	(0.8)	(3.0)	(4.2)	(3.6)	(3.0)	(2.5)	(2.0)	(1.6)	(1.2)	(0.9)
Electric Meter & Gas Module (Failures)	2.0	-	-	-	-	0.1	0.1	0.2	0.3	0.4	0.3	0.3	0.2	0.1	-	-	-	-	-	-	-
Information Technology (Applications and Operations)																					
Hardware	4.0	-	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
Software	28.4	0.0	0.6	0.5	0.4	0.9	1.0	1.3	1.7	1.8	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.9	1.9	1.9	1.9
Labor	58.7	0.1	0.8	0.8	1.9	2.9	2.9	2.7	3.0	3.2	3.2	3.3	3.4	3.5	3.6	3.7	3.7	3.8	3.9	4.0	4.1
Integrated Operations Center	21.9	-	-	0.8	0.6	0.8	0.7	0.8	1.0	1.3	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.6
Asset Management	1.8	-	-	-	-	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Management and Other Costs																					
Program Management	0.5	-	-	-	-	0.1	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Metering Operations	0.2	-	-	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Change Management	1.6	-	-	0.7	0.4	0.1	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
AMR Termination Fee	7.1	-	-	-	-	-	-	3.3	3.8	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	0.0	-	-	-	-	-	-	-	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-
Customer Education - Deployment & Initial Functionality	8.2	-	0.3	1.3	1.1	1.0	1.5	1.5	1.5	-	-	-	-	-	-	-	-	-	-	-	-
Demand Response	4.9	-	-	-	-	0.1	0.2	0.3	0.6	0.7	0.5	0.6	0.6	0.5	0.4	0.3	0.1	0.0	0.0	0.0	0.0
Energy Efficiency	4.9	-	-	-	-	0.1	0.2	0.3	0.6	0.7	0.5	0.6	0.6	0.5	0.4	0.3	0.1	0.0	0.0	0.0	0.0
Electric Vehicle Enhancement	25.3	-	-	-	-	0.5	0.8	1.7	2.9	3.3	2.9	3.1	3.2	2.5	1.9	1.4	0.7	0.1	0.1	0.0	0.0
Customer Technology Interface & Support	23.0	-	-	-	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.2	0.2	0.2	0.2	0.2
Total O&M	207.3	0.1	1.8	5.2	6.7	12.5	14.9	20.5	23.9	17.9	16.2	12.9	10.6	8.4	9.0	10.0	6.6	6.1	6.6	8.0	9.4
Grand Total O&M / Capital	520.5	2.9	19.9	38.1	52.8	49.9	74.9	77.1	71.7	21.7	16.4	13.2	10.9	8.7	9.4	14.7	6.9	6.4	6.9	8.3	9.7

7.3. Benefits Summary by Year (in $ millions)

	20-Year Total	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
O&M Items - Summary																					
Meter Reading																					
Reduction in Manual Meter Reading Expenses	119.6	-	-	-	-	3.1	5.1	6.7	6.9	7.1	7.3	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.9	9.1	9.3
Reduction in AMR Meter Reading Expenses	140.0	-	-	0.4	0.4	0.4	0.8	3.0	6.9	9.5	9.7	9.9	10.1	10.3	10.5	10.8	11.0	11.2	11.4	11.7	11.9
Reduction in Manual and AMR Meter IT Costs	1.8	-	-	-	-	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Reduction in On-Cycle Meter Reading Vehicle	1.2	-	-	-	-	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Field & Meter Services																					
Reduction in Manual Disconnect / Reconnect Meters	147.2	-	-	-	0.4	2.0	3.7	5.9	8.1	9.2	9.4	9.7	9.9	10.2	10.4	10.7	10.9	11.2	11.5	11.8	12.1
Reduction in Manual Off-Cycle / Special Meter Reads	39.7	-	-	-	0.2	1.1	1.8	2.2	2.3	2.3	2.4	2.4	2.5	2.6	2.6	2.7	2.8	2.8	2.9	3.0	3.1
Reduction in Nuisance Stopped Meter Orders	2.9	-	-	-	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Reduction in Field Services Vehicle Expense	29.7	-	-	-	0.1	0.5	0.9	1.3	1.7	1.9	1.9	2.0	2.0	2.0	2.1	2.1	2.2	2.2	2.3	2.3	2.3
Reduction in Customer Equipment Problem Outage Field Tri	3.5	-	-	-	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
Reduction in "OK on Arrival" Outage Field Trips	17.8	-	-	-	0.1	0.2	0.4	0.7	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4	1.5
Salvage Value of Replaced Meters	1.0	-	-	0.0	0.1	0.2	0.2	0.2	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Reduction in Unaccounted for Energy																					
Theft / Tamper Detection & Reduction	32.1	-	-	-	-	0.2	0.9	1.4	1.9	2.1	2.2	2.2	2.2	2.3	2.3	2.3	2.4	2.4	2.4	2.5	2.5
Faster Identification of Dead Meters	2.6	-	-	-	-	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Customer Care Improvements																					
Customer Service Support of AMI Implementation	1.2	-	0.1	0.4	0.6	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reduction in Call Volume	9.6	-	-	-	-	0.1	0.3	0.4	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8
Reduction in Float Between Meter Read & Customer Billing	0.6	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reduction in Customer Accounts Management	1.2	-	-	-	-	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Information Technology (Applications and Operations)																					
Information Technology	3.5	-	-	-	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
Distribution Network Efficiencies																					
Distribution System Management	1.5	-	-	-	-	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Outage Management	7.8	-	-	-	-	0.1	0.2	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Asset Management Planning	5.2	-	-	-	-	0.0	0.1	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Total O&M Impacts	569.6	-	0.1	0.8	2.0	8.3	15.1	23.4	31.2	35.9	36.7	37.5	38.4	39.2	40.1	41.1	42.0	43.0	43.9	45.0	46.0
Capital Items - Summary																					
Distribution System Management	13.4	-	-	-	-	0.2	0.4	0.6	0.8	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.1
Outage Management	11.6	-	-	-	-	0.2	0.3	0.5	0.6	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0
Asset Management Planning	9.1	-	-	-	-	0.1	0.2	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.8
Avoided Meter Purchases	26.2	-	-	0.2	0.7	1.3	2.0	2.0	2.1	2.1	2.0	1.9	1.6	1.4	1.2	1.2	1.2	1.3	1.3	1.4	1.4
Total Capital Impacts	60.3	-	-	0.2	0.7	1.8	2.9	3.4	3.9	4.2	4.2	4.1	3.9	3.7	3.6	3.7	3.8	3.9	4.0	4.1	4.2
Customer Benefits																					
Consumption on Inactive Meters	22.3	-	-	-	-	0.3	0.4	0.7	1.2	1.5	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8
Uncollectible Expense	67.2	-	-	-	-	0.9	1.8	2.8	3.8	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4
Demand Response	589.6	-	-	-	-	0.3	1.0	3.4	9.0	17.7	25.1	34.4	41.5	47.1	51.5	55.0	56.0	58.5	60.8	63.0	65.3
Energy Efficiency	35.0	-	-	-	-	0.0	0.1	0.3	0.6	1.1	1.6	2.2	2.7	3.0	3.2	3.3	3.3	3.3	3.4	3.4	3.4
Electric Vehicle Enhancement	220.6	-	-	-	-	0.2	0.6	1.8	4.1	7.1	10.0	13.5	16.1	18.0	19.5	20.6	20.7	21.3	21.9	22.3	22.9
Carbon Reduction	15.5	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	1.8	2.0	2.2	2.4	2.6	2.7
Value of Reduced Outage Duration	35.4	-	-	-	-	0.2	0.9	1.4	2.0	2.2	2.3	2.4	2.4	2.5	2.5	2.6	2.7	2.7	2.8	2.9	2.9
Total Customer Impacts	985.6	-	-	-	-	2.0	4.7	10.4	20.7	33.9	44.9	58.5	68.8	77.0	84.8	89.9	91.3	94.9	98.2	101.3	104.5
Grand Total	1,615.6	-	0.1	0.9	2.7	12.1	22.6	37.2	55.8	74.0	85.8	100.2	111.1	119.9	128.5	134.6	137.1	141.8	146.1	150.3	154.7

7.4. 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
O&M Benefits																				
Total AMI O&M Savings	-	0.1	0.8	2.0	8.3	15.1	23.4	31.2	35.9	36.7	37.5	38.4	39.2	40.1	41.1	42.0	43.0	43.9	45.0	46.0
O&M Expenses																				
Meters and Modules	-	-	(1.0)	(2.0)	(3.7)	(5.1)	(5.8)	(6.3)	(4.7)	(3.7)	0.2	2.7	4.0	2.7	1.3	2.1	1.9	1.5	0.2	(1.0)
Information Technology Applications and Operations	(0.1)	(1.5)	(2.2)	(3.1)	(4.8)	(4.8)	(5.2)	(6.0)	(6.5)	(6.6)	(6.7)	(6.9)	(7.0)	(7.2)	(7.3)	(7.5)	(7.6)	(7.8)	(7.9)	(8.1)
Management and Other Costs	-	(0.3)	(2.0)	(1.5)	(4.0)	(5.0)	(9.6)	(11.6)	(6.7)	(5.9)	(6.3)	(6.4)	(5.4)	(4.6)	(4.0)	(1.2)	(0.4)	(0.3)	(0.2)	(0.3)
Total AMI O&M Expense	(0.1)	(1.8)	(5.2)	(6.7)	(12.5)	(14.9)	(20.5)	(23.9)	(17.9)	(16.2)	(12.9)	(10.6)	(8.4)	(9.0)	(10.0)	(6.6)	(6.1)	(6.6)	(8.0)	(9.4)
Depreciation / Taxes and Total Costs to Customers																				
Net Change in Operation and Maintenance Expense	(0.1)	(1.7)	(4.4)	(4.8)	(4.2)	0.2	2.8	7.3	18.0	20.5	24.6	27.8	30.8	31.1	31.1	35.4	36.9	37.3	37.0	36.6
Net Change in Book Depreciation	(0.3)	(2.2)	(5.9)	(10.1)	(13.3)	(15.7)	(16.9)	(16.4)	(14.8)	(13.5)	(13.0)	(12.4)	(12.0)	(11.8)	(11.9)	(12.0)	(11.8)	(11.3)	(10.6)	(10.0)
Net Change in Income Taxes	(0.1)	(0.5)	(1.1)	(1.9)	(2.3)	(3.3)	(4.1)	(4.7)	(4.1)	(3.5)	(3.0)	(2.6)	(2.2)	(1.8)	(1.5)	(1.1)	(0.8)	(0.5)	(0.2)	0.1
Net Change in Return Requirement	(0.1)	(1.0)	(2.4)	(4.1)	(5.0)	(7.1)	(8.8)	(10.0)	(8.8)	(7.6)	(6.5)	(5.6)	(4.7)	(3.8)	(3.2)	(2.4)	(1.7)	(1.0)	(0.4)	0.1
Total Cost to Customers	(0.6)	(5.3)	(13.8)	(20.9)	(24.9)	(25.9)	(27.0)	(23.7)	(9.8)	(4.2)	2.0	7.2	12.0	13.8	14.5	19.9	22.6	24.5	25.8	26.9
Customer Benefits																				
Consumption on Inactive Meters	-	-	-	-	0.3	0.4	0.7	1.2	1.5	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8
Uncollectible Expense	-	-	-	-	0.9	1.8	2.8	3.8	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4
Demand Response	-	-	-	-	0.3	1.0	3.4	9.0	17.7	25.1	34.4	41.5	47.1	51.5	55.0	56.0	58.5	60.8	63.0	65.3
Energy Efficiency	-	-	-	-	0.0	0.1	0.3	0.6	1.1	1.6	2.2	2.7	3.0	3.2	3.3	3.3	3.3	3.4	3.4	3.4
Electric Vehicle Enhancement	-	-	-	-	0.2	0.6	1.8	4.1	7.1	10.0	13.5	16.1	18.0	19.5	20.6	20.7	21.3	21.9	22.3	22.9
Carbon Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	1.8	2.0	2.2	2.4	2.6	2.7
Customer Outage Benefits	-	-	-	-	0.2	0.9	1.4	2.0	2.2	2.3	2.4	2.4	2.5	2.5	2.6	2.7	2.7	2.8	2.9	2.9
Terminal Value	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	455.7
Total Customer Benefits	-	-	-	-	2.0	4.7	10.4	20.7	33.9	44.9	58.5	68.8	77.0	84.8	89.9	91.3	94.9	98.2	101.3	560.2
Net Customer Impact (Change in Customer Costs)	(0.6)	(5.3)	(13.8)	(20.9)	(22.9)	(21.2)	(16.6)	(3.0)	24.1	40.7	60.6	75.9	89.0	98.6	104.4	111.2	117.5	122.7	127.0	587.0
Cumulative Net Customer Impact	(0.6)	(5.9)	(19.7)	(40.6)	(63.5)	(84.7)	(101.3)	(104.3)	(80.2)	(39.5)	21.1	97.0	186.0	284.5	388.9	500.1	617.7	740.3	867.4	1,454.4
Net Present Value of Net Customer Impact	550.3																			
INTERNAL RATE OF RETURN	28.4%																			

7.5. Total Resource Costs (TRC) and Ratepayer Impact Test Analyses by Year

(In $ Millions, except TRC ratio and Average Cost Per Month)

TOTAL RESOURCE COST ANALYSIS	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Total Customer Benefits (non-discounted)	-	0.1	0.8	2.0	10.3	19.8	33.7	51.9	69.8	81.6	96.0	107.1	116.2	124.9	130.9	133.3	137.9	142.1	146.2	606.3
Total Customer Benefits (discounted)	-	0.1	0.7	1.6	7.8	14.3	23.1	33.6	42.8	47.4	52.8	55.8	57.3	58.4	58.0	55.9	54.8	53.5	52.1	204.5
NPV of Customer Benefits	874.4																			
Total Customer Costs (non-discounted)	(0.6)	(5.4)	(14.6)	(22.9)	(33.2)	(40.9)	(50.3)	(54.9)	(45.6)	(40.9)	(35.5)	(31.2)	(27.2)	(26.4)	(26.6)	(22.1)	(20.4)	(19.4)	(19.2)	(19.2)
Total Customer Costs (discounted)	(0.5)	(4.8)	(12.4)	(18.4)	(25.3)	(29.6)	(34.4)	(35.5)	(28.0)	(23.7)	(19.5)	(16.3)	(13.4)	(12.3)	(11.8)	(9.3)	(8.1)	(7.3)	(6.8)	(6.5)
NPV of Customer Costs	(324.1)																			
Total Resource Costs	2.70																			

RATEPAYER IMPACT TEST	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Average Cost per Month per Residential Customer	$ 0.03	$ 0.31	$ 0.80	$ 1.21	$ 1.37	$ 1.37	$ 1.36	$ 1.08	$ 0.23	$(0.10)	$(0.47)	$(0.77)	$(1.06)	$(1.17)	$(1.21)	$(1.54)	$(1.70)	$(1.82)	$(1.90)	$ (1.97)
Average Cost per Month per Small Non-Residential Customer	$ 0.07	$ 0.67	$ 1.74	$ 2.63	$ 2.98	$ 2.98	$ 2.95	$ 2.35	$ 0.50	$(0.22)	$(1.01)	$(1.67)	$(2.30)	$(2.54)	$(2.64)	$(3.34)	$(3.69)	$(3.95)	$(4.13)	$ (4.28)

	Annual Bills (in Millions)	% of Revenue Requirement
DS-1 Residential	12.7	73.6%
DS-2 Small Non-Residential	1.8	22.3%

7.6. Terminal Value Summary

(in $)

	5-Year Average 2027 - 2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
Number of Meters Installed	1,248,453	1,248,453	1,248,453	1,202,107	1,040,540	861,641	555,904	250,167	-	-	-	-	-	-	-	-
AMI System Still at Scale?		Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
(designates whether there are at least 100,000 meters installed)																
Total AMI O&M Annual Expense	(7,324,946)	(7,471,445)	(7,620,874)	(7,773,292)	(7,928,758)	(8,087,333)	(8,249,079)	(8,414,061)	-	-	-	-	-	-	-	-
Total Net Customer Impact (Change in Customer Costs)	121,966,114															
Total Net Customer Impact Without O&M Annual Expense	129,291,061															
Average Per Meter Net Customer Impact Without O&M Annual Expense	103.56	100.11	96.66	93.20	89.75	86.30	82.85	79.40	-	-	-	-	-	-	-	-
(assumes benefit declines 100% to 50% on straight-line basis)																
Calculated Net Customer Impact (Change in Customer Costs)		117,509,913	113,050,782	104,268,988	85,462,704	66,273,015	37,806,907	11,448,393	-	-	-	-	-	-	-	-
NPV of Terminal Value in 2031	$ 455,691,100															