Exhibit No. ___ (HLR-3)

BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

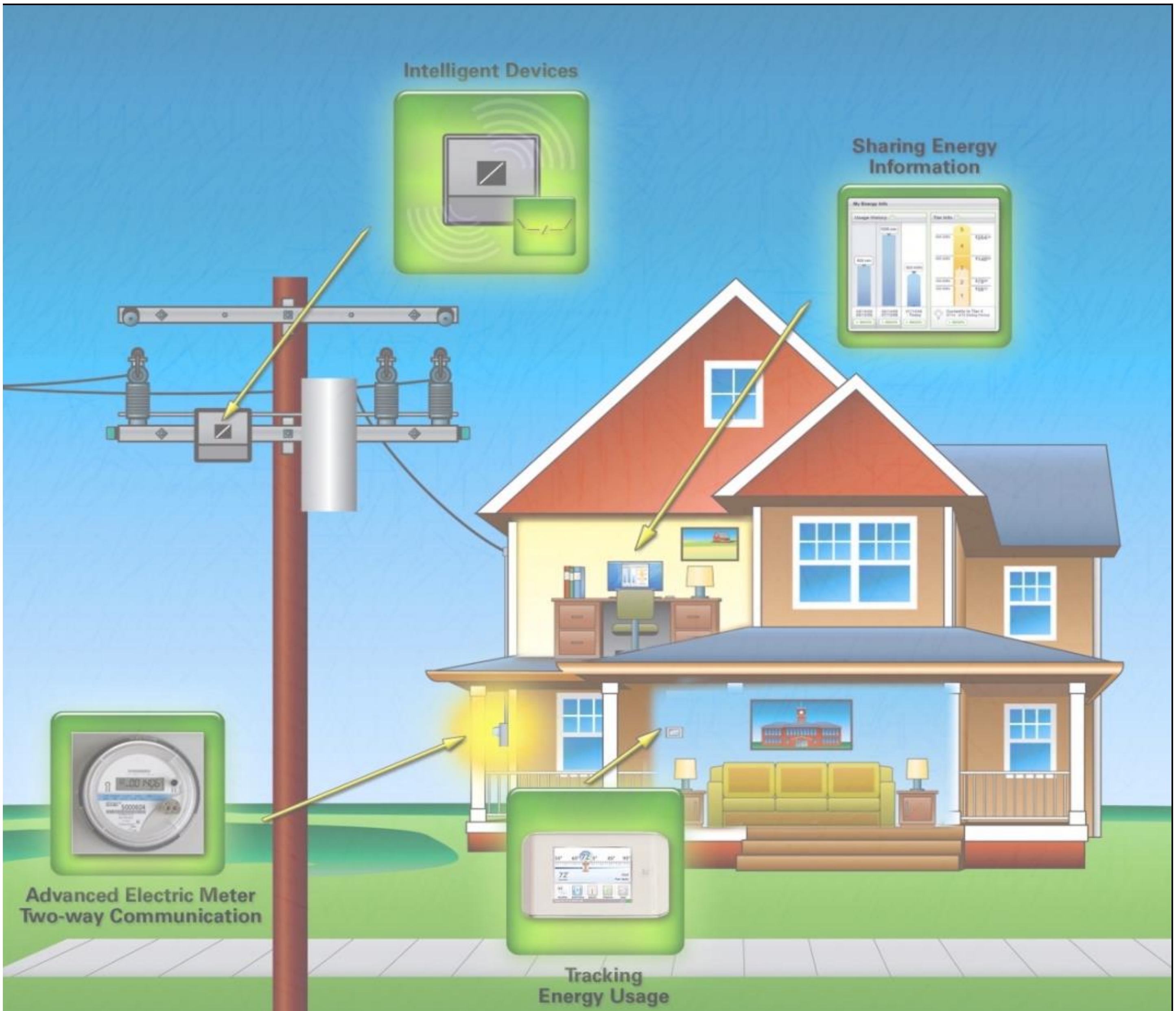
DOCKET NO. UE-16 _______

DOCKET NO. UG-16 _______

EXHIBIT NO._____(HLR-3)

HEATHER L. ROSENTRATER

REPRESENTING AVISTA CORPORATION



Avista Utilities Advanced Metering Project – Business Case

Washington

February 2016

Washington Advanced Metering Project
Business Case

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I. Executive Summary

Avista Utilities ("Avista" or the "Company") is committed to delivering cost-effective service and achieving high levels of value and satisfaction for our customers. As part of this endeavor the Company has in recent years field tested new smart grid technologies[1] that have enabled us to make improvements in the reliability[2] of our electric system and help reduce the cost of operation. The Company evaluates these technology solutions by considering the life-cycle benefits of the technology, its integration requirements with our systems, security, and processes, and its ultimate cost effectiveness for our customers. Through these evaluations, many of these new technologies have been incorporated into Avista's standards governing the design, construction, maintenance, and operation of our system. These standards reflect the emerging and evolving future of the electric grid toward the integration of load and customer-owned generation at the distribution level, providing greater visibility of operational status using real-time information and applications, enabling communications and automated controls that increase operational efficiency and reliability, and fundamentally improving customer empowerment, experience, and satisfaction.

Advanced Metering Infrastructure (or "AMI" or "advanced metering") is one element of the smart grid system that is rapidly becoming the metering standard for the utility industry. Penetration of advanced meters in the U.S. has increased from just under 5% in 2008 to over 30% by 2013,[3] and is expected to reach 50%[4] to 70%[5] by the year 2020. Advanced meters are capable of two-way communication and are equipped to measure the flow of energy in configurable intervals that range from 5 minutes to an hour. The advanced metering system can remotely transmit energy-use information to the utility and the customer, and can also receive and respond operationally to signals sent from the utility to the meter. Utilities are deploying advanced metering systems to optimize the value of other smart technologies and to provide customer benefits ranging from lower operating cost and improved reliability, to providing customers information and tools to better understand and derive greater value from their energy service. Avista views advanced metering as an enabling technology key to achieving its long-term customer service objectives,

[1] Smart grid technologies include a range of remote sensing and automation devices and data analyses and two-way communications systems that are being deployed across the electric grid to improve operations and reliability, optimize energy supply and demand, and enable customers to better understand and derive greater value from the energy they use.

[2] Each year as the Company's electric infrastructure ages, its integrity and reliability would diminish slightly were it not for the annual capital investments that offset the effects of aging. These annual investments have the incremental effect of "improving the reliability" of the particular facilities targeted by the investments (such as improvements on one feeder), but their overall impact, as measured across the entire system over time, is to generally maintain our current levels of system reliability, which we believe is reasonable and cost effective.

[3] Assessment of Demand Response and Advanced Metering. Federal Energy Regulatory Commission Staff Report, October 2013.

[4] Leveraging Business Intelligence and Analytics to Improve Performance. Presentation by Gartner Research made to Avista in 2014.

[5] From Pike Research in 2012, as cited from Elster presentation made to Avista in 2015.

and is currently planning for its implementation across our Washington service area. The Washington Advanced Metering Project (or ”Project”) will install AMI for approximately 253,000 electric customers and 155,000 natural gas customers, and the deployment is slated for completion by year 2021.[6] Avista is planning to replace all of its existing Washington electric meters, the majority of which are conventional electro-mechanical meters, with a new advanced meter. Existing natural gas meters will be upgraded with a new digital communicating module. The natural gas meter itself will not be replaced.

A. Project Costs

Avista has continued to update its estimates of the costs to deploy advanced metering, which reflect up-to-date information on the installation and operating costs required to support the system and to achieve the full benefits for our Washington customers. Though Avista has not executed any primary vendor contracts for infrastructure or services required for the Project, we have received pricing for many components of the system, including services supporting its operation and maintenance, from vendors responding to the Company’s formal Requests for Proposals (“RFP”). Better understanding the system specifications, initial contract pricing, and Avista’s labor requirements, has allowed us to estimate costs with increased confidence. We will continue to refine the estimates as vendor pricing is finalized by contract, and as additional technical and design information (work the vendors will complete under contract) is developed through the course of implementation. In addition to having more complete cost information we have also included a contingency amount of approximately $20.8 million, which is included in the total estimated capital costs.

The Company’s current estimate of the total capital cost of the Project on a nominal or cash basis[7] is $166.7 million. This estimate is within the level of spending approved for the Project by Avista’s executive leadership and board of directors. The cash value of the total operating expense over the Project lifecycle is $123.4 million. These capital and operating costs are shown by major component in Table 1. The present value[8] of the Project total capital costs and operating expenses is provided in Table 2, below. The estimated level of spending by component during each year of the Project lifecycle is provided on a cash basis in Table 3, below. Additional detail on the activities comprising these cost components is provided in Section VI, and in Appendix A of this business case.

[6] Number of customers expected for the deployment period.
[7] Avista uses the terms “nominal value” and “cash value” as synonymous.
[8] The discount rate used is 6.58%, which is Avista’s weighted cost of capital.

Table 1. The estimated total capital investment and operating expense over the Project lifecycle (cash $millions) for major components of Avista's Washington Advanced Metering Project.

Major Cost Components	Total Capital Investment (Cash Value)	Total Operating Expense (Cash Value)
Meter Data Management	$12.0	$18.0
Head End Systems	$12.8	$20.3
Collector Infrastructure	$31.7	$29.0
Data Analytics	$5.1	$19.1
Meter Deployment	$100.4	$12.0
Energy Efficiency	$4.7	$6.4
Regulatory Process	$0.0	$18.6
Totals	**$166.7**	**$123.4**

Table 2. Present value of the total capital investment and operating expense over the Project lifecycle ($millions) for major components of Avista's Washington Advanced Metering Project.

Major Cost Components	Total Capital Investment (Present Value)	Total Operating Expense (Present Value)
Meter Data Management	$11.5	$9.9
Head End Systems	$12.3	$11.3
Collector Infrastructure	$28.2	$16.4
Data Analytics	$4.9	$10.7
Meter Deployment	$84.6	$6.6
Energy Efficiency	$2.6	$4.6
Regulatory Process	$0.0	$11.6
Totals	**$144.1**	**$71.1**

Table 3. Estimated capital (CAP) and operating expense (EXP) for major cost components (cash $millions) for each year of the Project lifecycle for Avista's Washington Advanced Metering Project.

Year	Meter Data Management		Head End Systems		Collector Infrastructure		Data Analytics		Meter Deployment		Energy Efficiency		Amortized Meters		Totals	
	CAP	EXP	CAP	EXP	CAP	EXP	CAP	EXP	CAP	EXP	CAP	EXP	CAP	EXP	CAP	EXP
2015	$0.2		$0.1						$0.3		$1.2				$1.7	
2016	$9.3		$10.3		$5.5		$3.7		$2.6		$0.8				$32.1	
2017	$2.4	$0.8	$2.4	$0.9	$7.0	$1.2	$1.4	$0.9	$28.2	$0.5	$0.8	$0.2		$1.2	$42.1	$6.4
2018	$0.1	$0.8		$0.9	$7.3	$1.2		$0.9	$30.0	$0.5	$0.8	$0.2		$1.2	$38.2	$6.4
2019	$0.1	$0.8		$0.9	$6.2	$1.3		$0.9	$23.7	$0.5	$0.8	$0.3		$1.2	$30.7	$6.6
2020	$0.1	$0.9		$1.0	$5.7	$1.3		$0.9	$4.7	$0.5	$0.5	$0.3		$1.2	$11.0	$6.8
2021		$0.8		$1.0		$1.3		$0.9		$0.6		$0.3		$1.2		$6.8
2022		$0.9		$1.0		$1.4		$0.9		$0.6		$0.3		$1.2		$7.0
2023		$0.9		$1.0		$1.4		$0.9		$0.6		$0.3		$1.2		$7.1
2024		$0.9		$1.0		$1.4		$1.0		$0.6		$0.3		$1.2		$7.1
2025		$0.9		$1.0		$1.5		$1.0		$0.6		$0.3		$1.2		$7.2
2026		$0.9		$1.0		$1.5		$1.0		$0.6		$0.3		$1.2		$7.2
2027		$1.0		$1.1		$1.5		$1.0		$0.6		$0.3		$1.2		$5.5
2028		$1.0		$1.1		$1.6		$1.0		$0.6		$0.3		$1.2		$5.6
2029		$1.0		$1.1		$1.6		$1.0		$0.6		$0.4		$1.2		$5.7
2030		$1.0		$1.1		$1.6		$1.1		$0.7		$0.4		$1.2		$5.9
2031		$1.0		$1.1		$1.7		$1.1		$0.7		$0.4		$1.2		$6.0
2032		$1.0		$1.2		$1.7		$1.1	$0.6	$0.7		$0.4			$0.6	$6.1
2033		$1.0		$1.2		$1.7		$1.1	$2.8	$0.7		$0.4			$2.8	$6.1
2034		$1.0		$1.2		$1.8		$1.1	$3.3	$0.7		$0.4			$3.3	$6.2
2035		$1.0		$1.2		$1.8		$1.1	$3.4	$0.8		$0.5			$3.4	$6.5
2036		$0.3		$0.3		$0.4		$0.2	$0.8	$0.2		$0.1			$0.8	$1.6
Totals	$12.0	$18.0	$12.8	$20.3	$31.7	$29.0	$5.1	$19.1	$100.4	$12.0	$4.7	$6.4		$18.6	$166.7	$123.4

B. Customer Benefits

The Project will provide a range of benefits with quantified financial value for customers, such as the avoided costs for manually reading meters and reduced field service calls. These benefits are grouped by major area as listed in Table 4, below. The total cash value of the estimated benefits over the Project lifecycle is $510.7 million. The present value of the lifecycle benefits is $241.7 million. The expected level of benefits is shown for each year of the Project lifecycle on a cash basis in Table 5, below. Additional detail on the descriptions, estimates of the value, and the timing of realizing these benefits, is provided in Section VII, and in Appendix B of this business case.

Table 4. The total cash value and present value ($millions) of customer benefits over the Project lifecycle shown by area of benefit for Avista's Washington Advanced Metering Project.

Area of Benefit	Total Benefit Value (Cash Value)	Total Benefit Value (Present Value)
Meter Reading and Meter Salvage	$162.0	$75.9
Remote Service Connectivity	$45.7	$24.3
Outage Management	$86.4	$40.3
Energy Efficiency	$127.2	$59.4
Energy Theft and Unbilled Usage	$62.8	$28.9
Billing Accuracy	$22.2	$10.7
Utility Studies	$4.4	$2.2
Total	**$510.7**	**$241.7**

Table 5. The estimated level of customer benefits (cash $millions) shown by major area of benefit for each year of the Project lifecycle for Avista's Washington Advanced Metering Project.

Year	Meter Reading / Salvage	Remote Service Connect	Outage Management	Energy Efficiency	Energy Theft / Unbilled	Billing Accuracy	Utility Studies	Total
2016				$ 0.1			$ 0.2	$ 0.3
2017	$ 2.4	$ 0.7	$ 0.1	$ 1.0	$ 0.4	$ 0.2	$ 0.2	$ 5.0
2018	$ 4.0	$ 1.2	$ 1.7	$ 3.5	$ 1.0	$ 0.7	$ 0.2	$ 12.3
2019	$ 4.7	$ 1.6	$ 3.6	$ 4.6	$ 2.1	$ 0.9	$0.2	$ 17.7
2020	$ 6.4	$ 1.9	$ 3.8	$ 5.1	$ 2.7	$ 0.9	$ 0.2	$ 21.0
2021	$ 6.7	$ 2.0	$ 3.9	$ 5.4	$ 2.8	$ 1.0	$ 0.2	$ 22.0
2022	$ 7.0	$ 2.1	$ 4.1	$ 5.6	$ 2.9	$ 1.0	$ 0.2	$ 22.9
2023	$ 7.4	$ 2.1	$ 4.2	$ 5.9	$ 3.0	$ 1.0	$ 0.2	$ 23.8
2024	$ 7.7	$ 2.2	$ 4.4	$ 6.1	$ 3.2	$ 1.1	$ 0.2	$ 24.9
2025	$ 8.2	$ 2.3	$ 4.5	$ 6.4	$ 3.3	$ 1.1	$ 0.2	$ 26.0
2026	$ 8.7	$ 2.4	$ 4.7	$ 6.6	$ 3.4	$ 1.2	$ 0.2	$ 27.2
2027	$ 9.2	$ 2.5	$ 4.8	$ 6.9	$ 3.5	$ 1.2	$ 0.2	$ 28.3
2028	$ 9.8	$ 2.6	$ 5.0	$ 7.2	$ 3.7	$ 1.2	$ 0.2	$ 29.7
2029	$ 10.3	$ 2.7	$ 5.2	$ 7.6	$ 3.8	$ 1.3	$ 0.2	$ 31.1
2030	$ 10.7	$ 2.8	$ 5.3	$ 7.9	$ 3.9	$ 1.3	$ 0.2	$ 32.1
2031	$ 10.9	$ 2.9	$ 5.5	$ 8.2	$ 4.1	$ 1.4	$ 0.2	$ 33.2
2032	$ 11.0	$ 3.0	$ 5.7	$ 8.6	$ 4.2	$ 1.4	$ 0.2	$ 34.1
2033	$ 11.1	$ 3.1	$ 5.9	$ 9.0	$ 4.4	$ 1.5	$ 0.3	$ 35.3
2034	$ 11.2	$ 3.3	$ 6.1	$ 9.3	$ 4.5	$ 1.5	$ 0.3	$ 36.2
2035	$ 11.5	$ 3.4	$ 6.3	$ 9.7	$ 4.7	$ 1.6	$ 0.3	$ 37.5
2036	$ 3.1	$ 0.9	$ 1.6	$ 2.5	$ 1.2	$ 0.7	$ 0.1	$ 10.1
Total	$ 162.0	$ 45.7	$ 86.4	$ 127.2	$ 62.8	$ 22.2	$ 4.4	$ 510.7

Beyond these quantified benefits, there is a range of unquantified or intangible customer benefits that will be provided by the Project. Though these intangible benefits certainly provide customer value, they are not included in the analysis of costs and benefits at this time. These customer benefits are listed in Table 6.

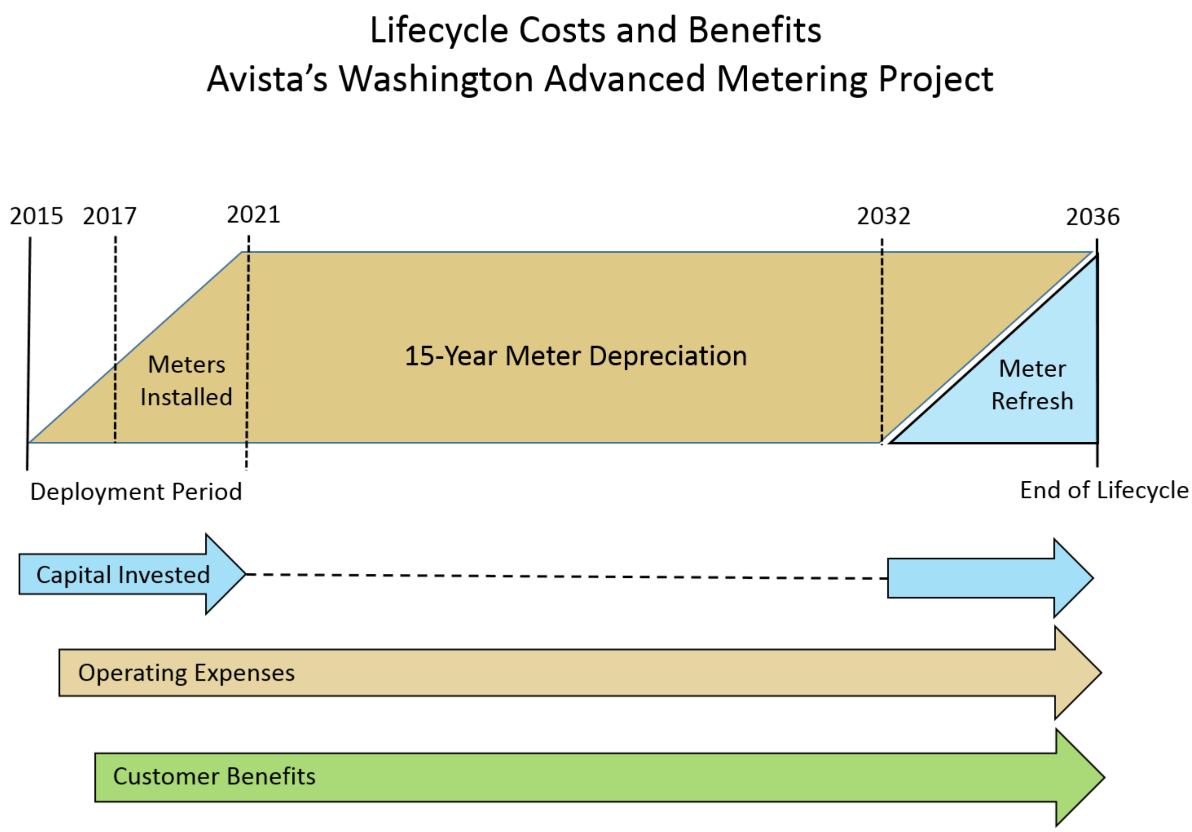
Table 6. Customer benefits to be provided by Avista's Washington Advanced Metering Project, for which value has not been financially quantified or included in the cost-benefit analysis.

Advanced Metering Customer Benefits – Not Quantified Financially
Customer Access to Interval Energy Use Data
Customer Home Area Network Interface
Energy Alerts
Customer Privacy
Engineering Studies and Asset Planning
Utility Employee Safety
Future Opportunities for Benefits
• Rate Options
• Micro Grids & Smart Cities Initiatives
• Additional Data Analytics
• Additional Distributed Generation
• Demand Response
• Enabling Electric Vehicles

C. Project Lifecycle

Avista began the planning phase of the Project in mid-2015 and is planning to begin the installation of system applications and computer hardware in mid-2016. The deployment of communications systems and advanced meters is slated to begin in early 2017, and the current plan is to complete the deployment of all of the Project components, including meters, by year 2021. With respect to the period of depreciation for the advanced meters, Avista chose to use 15 years, which is consistent with our policies and similar to other AMI deployments. Meters installed in 2017 will be fully depreciated in year 2032 and all meters will be fully depreciated by year 2036. The Project lifecycle, which is the time horizon selected by the Company for evaluating Project costs and benefits, spans the period from mid-2015 until year 2036. Customer benefits will ramp up to full value over the deployment period and will continue at that level through the remainder of the lifecycle. Project operating expenses will phase in during the deployment and the full operating costs continue through the lifecycle to support the continued delivery of customer benefits. Capital costs for the replacement of meters, which could begin as early as year 2032, are also included in the final years of the lifecycle.[9] The Project lifecycle showing the aspects described above is depicted in Figure 1, below.

Figure 1. Project lifecycle for Avista's Washington Advanced Metering Project showing the timing and duration of planned capital investments, expected annual operating costs, and the quantified customer benefits as used in the cost-benefit analysis.



D. Positive Net Benefits

Over the Project lifecycle the nominal or cash value of the quantified benefits exceeds that of the combined capital and operating costs by $220.6 million, as shown in Figure 2, below. On a net present value basis, as shown in Figure 3, below, these benefits exceed the costs by $26.5 million. Avista also conducted sensitivity analysis on the value of the quantified benefits. In the extreme case where all Project benefits were assumed to fall below our estimates, the overall net benefit

[9] Though the Company has chosen a period of 15 years for the depreciation of the advanced meters, the meter manufacturer that has been tentatively selected for this deployment projects the useful life of the meter to be 20 years. If the advanced meters have a useful life beyond 15 years, it would result in an increase in the net present value of benefits from the Project, above that presented in this business case.

would be a negative $8.5 million on a net present value basis. In the other extreme scenario where the value of all quantified benefits was assumed to be greater than estimated, the project would produce a net benefit of $61.5 million on a net present value basis. In both of these scenarios the Company assumed the ultimate deployment cost equaled the currently-estimated Project costs (i.e. cost estimates + contingency amount). The positive impact on the Project net benefits of the final capital costs potentially falling below the current estimates was not evaluated. Based on these analyses, the Company believes it is likely that the Washington Advanced Metering Project will provide cost effective, meaningful, and sustainable benefits for our customers, and help advance the State of Washington toward achieving a cleaner energy future.

Figure 2. Cash value of the lifecycle capital investment, operating costs, customer benefits, and net benefits for Avista's Washington Advanced Metering Project.

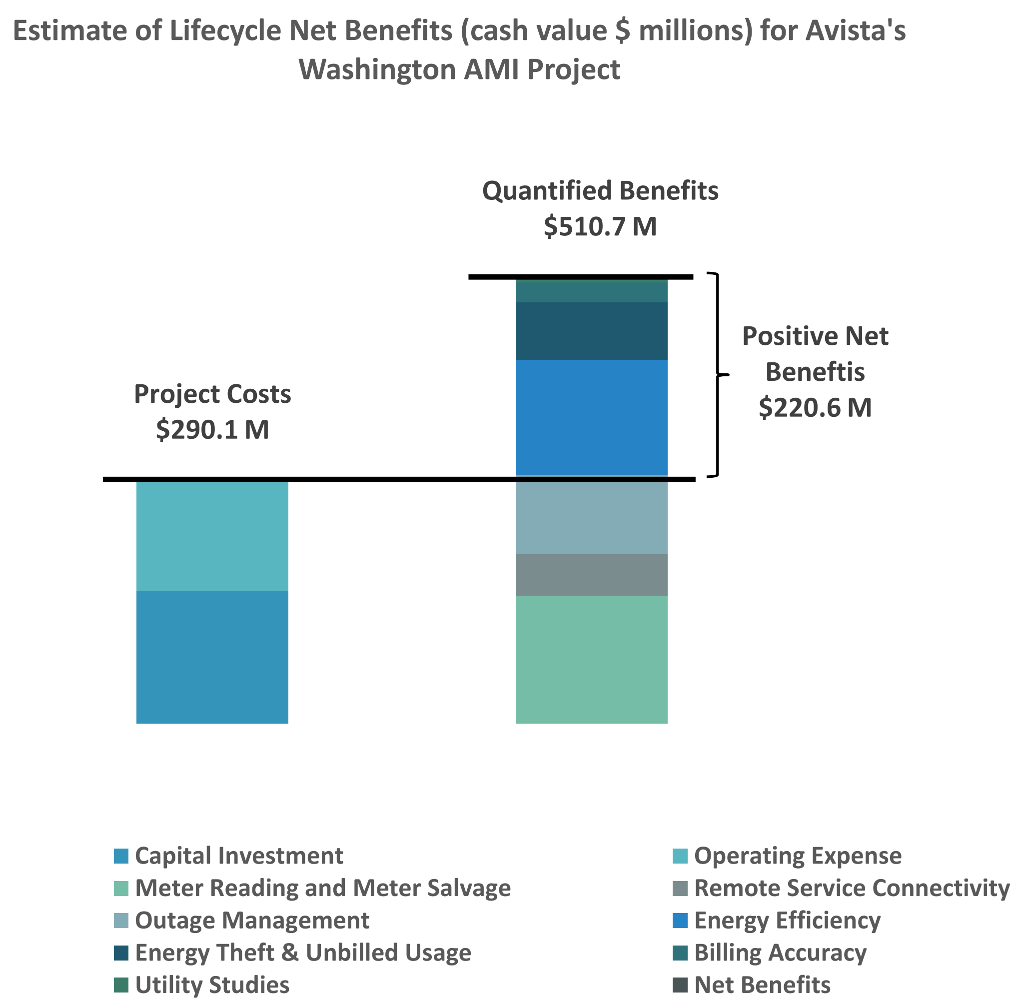
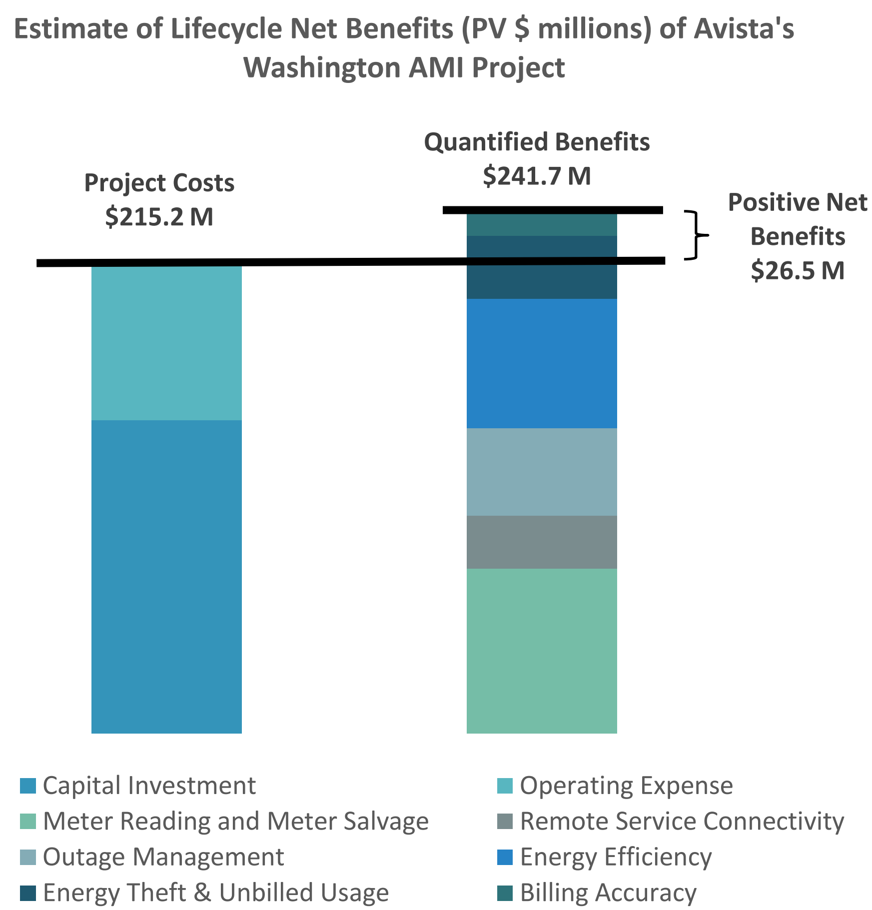


Figure 3. Net Present Value ($ millions) of the lifecycle capital and operating costs and benefits for Avista's Washington advanced metering project.



II. Introduction

The Company's planned deployment of advanced metering in Washington represents another step in Avista's ongoing evaluation and deployment of technologies that help improve the quality of service we provide our customers. Advanced metering is one of a number of smart grid applications that have enhanced the utility industry's ability to achieve this goal. Collectively, these systems provide real-time sensing and monitoring of the grid and the capability for remote automation, which improves reliability. They also optimize the supply and demand on the system to enable the integration of more variable renewable energy. Finally, these tools can provide customers with detailed energy use information, support improved customer service, as well as enable interactive appliances and energy-saving devices in homes and businesses.

Avista began building the foundation for these new systems by using sophisticated new asset management tools to improve the analysis of electric and natural gas equipment life, and the optimization of capital and operations and maintenance (O&M) costs. This work led to the creation of a systemic program to rebuild the Company's electric distribution lines or feeders, including the installation of automated equipment. This effort established the Company's initial specifications for a smart grid system.

In October 2009, Avista received matching funds of approximately $20 million from the U.S. Department of Energy for a Smart Grid Investment Grant. This grant funded smart grid investments applied to 59 electric feeders and 14 substations in the City of Spokane, serving approximately 110,000 customers. Improvements included the installation of smart-grid enabled switches, capacitor banks, and voltage regulators, as well as supporting communications systems and computer applications. One of these applications, the Distribution Management System, receives and integrates real-time data from these smart grid devices to provide greater visibility into the operational status and performance of the grid, as well as automating certain operations. Appendix C of this report provides a brief description of the smart grid devices and systems installed by the Company.

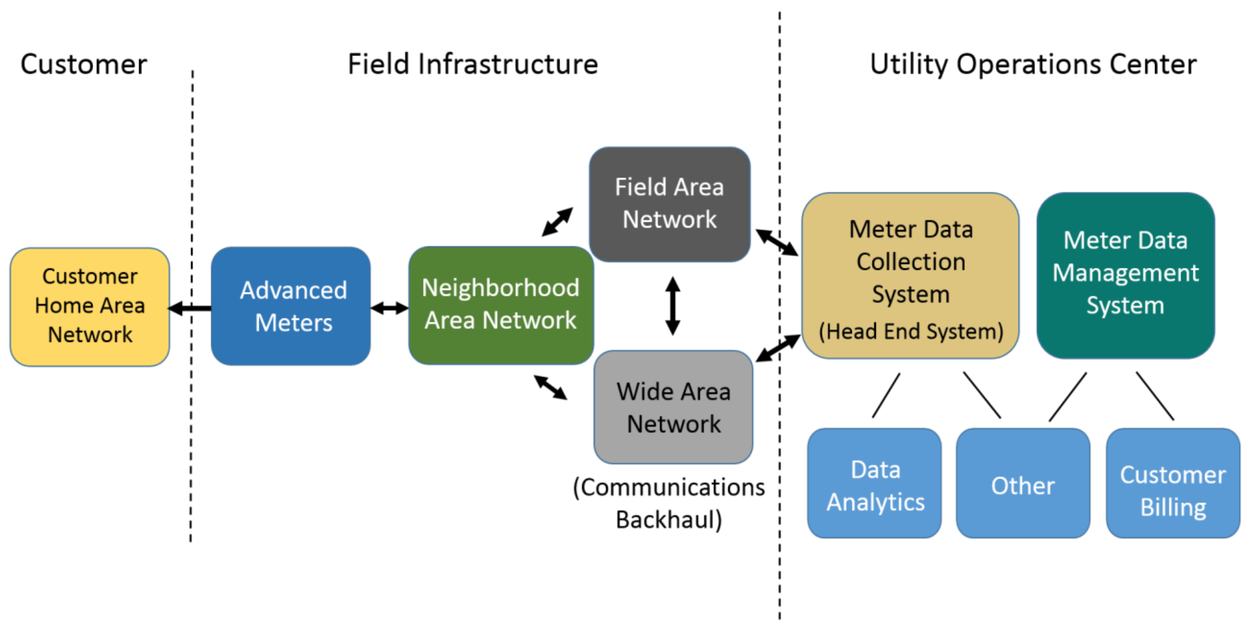
Avista was also selected to lead a $38 million Smart Grid Demonstration Project, which was implemented in the city of Pullman, Washington. Also funded by the U.S. Department of Energy, this project created the first "smart community" in the Pacific Northwest. Similar to the Spokane smart grid project, this effort included smart grid upgrades to feeders and substations, but in addition, it also helped fund the deployment of smart transformers, fault indicators, and an advanced metering system for approximately 13,000 Avista customers. This pilot project gave the Company valuable experience and insight into the deployment, capabilities, and management of an advanced metering system, adding to its experience with automated meter reading systems in its other jurisdictions. In its Oregon service area, Avista has for many years operated a mobile meter data collection system for approximately 104,000 meters. In 2004 - 2008, Avista installed approximately 220,000 automated meter reading meters and associated network systems in its Idaho service territory.

Through these smart grid projects and other evaluations, the Company has demonstrated that capably designed, tested, and deployed technologies can deliver cost-effective benefits to our customers. Accordingly, Avista has since integrated many of these tools into its distribution and substation design standards, and its long-term planning processes.

III. AMI Systems

Advanced or smart meters are digital meters equipped with the capability for two-way communication, including certain remote sensing and operating capabilities. The meters are connected with specialized communications and enabling computer hardware and software systems, which are collectively referred to as Advanced Metering Infrastructure. These systems are depicted in Figure 4 and are briefly described in the following pages.

Figure 4. Diagram showing the key systems and architecture of an advanced metering system.



A. System Components

1. **Advanced Meters** - Traditionally, utility customers have had few tools to effectively understand and manage their energy use because conventional meters, including automatic meter reading systems (AMR),[10] are not equipped to provide near real-time information on energy consumption. Advanced meters[11] can measure the incoming and outgoing[12] flow

[10] Automatic meter reading meters (or "AMR") typically provide only one-way communication from the meter to the utility in the form of one monthly reading of the customer's energy use.
[11] The advanced electric meter replaces conventional electro-mechanical, non-communicating digital, or AMR meters. Advanced metering for natural gas is accomplished by replacing the mechanical register on the existing natural gas meter with a new digital, communicating module. The gas meter itself is not replaced.
[12] Advanced meters measure the energy and demand used by the customer, and also measure the amount of energy being delivered from the customer's distributed generation onto the utility distribution system (known as 'net metering").

of energy from a customer's premises in configurable intervals that range from 5 minutes to an hour. This energy data can be remotely transmitted to the utility and the customer, and the meter can also receive and respond operationally to signals sent from the utility to the meter. When the interval data is provided to the customer through a web portal, or an in-home energy display through their Home Area Network, it helps them better understand their energy consumption and provides the intelligence to support informed and timely actions to manage their energy use.

2. **Metering Communications Network** - A specialized and secure communication system is required to carry data and communications between the advanced meter and the utility. And while there are various options available for providing this communication linkage, it often consists of three integrated systems referred to as the Neighborhood Area Network, the Field Area Network and the Wide Area Network.

    - The Neighborhood Area Network, also known as the "collection system" or "meter mesh network," consists of the wireless communication occurring between the individual advanced meters. Through this network of meter communication, information is transmitted from meter to meter and in the process is aggregated by a collection device and transmitted to the Field Area Network or the Wide Area Network, depending on the network design.[13]
    - The Field Area Network is a broadband wireless system that may support only one function, such as advanced metering, but which may also support a full range of advanced grid-device communications. Avista's Field Area Network supports communication controls for substations and transmission facilities, and distribution system sensing, monitoring, and remote operation, as well as specialized applications like the Smart City Initiative.
    - The Wide Area Network, also referred to as the "back-haul," is a separate computer or cellular based communication network that connects seamlessly with the Field Area Network. The Wide Area Network is responsible for transmitting communications and data collected by the Field Area Network or the Neighborhood Area Network to the utility operations center. The design of these three network systems is dependent on the characteristics of each utility's system, the geography of the service area, and the advanced metering solutions ultimately selected.

3. **Meter Data Collection System (Head End System)** - This system is composed of computer hardware and software applications that control and coordinate the meter communication networks. In addition to this function, the system aggregates the usage data from the advanced meters in the field and route this data to the Meter Data Management system and other specialized software applications.[14] The meter data collection system software is designed and provided by the manufacturer of the advanced meters.

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13 This system works in reverse order to carry information transmitted from the utility to the meter.

14 These specialized applications perform a range of business functions such as outage management integration, conservation voltage monitoring, and theft detection.

4. **Meter Data Management System** - This system includes computer hardware and software applications that store, validate, edit, and analyze the interval consumption data, as well as coordinate specified metering commands. Meter data information from this system is also routed to other specialized software applications that perform a range of business functions such as customer billing, use of specialized rate options such as time-of-use, or the web presentment of customer usage data.

5. **Data Analytics -** This component of the AMI system includes computer hardware and software applications that provide deeper analysis of the advanced metering data. Meter data is compiled in these systems from both the Meter Data Management System as well as the Meter Data Collection System, and is used to derive customer benefits including theft detection, conservation voltage reduction, outage management, or utility engineering studies.

B. AMI Supports Improved Customer Engagement and Satisfaction

Across all types of businesses, the rise of e-commerce has had a profound impact on customers' service expectations. The instant ability to compare providers, products, services, and prices, has forced businesses to look beyond product features and price to differentiate their service and value to consumers. As more and more businesses provide tailored customer service, these customers naturally expect it from all businesses with whom they interact. Though utilities are viewed as lagging behind their retail counterparts, the industry is moving forward in better understanding its customers' preferences and providing differentiated services that better inform and satisfy customers. Advanced metering is becoming an increasingly important tool for achieving these objectives. Utilities installing these systems are aiming to provide customers with data and helpful tools to better understand and manage their energy use, to deliver improved customer service and reliability, and to achieve cost-effective savings all focused on delivering greater customer experience and satisfaction.

C. AMI Adds Value by Integrating Other Applications

Beyond providing traditional metering data and supporting multiple rate options, advanced metering delivers added customer value by integrating applications that leverage AMI data. When combined with enabling analytics, as noted above, advanced metering aids the utility in detecting energy theft, more efficiently managing service outages, producing energy conservation savings, detecting problems with a meter or costly issues with customer heating and cooling systems, and improving utility infrastructure studies. Advanced metering is also increasingly important in helping customers add value by enabling new and emerging third-party technologies that integrate and automate energy saving and other smart devices, also known as the "internet of things."[15] When fully deployed, Avista's Washington Advanced Metering Project will enable the following minimum capabilities.

- **Automated meter reading** providing greater reliability, accuracy, reduced carbon

[15] The phrase "Internet of Things" or ("IOT") refers to the developing use of the internet to provide network connectivity to intelligent appliances, devices, and personal items, allowing them to send and receive data and to enable actions based on that information.

emissions, and lower cost than manual meter reading.

- **Customer web portal** providing our customers energy consumption information, including near-real time interval use,[16] daily use, energy cost, and demand. This information will enable our customers to better manage their energy use, including savings associated with behavioral changes and conservation measures they install.
- **Customer text alerts** used to message customers on the status of their energy use according to predetermined metrics they establish.
- **Remote Service Connectivity** provides the capability to eliminate consumption on inactive accounts, reduce operating costs by avoiding field service trips, expedite service reconnection, avoid carbon emissions, and reduce employee risk and injury.
- **Reduced outage duration** results from earlier notification of an outage and greater system visibility during large outage events. This visibility enables more efficient dispatch of restoration resources, reducing outage duration, restoration cost, and financial losses for our customers.
- **Conservation voltage reduction** allows the electric distribution system to be operated at lower voltage, saving energy and reducing resource costs.
- **In/out (or "net") metering capability** effectively integrates customer-owned distributed generation at lower cost than with conventional metering.
- **Monitoring and evaluation** of metering anomalies and feeder load data to identify and remediate meter reading errors, equipment malfunction, system or service issues, and cases of theft diversion of service.
- **Remote diagnostics** of meter health provides improved ability to identify and correct problems with meter configuration and slow or failing meters.
- **More accurate** and readily-available information on energy use provides customers with more accurate bills and more streamlined and efficient bill-inquiry processes.
- **More accurate and comprehensive data** on patterns of customer energy use reduces the cost of performing studies such as customer demand, system load, asset management, and predictive inspections and maintenance.

D. Industry Trends in Advanced Metering

The focus of utilities to improve the performance of the electric grid and to achieve greater customer experience and satisfaction, has helped propel a trend toward advanced metering across the industrialized world. Advanced metering systems today are more robust and reliable than previous iterations, and technologies are coalescing around proven standards of security and interoperability. In addition to utilities themselves, state and federal regulatory policies, as well as those of regulatory associations, such as NARUC,[17] have played a role in accelerating the

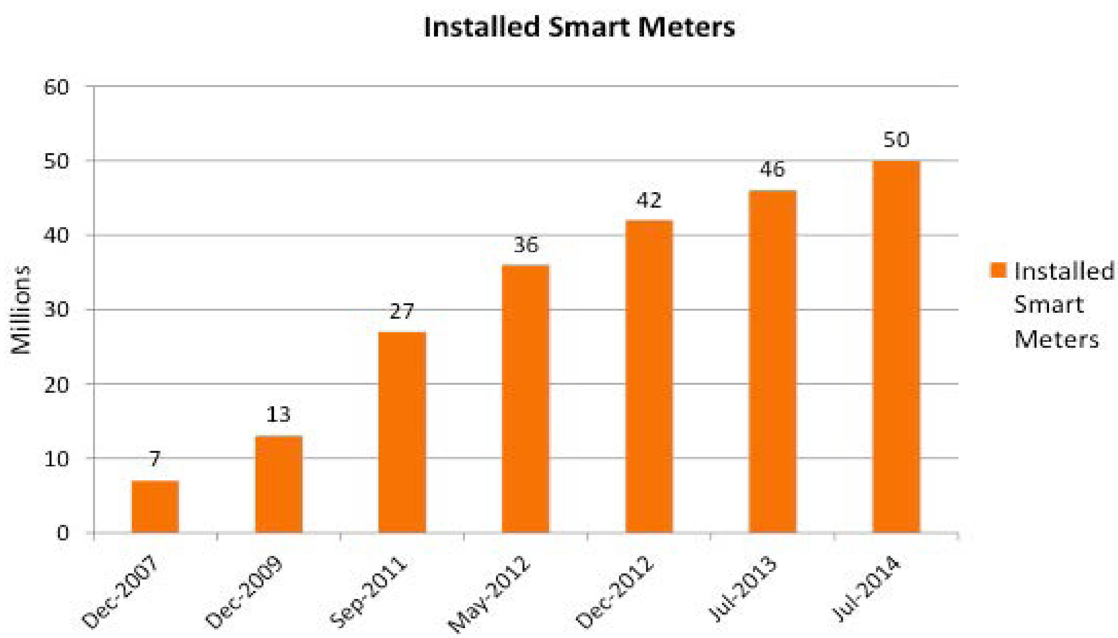
[16] Real-time usage will also be available to the customer through customer-installed home energy management devices and applications.
[17] National Association of Regulatory Utility Commissioners.

deployment of advanced metering systems. The Energy Information Administration[18] reported in 2012 that 533 U.S. utilities had installed 43,165,183 advanced meters. Data collected from various sources by the Federal Energy Regulatory Commission reported the penetration of advanced meters as climbing from just under 5% in 2008 to over 30% by 2013. [19] In addition to rates of penetration, the report documents federal and state regulatory efforts promoting advanced metering, customer benefits resulting from deployment, and efforts around the nation to promote demand response initiatives. According to the September 2014 report by the Edison Foundation Institute for Electric Innovation[20] on "Utility-Scale Smart Meter Deployments:"

> Smart meters are playing a critical role in shaping the electric grid of tomorrow and enabling the integration of new technologies and innovations across the grid. As the power grid evolves into a broad platform for integrating new energy services and technologies, the ability to connect legacy assets and systems and integrate new ones is critical; smart meters are supporting this evolution. In addition, the data collected by smart meters (or automated metering infrastructure (AMI)) opens the door for greater integration of new resources and new energy services for customers.

The report documents the deployment levels of advanced electric meters in the United States over the past several years, shown below in Figure 4. The figure illustrates deployments increasing markedly from only seven million in 2007, to a level of 50 million by July 2014.

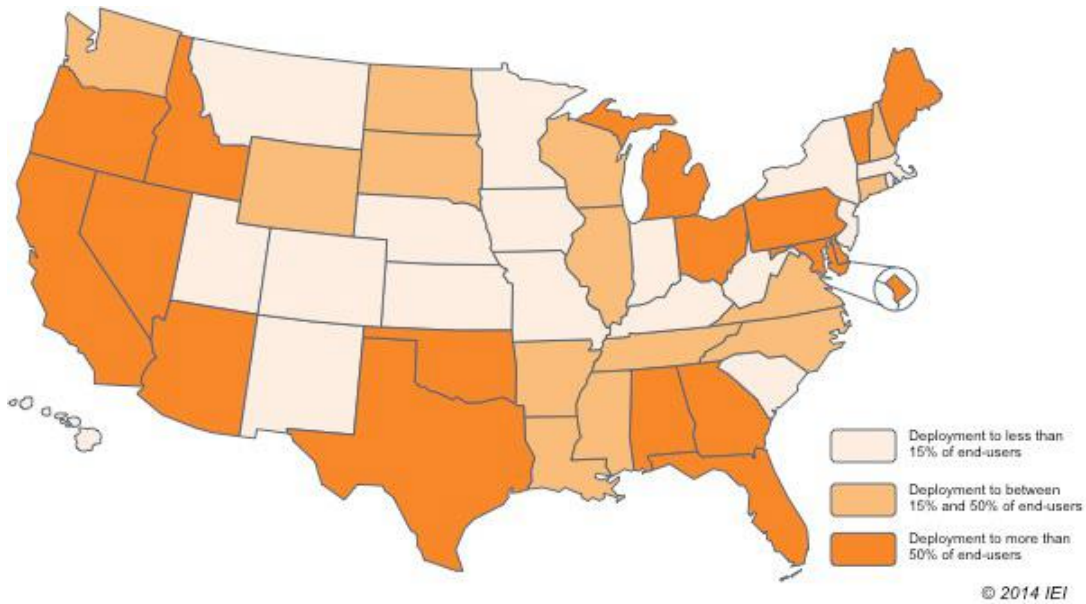
Figure 5. Cumulative number of advanced meters (millions) installed by U.S. utilities, December 2007 through July 2014.



[18] Energy Information Administration. Frequently Asked Questions: How many smart meters are installed in the U.S. and who has them?
[19] Assessment of Demand Response and Advanced Metering. Federal Energy Regulatory Commission Staff Report, October 2013.
[20] Utility-Scale Smart Meter Deployments: Building Block of the Evolving Power Grid. The Edison Foundation, Institute for Electric Innovation. September 2014.

The report also notes the rate of penetration of advanced electric meters at 43% for residential applications in 2014, and the forecasted penetration state by state for 2015, as shown in Figure 5.

Figure 6. Forecasted penetration rates of advanced meters for each state by 2015. Light shading represents rates less than 15%, intermediate shading is for rates between 15% and 50%, and dark shading is for rates exceeding 50%.



According to Gartner research the installation of advanced meters is expected to top 130 million in Europe by 2016.[21] In the United States, the number of deployment projects for advanced meters is expected to reach 260 in 2016, double the number of deployment projects in 2009. Longer term, the penetration of advanced meters in the U.S. is expected to reach 50% to 70%[22] by the year 2020. Here in the Pacific Northwest several public and investor-owned utilities have already implemented advanced metering systems, including Avista's neighboring Washington utility, Inland Power and Light.

[21] Leveraging Business Intelligence and Analytics to Improve Performance. Presentation by Gartner Research made to Avista in September 2014.

[22] From Pike Research in 2012, as cited from an Elster presentation made to Avista in 2015.

IV. AMI System Deployment Plan

Avista initiated the planning phase of the Project in mid-2015, which focused on the development of technical specifications and RFP's for hardware and software systems and installation and support services. The AMI Project team has evaluated vendor proposals, continued to update cost estimates, and has made preliminary selections of some systems and vendors. Beyond the initial support required to develop its RFP's, the Company has not executed any vendor contracts, pending the outcome of its request for accounting treatment from the Washington Utilities and Transportation Commission (or Commission) for existing electric meters. The implementation will begin with the installation and integration of computer hardware and software systems required to enable the basic functionality of the advanced meters upon installation, such as capturing, managing, and presenting accurate meter data for the customer web portal and monthly billing. Early implementation will also include the installation of required communications infrastructure. Together, these systems will enable the Company and our customers to capture value from the meters at the time of their installation. Avista will begin the field deployment of equipment in limited areas of Spokane near our main service center. This locale will support the efficient resolution of any technology issues prior to extending the deployment to other communities and rural areas. In addition to these considerations, the deployment plan will be informed by the results of customer surveys in order to focus early deployments in areas where customers are more likely to make the greatest initial use of the new technology.

Once Avista has ensured the system is functioning properly through the initial deployment, we will begin the systematic installation of communications networks and advanced meters, as well as additional enabling systems and features, such as outage management and remote service connectivity. The installation of meters and the enablement of applicable service features for our customers will be preceded and accompanied by a comprehensive communications program, described later in this section. While it is the Company's intention to make advanced metering available for each of our Washington customers, we are also mindful that in certain remote service locations it may be cost prohibitive. In this respect, the Company will optimize the use and cost of all types of communication technologies across diverse service areas (rural, urban, gas only, etc.), to ensure we are appropriately balancing the costs and benefits of advance metering for all of our Washington customers. Following, is a brief description of key elements of the AMI deployment plan.

A. Project Management

Avista understands the critical importance of the role effective project management plays in the successful deployment of large technology and infrastructure projects. The Company's recent and relevant experience implementing large systems, such as Project Compass, smart grid, and advanced metering, has helped us refine a standardized approach to effective project management. Some key elements of this approach, include:

- **Project Manager Expertise and Governance** – Project managers receive specialized training and certification, and are required to produce project documentation demonstrating that their decisions impacting project scope, timeline, and costs are reasonable and prudent.

Project managers are also accountable to executive sponsors who receive regular reports on the status of each major project to ensure it is achieving its financial, strategic, operational, and customer benefit objectives.

- **Financial Tracking** – The financial performance of large capital projects is reported monthly including any updates of project costs.
- **Technology and Vendor Selection** – The project manager uses robust and objective procurement and sourcing processes to select the technologies and associated vendors that will provide Avista customers with the optimum cost effective solution.
- **Issue and Risk Management** – The project manager is responsible for the effective identification and management of risks and issues that arise through the course of deployment. Risk and issue management involves a minimum monthly review that includes an assessment of potential impacts and their likelihood, as well as development and implementation of action plans to mitigate the risks.
- **Testing and Commissioning** – As part of its quality management process, the project manager is required to develop a testing and commissioning plan for all elements of the project. Examples of testing and commissioning include factory acceptance testing for meters and hardware, performance testing to ensure scalability, user acceptance testing for software, meter shop bench testing, and software design reviews.
- **Managing Business Process Integration** – Project managers must ensure that new systems are effectively integrated into the Company's business processes. This requires a review of how existing business processes will be impacted and the development of implementation plans. These plans reflect a balance between the changes made to the project with those required for business processes to allow the Company to deliver an optimized solution.
- **Change Management** – As described above, significant new systems such as advanced metering will influence many aspects of Avista's business, requiring many internal and external processes to be revised or replaced. An effective Change Management program is essential to ensure that each employee understands the importance of the project, the reason for changes, and the importance of their individual roles in helping to assure the success of the effort. Communications, training, feedback, alignment, and constant improvement are key to this success.

B. Information Technology Systems

The AMI Project involves significant requirements for new information technology infrastructure, including the data storage and specialized applications required to deliver the full benefits to our customers. As described above, underlying computer hardware and software systems will be the first elements of the Project implemented. Some of these systems include the operating and security software applications in the meters themselves, the applications supporting the backhaul network, and the meter data collection software portion of the Head End system. Another key software application supporting advanced metering is the Meter Data Management System. This application performs a range of functions supporting automated meter reading and advanced metering, and is highly integrated with Avista's other information technology systems, including customer, financial, and work and asset management. The new meter data management system will replace the Company's existing system and will support metering programs in all of our jurisdictions. Additional information technology systems required to achieve the anticipated Project benefits, such as those required to perform data analytics, will be installed and tested throughout the period of deployment. This effort will involve the following key activities.

1. **Application Installation -** Installing new software applications requires the services of a systems integration vendor as well as many other specialized information technology contractors. Avista will use a combination of employee and contract personnel to complete the following installation processes: 1) analysis and requirements definition, technical design, and documentation; 2) application configuration, extension coding, and integration, and 3) unit and system testing of the functionality of the installed applications supporting the advanced metering system.
2. **Product Test and Production Readiness -** This work focuses on identifying, writing, and executing test scripts (or "test cases") to confirm that the programming logic meets the business and process requirements developed in the design phase. Testing will also include "day-in-the-life" scenario testing, designed to ensure that all of the components of the integrated applications will support the Company's day-to-day operations. This includes testing the advanced metering and meter data management systems, the integrations between these and other systems, and the end-to-end business processes they support. The timeframe for this testing will commence several months after installation begins, and will continue through the period of preparation for the launch of the new system.
3. **Systems Go Live -** Placing the new systems into active service, referred to as the "Go Live," is planned to occur in phases based on the functionality required (e.g. billing, customer web portal, etc.) to support the field deployment of the advanced metering infrastructure. As mentioned above, key functionality of systems required to support primary business activities will be placed into service prior to the full-scale deployment of advanced meters, planned for early 2017.
4. **Business Process Design and Review** - Concurrent with the technology work processes, the Company will complete reviews of its affected business processes, as described above, which will address employee impacts, identify training needs, and arrange for the design and deployment of training as required. This effort will continue through the Application Installation Phase and continue as necessary through the testing and Go Live phases.

C. Communications Networks

This effort involves the installation of collection devices and networks, as described earlier, which are integrated with the Field Area Network and Wide Area Network (backhaul). For locations in the proximity of the Company's existing Field Area Network, that system will be used to provide the communications backhaul. In cases where an existing Field Area Network is not available, Avista is planning to use commercial cellular networks to provide the backhaul. In particular, for rural applications, there will be instances where neither commercial cellular service nor the Field Area Network is available. In those cases, the Company will have to use other communications technologies to bridge the network gap. An estimate of the expected costs for this incremental communications infrastructure is included in the Project estimate. As noted earlier, it is Avista's intention to install advanced metering for all of our Washington customers, including those on areas of its system that are rural and very remote. The Company will, however, monitor the incremental cost of deployment in these circumstances and will recommend alternatives to full deployment in the event these costs appear to be prohibitive.

D. Advanced Meters

Avista is planning to install approximately 253,000 advanced electric meters and 155,000 natural gas meter communication modules. Meter deployment is currently scheduled to begin the second quarter of 2017, and is slated for completion by year 2021.[23] Installation of residential meters will be completed in 2019, while the installation of commercial metering is planned to extend throughout the deployment period. Avista is tentatively planning to install commercial meters and modules with Company employees and to hire contract crews to install residential meters and gas modules.

1. **Metering Technology** - Avista is planning to install the OpenWay Riva™ metering platform developed and sold by Itron Corporation, a leading global vendor of advanced metering products and services. While advanced metering technology has matured in recent years around standardized metering platforms, the forward market for smart metering systems is converging with broader markets for smart grid technologies, smart cities, and the "internet of things." The OpenWay Riva technology features "distributed computing" contained in the meter itself, allowing it to run multiple applications on a single network. This feature will provide increased grid visibility, functionality, enhanced reliability, and greater capability to enable new and emerging technologies. Avista believes this distributed, multi-application capability will better serve the needs of our customers as smart grid-related technologies deliver increasingly greater convenience, value, and satisfaction throughout the Project lifecycle.

   Another feature of the OpenWay Riva platform is its Adaptive Communications Technology, which supports reliable and cost-effective high-speed communications with field devices in remote locations. This technology integrates both Radio Frequency (RF) and Power Line Carrier (PLC) communications on the same chip set. This combination enables meters and grid devices to intelligently and continuously use the optimal communications path along the network, delivering assured connectivity at the highest possible speed. Avista believes this solution will provide significant infrastructure savings over alternative solutions. In fact, compared with Avista's most-recent coverage study, conducted in 2014, the network infrastructure requirements enabled by the Adaptive Communications Technology will be substantially reduced for collector devices (49%) and for range extenders (83%). This capability will reduce the capital cost of deployment, help ensure Avista can cost-effectively achieve its goal of 100 percent deployment, and help reduce the ongoing operating costs of the system.

   Avista understands that providing data security is a very critical requirement of smart grid technologies. The Company believes the partnership between Cisco and Itron provides the application security controls and management combined with secure network infrastructure required to create an industry-leading solution to secure data, communications, and access to other smart grid components. Itron's leading-edge security ensures communications are encrypted, commands are digitally signed, and access to the

[23] While the Company is planning to complete deployment activities by the end of 2020, it is possible that some work could extend into the first quarter of 2021.

network requires authentication to the network management system, and then to the head end collection application.

2. Meter Deployment Process

a. **Meter Socket Preparation -** This work involves inspecting all customer-owned meter sockets to identify and repair any potentially hazardous conditions, such as a damaged meter base. This work is completed prior to placing a new meter at the customer's premises, often accomplished during the process of installation. Avista is planning to employ qualified contractors in this effort. In addition to performing any needed repairs, any existing "A-based" service points will be converted to the current meter socket standard.

b. **Real Estate & Joint Permitting -** Avista's Real Estate group will support the project by helping to identify the need for, and obtaining any permits required to install new communications infrastructure at locations specified in the network design plan.

c. **Network Communications -** Avista plans to provide its customers access to their energy use information via the Company's customer web portal within a week of meter installation. As noted earlier, any required installation and testing of communications network infrastructure must be accomplished prior to meter deployment. Avista's current deployment plan provides for applicable network investments to be designed and installed at least 6 weeks ahead of meter deployment to allow time for adequate testing of the network and its integration with head end systems, including the customer web portal.

d. **Initial Systems Deployment -** Avista is planning to deploy a small number of meters (2,000 to 5,000) in varied settings (e.g. urban, rural, and gas-only areas) to validate the connectivity and functionality of the various technology systems, end to end. The anticipated period of this initial deployment is six months.

e. **Meter Installation** - As advanced meters and modules are installed the existing meter at each service will be photographed to record the meter specifics, including type, location, and current usage. Geographic coordinates will be associated with each photograph, which will be used in the future to verify Avista's geographic information system (GIS) coordinates for its Washington meter service points. This work will be performed during meter deployment because it will likely be several years before each service point in the system will again be systematically inspected.

E. Customer Engagement and Communication

The widespread deployment of advanced metering across the country has demonstrated the potential for some customers to be concerned with the new technology. Even though only a small percentage of customers may raise these concerns, the manner in which the utility addresses them can have a profound impact on the success of the overall deployment. In other AMI projects, as well as in Avista's own experience, customer concerns are generally grouped in three areas, including:

Health - concerns related to the perceived safety of the wireless (radio) communication of the metering system.

Privacy - questions related to the kind of customer information being communicated by the meter and collected by the utility, and how that information might be used.

Accuracy - concerns about the perceived accuracy of digital meters compared with conventional metering.

Any of these issues, in addition to numerous others, could be of such concern to a customer that they ultimately oppose having a new digital meter or wireless meter communications at their premises. This customer decision is known in the industry as "opt out." As part of the Washington Advanced Metering Project, Avista will be proactive in our communication and outreach to customers, community members, our employees and other stakeholders, and will respond quickly and effectively to any customer issues or concerns raised in connection with advanced metering. In addition to proactive communications, the Company will continue its practice of responding directly to every customer who raises an issue associated with advanced metering. We have found this direct approach of providing accurate, understandable, and balanced information to be very helpful and effective to our customers. Even though no customers chose to opt out of Avista's advanced meter deployment in Pullman, we do anticipate that some will choose this option in the planned full deployment across our Washington service area. Accordingly, the Company is committed to providing metering options for our customers and will pursue the development of an opt-out program, working in concert with Commission Staff and other regulatory stakeholders.

1. **Communication Objectives -** The goal of Avista' communication outreach is to build a broad awareness of the growing application of smart grid technologies being used to modernize the electric grid, and in particular, of advanced metering systems. The Company will focus on explaining the reasons for deploying this new technology, its expected customer benefits, and the cost effectiveness of the investment. The engagement and communications initiative will have the following key objectives:

   - Educate and prepare our employees to be able to respond effectively to questions raised by our customers and others in the community related to the deployment of the advanced meters. The goal is to ensure our employees are equipped to provide accurate, balanced, and responsive information when asked, and to actively listen to, and bring back any concerns expressed by our customers and others.
   - Engage customers, regulators, and other stakeholders early in the course of the project to build a broad awareness and understanding of the advanced metering system and the benefits it will provide our customers, explain the deployment process, respond effectively to key issues and concerns, and promote the dialog that will help surface and effectively respond to new and emerging issues.
   - Provide helpful information explaining the AMI benefits to customers, focusing on: 1) easy online access to information on their energy use; 2) tips on how to use this information to conserve energy and save money; 3) the savings associated with more efficient operations such as meter reading, remote service connectivity, conservation voltage, and outage management; and 4) service improvements such as accurate billing,

streamlined customer inquiries, and text alerts notifying customers of usage parameters they select.

- Proactively inform customers about the process and timing of meter installation in their locale so they know what to anticipate and have the opportunity to raise any issues or concerns.
- Provide energy expertise for our customers by equipping them with detailed energy-use information along with useful energy conservation advice and effective programs so they can implement cost-effective efficiency measures.

Early in the project, Avista will leverage its experience implementing smart grid, automated meter reading, and advanced metering systems using the communication and outreach approaches we have found to be effective for our customers. In addition to this experience, the Company recently surveyed its Washington customers to gather additional baseline information on their current understanding and perceptions of the smart grid and advanced metering. Avista is also researching industry best practices and reaching out to other utilities to learn more about communications approaches that have been effective in supporting successful deployments. By actively listening to our customers over the course of the Project, we will be able to adjust our communication and outreach efforts to ensure we are addressing the full range of issues important to all of our customers, audiences, and stakeholders.

2. **Phases of Communication -** Avista's communications outreach is organized into three phases we have defined as "setting the context," "meter installation," and "focus on value." **Setting the context** encompasses broad communications to precede the first installation of advanced meters. This communication will encompass smart grid and AMI investments, the benefits of advanced metering, and the pending deployment. Communication will focus on our Washington customers, but will also include our customers in Idaho, Avista employees, community and business leaders, regulators and policy makers, and other stakeholders. **Meter Installation** will focus on customers who will be receiving an advanced meter in the next 30 – 60 days to let them know what to expect in the process and the likely timing. These communications will encourage customers to contact the Company in the event they have questions or concerns associated with the installation, and will introduce the web portal that will allow them to view and monitor their interval energy usage. **Focus on value** will include a range of communications from broad to very targeted that will focus on the status of the deployment, the customer benefits of advanced metering, and ways to take advantage of usage and other information available to the customer. These communications will encompass the full period of deployment of the advanced meters.

3. **Audiences** - In addition to the broad classifications of our customers, employees, communities, and regulatory stakeholders, Avista's communications will be tailored to more specific audiences as appropriate. These include groups of customers by class (residential, commercial, and industrial), subsets within customer groups, customers in areas where pilot deployments are planned, customers in very urban and more rural parts of our service area, Company employees more likely to receive questions from customers and others, technology vendors and partners, and local media outlets.

4. **Communication Channels -** The Company will rely on several communication channels and approaches through the course of the project. These include:
    - Videos, frequently asked questions, and other materials that will be hosted on a special section of Avista's customer website.
    - Articles in the Company's customer newsletter.
    - Other direct customer materials including door hangers, direct mail, e-mail, special bill inserts, and social media.
    - Community presentations.
    - Regulatory and other stakeholder presentations.
    - Earned media as well as paid advertising.
    - Employee newsletter, meetings, and specialized training.

F. Achieving Program Benefits

An important focus of Avista's Washington Advanced Metering Project will be the achievement of benefits forecasted in this business case. The Company will measure and track the applicable results for each benefit area to provide performance feedback helpful in identifying any work process or other changes needed to achieve the full benefit potential. In measuring these benefits, it will be important to distinguish between those results that can be easily and directly measured, results that can be estimated using validated methods or models, and estimates that are based on the operational experience of Avista or other utilities, but where the ability to directly measure the results presents a challenge that may require us to develop and test new and innovative metrics. Following are some illustrative examples of these types of measures:

Direct Results – In the case of eliminating manual meter reading and the service trips associated with connecting/disconnecting meters, Avista will be able to directly measure the reduction in these activities and the resulting impact on the Company's known labor, transportation, and related expenses.

Estimated and Validated Results – In the example of conservation voltage reduction, Avista uses electrical models and its knowledge of the characteristics of its electric feeders to estimate the potential savings to be achieved across the system. The results can be validated after the program is in operation by comparing before and after voltage levels in samples taken across the system.

Estimated Results - there are some benefits where the ability to directly measure the result will be challenging. An example of this is the customer benefit associated with managing outage restoration more efficiently. While it is clear during an outage event today that AMI will provide opportunities to reduce outage duration and costs, it will likely be difficult after the system is operational to quantitatively establish what outage inefficiencies *would have occurred* during a particular outage event had AMI not been installed.

In addition to measuring customer benefits, Avista will track the status of the project, which will include the progress made in achieving deployment milestones for each system component and describing any material changes to the overall program, including forecasted timeline, scope, and budget.

V. AMI Privacy, Security and Interoperability

A. Customer Privacy and Security Control

The foundational value of an advanced metering system is the ability to capture, control, protect, and enable the customer and the utility to effectively use the energy consumption data. Avista understands that this marked increase in the flow of information raises the concern of customers and other stakeholders about what data is collected, how the data will be used, and how it will be protected. The Company is committed to protecting our customers' safety, security and privacy, and we have stringent procedures in place for the use and protection of customers' personal information. This includes any personally-identifying information we collect through the metering process. As part of implementing these policies, Avista has instituted extensive security controls to ensure the cyber integrity of its systems and to secure and protect customers and customer data from cyber threats. Customer information that is gathered, stored, and transmitted, is safeguarded on secure systems that have restricted and controlled access. All Company employees as well as contractors acting on Avista's behalf, who have access to customer information, are required to comply with our privacy and security practices and policies. Avista treats all customer information as confidential, consistent with our policies and all legal and regulatory requirements, and will not sell or otherwise provide customer data to third parties without the customer's consent.[24]

B. Data collected by Avista

In the course of service to our customers, the Company needs standard customer contact information, including name, address, customer's phone number of preference, and optionally, an email address. Our service also requires us to collect identifying financial information, including payment and credit histories. Historically, data on electricity and natural gas use has been collected monthly for the purpose of billing and additional customer information is often gathered to support the individual customer's participation in energy efficiency programs and rebates.

With advanced metering, the Company will capture and store very detailed energy-use data for each customer, which we will use for billing, will make available to the customer through the web portal, and which may be used for a variety of analyses, including heating and cooling equipment diagnosis. The data will help identify customers for energy conservation programs that are tailored to their energy-use patterns. Advanced metering will allow the Company to send the customer text messages in response to the customer's request to be notified based on usage parameters they select, and to identify potential problems with the meter, including potential cases of energy diversion. Additionally, Avista will use the meter status to determine whether a service outage is caused by problems on the customer side of the meter, and to determine if service has been restored to all customers in an area where outage restoration has been completed. For those customers who choose to share their energy use data on the web portal with a third-party service provider, Avista

[24] Exceptions include those instances where the Company may be legally required to provide information to law enforcement officers by warrant or subpoena, to governmental or regulatory agencies with jurisdiction over Avista when they require such information, or to credit reporting and collection agencies if an account is assigned for collection.

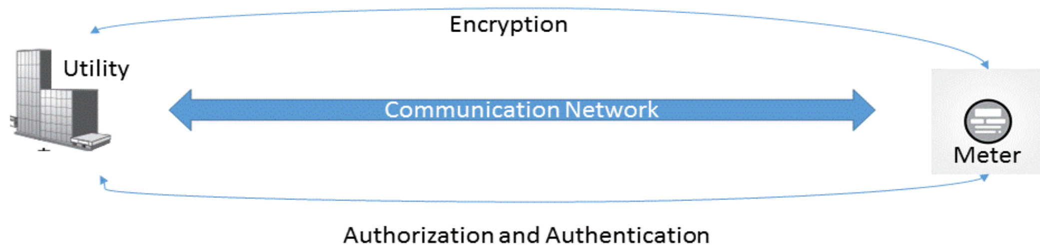
will ensure that the instructions and technology for authorizing and completing this process are readily available and safe and easy to use.

C. Cyber Security

1. **Approach** - Avista's cyber security practices are designed to ensure that operational objectives are effectively achieved, while ensuring the integrity of our data and systems is protected at every level from possible unintentional incidents, and the full range of potential cyber security threats. Cyber security is a foundational part of every system and is designed from the ground up to meet the Company's security and confidentiality standards, various regulatory requirements, and interoperability standards, among others. Security is highly integrated into each phase of every project, including planning, design, build, test, Go Live, and ongoing operations. In every application, the goal of Avista's security processes is to ensure we have appropriate and cost-effective measures in place that provide comprehensive and seamless protection for our customers, employees, contractors, and work processes, across computer hardware and software systems, energy delivery and communications infrastructure, and myriad end-use devices. These processes ensure the Company can meet a range of objectives, including the following:
    - Ensure the safety of employees, our customers, and the public.
    - Meet the Company's primary business objectives.
    - Establish effective security leadership and enterprise-wide governance.
    - Protect Avista data and systems and maintain exclusive system control.
    - Protect customer data.
    - Resist and repel cyber attacks.
    - Respond effectively to potential acts of sabotage or disruptive natural events.
    - Provide controlled and secure access for employees, vendors, and customers.
    - Ensure employees are aware of and trained to resist threats to Avista's systems.
    - Maintain forward-looking awareness of emerging and potential cyber threats.
    - Have processes in place for change control and configuration management.
    - Provide evidence that regulatory and other requirements are achieved.
    - Have standing rules for exceptions and risk mitigation.

2. **Changing Nature of Security Applications -** The nature of cyber security applications and programs has changed in recent years from a system-by-system security application approach to an enterprise-wide security platform supported by centralized staff expertise, adaptive work processes, and constantly evolving technology capabilities. In this approach, investments made at the enterprise level can be broadly applied to many systems and be reused and leveraged to support a range of individual applications and systems. Examples of some of these leveraged enterprise-wide systems include Log-In Monitoring, Antivirus Detection / Repair, Intrusion Detection, Change Management processes, Security Operations, and Incident Response. In this respect, the cyber security for the Company's existing advanced metering system is not composed of a collection of stand-alone security applications. The Washington Advanced Metering Project will be no different in that Avista will incur incremental costs to implement security for the system but will not be purchasing substantial new security equipment or hiring significant staff dedicated solely to AMI security. In addition to support from enterprise-wide security applications,

contemporary advanced metering systems are delivered with security applications and hardware already built into the product. Examples include cyber security systems embedded into meters, communication system components, and computer application systems, which are an integral part of the architecture of these systems. A very basic example of advanced metering security is provided in the illustration below. In this illustration, the advanced metering solution provides the software and hardware necessary for encryption, authorization, and authentication to secure it from intrusion.



The Company will require the selected vendors for these systems, as part of each contract, to provide a security architecture for each application that is suitable to Avista. The Company will be responsible for configuring and integrating these embedded security applications into its existing security platform.

3. **Cyber Security Risk Mitigation** - Avista's risk management program is the responsibility of the Company's senior management and includes the alignment of risk planning, risk objectives, risk resources, corporate policies, and mitigation tools. Avista continues to maintain its own policies and procedures related to cyber security, which are based on industry best practices, such as NIST 800-39, regulatory guidelines and standards, and guidance from reputable third parties. The risk mitigation process involves the evaluation of each major area of risk, which includes identification of threats, assessments of the probability of occurrence, evaluation of the potential impacts, overall prioritization, and selection of mitigation strategies. This effort is supported by technical teams such as Avista's Information Security group. This group develops cyber security checklists based on applicable regulations and standards, and uses them to assess cyber risks and vulnerabilities, and to establish appropriate mitigation plans. The requirements, guidance, and standards influencing Avista's policies and procedures are developed using input from many different sources, including, governmental and regulatory agencies, standards setting organizations, industry groups, and commercial standards organizations relevant to Avista's environment. Sources include, but are not limited to the following:

- NERC CIP 002 – 009
- DHS Catalog of Control System Security
- NIST 800-52 and 800-53
- NISTIR 7628 Volumes 1-3
- NIST Catalog of Standards (COS)
- NIST SP800-82
- Avista Minimum Security Baselines and Policies
- Applicable Federal and State Laws

4. **Asset-Based Security Application** - Different assets are associated with differing cyber security threats, risks, and vulnerabilities. The assessment of these risks includes all elements associated with the asset, including people, policies, procedures, platforms (hardware and software) and networks. Technical assessments also evaluate the application or components' ability to be updated to meet future cyber security standards and requirements. Finally, steps are identified and implemented to manage the asset risk using the appropriate technology, processes, and controls. This approach is applied to all new systems, interfaces, processes, and devices to be placed into service, which includes advanced metering infrastructure. Security control checkpoints are established at each phase of a project to ensure that appropriate security assessments and requirements have been met. The project cannot continue without Information Security approval at these checkpoints.

5. **Cyber Security Criteria for Evaluating AMI Vendors and Devices -** As noted above, Avista's cyber security policies require smart grid vendor solutions to meet threshold security standards determined by the Company. These standards are derived from the requirements listed in NISTIR 7628. Additionally, potential vendors must demonstrate they have a robust security culture inside their own business, as evaluated in their responses to RFP's and in the evaluation and selection processes. Vendor's adherence to these standards is evaluated prior to purchasing any solution, which must meet the minimum security requirements listed below:

   - Prove the system or application has not been compromised with malicious software. The proposed solution must provide a centrally managed capability to validate that the firmware and software in use has continually remained the same approved version.
   - Guarantee that only explicitly-approved devices and users have access to the defined system or architecture. The system or application must support a native capability to authenticate and authorize field devices and system users utilizing third party authentication. Systems such as TACACS, RADIUS, LDAP, or Active Directory are preferred.
   - Devices that are not secured in a controlled facility must be equipped with local tamper detection capability via FIPS 140-Level 2. Physical tamper detection will save time and money by providing the ability to easily identify signs of tampering without requiring physical removal of the device.
   - Confidentiality must be guaranteed in every instance where Avista's proprietary data and information, including the personally identifiable information of our customers and employees, is transmitted across logical interfaces as identified in NISTIR 7628-Vol 1. To generate assurances that the data has remained confidential, Avista requires the ability to encrypt data in-flight via FIPS 140 approved encryption mechanisms with a 128 bit minimum encryption.
   - Centralized key and certificate management that provides the ability to manage the keys used for all systems and users throughout the infrastructure, without requiring a field visit. If a certificate becomes compromised or a policy change dictates revocation or generation of new certificates, mass distribution of new certificates must be possible.

- Mechanisms must exist to ensure remote access or management interface access is granted to a system or system component only through authorized, authenticated, and encrypted means.
- A centrally managed and automated patch and firmware management system that has the ability to roll back to the last patch or firmware level if a current patching attempt fails.
- The ability to provide non-repudiation for access to all components in the system to ensure any action performed, or connectivity to, is by an approved and authenticated entity.
- Provide the ability to log, alert, and report on: security events; use of access rights; system changes; system state; and anomalous system behavior on all devices included in the proposed solution. All logs should be capable of being integrated with a centralized log-management system and should support the ability to send logs via syslog.
- Evidence must be provided by the vendor that the proposed system has been developed using the Systems Development Lifecycle (SDLC) methodologies, including regular and auditable penetration testing by a qualified third party.
- Malware and antivirus protection must be supported by all non-embedded systems or applications.
- If malware or antivirus software is not supported then a detailed mitigation strategy must be defined and documented.
- The solution must have the ability to establish a standard password policy that mirrors Avista's corporate password policy (password length, complexity, and change frequency), including the ability to disable accounts after a set number of invalid logins for a set length of time.

6. **AMI will Support Smart Grid Cyber Security Standards -** Avista's intent is to design and implement smart grid technologies, including advanced metering by relying on a foundation of current standards, requirements, and best practices. In support of this effort, we continue to actively participate in industry working groups, such as EEI's Cyber Security Committee, which are focused on development and refinement of applicable cyber security standards. As appropriate, the Company will apply these new standards to our systems over time, allowing us to ensure our standards are effective throughout the lifecycle of the advanced metering system.

D. Interoperability

Interoperability is defined as the capability of two or more networks, systems, devices, applications, or components, to externally exchange and readily use information securely and effectively. Recognized standards of interoperability are critical to enabling the capability of interconnected systems and components, and are the foundation of mass markets for all components and devices that will ultimately have a role in the future smart grid. These interoperability frameworks and standards provide a foundation to effectively plan, design, build, test, deploy, maintain, and operate smart grid and advanced metering systems and solutions in a way that will deliver consistent customer value across the lifecycle of each system.

1. **Interoperability Frameworks** - Avista's approach to smart grid interoperability follows established frameworks defined by the National Institute of Standards and Technology (NIST) and is further augmented by the work of the GridWise Architecture Council and the Institute of Electrical and Electronics Engineers (IEEE). Frameworks provide conceptual reference models for discussing the characteristics, uses, behaviors, interfaces, and other elements of smart grid systems, as well as the relationships among these elements, both within the smart grid system and across other systems. These models are the tools used for identifying the standards and protocols needed to ensure interoperability and cyber security, and for defining and developing the architectures for smart grid and other systems and subsystems within them.

   Because smart grid technologies are integrated with many different systems, such as generation, communications, and information technologies, interoperability must take into consideration all of these interconnected power system elements. The NIST conceptual model defines appropriate smart grid domains, and the IEEE 2030 standard defines three interoperability domains, which include the power system (and its components), the communications system (and its components) and the information systems. Finally, the integrated model is used to define the required layers of interaction between elements in each domain, and their respective technology interfaces. Together, this interoperable system of systems, which includes advanced metering, will enable a more reliable, customer centric, efficient, and flexible energy delivery system.

2. **Interoperability Standards** - There are a variety of proprietary, industry, national, and international standards that are applicable to Smart Grid systems. Avista's approach to standards favors the use of open technologies over proprietary systems, which includes the adoption of officially recognized and standardized technologies over those that are not. Since Avista uses the NIST framework to guide its approach to smart grid and advanced metering interoperability, we actively track the ongoing development efforts of the NIST interoperability standards. Naturally, we also favor vendor products and solutions that support and comply with these standards.

   While standards are necessary for achieving effective interoperability, they are by themselves not entirely sufficient. A conformance testing and certification process is essential to support these standards. In consultation with industry, government, and other stakeholders, NIST has initiated work to develop an overall framework for conformance testing and certification, and is taking steps toward its implementation. Avista will continue to actively support this process and will favor contractors and manufacturers who do likewise.

VI. AMI Project Costs

The Company's AMI project team has worked through formal RFP processes to evaluate multiple vendors and to obtain initial pricing[25] for advanced metering field hardware (meters and mesh collectors), meter installation, communications infrastructure and installation, and project support and maintenance. The team also solicited RFP's from information system technology vendors, as well as using Company information systems staff and data from other utility deployments to assess information technology system costs. These costs include computer hardware, software purchasing, licensing, implementation and integration, and overall support and maintenance of these enabling systems and infrastructure. Avista also engaged its internal subject matter experts to help estimate the costs associated with the operational improvements that will be required to deliver the expected Project benefits. These costs include labor requirements, needed capital investments, and a range of administrative costs such as customer engagement and outreach, and regulatory and technical support. With respect to the anticipated useful life of the advanced meters, Avista chose a period of 15 years, which is consistent with our policies as well as that of other AMI deployments. In addition to the expected useful life of the meters, the period used for the analysis of Project costs, the Project Lifecycle discussed in Section I of the report, includes the period of project planning and systems and vendor selection, the installation of information technology systems, and the field deployment of communications systems and meters. The estimated capital investment, levelized annual operating expenses, and lifecycle operating costs for major components of the system are provided in Table 7. These component costs are briefly described in the following pages and a comprehensive electronic workbook containing supporting details for each cost component is provided in Appendix A. The estimated level of spending by component during each year of the Project lifecycle is provided on a cash basis in Table 8, below.

Table 7. Estimated total capital investment and the levelized annual and lifecycle operating expenses (cash $millions) for major components of Avista's Washington Advanced Metering Project.

Major Cost Components	Capital Investment	Levelized Annual Operating Expense	Lifecycle Operating Expense
Meter Data Management	$12.0	$1.0	$18.0
Head End Systems	$12.8	$1.1	$20.3
Collector Infrastructure	$31.7	$1.6	$29.0
Data Analytics	$5.1	$1.0	$19.1
Meter Deployment	$100.4	$0.7	$12.0
Energy Efficiency	$4.7	$0.4	$6.4
Regulatory Process	$0.0	$1.0	$18.6
Totals	**$166.7**	**$6.8**	**$123.4**

[25] Initial pricing refers to the vendor's confidential statement of cost in their response to an RFP. From that point, final costs are determined by additional design work that must be done, refinement of statements of work, and negotiation and execution of a contract and final pricing.

Table 8. Estimated capital (CAP) and operating expense (EXP) for major cost components (cash $millions) for each year of the Project lifecycle for Avista's Washington Advanced Metering Project (Meter amortization is included in the cost category "Regulatory Process").

Year	Meter Data Management		Head End Systems		Collector Infrastructure		Data Analytics		Meter Deployment		Energy Efficiency		Amortized Meters		Totals	
	CAP	EXP	CAP	EXP	CAP	EXP	CAP	EXP	CAP	EXP	CAP	EXP	CAP	EXP	CAP	EXP
2015	$0.2		$0.1						$0.3		$1.2				$1.7	
2016	$9.3		$10.3		$5.5		$3.7		$2.6		$0.8				$32.1	
2017	$2.4	$0.8	$2.4	$0.9	$7.0	$1.2	$1.4	$0.9	$28.2	$0.5	$0.8	$0.2		$1.2	$42.1	$6.4
2018	$0.1	$0.8		$0.9	$7.3	$1.2		$0.9	$30.0	$0.5	$0.8	$0.2		$1.2	$38.2	$6.4
2019	$0.1	$0.8		$0.9	$6.2	$1.3		$0.9	$23.7	$0.5	$0.8	$0.3		$1.2	$30.7	$6.6
2020	$0.1	$0.9		$1.0	$5.7	$1.3		$0.9	$4.7	$0.5	$0.5	$0.3		$1.2	$11.0	$6.8
2021		$0.8		$1.0		$1.3		$0.9		$0.6		$0.3		$1.2		$6.8
2022		$0.9		$1.0		$1.4		$0.9		$0.6		$0.3		$1.2		$7.0
2023		$0.9		$1.0		$1.4		$0.9		$0.6		$0.3		$1.2		$7.1
2024		$0.9		$1.0		$1.4		$1.0		$0.6		$0.3		$1.2		$7.1
2025		$0.9		$1.0		$1.5		$1.0		$0.6		$0.3		$1.2		$7.2
2026		$0.9		$1.0		$1.5		$1.0		$0.6		$0.3		$1.2		$7.2
2027		$1.0		$1.1		$1.5		$1.0		$0.6		$0.3		$1.2		$5.5
2028		$1.0		$1.1		$1.6		$1.0		$0.6		$0.3		$1.2		$5.6
2029		$1.0		$1.1		$1.6		$1.0		$0.6		$0.4		$1.2		$5.7
2030		$1.0		$1.1		$1.6		$1.1		$0.7		$0.4		$1.2		$5.9
2031		$1.0		$1.1		$1.7		$1.1		$0.7		$0.4		$1.2		$6.0
2032		$1.0		$1.2		$1.7		$1.1	$0.6	$0.7		$0.4			$0.6	$6.1
2033		$1.0		$1.2		$1.7		$1.1	$2.8	$0.7		$0.4			$2.8	$6.1
2034		$1.0		$1.2		$1.8		$1.1	$3.3	$0.7		$0.4			$3.3	$6.2
2035		$1.0		$1.2		$1.8		$1.1	$3.4	$0.8		$0.5			$3.4	$6.5
2036		$0.3		$0.3		$0.4		$0.2	$0.8	$0.2		$0.1			$0.8	$1.6
Totals	$12.0	$18.0	$12.8	$20.3	$31.7	$29.0	$5.1	$19.1	$100.4	$12.0	$4.7	$6.4		$18.6	$166.7	$123.4

A. Meter Data Management System

Costs include the capital investment associated with the selection, installation, configuration, integration, and coding of extensions for the Meter Data Management application.[26] The operating expenses reflect the ongoing requirements for maintaining the system and supporting business processes. Capital investment and the levelized and lifecycle operating expenses for major components of this system are presented in Table 9.

Table 9. Estimated total capital investment and levelized annual and lifecycle operating expenses (cash $millions) for components of the meter data management system.

Meter Data Management Cost Components	Capital Investment	Levelized Annual Operating Expense	Lifecycle Operating Expense
Avista Labor	$3.1	$0.7	$12.1
Contractors	$2.7	$0.0	$0.0
Services	$3.3	$0.0	$0.0
Software	$1.5	$0.2	$4.2
Hardware	$1.3	$0.1	$1.7
Administrative	$0.1	$0.0	$0.0
Totals	**$12.0**	**$1.0**	**$18.0**

B. Head End Systems

Costs include the meter data collection computer hardware and software, meter security computer hardware and software, and other information technology equipment, including data storage and central systems design. Operating costs reflect the estimated annual requirement to support these systems through the Project lifecycle. Capital investment and the levelized annual and lifecycle operating expenses for major components of this system are presented in Table 10, below.

[26] Since the meter data management system will support metering and billing for both electric and natural gas service in all of the Company's jurisdictions, the costs for this system will be allocated accordingly. The costs included in the business case represent Washington's allocated share.

Table 10. Estimated total capital investment and the levelized annual and lifecycle operating expenses (cash $millions) for components of the head end systems.

Head End System Cost Components	Capital Investment	Levelized Annual Operating Expense	Lifecycle Operating Expense
Avista Labor	$3.3	$0.6	$11.5
Contractors	$0.9	$0.0	$0.0
Software	$4.7	$0.4	$7.5
Hardware	$2.3	$0.1	$1.3
Services	$1.5	$0.0	$0.0
Administrative	$0.1	$0.0	$0.0
Totals	**$12.8**	**$1.1**	**$20.3**

C. Collector Infrastructure

These costs include the collection network supplied by the meter vendor, the hardware integration of the collector system with the backhaul network, and related project management. Also included are the estimated capital costs for backhaul network additions required to support advanced metering, field mitigation measures, lab requirements, and operations construction equipment costs. The operating costs reflect the estimated annual requirements for the communications and mitigation infrastructure. Capital investment and the levelized annual and lifecycle operating expenses for major components of this system are presented in Table 11.

Table 11. Estimated total capital investment and the levelized annual and lifecycle operating expenses (cash $millions) for the meter collectors and related infrastructure.

Collector Infrastructure Cost Components	Capital Investment	Levelized Annual Operating Expense	Lifecycle Operating Expense
Avista Labor	$11.6	$1.0	$22.6
Contractors	$2.9	$0.0	$0.0
Software	$2.8	$0.0	$4.2
Hardware	$0.0	$0.2	$2.2
Services	$14.1	$0.0	$0.0
Administrative	$0.3	$0.1	$0.0
Totals	**$31.7**	**$1.3**	**$29.0**

D. Data Analytics

These costs reflect computer hardware and software applications and the systems integrations required to derive the AMI benefits anticipated by the Company. The operating costs reflect the annual staffing and systems support for the maintenance of the data analytics platform. Capital investment and the levelized annual and lifecycle operating expenses for major components of these systems are presented in Table 12.

Table 12. Estimated total capital investment and the levelized annual and lifecycle operating costs (cash $millions) for computer hardware and software applications required to provide data analytics capabilities.

Data Analytics Cost Components	Capital Investment	Levelized Annual Operating Expense	Lifecycle Operating Expense
Avista Labor	$1.4	$0.5	$10.0
Contractors	$0.4	$0.0	$0.0
Software	$0.6	$0.5	$9.1
Hardware	$2.1	$0.0	$0.0
Services	$0.5	$0.0	$0.0
Administrative	$0.1	$0.0	$0.0
Totals	**$5.1**	**$1.0**	**$19.1**

E. Meter Deployment

Costs include all of the advanced meters and their field installation, including all customer communications required to support the successful deployment of the system. The operating costs reflect the estimated annual requirements for ongoing metering operations. Capital investment and the levelized annual and lifecycle operating expenses for major components of these systems are presented in Table 13.

Table 13. Estimated total capital investment and the levelized annual and lifecycle operating expenses (cash $millions) for the deployment of advanced meters.

Meter Deployment Cost Components	Capital Investment	Levelized Annual Operating Expense	Lifecycle Operating Expense
Avista Labor	$16.5	$0.4	$7.4
Contractors	$0.3	$0.0	$0.0
Software	$21.0	$0.0	$0.0
Hardware	$0.0	$0.0	$0.0
Services	$62.2	$0.3	$4.6
Administrative	$0.4	$0.0	$0.0
Totals	**$100.4**	**$0.7**	**$12.0**

F. Energy Efficiency

An additional increment of savings can be derived from conservation voltage reduction by making specific improvements to the Company's electric distribution system. Capital investment and the levelized annual and lifecycle operating expenses for these improvements are presented in Table 14.

Table 14. Estimated total capital investment and the levelized annual and lifecycle operating expenses (cash $millions) for distribution system improvements required to achieve an incremental increase in conservation voltage benefits.

Energy Efficiency Cost Components	Capital Investment	Levelized Annual Operating Expense	Lifecycle Operating Expense
Avista Labor	$1.5	$0.4	$6.4
Contractors	$0.0	$0.0	$0.0
Software	$0.0	$0.0	$0.0
Hardware	$3.2	$0.0	$0.0
Materials	$0.0	$0.0	$0.0
Administrative	$0.0	$0.0	$0.0
Totals	**$4.7**	**$0.4**	**$6.4**

G. Regulatory Processes

Costs include those estimated for Avista staff support in regulatory activities before the Commission, as well as the expense associated with depreciating the remaining value of the existing electric meters. The associated levelized annual and lifecycle expenses are presented in Table 15.

Table 15. Estimated levelized annual and lifecycle expenses (cash $millions) for Avista regulatory staff support and for the depreciation of existing electric meters.

Regulatory Cost Components	Capital Investment	Levelized Annual Operating Expense	Lifecycle Operating Expense
Avista Regulatory Support	$0.0	$0.0[27]	$0.0
Retirement of Existing Meters	$0.0	$1.0	$18.6
Totals	**$0.0**	**$1.0**	**$18.6**

[27] Estimated annual expenses for regulatory support activities is estimated to be less than $100,000.

VII. AMI Quantified Customer Benefits

Avista has continued to refine its estimates of the customer benefits expected through the planned deployment of the Washington Advanced Metering system. This analysis has relied on both internal and external experts to identify areas of expected benefit, and to quantify the expected annual savings for each area, including the expected ramp-up of the benefit value during the period of deployment. These financial benefits arise from cost savings that reduce Avista's cost to provide service to our customers and from savings that will accrue to customers by other means (such as reduced energy theft and customer-installed energy efficiency measures). Estimating benefits in some areas, such as for the elimination of manual meter reading, is relatively straightforward because it is based on a direct reduction in the Company's known labor, transportation, and support costs. In other areas, such as conservation voltage reduction, the Company is using validated methodologies and models to estimate the expected value of the benefit. In limited instances, such as the customer benefits associated with reduced outage duration, Avista had to estimate the magnitude of the likely improvement, and then employ standardized modeling to quantify the expected financial value. Project benefits are evaluated over the same lifecycle period as the Project capital and operating expenses.

The major areas of the quantified customer benefits are listed in Table 16, below. A brief description of each area of benefit follows. In addition to these descriptions, Appendix B contains worksheets describing each benefit and explaining the calculation of its value. Additional detail on the determination of benefit value, including data, assumptions, dependencies, the expected timing for achievement of the benefit, and other supporting information, is provided in the electronic workbook in Appendix B. The estimated annual value for each area of benefit over the Project lifecycle is provided on a cash basis in Table 17, below.

Table 16. The estimated levelized annual and lifecycle value (cash $millions) for major areas of the quantified customer benefits to be achieved through the implementation of Avista's Washington Advanced Metering Project.

Area of Benefit	Levelized Annual Value	Lifecycle Value
Meter Reading and Meter Salvage	$8.1	$162.0
Remote Service Connectivity	$2.3	$45.7
Outage Management	$4.3	$86.4
Energy Efficiency	$6.4	$127.2
Energy Theft and Unbilled Usage	$3.1	$62.8
Billing Accuracy	$1.1	$22.2
Utility Studies	$0.2	$4.4
Total	**$25.5**	**$510.7**

Table 17. The estimated level of customer benefits (cash $millions) shown by major area of benefit for each year of the Project lifecycle for Avista's Washington Advanced Metering Project.

Year	Meter Reading / Salvage	Remote Service Connect	Outage Management	Energy Efficiency	Energy Theft / Unbilled	Billing Accuracy	Utility Studies	Total
2016				$ 0.1			$ 0.2	$ 0.3
2017	$ 2.4	$ 0.7	$ 0.1	$ 1.0	$ 0.4	$ 0.2	$ 0.2	$ 5.0
2018	$ 4.0	$ 1.2	$ 1.7	$ 3.5	$ 1.0	$ 0.7	$ 0.2	$ 12.3
2019	$ 4.7	$ 1.6	$ 3.6	$ 4.6	$ 2.1	$ 0.9	$0.2	$ 17.7
2020	$ 6.4	$ 1.9	$ 3.8	$ 5.1	$ 2.7	$ 0.9	$ 0.2	$ 21.0
2021	$ 6.7	$ 2.0	$ 3.9	$ 5.4	$ 2.8	$ 1.0	$ 0.2	$ 22.0
2022	$ 7.0	$ 2.1	$ 4.1	$ 5.6	$ 2.9	$ 1.0	$ 0.2	$ 22.9
2023	$ 7.4	$ 2.1	$ 4.2	$ 5.9	$ 3.0	$ 1.0	$ 0.2	$ 23.8
2024	$ 7.7	$ 2.2	$ 4.4	$ 6.1	$ 3.2	$ 1.1	$ 0.2	$ 24.9
2025	$ 8.2	$ 2.3	$ 4.5	$ 6.4	$ 3.3	$ 1.1	$ 0.2	$ 26.0
2026	$ 8.7	$ 2.4	$ 4.7	$ 6.6	$ 3.4	$ 1.2	$ 0.2	$ 27.2
2027	$ 9.2	$ 2.5	$ 4.8	$ 6.9	$ 3.5	$ 1.2	$ 0.2	$ 28.3
2028	$ 9.8	$ 2.6	$ 5.0	$ 7.2	$ 3.7	$ 1.2	$ 0.2	$ 29.7
2029	$ 10.3	$ 2.7	$ 5.2	$ 7.6	$ 3.8	$ 1.3	$ 0.2	$ 31.1
2030	$ 10.7	$ 2.8	$ 5.3	$ 7.9	$ 3.9	$ 1.3	$ 0.2	$ 32.1
2031	$ 10.9	$ 2.9	$ 5.5	$ 8.2	$ 4.1	$ 1.4	$ 0.2	$ 33.2
2032	$ 11.0	$ 3.0	$ 5.7	$ 8.6	$ 4.2	$ 1.4	$ 0.2	$ 34.1
2033	$ 11.1	$ 3.1	$ 5.9	$ 9.0	$ 4.4	$ 1.5	$ 0.3	$ 35.3
2034	$ 11.2	$ 3.3	$ 6.1	$ 9.3	$ 4.5	$ 1.5	$ 0.3	$ 36.2
2035	$ 11.5	$ 3.4	$ 6.3	$ 9.7	$ 4.7	$ 1.6	$ 0.3	$ 37.5
2036	$ 3.1	$ 0.9	$ 1.6	$ 2.5	$ 1.2	$ 0.7	$ 0.1	$ 10.1
Total	$ 162.0	$ 45.7	$ 86.4	$ 127.2	$ 62.8	$ 22.2	$ 4.4	$ 510.7

A. Elimination of Manual Meter Reading and Meter Salvage

Deployment of advanced meters virtually eliminates manual meter reading, which provides substantial operational benefit. In Avista's Washington service territory, there were approximately 41 meter readers that completed 4.65 million manual reads on regular routes in 2014. Costs for manual meter reading include labor, meter reading hardware and transportation, along with apportioned costs for facilities, administration, and safety-related incidents.

Avista's meter readers also perform an average of 7,740 special meter reads each year. While special reads are a small fraction of the overall reads gathered, they represent a significant cost since they are often not part of the meter readers' regular assigned route. In addition to the time spent gathering the read, there are added costs for driving to and from the individual premises and for the customer service representatives' time spent setting up the read and then updating the customer information after the read is complete.

Beyond the savings associated with meter reading, we have also estimated the salvage value of the existing conventional meters, and the avoidance of installing special metering (net metering) to support customer-owned distributed generation. The levelized annual and lifecycle cost savings associated with automated meter reading, meter salvage, and net metering, are presented in Table 18.

Table 18. The estimated levelized annual and lifecycle value (cash $millions) associated with the elimination of manual meter reading, meter salvage, and of the net metering required to support the integration of customer-owned generation. The annual value[28] shown for the salvage of retired conventional meters is for the period of deployment only.

Meter Reading, Net Metering and Meter Salvage	Levelized Annual Value	Lifecycle Value
Regular Reads	$7.4	$148.3
Special Reads	$0.1	$0.9
Salvage Value of Retired Meters	$0.0	$0.0
Net Metering	$0.5	$10.8
Local Economy Jobs	$0.1	$2.0
Total	**$8.1**	**$162.0**

B. Remote Service Connectivity

The remote service switch is a feature of the advanced meter that allows it to be remotely disconnected and reconnected, avoiding what otherwise requires a field visit to the service location or the customer's premises. In 2014, Avista personnel made approximately 13,600 service trips for general service disconnects and reconnects, and approximately 21,500 trips for credit-related service. In addition to reducing operating costs, the process of reconnecting service for our customers using advanced metering is much more rapid than with physical service calls. Remote connectivity will result in a significant cost savings by reducing the number of personnel,

[28] Because of the scale of advanced meter deployments across the country there is no current market for conventional electric meters like Avista's to be purchased, refurbished and redeployed by another utility. The salvage value shown here represents a recycled scrap value that offsets the cost of disposal.

transportation, and other expenses required for conventional field service activities. The levelized annual and lifecycle cost savings associated with remote service connectivity are presented in Table 19.

Table 19. The estimated levelized annual and lifecycle value (cash $millions) associated with reduced field service activities and service fees enabled by remote service connectivity.

Remote Service Connectivity	Levelized Annual Value	Lifecycle Value
Account Open / Close / Transfer	$1.2	$24.7
Credit Collections / Connections	$1.0	$20.0
After Hours Fees	$0.1	$1.0
Total	**$2.3**	**$45.7**

C. Outage Management

Advanced meters are constantly sensing meter function and communicating with the utility's data systems to alert any changes of status at the meter. This allows the utility to know in near real-time whether or not there is power to the individual meter. When power is disrupted the advanced meter sends a signal indicating an outage at the particular customer premises. This outage information, which the meter data management application imports to Avista's outage management system, provides an earlier notice of an outage event,[29] and provides a more complete picture of overall system outages. With better visibility of the many isolated outages during a large outage event, Avista will be able to remotely verify that service to all customers affected by a local outage event has been restored before dispatching the crew to the location of the next localized outage. As a result, the investigation and restoration processes will be more efficient and shorter in duration, resulting in both reduced operating costs and avoided customer losses.

Customers impacted by an electric outage, depending on the duration, will experience financial losses due to manufacturing or service disruptions, food spoilage, and myriad other causes. This is particularly true for commercial and industrial customers who very often cannot conduct their business without electric service. Avista uses a model known as the Interruption Cost Estimator (ICE)[30] to determine the financial value to customers associated with specific reliability improvements. The model does this by estimating the cost to customers resulting from electric outages of varying types and durations. For this business case Avista has used the model to predict financial losses customers will avoid from reduced outage duration. The levelized annual and lifecycle cost savings associated with improvements in outage response and reduced outage duration are presented in Table 20.

[29] Without the advanced metering system, the Company is notified of an individual customer outage when the customer calls Avista to report their loss of service.
[30] http://www.icecalculator.com/ice/

Table 20. The estimated levelized annual and lifecycle value (cash $millions) of the benefits resulting from earlier outage notification, more efficient management of outage restoration, and customer savings associated with reduced outage duration.

Outage Management	Levelized Annual Value	Lifecycle Value
Avoided Customer Outage Losses	$3.5	$70.1
Avoided Single Lights Out[31]	$0.3	$6.3
Reduced Customer Calls	$0.2	$3.0
Storm Restoration Efficiencies	$0.3	$7.0
Total	**$4.3**	**$86.4**

D. Energy Efficiency

There are two principal areas of energy efficiency savings enabled by the deployment of advanced metering: measures that are undertaken by the customer as a result of having access to detailed energy use data, and energy savings associated with improved efficiency of the electric distribution system.

1. **Customer Energy Efficiency -** When customers have access to detailed and timely energy-use data, coupled with utility-provided information and education on energy conservation, customers will have new and advanced tools to undertake structural and behavioral changes to reduce their energy use and costs. Avista estimates that three percent of its customers will take additional steps to save energy as a result of having access to their interval energy use data, and as a result, will reduce their energy consumption by an average of three percent. Also, because the Company will be able to distinguish between customers who are viewing and not viewing their energy data on the web portal, we will be able to tailor the energy conservation information we provide to individual customers.

2. **Conservation Voltage Reduction -** The electric distribution system is designed to operate within a voltage range that is manually set for each neighborhood "feeder" line at a voltage regulator in the substation. The types and the magnitude of electrical loads on a feeder (e.g. motors vs. lighting) are constantly in flux causing variation in the actual voltage level on the feeder over time. Since Avista is required to maintain a minimum line voltage, the set-point voltage range is conservatively set at a higher level than is required most of the time in order to ensure there is an adequate buffer to account for the variation in loads. Since more electrical energy is required to support higher line voltages, providing this buffer has a cost that is directly proportional to the size of the buffer.

[31] The term "Single Lights Out" refers to outages that involve only one customer, which can be caused by electrical problems on the customer's side of the meter. Electrical issues on the customer side cannot be repaired by Avista and are the responsibility of the homeowner.

Recently, Avista has deployed smart grid technology that allows the voltage on a feeder to be adjusted based on actual voltage readings taken from distribution line devices along the feeder. The approach uses the distribution management system to process the voltage readings from these devices and send voltage control signals to the regulator in the substation in near real time. This capability allows the range of the buffer to be reduced, thus reducing the amount of energy required to maintain the required line voltage. This capability, noted earlier, is known as conservation voltage reduction. The energy savings from conservation voltage reduction can be further optimized by adding advanced meters that are equipped with voltage alarm capability. Now, instead of relying on voltage readings from the devices on the feeder, the actual voltage at the customer's premises can be monitored and those readings can be used to further-reduce the feeder voltage needed to meet the standard. In addition to monitoring voltage at the customer level and adjusting the feeder voltage accordingly, the Company will also identify those services where a particularly low voltage (such as caused by the operation of a large electric motor) is limiting the overall reduction in voltage that can be achieved on the entire feeder. Avista will install line devices at those locations to boost the service voltage to a level that will allow the setting for the entire feeder to be reduced. The cost for these line devices, including their installation and maintenance, is included in the estimated Project cost. The levelized annual and lifecycle cost savings associated with improvements in customer and distribution system energy efficiency are presented in Table 21.

Table 21. The estimated levelized annual and lifecycle value (cash $millions) associated with energy efficiency savings from customer-installed energy efficiency measures and improvements in conservation voltage reduction.

Energy Efficiency	Levelized Annual Value	Lifecycle Value
Customer Energy Efficiency	$0.5	$9.6
Conservation Voltage Reduction	$5.9	$117.6
Total	**$6.4**	**$127.2**

E. Energy Theft and Unbilled Usage

Tampering or theft diversion occurs when a customer purposefully alters the meter or service entrance enabling power to be used at the premises without being registered on the meter. Advanced meters are equipped with tamper alarms that will automatically alert the utility in the event a person attempts to circumvent the metering of energy. In addition to the alarm capability, Avista will employ data analytics to evaluate the interval metering data to more-accurately identify potential theft of service. Using theft-detection software enables field inspection personnel to be dispatched more efficiently, further reducing the frequency of field service calls and customer disruptions. In addition to helping curb energy theft, advanced metering also aids the utility in isolating potential unbilled usage at a premises, as well as identifying slow, failing, and stopped meters.

The development of estimates for the value associated with energy theft is based on Avista's own experience, as well as informed by a range of estimates reported by the utility industry. In most literature the potential opportunity is often reported as ranging between 1 and 3 percent of total utility revenue. In some business cases for advanced metering projects the opportunity to address theft represents the single largest benefit among all those evaluated.[32] Avista believes its savings opportunity is likely on the lower end of industry-reported results. Accordingly, we have estimated the opportunity at 0.43% of total revenue. Several research studies, business cases, and anecdotal conversations with other utilities support this as a reasonable assumption.

1. **Unbilled Usage -** Unbilled usage occurs when an account has been inactivated and there is no customer associated with the account, but where energy usage is still occurring at the premises. This unbilled usage is difficult to initially identify with conventional metering, and consequently, it can take several weeks to several months before an issue is identified and resolved. Advanced meters can either be remotely disconnected when an account is closed to prevent unbilled usage, or the meter can trigger an alarm when usage is occurring during a period when there is no active customer account. In either event the amount of unbilled usage can either be eliminated or substantially reduced.

2. **Slow or Failing Meters -** Electromechanical meters can slow down over time (i.e. register less energy used than the actual usage) resulting from excessive wear on the internal moving parts. Depending on the degree of error, slow and failing meters can be very difficult to isolate with conventional metering. The longer the time the meter is not functioning properly the more complex the issue becomes to resolve. This can create a significant under billing issue for customers and it also places the under-billed revenue at risk for recovery.

3. **Stopped Meters -** When a meter appears to have stopped recording energy use it is flagged for investigation by the Company's meter shop personnel. Unfortunately the great majority of the time meters are reported as potentially stopped there has simply been no use at the premises and the meter is working properly. This is what's known as a "false positive." Currently, Avista experiences these false positives in 85% of the cases we investigate for electric meters and 95% for natural gas meters. Reducing the number of field visits to investigate these false positives represents the core savings associated with stopped meters. The levelized annual and lifecycle cost savings associated with improvements in energy theft detection and reduced unbilled energy use are presented in Table 22.

[32] Smart Metering & Infrastructure Program Business Case. BC Hydro, 2010.

Table 22. The estimated levelized annual and lifecycle value (cash $millions) associated with the reduction in energy theft diversion and energy use that is unbilled.

Energy Theft & Unbilled Usage	Levelized Annual Value	Lifecycle Value
Theft Diversion	$2.1	$42.9
Unbilled Usage	$0.2	$4.6
Slow/Failing Meters	$0.5	$9.2
Stopped Meters	$0.3	$6.1
Total	**$3.1**	**$62.8**

F. Billing Accuracy

Because energy-use information is available from the advanced meter to the utility on an interval basis, Avista will no longer be required to estimate bills for missing meter reads, or for the processes of opening, closing, or transferring utility service. Each year, these activities require the Company's customer service representatives to estimate meter reads for approximately 92,000 transactions in our Washington service area. With advanced metering Avista expects it will be able to reduce the average call time for each of these transaction because our representatives will not have to estimate the metered energy use. In addition to doing away with the need to estimate usage, the availability of detailed energy-use information will equip our customer service representatives with timely and meaningful usage data to assist customers during billing inquiries. This increase in accuracy and convenience is valued by customers.

Avista employs billing analysts who review customer billing data each month to look for anomalies that might suggest a problem with an electric or natural gas meter. Typical billing situations flagged by the analysts include abnormally high or low monthly bills. Each unusual billing situation is evaluated by analysts who have to make a determination whether to send a meter technician to test the subject meter. Deployment of advanced metering will eliminate much of the review process for these types of bills because diagnostic algorithms in the metering system will enable us to better determine whether there is an actual problem with the meter.

Another area of benefit resulting from advanced metering is in the work process known as "rebilling." A variety of instances can lead to errors in the initial bill sent to a customer, particularly from the need to estimate the billing amount, requiring a new bill to be generated and sent to the customer. The elimination of estimating bills will significantly reduce the need for customer rebilling. The levelized annual and lifecycle cost savings associated with improvements in energy theft and unbilled energy usage are presented in Table 23.

Table 23. The estimated levelized annual and lifecycle value (cash $millions) of the savings from business process improvements supported by the availability of timely and accurate energy use information.

Billing Accuracy	Levelized Annual Value	Lifecycle Value
Estimated Bills	$0.6	$12.0
Bill Inquiries	$0.3	$5.9
Billing Analysis	$0.1	$2.8
Rebilling	$0.1	$1.5
Total	**$1.1**	**$22.2**

G. Utility Studies

Utility departments such as rates and engineering use electricity load information in studies related to system planning, customer rates, reliability, and energy efficiency. Having information on the use patterns of the individual customer will allow Avista to better understand how and when each customer interacts with its system. This more-detailed information makes these particular studies easier and less expensive to perform and the results more accurate. In addition to these benefits, the deployment of advanced metering will reduce the cost of the annual meter testing program.

1. **Retail Load Study -** Every five years, the Company conducts a study of the electrical "demand" placed on the system by each of its groups or classes of customers. This information is used as part of the Company's cost of service analysis developed for each customer class. Currently, this demand data is collected at hourly intervals from a sample of customers by using approximately 700 specialized meters that have been placed in the field just for this purpose. Installing these meters and moving them periodically as well as providing them with communication capability, is a substantial portion of the cost of these studies. With the deployment of advanced metering, each customer meter will have the capability to record and communicate demand information so there will no longer be a need to deploy specialized meters or incur the communication costs.

2. **Meter Shop -** Avista meter technicians field test a sample of meters each year to determine whether the overall 'population' of meters in service is performing reasonably. The number of meters in the sample tested each year is approximately 1,900. The sample size is relatively large, in part, because over the years there have been several classes or 'families' of meters placed into service, and the sample must contain an adequate number from each of these meter families. With the deployment of advanced meters, there will be a much-more uniform population of meters, meaning the sample size of meters to be tested each year will be considerably smaller. The levelized annual and lifecycle cost savings associated with advanced metering support of utility studies are presented in Table 22.

Table 24. The estimated levelized annual and lifecycle value (cash $millions) associated with savings for conducting utility studies and meter sampling.

Utility Studies	Levelized Annual Value	Lifecycle Value
Retail Load Studies	$0.1	$2.2
Meter Sampling	$0.1	$2.2
Total	**$0.2**	**$4.4**

VIII. AMI Customer Benefits - Value Not Quantified

The customer benefits described above include only those for which financial value was quantified for inclusion in the cost-benefit analysis performed for the business case. In addition to these benefits, there is a range of legitimate customer benefits for which Avista did not attempt to quantify. The value of some of these benefits, such as the capability to implement demand response programs or time-of-use rates, would be easy to quantify, however, Avista is not currently proposing these mechanisms. Others, such as providing support for the customer home area network, may be quantified as well based on how our customers will interact with this technology. Still other benefits, while contributing to our customers' overall satisfaction, are difficult to quantify financially. Examples are the customer value associated with the availability of interval usage data, or text alerts, or having additional bill payment options, or more accurate billing and streamlined resolution of billing issues. While we believe most would agree that these services have value to customers, it is difficult to assign a financial value to them. In the final analysis, these customer benefits should be appropriately included in the Company's advanced metering business case as additional weight supporting the prudence of the investment in advanced metering for our customers. Several of these intangible benefits are briefly described below.

A. Customer Access to Interval Energy Usage Data

Customers can use the utility web portal to view and analyze their energy use to learn more about how they use energy. Even though a customer may not take active steps to reduce their energy consumption as a result of viewing their usage data, they will still consider the availability and easy access to such data as a service improvement.

B. Customer Home Area Network Interface

The home area network is a specialized wireless network for energy data; advanced meters have the capability to interface with this network. This interface allows the advanced meter to provide the customer actual real-time energy-use data via an in-home display or for use by a "smart" thermostat. As consumer technologies continue to evolve, the home area network interface to real-time energy data will play an increasingly important role in the development of "smart" homes and businesses.

C. Energy Alerts

The detailed information on energy usage provided by advanced metering gives the utility the ability to send outbound messages to customers about the status of their energy use at any given point in time. An example of an energy alert would be the customer's request to be notified by the utility when the customer's monthly usage reached a certain level, or instantaneous demand surpassed a customer-set number.

D. Customer Privacy

With advanced metering there is no longer the need for meter readers to be on the customer's property each month. While there will still be instances where utility employees must visit the customer's premises, advanced meters significantly reduce the overall frequency of such occurrences.

E. Engineering Studies and Asset Planning

Utilities are experiencing new influences such as the increasing penetration of electric vehicles and customer-owned distributed generation that are affecting the performance and predictability of their electric distribution systems. These new dynamics can impact the reliability of conventional engineering models that have been used to evaluate system performance and plan for future infrastructure investment. The data provided by advanced metering will help engineers better understand the new ways customers are interacting with the system, and to more accurately model current and future system performance, providing for more efficient deployment of capital.

F. Utility Employee Safety

The deployment of advanced metering reduces the number of instances where a utility employee is dispatched for a field service call. Fewer field service calls will reduce the risk of injury to employees engaged in these activities.

G. Future Opportunities for Benefits

Advanced metering is an enabling technology that provides the platform to achieve additional customer value and satisfaction. Though some of these consumer benefits may not yet be practical for Avista, due to relatively low retail electricity prices, they have been implemented by utilities in other parts of the country. Having advanced metering allows the utility to have the technology available to integrate additional customer benefits as the timing becomes appropriate. Some of these future benefits are described below.

1. **Rate Options -** Advanced metering is a foundational technology for enabling the utility to implement rate structures that require interval metering capabilities. Some of these rate options include time-of-use pricing, critical peak pricing, and demand pricing. Of these options, demand pricing is emerging as a likely means to ensure customers' rates more accurately reflect the value of the system they use. This is particularly the case for customers owning distributed generation. Advanced meters with remote connectivity can also be used to support demand-response initiatives and rate offerings such as "pre-pay."

2. **Micro Grids and Smart Cities -** The field area network can be designed as a 'multi-application' network. As such, the network can support the communication needs of a range of other grid modernization and automation efforts, including micro grids and smart cities initiatives.

3. **Additional Data Analytics -** While there are many documented uses of the information provided by advanced metering that provide customers value, the industry expects it will provide a platform for capturing added benefit from new and innovative uses of interval energy and other data that will emerge over time.

4. **Additional Distributed Generation -** Advanced metering provides the utility with improved capability to accommodate the increasing prevalence of customer-owned generation on its system. AMI will provide a better understanding of the operation and effects of distributed generation on the system, as well as support a range of utility programs to appropriately compensate customers for the contribution of their generation.

5. **Demand Response -** Another opportunity to better-align service options with the real-time cost of energy is in demand response programs. These programs, though currently uncommon in the Northwest, are used around the country to incent customers to reduce load during the most expensive hours of the day, or critical peak periods, reducing the aggregate electricity demand and the overall cost of serving customers. As Avista deploys advanced metering the use of demand response rate options, including time-of-use, may be evaluated, both as a benefit to our customers, as well as the potential benefit to the achievement of broader environmental objectives.

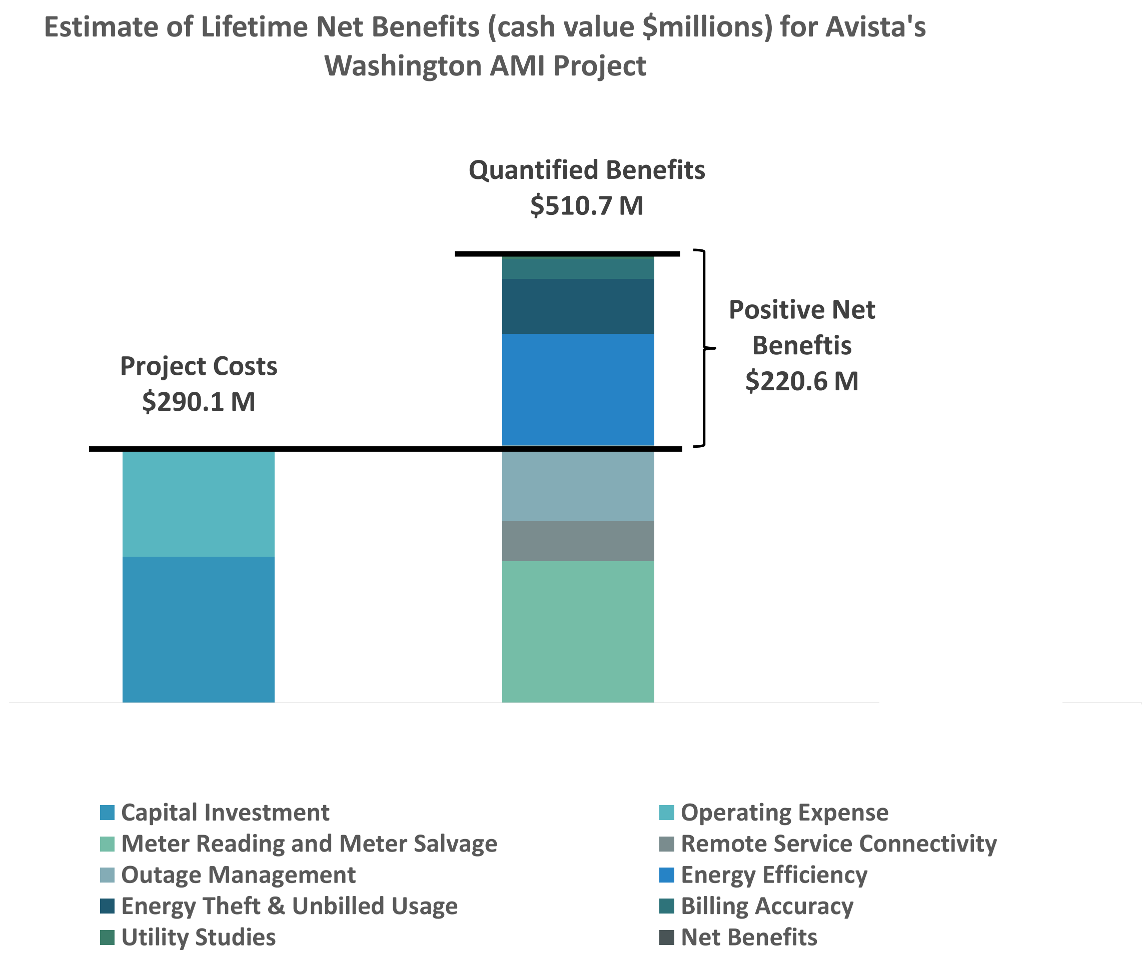
6. **Enabling Electric and Plug-in Hybrid Vehicles -** Advanced metering combined with smart charging technologies will allow electric vehicle owners to charge their vehicles at non-peak times, helping to reduce costs for all customers. In the event the Company implements time-of-use rates, offering lower rates for off-peak charging will lower the cost-per-mile for electric vehicles, which will help encourage their wider adoption.

IX. AMI Program Cost-Benefit Analysis

A. Comparison of Project Costs and Benefits - Cash Basis

Descriptions of the Project costs and benefits in Sections VI and VII, and in Appendices A and B, include the timing of when costs are expected to be incurred and customer benefits realized. The resulting annual capital costs, operating expenses, and customer benefits are reflected in the Project costs-benefit analysis. As noted above, Avista plans to spend on a cash basis a total of $166.7 million installing the AMI system, and to incur $123.4 million in total operating expenses through the Project lifecycle. The sum of the capital and lifecycle operating costs is $290.1 million, and the cash value of the quantified benefits over the Project life is estimated to be $510.7 million. The resulting Project net benefits are $220.6 million. Project capital costs, operating expenses, quantified customer benefits, and net benefits, on a cash basis, are shown in Figure 7.

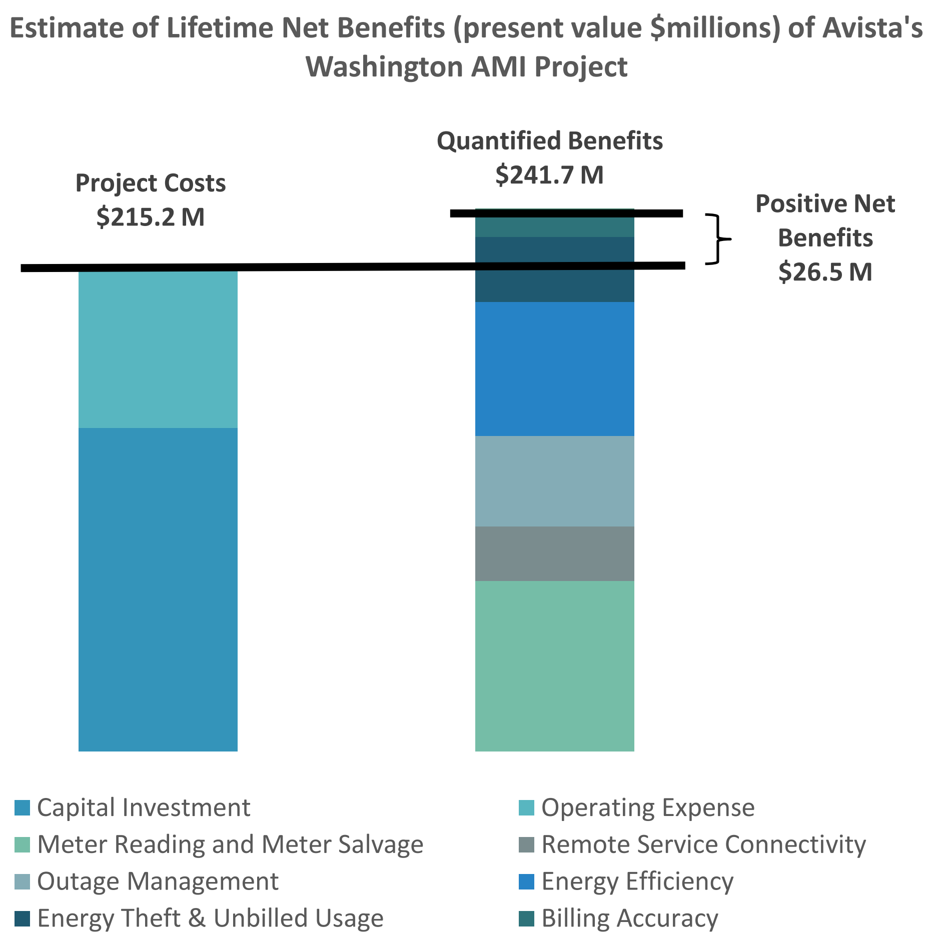
Figure 7. Cash value of the lifecycle capital investment, operating costs, customer benefits, and net benefits for Avista's Washington Advanced Metering Project.



B. Comparison of Project Costs and Benefits – Present Value

Over the life of the Project, the present value of the estimated capital costs and operating expenses is $144.1 million and $71.1 million, respectively. The present value of the estimated Project benefits is $241.7 million. The Project is expected to produce positive benefits on a present value basis of $26.5 million, as shown in Figure 8.

Figure 8. Net Present Value ($ millions) of the lifecycle capital and operating costs and benefits for Avista's Washington advanced metering project.



C. Sensitivity Analysis

As noted in the prior discussion, there are varying degrees of uncertainty associated with estimating the ultimate costs and benefits of the Washington Advanced Metering Project. For some costs such as the advanced meters, for which Avista has firm vendor pricing, we believe the degree of uncertainty is fairly limited. For other categories, however, such as communication systems and mitigation, additional detail in technical specifications and system design will be developed by the vendors ultimately chosen to support the Project. In recognition of these cost uncertainties Avista has added a contingency amount of approximately $20.8 million. These contingency funds represent 15.4% of the estimated deployment costs,[33] and are included in the estimate of the total capital cost for the Project.

For the quantified benefits, while there are some areas where the certainty of delivery is high, such as the elimination of manual meter reading and the implementation of remote service connectivity, there are others such as customer-installed energy efficiency measures, where the underlying estimates are subject to greater uncertainty. In an effort to assess the potential impact of uncertainties in estimating the value of customer benefits, Avista conducted sensitivity analysis of the estimated value of the quantified customer benefits.

1. **Approach and Assumptions** - Listed in Table 25, below, is a summary of the assumptions considered for each area of benefit in the sensitivity analysis. For each variable, we included the base-case value, an assigned range of variability, the rationale for the range, and the resulting impact on the net present value of the lifecycle benefit, compared with the Project base case. Results of the analysis are presented in Figure 9, below.

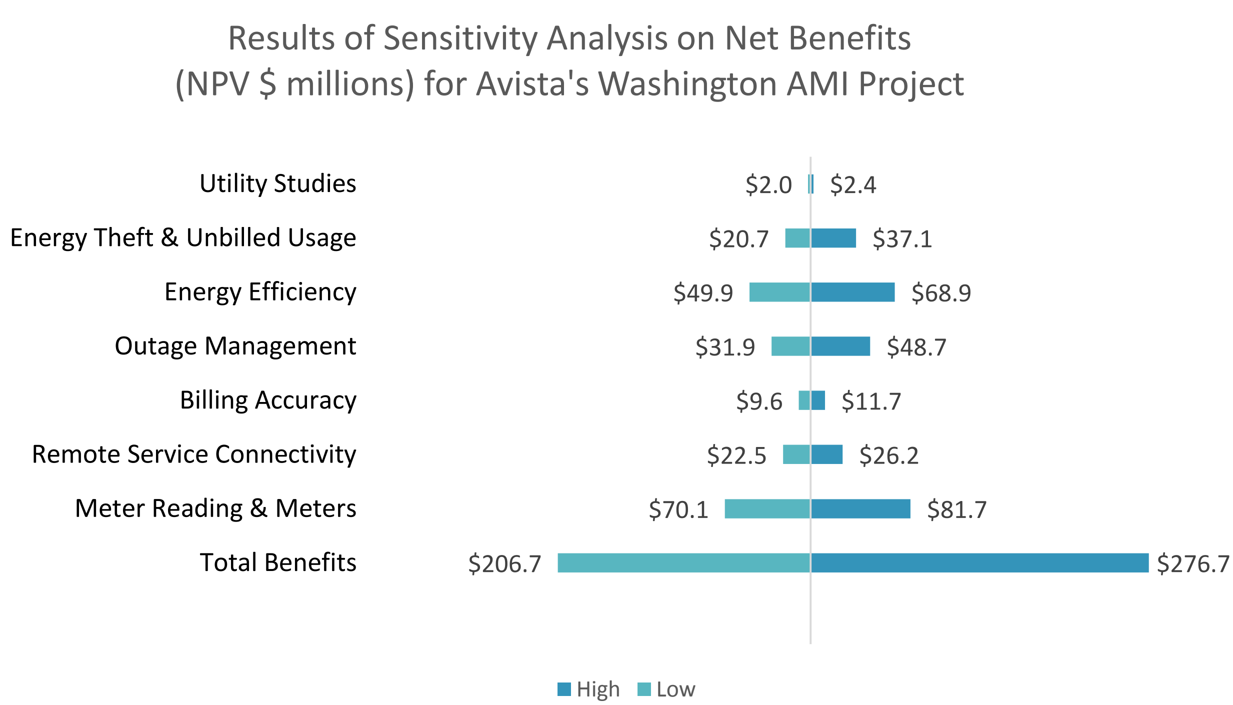
Table 25. Variables and assumptions used to assess the impact of uncertainties in the value of quantified benefits on the overall net benefits of the Washington Advanced Metering Project (NPV $ millions).

Sensitivity Variable	Base Case Value	Sensitivity Assumption	Variable Changed	Impact on Present Value
Meter Reading & Meters – Regular Reads	$68.9	+/- 5%	Base budget changes	High - $72.4 Low – $70.1
Meter Reading and Meters – Special Reads	$0.4	+/- 10%	Quantity of special reads	High - $0.5 Low – $0.4
Meter Reading and Meters – Net Metering	$4.6	+/- 50%	Quantity and cost of solar panels	High - $6.9 Low – $2.3
Remote Service Connectivity – Account Open/Close/Transfer	$11.8	+/- 10%	Quantity of instances	High - $12.9 Low – $10.6
Remote Service Connectivity – Credit Collections/ Connections	$12.2	+/- 5%	Quantity of instances	High - $12.8 Low – $11.6
Remote Service Connectivity – After Hours Fees	$0.4	+/- 10%	Quantity of instances	High - $0.43 Low – $0.36
Billing Accuracy	$10.6	+/- 10%	Quantity of instances	High - $11.7 Low – $9.6

[33] Deployment costs include all of the capital to fully deploy the Project by year 2021. Avista did not apply the 15% contingency to the future costs of installing replacement meters, which could commence as early as year 2032.

Outage Management – Customer Calls	$37.5	+/- 20%	Quantity of instances	High - $44.6 Low – $29.7
Outage Management – Restoration Efficiencies	$3.1	+/- 30%	Quantity of instances	High - $4.1 Low – $2.2
Energy Efficiency – Conservation Voltage Reduction	$55.0	+/- 15%	Customer voltage requirements	High - $63.3 Low – $46.8
Energy Efficiency – Customer Managed	$4.4	+/- 30%	Customer participation	High - $5.7 Low – $3.1
Energy Theft & Unbilled Usage – Theft & Slow/Failed Meters	$24.1	+/- 30%	Quantity of instances	High - $31.3 Low – $16.9
Energy Theft & Unbilled Usage – Unbilled/Stopped Meters	$4.8	+/- 20%	Quantity of instances	High - $5.8 Low – $3.8
Utility Studies	$2.2	+/- 10%	Statistical Sampling	High - $2.4 Low – $2.0

Figure 9. Results of sensitivity analysis on the value of the quantified benefits for Avista's Washington Advanced Metering Project (NPV $ millions).



Avista Utilities Advanced Metering Project – Business Case

Appendix A

Avista Utilities Advanced Metering Project
Business Case Report

Appendix A – Project Costs

Comprehensive detail of the capital deployment costs for the Washington Advanced Metering Project, and the lifecycle operating expenses, is provided in the electronic workbook titled "Avista AMI Costs Workbook," which is located on the compact disc included with this report in Appendix B.

The workbook is organized by the major cost components as presented in the business case report, and as listed in the table below.

Major Cost Components	Total Capital Investment (Cash Value)	Total Operating Expense (Cash Value)
Meter Data Management	$12.0	$18.0
Head End Systems	$12.8	$20.3
Collector Infrastructure	$31.7	$29.0
Data Analytics	$5.1	$19.1
Meter Deployment	$100.4	$12.0
Energy Efficiency	$4.7	$6.4
Regulatory Process	$0.0	$18.6
Totals	**$166.7**	**$123.4**

The roll up of the activity costs within each major cost component, as presented the electronic workbook, also match the organization of costs as presented in the business case report. As an example, the component costs that make up the Meter Data Management portion of the Project are shown in the table below.

Meter Data Management Cost Components	Capital Investment	Levelized Annual Operating Expense	Lifecycle Operating Expense
Avista Labor	$3.1	$0.7	$12.1
Contractors	$2.7	$0.0	$0.0
Services	$3.3	$0.0	$0.0
Software	$1.5	$0.2	$4.2
Hardware	$1.3	$0.1	$1.7
Administrative	$0.1	$0.0	$0.0
Totals	**$12.0**	**$1.0**	**$18.0**

A brief description of the organization of the Project costs provided in the electronic workbook is provided below.

1. Open the Avista AMI Project Costs workbook and select the tab labeled “Business Case Tables. This section of the workbook includes the summary tables of the Project costs as they appear in the business case report, and as described above, mirror the organization of cost information in the workbook.

2. Open the tab labeled “Budget Summary Cash” to see a more-detailed listing of the individual costs (e.g. Resources, Workforce Contract, Services, Software, Hardware, Materials… AFUDC, and Contingency) making up each major cost component of the Project, such as the Meter Data Management or Collector Infrastructure.
   a. Column “C” lists the line item capital implementation costs in cash value for each major cost category.

   b. In line 2 of Column “D” the total capital cost for the Washington Advanced Metering Project is listed as $166,710,860. This total capital cost includes all of the AMI deployment costs, including only the portion of the capital costs for the Meter Data Management System that will be allocated to our Washington customers. This is the capital cost used in the Project cost-benefit analysis for the Washington AMI Project.

   c. In line 1 of Column “D” the cost for the Project implementation, which includes all of the Meter Data Management costs (including those to be allocated to Avista’s other jurisdictions) is listed as $175,964,959. While Avista will track this cost in the implementation of the overall project, this cost is not to be used in the Washington AMI Project cost-benefit analysis.

   d. Columns “E, F, and G” show the allocations of various costs to the cost categories shown in the table above (for Meter Data Management Cost Components), and the costs shown in Column “I” represent these allocated costs for each major component of the Project.
   e. Columns “J and K” provide the cash value of the annual and lifecycle operating expenses for the Project. The recurring expenses required to support the Project are shown for each year of the Project for each cost category in Columns “N – AI.”

3. The tab labeled “Budget by Project – Month” contains the cost inputs for the costs discussed above in the tab “Budget Summary Cash.”

4. The tab labeled “Post Production O&M” provides detail on the component expense costs required to operate and maintain the Washington AMI system over its Project lifecycle. The detail includes the new labor requirements shown by Department (Dept), and the non-labor Project expenses.

5. The tab labeled “Future Meters” shows the annual depreciation for the replacement meters that could be installed as early as year 2032.

6. The successive tabs, such as the first two, labeled “MDM R” and “MDM C” provide more detailed Project costs for labor resources and non-labor expenditures.
   a. The “MDM R” tab refers to “Meter Data Management – Resources,” which lists every job position (under the heading “Resource/Role”) that is expected to support the Project for every month of the Project deployment period. The resource lists include the names of Avista employees, as known at this point in time, who will support the Project, and also lists the labor resources that will be contracted by Avista.

   b. The “MDM C” tab provides the cost detail for the non-labor expenditures for that cost category.

   c. Labels for the tabs containing the labor resource costs and the non-labor costs, as they correspond to the titles of the major cost categories, are provided in the table below. Detailed costs for labor resources and non-labor expenses are not provided for the cost components “Regulatory Process” and “Energy Efficiency” due to the very-limited complexity of their cost elements.

Major Cost Components	**Tab Label for Labor Resources**	**Tab Label for Non Labor Costs**
Meter Data Management	MDM R	MDM C
Head End Systems	HE R	HE C
Collector Infrastructure	CI R	CI C
Data Analytics	DA R	DA C
Meter Deployment	MD R	MD C

7. The tab labeled “AMI Business Case NPV” provides the present value of the each of the component capital costs and operating expenses in total, and over the lifecycle of the Project.

Avista Utilities Advanced Metering Project – Business Case

Appendix B

Avista Utilities Advanced Metering Project
Business Case Report

Appendix B – Project Benefits

Each of the quantified customer benefits included in the Project cost-benefit analysis is briefly described in this Appendix. The description of each benefit includes a statement of the customer value, some helpful background information, a brief discussion on how the value is calculated, supporting information used in determining the benefit value, and other descriptive notes. The benefit descriptions also reference additional supporting information, which is provided in the electronic workbook titled "Avista AMI Benefits Workbook." The workbook is located on the compact disc included with this report in Appendix B. Following is a listing of the benefit descriptions provided in this Appendix, including the corresponding page number for each summary.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Elimination of Manual Meter Reading

Customer Value

Avista's annual cost of manually reading customer meters, which was approximately $4.9 million in 2014, will be virtually eliminated by deploying the advanced metering system. Avoiding these costs will help reduce the Company's overall cost of providing service compared with the expected costs without AMI. In addition to the avoided cost of manually reading meters, there are several additional customer benefits provided by AMI metering data, which include:

- ✓ Improved meter reading accuracy, bill accuracy, and customer billing inquiry processes.
- ✓ Very detailed consumption data available to customers in near-real time.
- ✓ Greater customer privacy - reduced need for Avista to access the customer's premises.

Background

In Avista's Washington service territory, the Company employed approximately 41 meter readers in 2014 who completed 4.65 million manual reads on regular assigned routes. With the exception of the City of Pullman, the electric meters in Avista's Washington service territory are primarily electromechanical, including some non-communicating digital meters. These electric meters along with all of the Company's natural gas meters must be read manually. Meter readers perform a monthly manual read of each meter on regular assigned routes and the consumption data is entered into a handheld device while at the service. The meter reads from the handheld are then loaded into a database linked to the customer information system, which executes billing in a nightly batch process. There are several manual steps required to get the meter data into the billing system, and during severe weather the entire workflow can be delayed.

Calculating the Benefit Value

Avista expects to reduce its meter reading workforce and budgeted labor as well as the associated capital and operating budgets for the supporting activities. Some avoided costs are directly assigned to the meter reading budget, such as labor, supervision, transportation, and equipment. Other savings will reduce the need for facility space and some Information Technology and Human Resources support, which will result in avoided costs in those areas, though not reflected in the reduced meter reading budget. All of the avoided costs considered in the analysis are summarized below.

Area of Avoided Cost	Base Annual Value
Employee Labor (loaded) ✓ 41 meter readers ✓ One supervisor and two support staff	$4,129,124
Information Technology - Support and Technologies ✓ Meter data applications and integrations ✓ Handheld meter reading devices and software	$279,122
Transportation ✓ Approximately 433,000 avoided miles driven each year	$454,971
Safety (Avoided Injuries)	$56,785
Carbon Emissions Eliminated	$1,664
Overhead Costs ✓ Facilities	$16,106
Total	$4,937,773

Supporting Information

Regular Meter Reads - The cost information for the activities supporting manual meter reading and relied upon for determining the quantified value of the avoided costs is provided in the "Avista AMI Benefits Workbook" included on the Compact Disc provided at the end of Attachment B, Project Benefits.

1. Open the Workbook titled Avista AMI Benefits Workbook.
2. In the open workbook, select the tab labeled "Summary Detail," which includes "Regular Reads" under the "Meter Reading and Meters" area of benefit.
3. The "Regular Reads" tab contains detailed cost information used to determine the baseline value of this benefit.
4. In addition to listing the cost category and the annual financial value, the "Regular Reads" tab includes the "Source or Reference" for each cost, as well as information showing the net present value of the benefit, the annual escalation of expected costs for customer growth and inflation, the ramp up in benefit value over the deployment period, and the estimated value of each cost category through the entire Project lifecycle.

Special Meter Reads – The cost and activity information used to calculate the value of avoiding special meter reads can be accessed by selecting the "special reads" category in the Summary Detail tab under the benefit area "Meter Reading & Meters."

Functional Requirements

Performance of the AMI system must be robust and highly reliable, including its seamless integration with various other applications, including customer information, asset management, and financial systems. In addition to the performance of the advanced metering system, Avista must have in place a process for collecting metering data for any customers who ultimately decide to opt-out of advanced metering. The Company expects that the incremental costs associated with opt-out meter reading will be borne by those customers to be established in an applicable tariff.

Additional Requirements

Cost - There are no incremental investments or costs required to achieve this benefit.

Business Process - Avista will have to verify the integrity of the metering data and ensure all reads are collected and accurate. Maintenance processes will need to be developed and implemented for supporting the new systems. The timing of batch processing will need to be aligned with the new system requirements and new performance monitoring system (dashboard) will have to be developed to identify and manage any potential problems with system performance.

Key Metrics

The elimination of budgeted costs supporting manual meter reading in Washington will be used as the baseline value of the customer benefit going forward.

Benefit Realization Schedule

Avista expects an approximate three-month lag between the time meters are installed for an entire regular meter reading route and the suspension of manual reading. Since meters are read by a walking route, and routes are the basis for the assignment of resources, the complete installation of advanced meters for a route is required before the automated system is fully enabled. The attrition of meter reading employees will not be reflected in the elimination of any individual route because one employee has responsibility for several routes each month. While reducing compliment throughout the meter deployment, Avista will ensure staffing is sufficient to maintain the integrity of manual reading for the remaining manual routes. Once the route is suspended, then the benefit for that route can be applied. When the entire deployment is complete, any remaining costs for supervision and administrative support will be fully realized. The anticipated ramp up in the level of benefit is shown in the electronic workbook discussed above.

Future Benefits

The cost of the AMI deployment required to achieve this benefit, including all associated requirements, is included in the estimated Project cost. There are no incremental costs to achieve this benefit.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Meter Salvage & Local Economy Jobs

Customer Value

The cost of installing the advanced metering system will be offset by the recycling / scrap value of conventional meters and the deployment will have a positive economic impact in our service area by boosting local employment during the installation period.

Background

Conventional Meters – Because of the scale of advanced meter deployments across the country and the world today, and the consequent availability of millions of used conventional electric meters, there is no longer a secondary market for these conventional meters to be sold, refurbished, and reinstalled by another utility. Another driver of the failure in the secondary meter market is the tendency of electricity suppliers in emerging economies to install new digital meters instead of refurbished electromechanical meters, presumably because of the greater ability it provides them to deter energy theft. In addition to the lack of a market for the meters, the recycling value of conventional meters is also very limited due to the currently-depressed pricing for metals. Avista plans to have its existing meters recycled and scrapped; the estimated value is expected to offset what otherwise would be the cost of disposing of the meters.

Local Economy – Jobs – The estimated positive impact of the Project on local employment is based on the forecasted effect of adding 13 direct jobs through the deployment period and the wage value expected for these positions.

Calculating the Benefit Value

Conventional Meters – Avista estimates the recycling / scrap value of its mechanical meters at approximately $.63 per meter, and its digital meters at approximately $.42 per meter, based on the differences in their average weight. The total estimated value of all meters to be replaced is $148,000.

Local Economy Jobs – Avista estimated the value of this incremental increase in employment and earnings using EMSI's "Gravitational Flows Multi-Regional Social Account Matrix Model (MR-SAM)." It is based on data from the Census Bureau's Current Population Survey and the American Community Survey, as well as the Bureau of Economic Analysis' National Income and Product Accounts, Input-Output Make and Use Tables, and Gross State Product data. The results estimate that the 13 added jobs in our nine-county region would create $1,042,100 in earnings, and that an additional 8 jobs would be created by the economic effect of the 13 net jobs added.

The cost information for the activities supporting local economy jobs and relied upon for determining the quantified value of this benefit is provided in the "Avista AMI Benefits Workbook" included on the Compact Disc provided at the end of Attachment B, Project Benefits.

1. Open the Workbook titled Avista AMI Benefits Workbook.
2. In the open workbook, select the tab labeled "Summary Detail," which includes "Local Economy Jobs" under the "Meter Reading and Meters" area of benefit.
3. The "Local Economy Job" page contains detailed cost information used to determine the baseline value of this benefit.

Benefit Realization Schedule

Both of these benefits will extend through the period of the advanced metering deployment.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Net Metering

Customer Value

With advanced meters in place, customers installing their own distributed generation will avoid the costs currently required to install special net metering.

Background

Today, customers who install solar panels or other distributed generation must have two new meters installed at their premises, one that can measure the net energy used by the customer, and the other to measure the amount of energy generated by the customer's resource. The net meters Avista currently installs cost 50% more than the advanced meters to be deployed under AMI Project, largely due to the economy-of-scale savings associated with the purchase of large quantities of meters.

Calculating the Benefit Value

The current unit cost of the new meters installed for net metering is $165; two meters are required for the net metering installation in Washington. The "production meter" measures the actual production of the distributed resource as required to qualify for the State production tax credit (PTC). The "net meter" measures the net of customer usage and customer generation for billing. Unit installation cost is estimated at $64 per meter, for a total installed cost for the meters of $458. With advanced metering, the customer will already have one digital meter in service. The cost for the second meter is approximately $97, plus installation, for a total incremental costs of $161. The resulting per customer benefit provided by the AMI Project is approximately $297. This unit benefit is expected to persist through year 2020, at which time Avista anticipates the production meter may no longer be required. Excluding the cost of the production meter for years 2021 through the end of the lifecycle reduces the avoided cost to each net metering customer from $297 to $229. Assuming Avista's forecasted rate of penetration for solar adoption over the Project lifecycle, as discussed below, the expected costs to be avoided by our customers with advanced metering is $4,567,870.

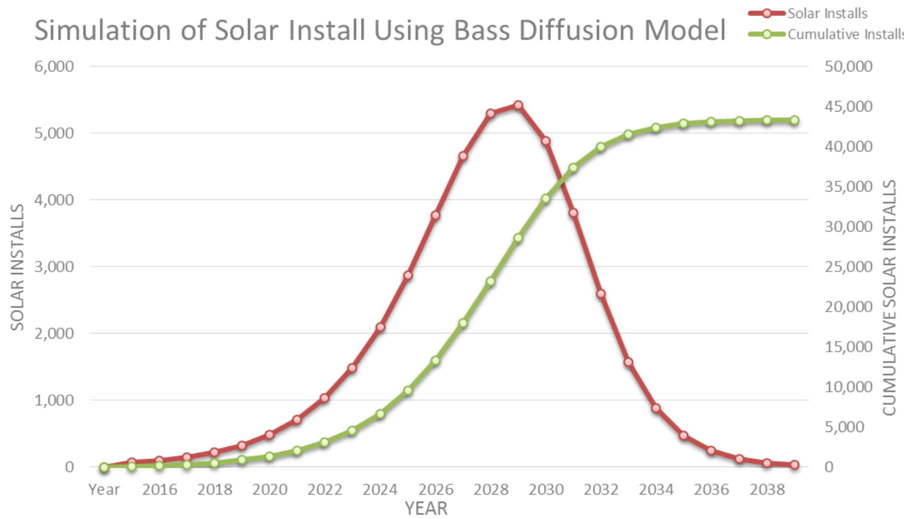
Supporting Information

The cost information supporting the value estimated for net metering is provided in the "Avista AMI Benefits Workbook" provided on the Compact Disc at the end of Attachment B, Project Benefits.

1. In the open workbook, the first tab is labeled "Summary Detail" and includes "Net Metering" under the "Meter Reading and Meters" area of benefit.
2. Select the link labeled "Net Metering" to open the tab, which contains the unit cost information, assumptions, and the forecasted rate of solar penetration used to calculate the baseline value over the Project lifecycle.

Current forecasts for solar installations are influenced by the low current rate of adoption (currently fewer than 350 systems in Washington), the uncertainty surrounding the tax credit renewal, and the projected costs of solar installations. Results of three forecasts were considered by the Company in its estimation of expected rates of adoption, which ranged from five percent to 14 percent. We also noted some correlation between forecasts based on national trends in solar adoption and those in Washington State. The Company also considered information contained in a Portland General Electric Solar Adoption Study.

Avista used forward electricity rates and forecasts of future costs of solar installations to model forecasted rates of solar adoption for our Washington service territory, as shown in the illustration below. The forecast predicts that 9 percent of Avista's Washington customers will install solar generation by the year 2040. Installations occur at a faster pace as costs decrease through technology and production efficiencies and market development. The recent extension of the 30% tax credit through the year 2020, with a gradual decrease to 10% over time will help promote solar adoption.



Functional Requirements

Performance of the AMI system must be robust and highly reliable, including its seamless integration with various other applications required to perform net metering for our customers.

Additional Requirements

Cost - There are no incremental investments or costs required to achieve this benefit.

Business Process - There will be no business process changes required.

Key Metrics

The number of Avista customers installing distributed generation, including solar panels, each year.

Benefit Realization Schedule

The realization of benefits tracks the forecasted rate of solar adoption as depicted in the illustration above.

Future Benefits

Beyond the basic net metering capability of the advanced meter, its ability to communicate in near real-time, to message, and to operate remotely, will enable Avista to take advantage of future benefits associated with the real-time integration and balancing of customer generation and loads at the distribution level.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Remote Service Connectivity – Account Open /Close /Transfer

Customer Value

Advanced metering will allow the Company to remotely disconnect and reconnect the electric service in support of changes in the status of the account. This capability will improve the quality of the service we provide our customers and reduce administrative and field service dispatch costs required by our conventional metering.

Background

For opening and transferring service, in cases where the service has been disconnected, the Company is required to dispatch service personnel to the premises, and for those services that are still energized, the customer service representative must estimate the opening meter read for establishing the new service. For closing and transferring service, the Company may dispatch field service personnel to disconnect the service, and for those cases where the service has not been disconnected, the representative will estimate the closing meter read. For those instances where the estimated meter read must be corrected, or when there is unbilled usage on the account, the Company initiates administrative processes to determine the proper opening meter read and assign the unbilled usage.

Calculating the Benefit Value

Avista manually disconnects and reconnects an estimated 3,190 services (x 2 field service trips per service) each year in support of opening, closing, and transferring accounts, and 3,646 services (x 2 field service trips per service) in support of reconciling unbilled to accounts. These tasks are generally assigned to the Company's electric servicemen, and the average unit cost for each field service dispatch (trip) is $57. The estimated average annual avoided cost for these service dispatches, as enabled by advanced metering, is $779,304. The Company will also have the ability to avoid manual processes associated with creating connect and disconnect orders, which will save an estimated $52,769. Avista expects a slight increase in some administrative activities ($2,179) which are reflected in the calculated value of the customer benefit.

Supporting Information

Data supporting the calculation of this customer benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Costs. The workbook contains the cost information for the activities associated with service connectivity as used in determining the quantified value of this benefit.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Account Open/Close/Transfer" under the "Remote Service Connectivity" area of benefit.
3. This tab contains the cost information for the activities related to this benefit, the activity levels, the calculation of the benefit, and the forecast of benefits through the Project lifecycle.

Functional Requirements

Avista will create an automated process in its customer information system to replace the current manual processes for customer requests for disconnect/reconnect and the current manual field service dispatch process.

Additional Requirements

Business Process – The service order process will change from “estimated usage” to actual account open and close date. Avista will communicate with customers and landlords about the associated work process changes. Changes in training and technical aids for customer service representatives will be made to accommodate work process changes.

Key Metrics

The Company will track the use of the remote service switch to disconnect and reconnect services as the direct measure of avoided field service dispatch trips and related activities.

Benefit Realization Schedule

The expected schedule for the delivery of this benefit is shown in the electronic workbook discussed above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Remote Service Connectivity – Credit Collections / Connections

Customer Value

Advanced metering will allow the Company to remotely disconnect and reconnect the electric service in support of credit and collections changes to accounts. This capability will significantly reduce the cost of providing service, and in addition, will substantially reduce the time currently required to reconnect the customer's service, and help avoid fees our customers currently pay for after-hours service.

Background

In cases where the customer's service is required to be disconnected and reconnected for credit / collection activities, the Company must dispatch service personnel to manually change the service status at the meter. For customers who make arrangements to have their service restored "after business hours," the customer is required to pay a tariffed fee for this service.

Calculating the Benefit Value

Eliminated Field Service Trips – In 2014, Avista's Outside Service employees (OSM), who have the responsibility for this work, manually disconnected and reconnected services in 10,848 instances in support of resolving credit / collection issues. The combined annual labor, transportation, facility, and other support costs for this employee group are $947,338 and these costs are expected to be eliminated with AMI.

After-Hours Fees – Customers who make arrangements for restoration of service after business hours are required to pay a tariffed service fee of $32. Avista anticipates reducing this charge from $32 to $16 due to the reduction in service costs enabled by advanced metering. There were 3,027 instances where customers paid an after-hours reconnect fee of $32 in 2014. Reducing the fee to $16 will save customers an estimated $49,974 in direct fees.

Supporting Information

Eliminated Field Service Trips - Data supporting the calculation of this customer benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits. The workbook contains the cost information for the activities associated with service connectivity as used in determining the quantified value of this benefit.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Account Credit Collections/Connections" under the "Remote Service Connectivity" area of benefit.
3. This tab contains the cost information for the activities related to this benefit, the activity levels, the calculation of the avoided costs, the ramp up in the expected level of the benefit, the annual escalation of expected avoided costs for customer growth and inflation, and the forecast of benefits through the Project lifecycle.

After-Hours Fees – Under the benefit area "Account Credit Collections/Connections," select the benefit labeled "After Hours Fees" to view the detail supporting the calculation of this customer benefit.

Functional Requirements

Avista will create an automated process in its customer information system to replace the current manual processes for creating service orders to dispatch field service employees.

Additional Requirements

Business Process – Avista will evaluate ways to minimize the potential for impacting customers resulting from the system-wide application of these process. The Company will communicate these changes to customers and others, and will modify training for customer service employees and others to accommodate work process changes.

Key Metrics

The Company will track the use of the remote service switch to disconnect and reconnect services as the direct measure of avoided field service dispatch trips and related activities.

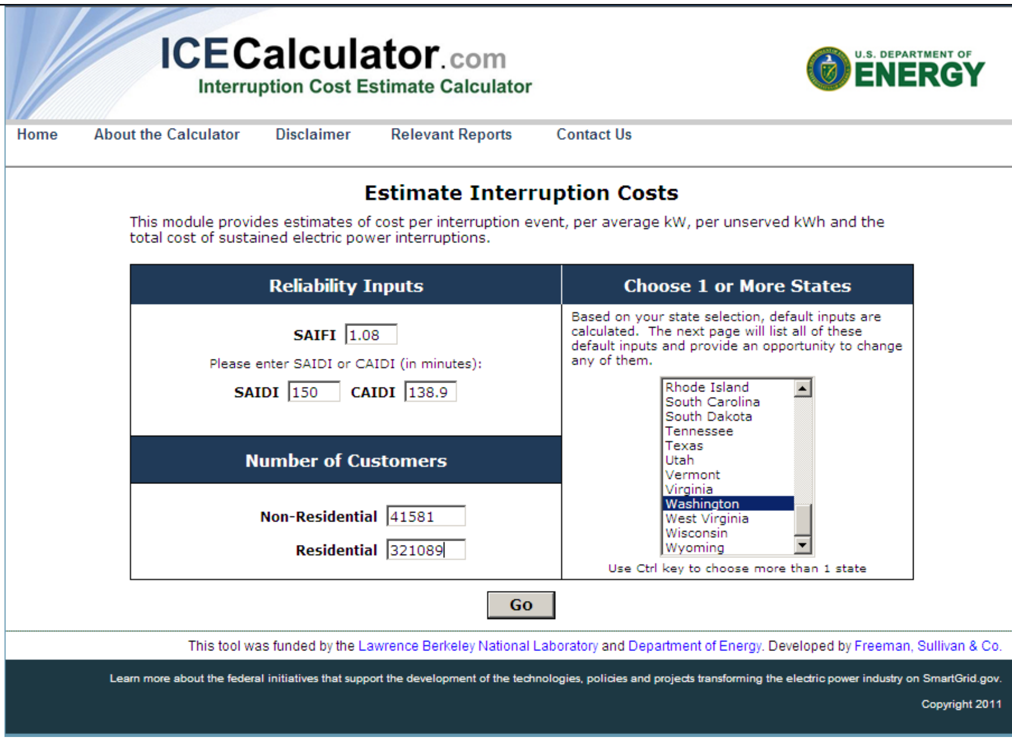
Benefit Realization Schedule

The expected schedule for the delivery of this benefit is provided in the electronic workbook discussed above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit
Outage Management – Reduced Customer Losses
Customer Value
Advanced metering provides the utility earlier notification of customer outages, and enables more efficient and timely restoration of outages. Both of these benefits help reduce the duration of outages, which results in a direct benefit to customers by reducing their outage-caused financial losses.
Background
All customers can experience direct financial losses as a result of electric service outages. The extent of the losses are determined by the particular outage circumstances (business hours vs. night, season of the year, etc.), its duration, and the type of customer (residential, commercial, or industrial). As a rule, all customers benefit when the duration of any outage can be reduced, but it is particularly the case for business customers who most often cannot operate without electric service. Business customers have operating costs (such as employee salaries) that may continue to be incurred during the outage period when they are no longer able to make sales, or they may experience significant manufacturing process losses depending on the type of product and duration of the outage. Advanced metering helps reduce outage duration in two primary ways. In the first instance, the utility receives earlier notification of outages than with conventional practices where the customer calls in to report. The immediate outage notification that is provided by integrating the outage alarm capability of the advanced meters with Avista's outage management system will immediately show the map location of the meter. This will allow the Company to immediately initiate the dispatch of restoration crews to the exact location of the outage. The second benefit is provided by the greater visibility of overall system outages, particularly during large outage events as enabled by the AMI integration with outage management. This situational visibility will allow the Company to confirm that each individual customer outage in a particular locale has been restored before the restoration crews are moved to a new area where the next group of outages will be restored.
Calculating the Benefit Value
Estimating the avoided customer losses associated with reduced outage duration requires two principal steps. Initially, Avista estimated the expected reduction in the average duration of service outages, and next used the Department of Energy's "Interruption Cost Estimator" Model (ICE) to assign a financial value to the expected incremental reduction in outage duration. To establish a reasonable expectation for a reduction in outage duration, Avista first researched the results reported by other utilities for similar improvements. Based on those results, combined with our experience of our electric system, service territory, and work practices, we elected to use a conservative value of 5% for the expected reduction in outage duration. This value was also reported in a 2011 study by The National Association of Regulatory Utility Commissioners (NARUC). To estimate the value associated with a 5% reduction in outage duration, Avista used the ICE model to quantify the cost to our customers based on our system and customer average outage frequency and duration. A screen shot, below, shows the initial model inputs used for this calculation.



ICECalculator.com
Interruption Cost Estimate Calculator

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Estimate Interruption Costs

This module provides estimates of cost per interruption event, per average kW, per unserved kWh and the total cost of sustained electric power interruptions.

Reliability Inputs

SAIFI 1.08

Please enter SAIDI or CAIDI (in minutes):

SAIDI 150 CAIDI 138.9

Number of Customers

Non-Residential 41581

Residential 321089

Choose 1 or More States

Based on your state selection, default inputs are calculated. The next page will list all of these default inputs and provide an opportunity to change any of them.

Rhode Island
South Carolina
South Dakota
Tennessee
Texas
Utah
Vermont
Virginia
Washington
West Virginia
Wisconsin
Wyoming

Use Ctrl key to choose more than 1 state

Go

This tool was funded by the Lawrence Berkeley National Laboratory and Department of Energy. Developed by Freeman, Sullivan & Co.

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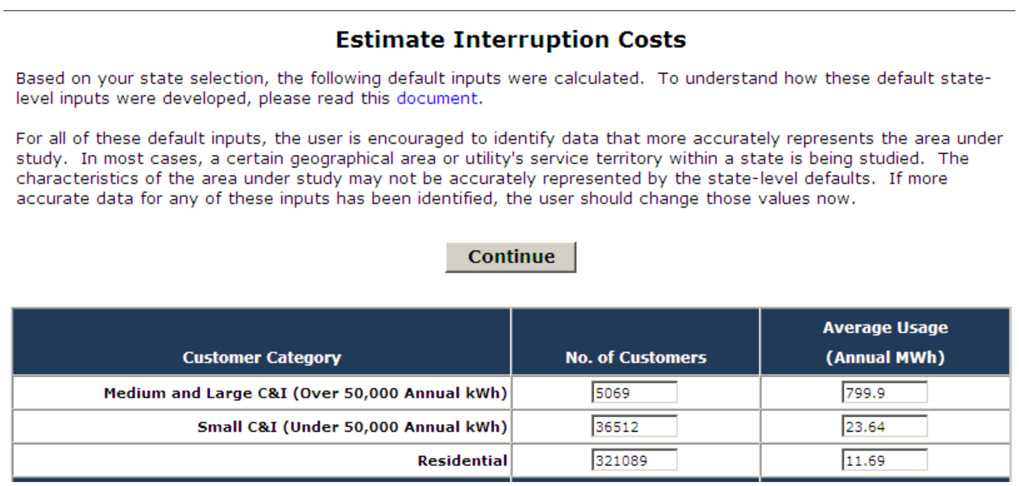
The next inputs are the number of Avista's electric customers by customer group, including the average annual use for each group, as shown below.



Estimate Interruption Costs

Based on your state selection, the following default inputs were calculated. To understand how these default state-level inputs were developed, please read this document.

For all of these default inputs, the user is encouraged to identify data that more accurately represents the area under study. In most cases, a certain geographical area or utility's service territory within a state is being studied. The characteristics of the area under study may not be accurately represented by the state-level defaults. If more accurate data for any of these inputs has been identified, the user should change those values now.

Continue

Customer Category	No. of Customers	Average Usage (Annual MWh)
Medium and Large C&I (Over 50,000 Annual kWh)	5069	799.9
Small C&I (Under 50,000 Annual kWh)	36512	23.64
Residential	321089	11.69

The next step involves the classification of the Company's Commercial and Industrial customers by business type as shown below.

C&I Industry Percentages	Medium and Large C&I	Small C&I
Agriculture, Forestry and Fishing	.27	1.54
Mining	1.35	.3
Construction	2.43	12.62
Manufacturing	16.17	4.29
Transportation, Communication & Utilities	5.66	4.86
Wholesale & Retail Trade	21.29	18.45
Finance, Insurance & Real Estate	5.93	11.07
Services	46.9	46.67
Public Administration	0.0%	0.0%
Unknown Industry	0	0.19
Total (must add to 100%)	100.0%	100.0%

Additional data is provided for the Company's commercial and industrial customers pertaining to the percentages having backup power supply and power quality equipment, as shown below.

Percent of C&I Customers with:	Medium and Large C&I	Small C&I
No or Unknown Backup Equipment	54.4%	70.4%
Backup Generation or Power Conditioning	37.2%	26.2%
Backup Generation and Power Conditioning	8.4%	3.4%
Total (must add to 100%)	100.0%	100.0%

Detailed information is also included for the Company's residential customers using applicable regional census data, as shown below.

Residential Customer Characteristics	Estimate	
Median Household Income	41223	
Residents per Household 0-6 Years Old	0.24	**NOTE:** These values are not percentages. These are the average number of residents per household within each age range.
Residents per Household 7-18 Years Old	0.44	
Residents per Household 19-24 Years Old	0.20	
Residents per Household 25-49 Years Old	0.96	
Residents per Household 50-64 Years Old	0.39	
Residents per Household 65+ Years Old	0.28	
Percent with Medical Equipment	5.1%	
Percent with Backup Generation	6.5%	
Percent with Recent Prolonged Outage	100	**NOTE:** Percent that have experienced an outage of longer than 5 minutes with the past year.

Additional inputs represent the percentage of housing types for residential customers, as shown below.

Residential Housing Percentages	Estimated Percentage
Detached	66
Attached	5.6
Apartment / Condo	19.7
Mobile Homes	8.7
Manufactured Housing	0.0%
Other or Unknown	0
Total (must add to 100%)	100.0%

Finally, specific outage data from the actual outage events on Avista's system is input into the model, reflecting the distribution of outages throughout the day, the week, and the year, showing also those outage events that were preceded by some type of advance warning. This distribution data is shown below.

Distribution of Outages by Time of Day	Estimated Percentage
Morning (6 am to 12 pm)	53.7
Afternoon (12 pm to 5 pm)	25.9
Evening (5 pm to 10 pm)	10.4
Night (10 pm to 6 am)	10
Total (must add to 100%)	100.0%
Distribution of Outages by Time of Year	**Estimated Percentage**
Summer (Jun thru Sep)	35.7
Non-Summer (Oct thru May)	64.3
Total (must add to 100%)	100.0%
Distribution of Outages by Time of Week	**Estimated Percentage**
Weekday (Mon thru Fri)	84
Weekend (Sat/Sun/Holiday)	16
Total (must add to 100%)	100.0%
Distribution of Outages by Advanced Warning	**Estimated Percentage**
Advanced Warning Provided	35.7
Advanced Warning Not Provided	64.3
Total (must add to 100%)	100.0%

The ICE model uses this data to calculate the estimated value of customer losses associated with the outages on Avista's system as shown below. The average cost per outage event for medium and large commercial and industrial customers is $8,500; for small commercial and industrial customers is $1,584; and for residential customers is $5.40. The average cost for all customers of all types for each outage event they experience is $283.10.

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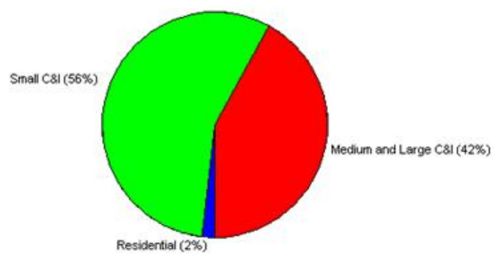
Interruption Cost Estimates

Sector	No. of Customers	Cost per Event (2011$)	Cost per Average kW (2011$)	Cost per Unserved kWh (2011$)	Total Cost of Sustained Interruptions (2011$)
Medium and Large C&I	5,069	$8,500.0	$93.1	$40.2	$46,533,496.9
Small C&I	36,512	$1,584.3	$588.1	$254.0	$62,471,982.4
Residential	321,089	$5.4	$4.0	$1.7	$1,860,966.2
All Customers	362,670	$283.1	$103.7	$44.8	$110,866,445.6

Total Cost of Sustained Interruptions by Sector



Input Values			
SAIFI:	1.080	No. of Non-Residential Customers:	41,581
SAIDI (in minutes):	150.0	No. of Residential Customers:	321,089
CAIDI (in minutes):	138.9		
States:	Washington		

This tool was funded by the Lawrence Berkeley National Laboratory and Department of Energy. Developed by Freeman, Sullivan & Co.

The model results are used to calculate the average cost to all classes of Avista customers for 60 minutes of outage time, which is $91.24. Using the average of the 2010 through 2014 results for Avista's Customer Average Incident Duration Index (CAIDI) of 138.9 minutes, results in an average annual per customer cost of $211.22. Reducing this amount by 5% to account for the expected reduction in outage duration reduces the per customer annual cost to $200.66, for a savings of $10.56 per customer. Multiplying this per-customer savings by the number of our Washington electric customers produces an annual value for avoided financial losses of $2,622,924.

Supporting Information

Information showing the ramp up in the level of this customer benefit, as well as its estimated annual value through the Project lifecycle is provided in the attached electronic workbook titled "Avista AMI Customer Benefits included on the Compact Disc provided at the end of Attachment B, Project Benefits.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Customer Avoided Costs" under the "Outage Management" area of benefit.
3. This tab contains the expected value for this customer benefit over the course of advanced metering Project lifecycle.

Avista's customer data set used in the ICE model to calculate the avoided customer losses is too large to provide electronically with this business case report, but the Company is available upon request to schedule a demonstration of the model at our main office for anyone who is interested.

Functional Requirements

The advanced metering outage alarm data has to be effectively integrated with the Company's outage management system.

Additional Requirements

Costs - There are no additional cost requirements beyond those identified in the estimated Project cost**s.**

Business Process – There are no required business process changes associated with achieving this benefit.

Key Metrics

Measuring and tracking this benefit represents a challenge because after the system has been installed it will require a thoughtful methodology to objectively measure what the outage duration results *would have been* had the AMI system not been placed into operation. Avista is continuing to research the methods used by other utilities, as well as to develop its own methodologies to measure and track the value of this benefit.

Benefit Realization Schedule

The anticipated ramp up of this benefit is shown in the electronic workbook as described above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Outage Management – Avoided Single Lights Out

Customer Value

Each year, Avista dispatches field personnel to respond to electric outages that are ultimately determined to be the result of electrical problems on the customer's side of the meter. In these instances, known as "false positives" the Company's service personnel will be unable to repair the problem, and the customer will have to call a commercial electrician to provide the needed repairs. With advanced metering, the Company will be able to query the meter in question to determine whether or not there is actually power to the meter. This will reduce the likelihood of dispatching restoration personnel in response to a false positive. Reducing the number of false positives will reduce time spent on the phones, data entry, and service dispatches to the customer's home, and allow the customer to more quickly schedule an electrician to repair the problem.

Background

Today, when a customer calls the Company to report an outage, and in the instance where it appears to be a single outage event, the customer service representative will try to help the customer determine whether their outage is the result of a loss of service to the meter, or is an issue with their service panel (or other). The representative will attempt to determine the meter state by asking the customer specific questions to help diagnose the cause of their outage. In the event the cause of the outage appears to be Avista's service, or is undeterminable, a crew will be dispatched to the customer's home to investigate and if need be resolve the problem.

Calculating the Benefit Value

In the period 2009 through 2014, Avista responded to an average of 1,681 outage calls each year that were ultimately determined to be a false positive. In 90 percent of these cases a serviceman was dispatched to investigate the incident. The associated annual cost for these investigations was $191,000. In the remaining 10 percent of the cases, a crew was dispatched to respond to the outage. These crew costs averaged $83,000 annually, and when combined with serviceman trips, totaled $274,000. Avista estimates it will be able to reduce these costs by at least 80 percent initially, for a net annual financial savings for our customers of $219,500. Though the Company believes it will be able to further reduce the incidence of false positives (to less than 20%) as it gains experience with the new AMI system, we did not include any incremental improvement in the forecast of customer savings over the Project lifecycle.

There is an additional financial benefit that was not included in the cost-benefit analysis. This results from the efficiency savings realized when crews and servicemen will avoid having to stop work on their current assignment, which requires breakdown and setup, as well as other transition activities, to respond to a false positive.

Supporting Information

The Information used by Avista to determine the financial value for this benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits included on the Compact Disc provided at the end of Attachment B, Project Benefits.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Single Lights Out" under the "Outage Management" area of benefit.

3. This tab contains the Information used to calculate the value of this benefit as well as showing the ramp up in the level of benefit and its estimated annual value in each year of the Project lifecycle.

Functional Requirements

To fully realize the benefits described above, the Company has identified the following requirements, which cost to implement has been included in the Project cost estimates.

- The advanced metering system must be fully and reliably integrated with the outage management system, and the capability for automated outage notification must be included in the functionality of the system.
- Customer service representatives and outage dispatchers must have the ability to query the advanced meter ("pinging" the meter) to determine its real-time service status during the customer's call, and to have access to interval data showing near-term usage (last 24-hours).
- Communication between the advanced meters and the outage system must occur at intervals not exceeding one minute, to ensure the customer service representative is aware of the real time status of the meter.

Additional Requirements

Cost – Costs to enable these benefits are included in the estimated Project costs.

Business Process

- Need to configure the outage status and outage reason codes to properly classify these avoided false positive calls.
- Training will have to be modified for customer service representatives and service dispatchers.
- Will need to develop a process for determining whether the outage should still be investigated even if power status is active

Key Metrics

The number of service trips avoided in response to problems on the customer side of the meter.

Benefit Realization Schedule

The schedule for the ramp up in benefits in provided in the electronic workbook referenced above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit
Outage Management – Reduced Customer Calls
Customer Value
Advanced meters, when integrated with Avista's outage management system, will automatically alert the Company to a loss of power to the customer's service. This automated awareness will accelerate the notification of an outage, and in addition to speed, will ensure the Company is aware of the outage even if the customer does not call in to report the outage. Though Avista will not discourage its customers with advanced metering from contacting the Company, we will use the AMI system to enable new processes that will make it less likely that our customers will call in outages in the future. In addition to having fewer inbound customer calls, the average duration of the calls we receive will likely be reduced. This reduction in duration will result from the customer service representative being automatically informed by the system of that customer's outage as the call is being received, and the representative not having to collect information from the customer or to use that information to complete an outage incident report. This reduction in phone calls will allow Avista to reduce the number of customer service representatives required to maintain our grade of service during outage events, which will lower the cost of providing service to our customers. In addition to reducing costs, the automated notification of the outage will help improve our customer's experience and satisfaction.
Background
With the integrated AMI system is place, Avista will have the ability upon receiving the signal from the meter that service has been disrupted, to immediately and automatically send an outbound message to the customer letting them know the Company is aware of their service outage. This outbound communication will be delivered using each customer's preferred communication channel (voice message to home or mobile phone, text message, e-mail, etc). Customers receiving this notification will know that they do not need to call Avista to report their outage, which is the conventional means for making the Company aware of service outages today. The outbound message (including subsequent messages) will also provide the customer pertinent known information about the outage (e.g. start time, outage cause, extent of the outage event, crew status, estimated restoration time, etc.). The better visibility of the overall outage event provided by AMI will allow the Company to more quickly understand the extent of the outage, which will be used to provide our customers more complete and accurate information about the outage and its likely restoration requirements. Avista will still encourage its customers to call in eye witness reports of events causing an outage, including the actual facilities damaged and any potential safety issues. Beyond the direct financial benefits provided by advanced metering, the integrated system will provide these additional customer benefits. ✓ Reduction in outage calls after normal business hours will reduce the average "call wait time," providing a customer service benefit. ✓ The ability to provide our customers earlier, more complete, and more accurate information is known to improve customer satisfaction and experience. ✓ For customers whose outage is the result of a failure of equipment inside their home (because the Company will be able to establish during the call that service to the meter <u>has not been</u> interrupted), the customer will be able to check their service panel, and if need be to make arrangements more quickly to have their service repaired because they don't have to wait for Avista personnel to arrive at their home, test the service, and then provide that assessment.

Calculating the Benefit Value

Avista has estimated the following benefits to be delivered by the integrated AMI system, including the new processes to be implemented to enable the features described above. These benefits include:

1. A reduction in customer outage phone calls will occur as the advanced meters are deployed across the system. This trend of a reduction in calls is expected to continue beyond the deployment as customer awareness and trust of the automated notification continues to build over time. The Company estimates that outage call volume will be reduced initially by 5%, or 831 inbound calls (In 2014 for Avista's Washington service territory, 16,619 outage incident reports were created by a customer service representative responding to an inbound call. Five percent of that total equals 831 calls). This base level of reduction in calls is expected to grow over time.
2. Avista estimates that for its customers with an advanced meter, the duration of the inbound call they make to report an outage will be reduced by an average of 26%. This reduction represents the time needed today for a service representative to gather the customer's information and to prepare and post an outage incident report.

Supporting Information

Information used by Avista to determine the financial value for this benefit is provided in the attached electronic workbook titled "<u>Avista AMI Customer Benefits</u>" included on the Compact Disc provided at the end of Attachment B, Project Benefits.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Reduced Customer Calls" under the "Outage Management" area of benefit.
3. This tab contains the Information used to calculate the value of this benefit as well as showing the ramp up in the level of benefit and its estimated annual value in each year of the Project lifecycle.

Functional Requirements

To fully realize the benefits described above, the Company has identified the following requirements, which cost to implement has been included in the Project cost estimates.

- The advanced metering system must be fully and reliably integrated with the outage management system, and the capability for automated outage notification must be included in the functionality of the system.
- Customer service representatives and outage dispatchers must have the ability to query the advanced meter ("pinging" the meter) to determine its service status during the customer's call.
- Communication between the advanced meters and the outage system must occur at intervals not exceeding one minute, to ensure outages are posted in the system before customers begin calling to report their outage. This benefit is greatly reduced if interval is more than 5 minutes.
- Outbound customer communication must be integrated with the outage management system and be automated for voice calling, texting, and e-mailing the customer.
- For customers who report their service outage via the customer web or the automated phone system, those systems will have to be configured to automatically receive the individual outage notifications to allow the Company to inform the customer that we're aware of their outage during that customer's contact.

Additional Requirements

Cost – the system costs required to achieve these benefits are included in the costs estimated to deploy the advanced metering system (e.g. the cost of integrating AMI with outage management and other Avista systems). Some activities, such as revised training, will be accommodated in normal course of updating training programs to reflect a variety of ongoing business process changes.

Business Process – Needed business process changes will include:

- Revising outage notification processes for business and after-hours periods.
- Scheduling and forecasting processes for customer service and dispatch.
- Automate the inputs for creating outage reports.
- Modified training for customer service and dispatch.

Key Metrics

- ✓Number of customer contacts to report service outages by type (customer service representative, automated phone, web, etc.).
- ✓Call duration for customer calls reporting service outages.
- ✓Cost per call for service outage calls.
- ✓Customer service scheduling during known outages.
- ✓Grade of service for Avista's contact center during known outages.

Benefit Realization Schedule

The anticipated timing of the increase in the level of this benefit is provided in the electronic workbook discussed above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

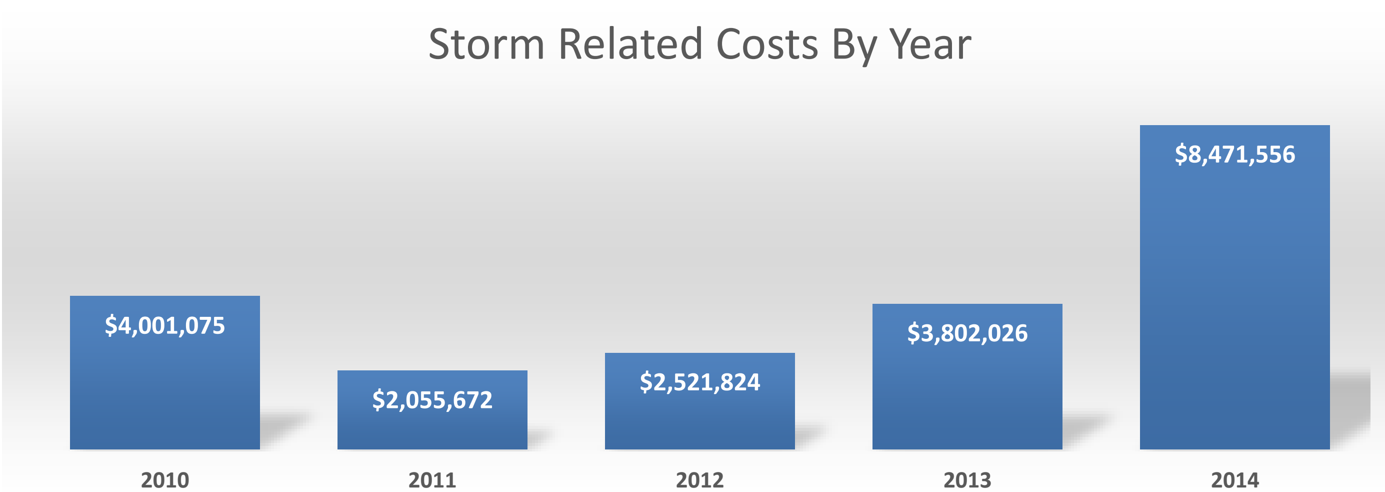
Outage Management – Outage Restoration Efficiencies

Customer Value

Advanced metering will provide customer benefits by providing the Company better visibility of overall customer outages during large[1] outage events, which will make outage restoration more efficient and reduce the cost of providing service.

Background

For the five-year period 2010 through 2104, Avista's average annual cost for storm damage restoration was $4.17 million. Annual costs for this period are shown in the figure below. In 2014, Avista experienced two windstorm events that caused significant customer outages, which substantially boosted restoration costs for that year compared with the prior period. The Company experienced another major storm in November of 2015, which by itself caused more damage than all of the storms combined from the five-year period shown in the figure, and resulted in more customer outages than even the ice storm of 1996, which had been the largest event in the Company's 126-year history. This trend toward increasing weather-related major outage events is not unique to Avista. A report[2] from the Lawrence Berkeley National Laboratory documents the increase in electric grid disturbances across the United States, representing an estimated annual economic impact of $104-$164 billion.



Avista's restoration of customer outages from storm damage will benefit from advanced metering by integrating the AMI system with the Company's outage management system. In short, when the new system is installed, any loss of service to a customer will be instantly posted on the geographic mapping system (GIS) that is integrated with the outage management application showing the exact location of the outage. Having this capability will benefit our customers in a number of ways as described in a report by the U.S. Department of Energy titled "Smart Grid Investments Improve Grid Reliability, Resilience, and Storm Responses." Several

[1] For this classification of events, Avista included costs for outages caused by weather-related events (Storms), but which also includes those caused by wildland fires.

[2] Electric Grid Disruptions and Extreme Weather. Lawrence Berkeley National Laboratory. U.S. Disaster Reanalysis Workshop, May 2012.

utilities cited in that report[3] were able to demonstrate that having advanced metering enabled them to reduce the time required to restore customers' service after a storm event, thus reducing the overall duration of the outages. Two utility examples include the Electric Power Board of Chattanooga, Tennessee, which showed a 40% improvement in their system average incident duration index (SAIDI), and Florida Power and Light Company, which showed a 21% improvement in the same reliability statistic.

Restoration efficiencies are enabled by advanced metering through improved situational awareness of the overall outage event, enabling more efficient work processes that result in a reduction in the time required to fully restore grid integrity and customer service. Efficiencies are achieved in a variety of ways, some of which are noted in the following examples:

- More accurate and rapid identification of the exact locations of faults.
- Reduction in the time required to provide real-time updates of system status resulting from resolved, new, delayed, or cancelled incidents.
- Greater visibility provides detailed graphical information that can be used to prioritize and optimally-deploy resources.
- Reduction in administrative work processes required to update the outage management system and to aggregate sub-incidents[4] into larger, more efficiently managed incidents.
- Improved predictive analysis will enable more accurate planning and dispatch of restoration crews helping to avoid rework and improve safety.
- More accurate prediction of outage causes at each incident ensuring that the right equipment and materials accompany the restoration crews and help avoid the need to make multiple supply trips.
- Greater situational awareness of the outage incidents will enable more efficient dispatching of restoration crews: crews will be more-efficiently dispatched to crew-related work, allowing servicemen to focus on areas of finish-up work that can be performed without a full crew.
- Knowing the exact locations of individual service outages will reduce the requirement to survey incident areas in the field to validate full restoration.

Calculating the Benefit Value

Though utilities have reported restoration efficiencies such as those cited above, ranging at and above 20%, Avista believes that for our practices and system an estimate of 10% improvement in storm restoration time is reasonable. Shorter storm restoration time will result cost savings that will be achieved through a reduction in employee and contractor labor hours, crew lodging, meals, and transportation and equipment costs.

Avista has estimated that a 10% reduction in restoration time will provide a corresponding reduction in storm related costs. The direct financial benefit to customers is included in the customer savings benefit "Customer Avoided Costs." A review of Avista's storm related costs shows that 59.5% of the costs are for employee and contractor labor, meals, lodging, and transportation and equipment costs. These costs will be directly reduced in proportion to the reduction in restoration time. Applying this cost percentage to a 10% reduction in restoration time (10% x .59) yields a reduction factor for overall storm restoration costs of 5.95 percent. Applying this cost reduction to the five-year average storm restoration cost of $4.17 million, noted above, results in an estimated average annual savings of approximately $248,000. Applying this percentage to the one storm event of 2015, which would be a very conservative savings factor for an event of that size, would result in a savings of approximately $1.25 million.

Supporting Information

[3] Smart Grid Investments Improve Grid Reliability, Resilience, and Storm Responses. U.S. Department of Energy, Smart Grid Investment Grant Program. November 2014.

[4] An storm or outage event is composed of outages that result from many individual points of damage on the system, which are referred to as "incidents." These incident points of damage are aggregated during the management of a storm into units of work that are prioritized and optimized in order to minimize the overall cost and duration of the event.

Information showing the ramp up in the level of this customer benefit, as well as its estimated annual value in each year of the Project lifecycle is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Restoration Efficiencies" under the "Outage Management" area of benefit.
3. This tab contains the expected value for this customer benefit over the course of advanced metering Project lifecycle.

Functional Requirements

The advanced metering outage alarm data has to be effectively integrated with the Company's outage management system.

Additional Requirements

Costs - There are no additional cost requirements beyond those identified in the estimated Project cost**s.**

Business Process – Though many work practices will be more effective and efficient as a result, there are no business process changes required to achieve this benefit.

Key Metrics

Measuring and tracking this benefit represents a challenge because after the system has been installed it will require a thoughtful methodology to objectively measure what the outage duration results *would have been* had the AMI system not been placed into operation. Avista is continuing to research the methods used by other utilities, as well as to develop its own methodologies to measure and track the value of this benefit.

Benefit Realization Schedule

The anticipated ramp up of this benefit is shown in the electronic workbook as described above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Customer Energy Efficiency

Customer Value

Avista customers will derive value from the detailed energy use information made available to them by advanced metering, and some customers will use the availability of that information to take actions to reduce their energy consumption and lower the cost of their energy service from Avista.

Background

Avista will use advanced metering to provide its customers access their near real-time energy usage data via the customer's account summary page at AvistaUtilities.com. This information will be made available for customers with a newly-installed advanced meter, no later than 7 days from the install date. Avista will communicate with its customers prior to the meter deployment, and during the full course of the deployment, making them aware of the availability of detailed usage data, how they can access and use the data, and with energy conservation tips that will enable them to get the most value from conservation measures they take as a result of having detailed energy information. While many of our customers who access their usage data may not undertake direct steps to reduce their use as a result of having access to their information, some customers will use their interval data to inform behavioral and structural actions they will take to reduce their energy consumption, and lower their cost of energy service. In addition to energy conservation, customers will also have the ability to use the detailed interval data to investigate abnormalities or fluctuations in their usage.

Calculating the Benefit Value

Estimating the financial savings for customers who have access to detailed interval usage data has two components. The first is estimating the percentage of customers who will take behavioral and structural steps to save energy and money, and the second is to estimate the average savings that will likely be achieved by these customers. To estimate likely participation rates, Avista relied on its direct experience with rates of customer participation in similar types of programs. For the expected average reduction in energy use for participating customers, Avista reviewed other similar programs among utilities and considered those results in the light of our own energy conservation expertise and experience. References to these utility studies are listed below.

For the purpose of this business case Avista assumed that our commercial customers would likely participate at a rate of 1%, and that residential customers would participate at 3%. For the expected average savings in energy use for these participating customer groups, the Company assumed a 3% reduction for both residential and commercial customers. Combined, these rates of participation and energy savings amount to a reduction of 0.05% of total load, representing over $307,000 in annual savings (0.06% of revenue). Expected rates of participation and savings by customer group are provided in the following table.

		Customers	% participating	% Reduced	kWh Reduction	
Commercial Customers		23,385	1%	3%	541,440	
Residential Customers	Under 500 kWh/Mo	46,061	1.0%	3%	46,334	
	500 - 1000 kWh/Mo	85,416	3.0%	3%	686,491	
	Over 1000 kWh/Mo	81,121	5.0%	3%	2,346,819	
	Total				3,621,085	$307,792

Avista believes these rates of participation will trend upward over time, consistent with the Company's efforts to expand participation in other customer programs, such as paperless billing, automatic payment, and comfort level billing. More importantly, the Company believes that the expanding number of third-party energy saving devices and applications available to customers and enabled by the Internet of Things, will drive substantial customer benefits in the future, based on the availability of real time energy use data via the home area network.

Supporting Information

Information used by Avista to determine the financial value for this benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Access to Interval Energy Data" under the "Customer Managed Energy Efficiency" area of benefit.
3. This tab contains the Information, estimates and assumptions used to calculate the value of this benefit as well as showing the ramp up in the level of benefit and its estimated annual value in each year of the Project lifecycle.

Some of the utility information considered by Avista in the process of developing estimates supporting this benefit are listed in the table below.

Source	% Reduced	Notes
BC Hydro Business Case [1]	2.0%	Website-based energy savings are 2 percent, with 15 percent penetration of residential customers. (page 28)
ENERGY STAR[2]	2.4%	Among our most interesting findings is that buildings that consistently benchmark energy use save an average of 2.4 percent per year.
CPL[3]	1.7%	While some households saved more than others, on average, the treatment group achieved electricity savings of 1.7% over the control group Households.
Environmental Change Insitute[4]	8.5%	Benders et al. (2005) report 8.5% savings from the use of an interactive web page by 137 Dutch households.
ACEEE[5]	4%-12%	A variety of new feedback initiatives – including real-time Web-based or in-home feedback devices and enhanced billing approaches – are making energy resources visible to residential consumers throughout the United States (and many other developed countries). These initiatives are opening the door to potential energy savings that, on average, have reduced individual household electricity consumption 4 to 12% across our multi-continent sample.
ASHRAE[6]	5%-15%	Several studies have shown that providing feedback to home occupants on their energy consumption can enable the occupants to reduce household electricity consumption by 5% to 15%
Florida Solar Energy Center[7]	5%-15%	Providing instantaneous feedback on household electrical demand has shown the promise to reduce energy consumption by 5-15%.

Functional Requirements

- Customer usage data must be made available to customers within a very short time of when they receive their new digital meter (no later than 7 days).
- To provide the above capability, the AMI system must be fully functional (related to immediately providing customers their interval usage data).
- Nightly batch files of advanced metering data must be securely transferred to the Company's third-party web provider in order to make the usage data timely available to our customers.

Additional Requirements

Cost – There are no new incremental costs to achieve these benefits beyond those already included in the estimated costs for the Project.

Business Process – Avista will need to define how it intends to manage the new relationship with its customers related to helping them achieve energy savings and other benefits through the availability of interval metering data.

Key Metrics

Rates of customer adoption, energy savings, and experience and satisfaction will be measured using the following tools.

- Tracking customer web-site use.
- Tracking "click-throughs" on the web to evaluate customers' selection of and time spent viewing their interval usage data, including using the load analysis tools provided.
- Conducting customer surveys.
- Monitoring impacts of marketing and outreach for the new customer-facing AMI tools (email tracking, uptake in usage after outreach campaigns, etc.).
- Potential analysis of customers' current and prior years' usage as a way to directly and indirectly estimate reductions in consumption associated with advanced metering.

Benefit Realization Schedule

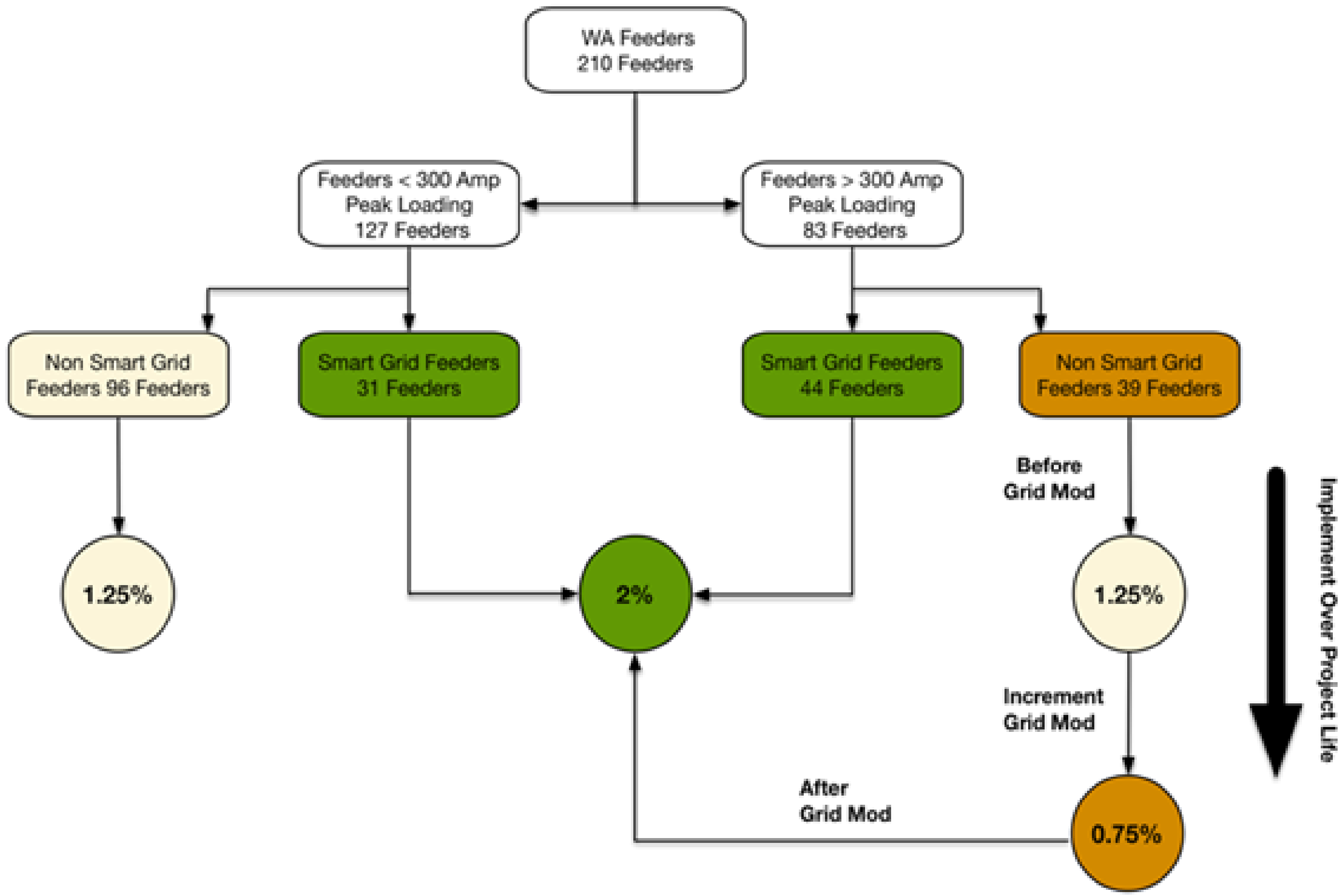
Avista's anticipated ramp up in the annual level of this benefit as well as the annual benefit expected in each year of the Project lifecycle is provided in the electronic workbook referenced above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

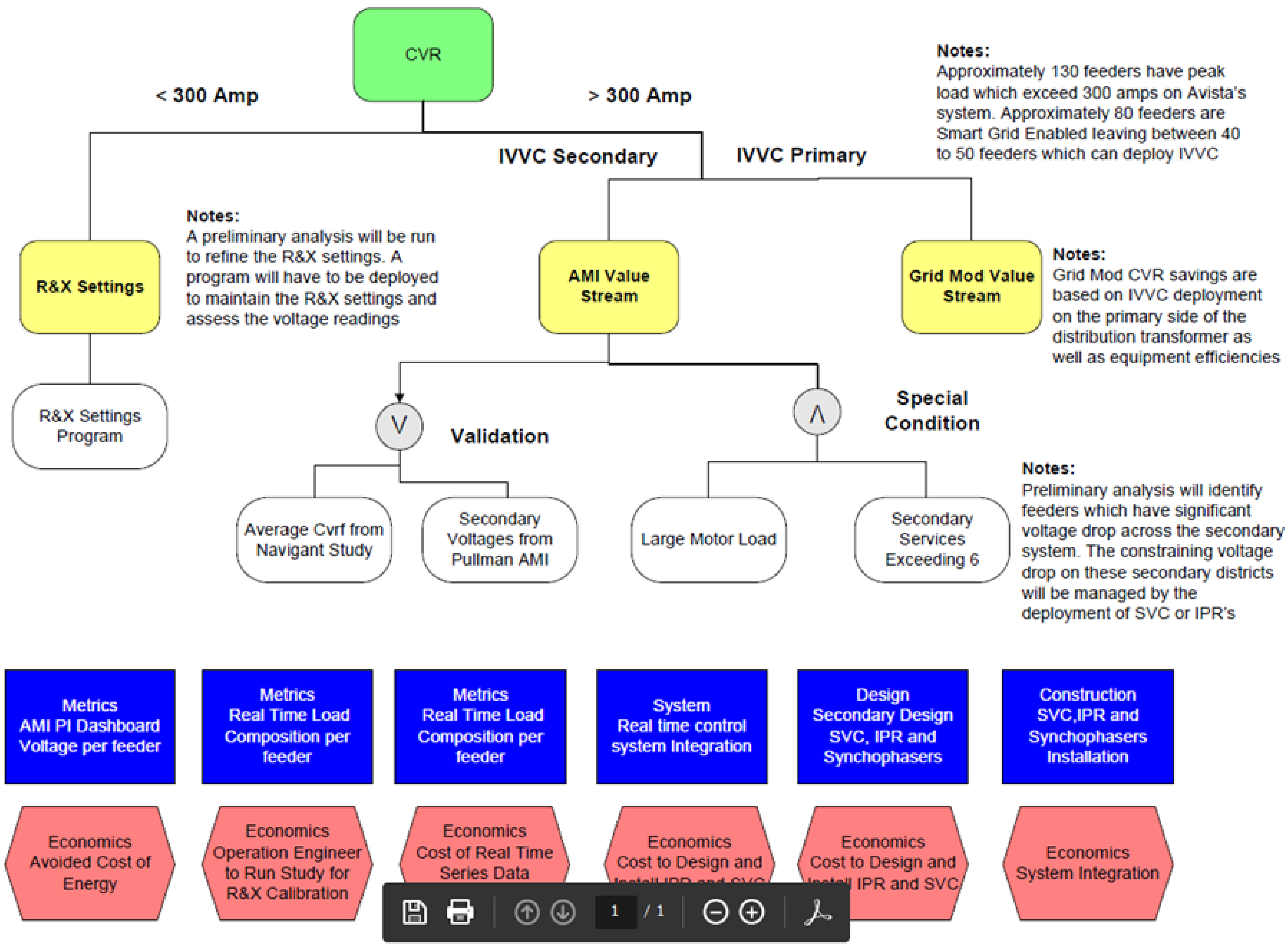
Area of Benefit
Conservation Voltage Reduction
Customer Value
As a result of the deployment of advanced meters across the Company's Washington service territory, Avista will be able to achieve additional savings through conservation voltage reduction, which will reduce the cost of providing service to our customers.
Background
The electric utility industry has generally agreed that lowering the voltage delivered to a customer meter, while maintaining the minimum required voltage, results in both reduced losses for the electric distribution system as well as reduced consumption for the customer. The methodology used to achieve the savings associated with lower voltage is referred to as conservation voltage reduction (CVR). This involves lowering the operating voltage of the distribution system toward the lower half of the acceptable range (126 V to 114 V) as defined by the American National Standards Institute (ANSI)[1]. Avista has attained a weighted average savings of 2.02% in its CVR deployments in Spokane and Pullman, as validated by Navigant Consulting. Advanced metering data from 13 of the feeders, located in Pullman, suggests that an additional increment of approximately 2% can be achieved with the installation of AMI.
Calculating the Benefit Value
Avista serves its Washington electric customers from 210 electric feeder lines. The diagram below outlines the anticipated savings from groups of feeders based on the load levels and planned upgrades under Avista's Grid Modernization Program (Grid Mod). For feeders loaded at less than 300 amps, CVR will be accomplished by making more aggressive voltage regulator settings (X&R savings) as determined from readings taken by the advanced meter. Avista estimates this methodology can provide an average savings of 1.25%. This estimation is based on the advanced metering data from the system in Pullman. These savings can only be achieved because the voltage reading from the advanced meter enables the reduction while ensuring the customer receives adequate voltage. For feeders with more than 300 peak amp loading, the grid modernization program will implement conservation voltage reduction with smart grid technologies over a 20 year period (approximately two feeders per year). Voltage savings will be captured with aggressive X &R savings until the feeder is converted, at which time the remaining savings can be achieved. The feeders have been prioritized for conservation voltage savings by highest to lowest peak load levels. To achieve the target savings will require us to install active mitigation at some points along the feeder which are associated with customer service drops and dynamic customer loads. The capital and expense costs required to complete and maintain the anticipated mitigation work is included in the estimated cost for the Washington AMI Project. *The diagram below depicts the Company's electric feeders in Washington, based on loading (AMPS), and identifies the source of the conservation voltage savings to be achieved over the Washington AMI Project lifecycle.*

[1] American National Standards Institute (ANSI), ANSI C84.1, ELECTRIC POWER SYSTEMS AND EQUIPMENT - VOLTAGE RANGES 1-2006



Supporting Information

The engineering models used to estimate the potential value to be achieved with AMI-enabled conservation voltage reduction, are shown schematically in the diagram below. Models include the "SynerGEE" engineering models, the DMS model, the GIS model, OsiSoft PI Historian, and all the AMI register and interval data as well as exceptions and events.



Data supporting the calculation of this customer benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Costs. The workbook contains the cost information for the activities associated with conservation voltage reduction used in determining the quantified value of this benefit.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Conservation Voltage Reduction" under that area of benefit.
3. This tab contains the cost information for the expected savings for this benefit, and the forecast of benefits through the Project lifecycle.

Functional Requirements

Where conservation voltage is to be implemented on feeders through grid modernization (AMI augmentation), using the distribution management system (DMS):

- The AMI data must be analyzed thoroughly to understand voltage reduction opportunity.
- The DMS set points must be modified and monitored for maximum benefit.
- Dashboard components will need to be created for the capture of real time savings.
- Mitigation strategies may need to be implemented.

Feeders leveraging X&R settings will require:

- Engineering analysis to thoroughly understand voltage reduction risk/opportunity.
- Regulator X&R settings must be modified by relay technicians and monitored for maximum benefit.

- Mitigation strategies may need to be implemented.

Additional tasks may include:

- Setting changes must be implemented quickly after AMI deployment.
- Dashboards may be necessary in order to better analyze conditions as system changes are made.
- Ongoing distribution system operations and PI[2] support will be necessary.

Additional Requirements

Costs - The various costs for the applications and reporting systems required to implement the conservation voltage benefits are included in the estimated capital and expense costs for the Project.

Business Process Changes - The Distribution Management System (DMS) process to establish voltage set points and produce metrics will need to be integrated with AMI data pre and post deployment.

Key Metrics

Actual conservation voltage savings will be tracked and reported over the Project lifecycle.

Benefit Realization Schedule

The ramp up in benefits and the expected annual savings in each year of the Project lifecycle are shown in the electronic workbook discussed above.

[2] "PI" is the application system used by the Company for various types of data capture and reporting.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit
Energy Theft Diversion
Customer Value
The work processes of curbing theft of energy service, also known as "diversion," is significantly enhanced by the availability of advanced metering systems and data analytics. While a reduction in energy theft does not reduce Avista's cost of providing service, customers will benefit from a reduction in cost that results from an increase in billed revenues associated with energy usage that is properly billed. Reduction in cases of diversion helps ensure all customers pay their fair portion of costs of providing utility service.
Background
Diversion of service can include instances of complete diversion, partial diversion, and intermittent diversion. A common trade reference on the significance[1] of service diversion cites a range of revenue impact resulting from energy theft of 0.5% to 3.0%. Several other articles support this range, such as those listed below, however, allowances must be made in the interpretation of the results to account for differences among utilities in factors such as energy prices and demographics, etc. Currently, Avista has only limited back office tools to detect cases of potential energy theft. Most of the cases that are detected result from anomalies that are discovered in the course of other business activities. Examples include energy usage detected at a recently disconnected service, field personnel attending to another matter noticing suspicious signs at a service, or analysts conducting research for another matter noticing anomalies in billing data, prompting them notify meter shop personnel of a potential problem. With advanced metering in place, Avista will use analytical capabilities of the meters, coupled with back office analytical tools with complex engineering algorithms and smart grid data to isolate potential cases of theft, including the potential magnitude and the likely probability of occurrence.
Calculating the Benefit Value
For the purpose of estimating the potential revenue impact resulting from energy theft, Avista used the low end of the range of industry values to establish a conservative range of likely revenue impacts. The Company believes that within our Washington service territory a rate of electric theft between .25% and .50% of revenue is reasonable, with half that rate assumed for natural gas diversion. To calculate the potential customer benefit enabled by advanced metering, Avista used lost revenue values of .375% for electric and .1875% for natural gas. The resulting lost revenue potential was calculated to be approximately $578,000.
Supporting Information
Information used by Avista to help determine the financial value for this benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits included on the Compact Disc provided at the end of Attachment B, Project Benefits. 1. Open the Benefits Workbook and select the tab "Summary Detail." 2. Select "Theft and Diversion" under the "Energy Theft and Unbilled Usage" area of benefit. 3. This tab contains the Information, estimates and assumptions used to calculate the value of this benefit as well as showing the ramp up in the level of benefit and its estimated annual value in each year of the Project lifecycle.

[1] Please see the "ELP Electric Light and Power" reference in the table, below.

Some of the utility information considered by Avista in the process of developing estimates supporting this benefit are listed in the table below.

Company	Summary	Notes
Austin Energy	0.30%	Noted that they had .3% with evidence of theft and or tampering
SMUD	0.70%	.7% of revenue (Conversation with Augi - Mgr of corporate performance)
ELP - Electric Light and Power Article	.5% to 3%	A national study found that .5 to 3 percent showed evidence of theft.
APS	1.70%	Sample study showed 1.7% of all meters had some tampering with an net .51% loss in revenue
DTE Energy	1% to 3%	Between 1-3 percent
Accenture	2% to 4%	Between 2-4 percent with up to 80% being theft
Detectant - Deputizing Data: Using AMI for Revenue Protection	> 1%	Greater than 1% (from prior literature)
Metering.com	< 1%	~1%
Idaho Power	< 1%	< 1% -- Graesch Arnold, Mary [MGraeschArnold@idahopower.com] It tends to vary greatly based on local social acceptance and crime rate. Idaho is low on both counts.
MeteringAmerica.com	1%	~1% - ROI on investigation is 4:1
SAP	>1%	>1%
SDG&E	1% to 2%	1-2%
CP&L	0.40%	0.40%
UAI		Recent article - comments that Rev Pro is the default first analytics initiative
CenterPoint Energy	1%	Susan Neel, Senior Director of Electricity Market Operations at CenterPoint Energy, a utility with 5 million metered electric and gas customers headquartered in Houston. Ms. Neel estimated the problem there to be about 1% of total electric load, and about 2% of the electricity provided to the residential and small commercial sector

Functional Requirements

This benefit is reliant on the fully functioning and integrated AMI system, including the installation and integration of two specialized modules that are part of the data analytics platform, and which costs have been included in the Company's estimate of Project capital and operating costs.

Additional Requirements

Business Process – Avista's analysts will have to develop a process for effectively using the meter tamper alarms and the analytics applications to be able to efficiently and effectively identify potential cases of diversion, to be assigned to the meter shop for subsequent investigation.

Key Metrics

The number of diversion cases identified will be tracked, including reasonable estimates of the associated foregone revenue.

Benefit Realization Schedule

Avista's anticipated ramp up in the annual level of this benefit as well as the annual benefit expected in each year of the Project lifecycle is provided in the electronic workbook referenced above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Unbilled Usage

Customer Value

Unbilled usage occurs when energy is being consumed at a premise in circumstances where a customer has not been associated with that account. Advanced metering will allow Avista to either turn off the meter when there is no customer associated with the account, or to monitor energy use and create alerts when energy is used at that location. Having these capabilities will reduce our customers' service costs because the revenue associated with unbilled use will be more likely to be properly assigned to those customers using the energy.

Background

Reducing the duration of the period when energy use at service is unbilled represents the primary value for this benefit, followed by a reduction in the time required by billing analysts to resolve the issue. Avista will use advanced metering to enable an automated process for sending notices to premises as needed, and to enable remote switching to disconnect meters to prevent unassigned energy usage.

Calculating the Benefit Value

During the period 2010 through 2014, Avista recorded an average of 3,646 electric accounts and 1,783 natural gas accounts where unbilled energy usage was incurred. The associated unbilled revenue for these accounts was $91,498 and $45,679, respectively. In addition, the Company spent an average of approximately $19,700 each year in related technical and administrative processes, for a total average cost of $156,882. By using the remote service switch and automated notification, as enabled by advanced metering, Avista believes it will be able to substantially avoid these costs on a going forward basis.

Supporting Information

The Information used by Avista to calculate the financial value for this customer benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Costs.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Unbilled Usage" under the "Energy Theft and Unbilled Usage" area of benefit.
3. This tab contains the Information, estimates and assumptions used to calculate the value of this benefit, as well as showing the ramp up in the level of benefit and its estimated annual value in each year of the Project lifecycle.

Functional Requirements

The functional requirements for delivering this benefit are included in the total capital and operating costs estimated for the Project.

Additional Requirements

Business Process - Avista will have to develop processes for effectively using the remote service switch and automated notification to customers to avoid the incidence of unbilled usage.

Key Metrics

The incidence of unbilled usage will continue to be tracked going forward.

Benefit Realization Schedule
Avista
Future Benefits
The anticipated ramp up in benefit value is provided in the electronic workbook described above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit
Slow and Failing Meters
Customer Value
Through advanced metering, Avista will be able to reduce the amount of time that currently elapses between when a meter begins to fail and when the problem is ultimately detected and remediated. Reducing this time helps ensure revenue is properly recovered, which reduces the cost of service to customers because recovery of costs will be properly assigned to those using the energy.
Background
Slow and failing meters can be very difficult to detect with conventional metering and the longer the meter is not functioning properly, the more complex the issue becomes. This increases the risk that appropriate revenues will not be recovered, and increases the cost to all other customers who pay for recovery of the unbilled revenue as part of their rates. Currently, several types of employees including customer account representatives may be required to resolve each issue, but for the purpose of this analysis, we only estimated the cost associated with the meter shop and billing analysts. Both of these employee groups will continue to be involved in these cases in the future.
Calculating the Benefit Value
The annual unbilled revenue associated with slow and failing electric and gas meters in Washington has averaged $324,000 for the period 2011 through 2014. In addition to better identifying slow and failing meters, advanced metering will reduce the potential of meters not being properly recorded, as well as validation checks in the system that will reduce the potential occurrence of improper multipliers. For this business case, Avista has used the historic average revenue, shown above, as the estimated benefit going forward.
Supporting Information
Information used by Avista to help determine the financial value for this benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits. 1. Open the Benefits Workbook and select the tab "Summary Detail." 2. Select "Slow/Failed Meters" under the "Energy Theft and Unbilled Usage" area of benefit. 3. This tab contains the Information, estimates and assumptions used to calculate the value of this benefit, as well as showing the ramp up in the level of benefit and the estimated annual value of the benefit in each year of the Project lifecycle.
Functional Requirements
This benefit is reliant on the fully functioning and integrated AMI system, including the installation and integration of applications that are part of the data analytics platform, and which costs have been included in the Company's estimate of Project capital and operating costs.
Additional Requirements
Business Process – Avista's analysts will have to develop a process for effectively using the metering data and the analytics applications to be able to efficiently and effectively identify potential slow and failing meters to be assigned to the meter shop for subsequent investigation.
Key Metrics

The incidence of slow and failing meters, including area light issues will continue to be tracked going forward.

Benefit Realization Schedule

The anticipated ramp up in benefit value is provided in the electronic workbook described above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Stopped Meters

Customer Value

Through advanced metering, Avista will be able to more accurately detect meters that have stopped recording energy use. This capability will reduce the need for Avista personnel to visit our customers' homes to check meters, to conduct rebilling based on estimated usage, and will provide a more rapid response to customer concerns about their meter condition. It will also reduce our customers' costs because the revenue we receive will be properly assigned to those using the energy.

Background

When a meter appears to have stopped recording energy use (i.e. the current monthly read is the same as the read for the prior month), it is flagged for investigation as a potentially stopped meter to be conducted by the Company's meter shop personnel. Unfortunately, the great majority of the time meters are reported as potentially stopped, there has simply been no use at the premise and the meter is working properly. This is what's known as a "false positive." Reducing the number of service calls for false positives represents the primary savings opportunity associated with this benefit.

Calculating the Benefit Value

Currently, the field service investigations of potentially stopped meters only detect meters that have actually stopped in approximately 14% of the cases for electric meters and approximately 7% for natural gas meters. Avista believes that with advanced metering and data analytics, the rates of positive identification would be at least 60% initially, for both electric and gas meters. This rate would produce a net improvement of 46% for electric and 53% for gas; this which would eliminate 1,959 service trips each year for electric meters and 1,743 service trips for natural gas meters. The meter technician service costs are estimated at $59 per visit, which includes travel time along with time spent investigating the meter and updating information in the Company's asset management system. The calculated benefits also account for an increase in billing analyst time that will be required to investigate and code accounts utilizing more complete and detailed information. The Company estimates the initial annual benefit at $112,800 in avoided electric meter checks and $101,900 for natural gas.

Supporting Information

The Information used by Avista to help determine the financial value for this benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Stopped Meters" under the "Energy Theft and Unbilled Usage" area of benefit.
3. This tab contains the Information supporting the calculation of the value of this benefit as well as showing the ramp up in the level of benefit and its estimated annual value in each year of the Project lifecycle.

Functional Requirements

This benefit is reliant on the fully functioning and integrated AMI system, including the installation and integration of data analytics applications, which costs have been included in the Company's estimate of the Project capital and operating costs.

Additional Requirements

Business Process – Avista's analysts will have to develop a process for effectively using the meter health diagnostics and the analytics applications to be able to efficiently and effectively identify potential cases of stopped meters, which can then be assigned to the meter shop for subsequent investigation.

Key Metrics

The currently estimated annual benefit will be used as the baseline for the estimation of benefits through the Project lifecycle, as modified by the ratio of investigated to actual stopped meters, which will continue to be tracked going forward.

Benefit Realization Schedule

The anticipated ramp up in benefit value is provided in the electronic workbook described above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Estimated Bills

Customer Value

Advanced metering will benefit billing activities by increasing the volume and quality of actual meter reads available to customer service representatives and analysts, which will virtually eliminate the need to estimate bills. Bills are currently estimated in cases of missing meter reads, incorrect reads, or the off-cycle change in the status of service (account open, close, and transfer). Our Customers will experience a more streamlined, rapid, and more accurate response to their billing inquiries, and will benefit from cost savings arising from the avoidance of the activities associated with estimating customer bills.

Background

Today, a customer service representative or billing analyst will estimate the currently metered usage on an account when a customer is opening, closing, or transferring service, or when a meter cannot be read due to issues with meter access. These circumstances required Avista to estimate approximately 116,000 customer bills on average each year for the period 2012 through 2014. When a customer service representative or billing analyst is required to estimate a bill, this often results in an unavoidable manual process required to generate a corrected bill for the customer. In addition to being tedious and costly to resolve, estimated bills can drive customer dissatisfaction due to a perception of inaccuracy and an unreasonable inability to have access to accurate meter data to ensure accurate billing for service status changes.

Calculating the Benefit Value

Avista estimated the time required to complete the bill estimation process for each transaction at 6.5 minutes, which has an associated cost of $4.28 for each estimated bill. The Company expects that the availability of accurate and timely metering data will nearly eliminate the requirement for estimating bills. Based on the unit cost of estimating bills, and an assumed 97% reduction in the need for estimating, we estimate an average annual savings for customers of $481,000.

Supporting Information

Data supporting the calculation of this customer benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits. The workbook contains the cost information for the activities associated with estimating bills used in determining the quantified value of this benefit.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Estimated Bills" under the "Billing Accuracy" area of benefit.
3. This tab contains the cost information for the activities related to this benefit, the activity levels, the calculation of the benefit, and the forecast of benefits through the Project lifecycle.

Functional Requirements

There are no functional requirements to achieve this benefit beyond those included in the estimated Project costs.

Additional Requirements

Business Process - Billing Analysts and Customer Service Representatives will need to be trained on the new applications in order to access the available interval data to properly bill the customer.

Key Metrics

The baseline data used to establish the annual value will be used to estimate the customer savings on a going-forward basis. The Company will also track the number of bills that have to be estimated each year.

Benefit Realization Schedule

The anticipated ramp up in benefit value is provided in the electronic workbook described above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Bill Inquiries

Customer Value

Advanced metering will benefit billing activities by making available to the customer service representative the actual metered use on a customer's account, as well as providing a detailed history of their interval energy use. In addition to improved service for our customers they will also benefit from the cost savings associated with more efficient bill inquiry processes.

Background

Today, our customer service representatives must respond to a customer's inquiry about their energy bill without having the current meter read or the customer's historical usage (normalized to the month and compared to the prior year's usage). Detecting billing anomalies without this information can be challenging. As a result, the steps required to answer a customer's billing question often involves estimations, assumptions, and substantial time for the customer service representative or billing analyst to resolve.

Calculating the Benefit Value

For the period 2012 through 2014, Avista's customer service representatives received an average of 277,389 customer calls each year that were billing related. Of these calls, 56.55% were from our customers in Washington. Avista estimates that the quality and efficiency of at least 25% of these calls can be improved by the availability of timely and detailed metering information. We estimated that 7.5 minutes could be eliminated from the call time required for a customer service representative to effectively respond to the average bill inquiry, with an associated savings of $4.94. The Company estimates an annual savings of $193,781 based on the recent history of these types of customer calls.

Supporting Information

Data supporting the calculation of this customer benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits. The workbook contains the cost information for the activities associated with bill inquiries used in determining the quantified value of this benefit.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Bill Inquiries" under the "Billing Accuracy" area of benefit.
3. This tab contains the cost information for the activities related to this benefit, the activity levels, the calculation of the benefit, and the forecast of benefits through the Project lifecycle.

Functional Requirements

There are no functional requirements to achieve this benefit beyond those included in the estimated Project costs.

Additional Requirements

Business Process - Customer Service Representatives will need to be trained on the new applications in order to use the available interval data and usage history to effectively respond to the customer's billing questions.

Key Metrics

The baseline data used to establish the annual value will be used to estimate the customer savings on a going-forward basis.
Benefit Realization Schedule
The anticipated ramp up in benefit value is provided in the electronic workbook described above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Billing Analysis

Customer Value

Advanced metering will benefit billing activities by making timely and detailed energy information available to billing analysts, which will reduce the effort required to effectively respond to our customer's billing issues. In addition to improved customer service, our customers will also benefit from the cost savings associated with a reduction in billing analysts' activities.

Background

Avista has a staff of several billing analysts who work through identified billing exceptions, such as high/low bills and daily edits, to ensure bills are correct prior to sending them out to the customer. Today, the billing exceptions are identified using an algorithm in the billing system, and every exception identified requires the review of a billing analyst. Though not every exception requires follow-up analysis, all exceptions are required to be manually cleared before the bill can be mailed.

Calculating the Benefit Value

For the period 2013 and 2014, Avista created an average of over 6 million bills each year. Approximately 3% of these bills were reviewed by analysts as billing exceptions, and 57% of these exceptions were for our Washington customers. Avista estimated the average time required by the billing analyst to review each exception at 5.5 minutes. We estimate that advanced metering will reduce the amount of time required by the analyst to process these exceptions by 70%. The corresponding average annual value of the reduction in analyst's time is $95,334.

Supporting Information

Data supporting the calculation of this customer benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits. The workbook contains the cost information for the activities associated with billing analysis used in determining the quantified value of this benefit.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Billing Analysis" under the "Billing Accuracy" area of benefit.
3. This tab contains the cost information for the activities related to this benefit, the activity levels, the calculation of the benefit, and the forecast of benefits through the Project lifecycle.

Functional Requirements

There are no functional requirements to achieve this benefit beyond those included in the estimated Project costs.

Additional Requirements

Business Process – Billing analysts will need to be trained to use information from the new applications to effectively process billing exceptions.

Key Metrics

The baseline data used to establish the annual value will be used to estimate the customer savings on a going-forward basis.

Benefit Realization Schedule
The anticipated ramp up in benefit value is provided in the electronic workbook described above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit
Rebilling
Customer Value
Advanced metering will improve Avista's billing activities by reducing the number of bills the Company must reissue each year, known as "rebilling." This result will improve the quality of service we provide our customers and reduce the cost of their service.
Background
Avista has a staff of several billing analysts who work through billing exceptions (as described in "Billing Analysis") in order to provide correct and timely bills to our customers. Some of these billing exceptions require a new bill to be created and sent to the customer. The Company has made successful efforts in recent years to significantly reduce the incidence of rebills. The number of rebills currently required each year for our Washington customers is approximately 16,715. The principal remaining driver for rebilling is the unavoidable error that results from the need to estimate bills.
Calculating the Benefit Value
Avista estimates that at least 80% of its Washington rebills can be avoided by the capabilities of advanced metering. The Company estimates that creating each new rebill requires 5.5 minutes of the analysts' time for an average unit cost of $3.62 per new bill. The estimated annual reduction in costs associated with rebilling is $48,454.
Supporting Information
Data supporting the calculation of this customer benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits. The workbook contains the cost information for the activities associated with rebilling used in determining the quantified value of this benefit. 1. Open the Benefits Workbook and select the tab "Summary Detail." 2. Select "Rebilling" under the "Billing Accuracy" area of benefit. 3. This tab contains the cost information for the activities related to this benefit, the activity levels, the calculation of the benefit, and the forecast of benefits expected each year through the Project lifecycle.
Functional Requirements
There are no functional requirements to achieve this benefit beyond those included in the estimated Project costs.
Additional Requirements
There are no additional incremental costs or process changes required to capture this customer benefit.
Key Metrics
The baseline data used to establish the annual value will be used to estimate the customer savings on a going-forward basis.
Benefit Realization Schedule
The anticipated ramp up in benefit value is provided in the electronic workbook described above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Retail Load Studies

Customer Value

As a result of deploying advanced meters across the Company's Washington service territory, Avista will be able to avoid the sampling costs currently required to periodically determine energy usage profiles for different classes of our electric customers. Customers will benefit as a result of the financial savings associated with the avoided costs for this sampling.

Background

The Company is required to study the load characteristics of customers in each of its rate classes to assign the appropriate costs of service to each class based on when energy is used, its peak demand, and the overall volume of use. This information supports the Company's cost of service analysis developed to ensure the rates paid by each customer class are fair and equitable. Currently, this demand data is collected at hourly intervals from a sample of customers by using specialized meters that are placed in the field solely for this purpose. Installing these meters, and moving them periodically, as well as providing them with cellular communication capability, is a substantial portion of the cost of conducting these studies.

In 2008, Avista installed 400 of these specialized meters throughout its Washington service territory to collect the required interval data to support its customer usage study. Over the period 2010 through 2012 additional meters were added to increase the size of the sample group. Each of these specialized meters requires its own cellular account to transmit the energy use data being recorded at specified intervals. Each cellular account has a monthly charge for access and use of the cellular network, which is in addition to the cost of the meters and their installation. Occasionally, the meters fail and need to be replaced. Each meter costs approximately $1,000 plus the install cost. There is monthly service charge for the cellular connection required for each meter. In addition, each meter must be integrated into a complimentary data base, which requires set up and validation.

Calculating the Benefit Value

Though Avista installs, moves, and maintains the specialized meters, the study itself is conducted by an outside contractor hired by the Company. These contract study costs will continue to be required going forward. By having advanced metering in place, however, Avista will be able to avoid all of the costs currently required to have specialized meters in the field to enable these studies. The estimated annual avoided cost for our Washington service area is $111,346.

Supporting Information

Data supporting the calculation of this customer benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits. The workbook contains the cost information for the activities associated with retail load studies used in determining the quantified value of this benefit.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Retail Load Analysis" under the "Utility Studies" area of benefit.
3. This tab contains the cost information for the activities related to this benefit, the activity levels, the calculation of the benefit, and the forecast of benefits through the Project lifecycle.

Functional Requirements
There are no functional requirements associated with enabling this customer benefit, beyond the advanced metering installation and integration requirements, which costs are included in the estimated Project costs.
Additional Requirements
There are no additional cost or work process requirements associated with enabling this customer benefit.
Key Metrics
The Company's current costs for providing specialized metering to support these studies will be used as the baseline value for determining the annual value of this benefit going forward.
Benefit Realization Schedule
The anticipated ramp up in benefit value is provided in the electronic workbook described above.

Avista's Washington Advanced Metering Project

Description of Quantified Customer Benefits

Area of Benefit

Meter Sampling

Customer Value

As a result of the deployment of advanced meters across the Company's Washington service territory, the requirement for annual sampling of electric meters will be reduced, which will lower the cost of providing service to our customers.

Background

The "population" of Avista's existing electric meters is composed of many "families" of meters, reflecting the natural processes of installing new meters and replacing old meters over an extended period of time, during which the manufacturers, types, models, and features of meters have been in constant flux. As a result, in Avista's Washington territory we currently have 835 single phase/network meter families and 208 poly phase meter families.

Each year, Avista's meter technicians field test a sample of meters to ensure the overall population of meters in service is meeting our accuracy requirements. The sample size is relatively large (can range up to 1,900) because of the many meter families we have in service and the requirement that the sample contains an adequate number from each of these families. The sample size for each meter family depends upon the meter family population size and its meter test results from the last five years. To pass the test a sampled meter must be able to accurately measure energy to within +/- 2%. In addition, all the meters in the sample size must pass a quality control standard required to assess the health of the entire population of meters in that family.

Over a four year period beginning in 2017, Avista will deploy new advanced electric meters across its Washington service territory. The resulting population of new meters will have 5 single phase/network meter families and 5 poly phase meter families. As a result of having a much-more homogenous meter population, and the meters all being relatively new and of similar age, the Company will be able to reduce its meter sampling program.

Calculating the Benefit Value

There are many component costs associated with the meter testing process. These includes analysts who determine meter sampling requirements and load meter data into the asset management system, the mobile dispatching of orders to meter technicians in the field, the meter shop personnel who perform the testing, and the administration of the program. Avista has estimated the individual unit costs to test each meter, as provided below.

Analyst Cost per Meter	$8
Dispatch Cost per Order	$3
Meter Technician Cost Per Order	$60
Travel Cost per Meter	$15
Performance Monitoring Per Meter	$5
Total Cost per Meter	**$88**

During the first year of reduced sampling, the expected incremental benefit will be included at 50% to reflect any uncertainty associated with suspending tests. In 2017, the avoided cost of sampling (based on a sample of 835 meters) was estimated at $78,000.

Supporting Information

Data supporting the calculation of this customer benefit is provided in the attached electronic workbook titled "Avista AMI Customer Benefits" included on the Compact Disc provided at the end of Attachment B, Project Benefits. The workbook contains the cost information for the activities associated with meter sampling used in determining the quantified value of this benefit.

1. Open the Benefits Workbook and select the tab "Summary Detail."
2. Select "Meter Sampling" under the "Utility Studies" area of benefit.
3. This tab contains the cost information for the activities related to this benefit, the activity levels, the calculation of the benefit, and the forecast of benefits through the Project lifecycle.

Functional Requirements

There are no functional requirements associated with enabling this customer benefit.

Additional Requirements

There are no additional cost or work process requirements associated with enabling this customer benefit.

Key Metrics

The number of meters sampled each year, and the annual cost of meter testing will continue to be tracked going forward.

Benefit Realization Schedule

The anticipated ramp up in benefit value (and its subsequent ramp down) is provided in the electronic workbook described above.

Avista Utilities Advanced Metering Project – Business Case

Appendix C

Avista Utilities Advanced Metering Project
Business Case Report

Appendix C – Recently Deployed Smart Grid Technologies

Avista has incorporated many of the following smart grid technology into its distribution system design standards, which it has integrated with other elements of its feeder rebuild program, into one construction process, known as Grid Modernization. These other elements include wood pole management, energy efficiency, and electrical code compliance, Under this program, each feeder is individually assessed to determine the appropriate level of smart grid investment, which can include major components, as described below.

Smart Transformers - Smart transformers equipped with temperature sensing and voltage measurement capabilities are used to collect customer-loading information to better size future transformer installations and to forecast the useful life of each transformer by monitoring oil and winding temperature. These transformers are also important in supporting the integrated volt var control system, described below.

Fault Circuit Indicators - Fault circuit indicators are used to further-enhance the capabilities of the Company's distribution management and outage systems. Fault circuit indicators are generally installed at primary fuse locations and main feeder junctions points to detect fault current and help identify the actual location of the fault.

Fault Detection Isolation and Restoration - A predictive application in the distribution management system that is integrated with the Fault Circuit Indicators, is the Fault Detection Isolation and Restoration program. This application allows for increased reliability for customers through rapid restoration of service when a circuit breaker has opened due to a fault on the feeder. To accomplish this, the application determines the location of the fault, or cause of the outage, and then restores service to customers by analyzing system conditions and remotely closing breakers upstream and downstream of the fault. The full process takes place in under 3 minutes, replacing the manual process that generally requires from 1-3 hours.

Integrated Volt-Var Control – This specialized application is also integrated with the Distribution Management System, and has two main components: Capacitor Bank Control and Voltage Control. Capacitor banks are used for power factor correction by enabling remotely-controlled capacitor banks to be operated, based on predetermined and defined system parameters. Every 30 seconds, the system uses telemetered realtime data from along the feeder to determine if the power factor is within the desired band, and when not, the system issues a control command to the capacitor bank to correct the feeder power factor. The system has the capability to operate multiple capacitor banks in each 30-second iteration.

Voltage Control is the second application embedded in the Integrated Volt-Var Control system. Real time voltage levels are queried every 30 seconds and used in a power flow model to determine the lowest and highest voltages at the distribution transformers along the feeder. If the lower voltage is outside the desired predetermined range, then the distribution management system employs the voltage control application to adjust voltage levels to within the desired range. This operation is known as **Conservation Voltage Reduction**. Given then the accuracy of the real-time telemetry and power flow calculations, Avista has been able to implement a conservation voltage reduction scheme that reduces the average voltage along each feeder by approximately 2 percent.

Advanced Metering – Another element of the Company's smart grid programs and experience was the deployment of approximately 13,000 advanced meters to its customers in Pullman, Washington. This effort provided the Company with valuable experience and insights into the deployment and management of an advanced metering system, including meter data management, backhaul communications, web presentment of customer's energy-use information, and the use of remote service connectivity. This effort added to Avista's experience with automated metering systems in its other jurisdictions. In its Oregon service area, Avista has for many years operated a mobile meter data collection system including approximately 104,000 meters. In 2004 - 2008, Avista installed approximately 220,000 automated meter reading meters and associated network systems in its Idaho service territory.