Avista Utilities Advanced Metering Infrastructure (AMI) Project Report

August 2020

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A. Report Highlights

- Advanced metering infrastructure (AMI) will actively promote the objectives of the Clean Energy Transformation Act (CETA) by creating the necessary platform for changing customer behaviors, as well as furthering necessary system modifications and efficient and cost-effective delivery of service.
- The "quantifiable" net benefits to customers over time are real—and will only increase over time as the Company "maximizes" the full potential of AMI (perhaps in ways not yet imagined.)
- AMI is, in effect, already operational on Avista's system, with 98% of electric meters and 95% of natural gas modules deployed as of September 1, 2020. The remaining 20,000 natural gas modules will be installed and functioning in the second quarter of 2021 (during pendency of Avista's next general rate case). The remaining capital cost to deploy modules and communications in the second quarter is estimated to be $1.3 million, well under one percent of total capital costs.
- Accordingly, "costs" have already been essentially "locked down" (and are $45 million under what was anticipated in the 2016 information provided in Avista's prior rate case).[1]
- The "benefits" have been refined, and in some cases expanded, as the Company has gained additional experience, and are sufficiently known to demonstrate a "net benefit" over time. The overall nominal valued net benefit is $240.5 million,[2] and on a net present value basis is $52.2 million. These "benefits" are only the hard-dollar benefits that have thus far been quantified, without taking into account many other "non-quantified" (but real) benefits such as safety, power quality, convenience, and service.
- Lastly, the Company fully appreciates the Commission's reluctance in two of Avista's prior rate cases to address the prudency of AMI — it was early in Avista's implementation process and much was yet to be learned (indeed, Avista experienced challenges along the way, as should be expected, but made necessary course corrections). Nearly four years later, the AMI program has sufficiently matured to allow for a determination of prudency and cost-recovery (both of and on investment). In order to be transparent, we have provided a comparison of costs and benefits between 2016 estimates and current figures, however, as the project has matured.

B. Purpose of this Report

This *Avista Utilities Advanced Metering Infrastructure (AMI) Project Report* (Report) has been prepared by order of the Washington Utilities and Transportation Commission (Commission) as a

[1] The current net present value of Avista's combined capital and operations and maintenance (O&M) costs is $169.7M, representing more than a 20% reduction in total costs compared with the Company's 2016 estimate of $215.1M.

[2] Nominal net benefits is the total value of nominal benefits shown at the bottom of Table 4-2 ($498.8 million) minus the total of nominal capital and O&M costs shown at the bottom of Table 3-1 ($156.6 million + $101.7 million).

condition of approval of the Company's amended accounting petition associated with our advanced metering infrastructure project.[3] The purpose of the Report is to provide an update on the capital costs of the project to date, the expected final capital investment and long-term operating costs (O&M), and the current and expected financial and non-financial customer benefits provided by the AMI system, including the current degree of its used and useful capabilities. The format of this Report, and in particular, the reporting of costs and benefits, follows closely the structure of the Company's initial business case for the advanced metering project filed as part of our 2016 general rate case in Washington (Exhibit HLR-3 in Dockets UE-160228 and UG-160229, *Consolidated*), which facilitates a comparison of previously-estimated net benefits with current results.

C. Overview of Avista's Advanced Metering Project

In 2016, Avista completed its competitive selection process for advanced metering software and hardware systems and announced its selection of the firm Itron as the winning bidder. Execution of this contract provided a basis for the Company's request (and subsequent approval) for deferred accounting for retired meters. This was followed by initiation of work on the meter data management and head end systems described herein. Avista continued to refine its plans for comprehensive customer engagement and communication and initiated customer outreach in 2017. Our initial project schedule called for a pilot deployment of communications infrastructure, advanced electric meters and natural gas communicating modules in 2017, with completion of the project slated for early 2020. For reasons discussed elsewhere in this Report, the full implementation of AMI was delayed by approximately one year—until the first quarter of 2021.[4]

Our meter data management system and head end systems projects have been in operation for nearly two years and our meter communications systems have been deployed and are functioning as needed as we complete each new phase of meter installation. As of September 1, 2020, the deployment of electric meters is 98% completed and natural gas modules is 95% compete. The remaining 20,000 natural gas meter modules will be in service by the end of the second quarter of 2021.

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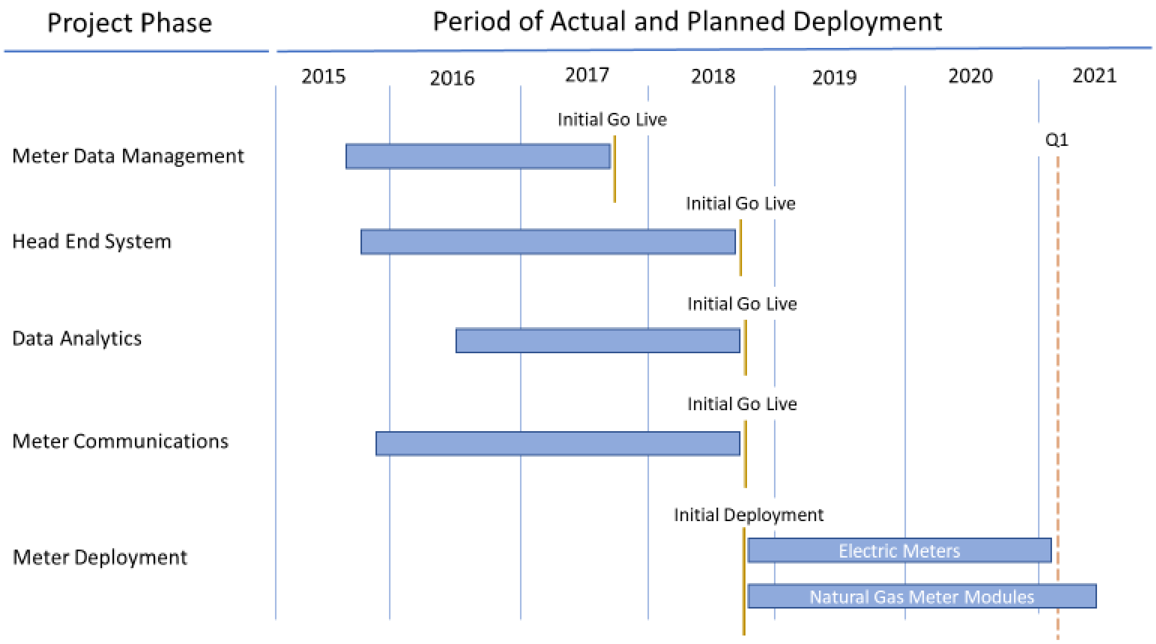
[3] See Commission Final Order pertaining to Avista's amended petition to defer the undepreciated net book value of its electric meters being replaced as part of the Company's advanced metering infrastructure project (Docket Nos. UE-170327 and UG-170328).

[4] The setback encountered during deployment arose from the need for additional software and hardware releases from Itron based on the product maturity of the RIVA metering platform. Avista understood when it elected to move forward with this system that its new generation capability for grid edge computing could result in such issues. In response to these delays we made the decision to delay the meter deployment phase of the project and to optimize other activities around this shift in timing. Because this optimization reflected careful, integrated and prudent decisions, however, the overall cost of the project still comes in well below the 2016 estimated cost.

FIGURE 3-2. DEPLOYMENT OF AVISTA AMI PROJECT OVER TIME.[5]



D. Recent Commission Guidance

In its recent Puget Sound Energy (PSE) Order (para. 153),[6] the Commission determined that the operational decision to install AMI was prudent, noting that "moving to a smart meter platform has become the industry standard, and the Company is appropriately on pace to keep up with this evolving technology." (Ibid.) As this Report demonstrates, the AMI platform has been embraced throughout the industry, as outdated metering systems are replaced. The operational decision by Avista to install AMI was prudent and in-line with industry practice; indeed, had it not done so, the fair question to have been asked is "Why not?" Whether the Company has done so in a prudent and sensible manner is, of course, always pertinent—and this Report describes the great care taken by Avista over the last several years in identifying costs and benefits, and in responding to challenges and lessons learned as it completes this project.

The recently-issued Order in PSE's general rate case (Dockets UE-190529 et.al) also provides some guidance with respect to the Commission's views on implementation and cost recovery for AMI.[7] In its Order 08, issued on July 8, 2020, the Commission reviewed PSE's request for cost recovery of

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[5] Dates shown represent the initial used and useful capability of various systems required for the initial meter deployment. As anticipated, additional investments have been made to these systems through course of the project to improve functionality and operation, add capability and enhancements, and to progressively add infrastructure as needed in the case of meter communications.

[6] Washington Utilities and Transportation Commission v. Puget Sound Energy, Dockets UE-190529 et al. (*consolidated*), Final Order 08, July 8, 2020 (hereinafter "PSE Order")

[7] Ibid.

its ongoing AMI program, slated to be completed in 2023. While the Commission allowed recovery of investment on AMI, it ordered the continued deferral of the recovery of the return on investment until the AMI project is complete (estimated to be 2023). (PSE Order at para. 156). This expressed the Commission's view that PSE "will not be able to demonstrate a significant portion of AMI benefits until the system is fully deployed." (Ibid.) It went on to observe that "[t]he final prudency determination thus rests on PSE's ability to live up to its promises of multiple customer benefits." (Ibid.)

Given the maturity of Avista's ongoing AMI completion and experience gained since 2015, it has essentially "buttoned-up" the cost-side of the equation (as AMI is fully implemented in early 2021) and has fine-tuned its "quantified" financial benefits, sufficient to demonstrate that it will meet the "net benefit" test, even without fully realizing other benefits yet to be quantified and other "softer" (but important) benefits not easily quantifiable. Importantly, Avista will continue to maximize benefits for customers over time—perhaps in ways that cannot yet be anticipated. As such, it is already "maximizing" its benefits of the six "use cases" identified in the Commission's PSE Order (See PSE Order at para 157).

In its PSE Order, the Commission observed that it "expect[s] PSE to take great strides to ensure that both the Company and its customers receive maximum value from its AMI system…", referencing a Utility Dive article entitled "Most utilities aren't getting full value from smart meters, report warns."[8] More specifically, the Commission instructed PSE to analyze the "six use cases" referenced in the article, and how they might be applicable. (Order at para. 157). The table below illustrates these "six use cases", along with Avista's approximation of the financial benefits of each, based on analyses to date:

Use Case	Avista Analysis
1) Time-of-use (TOU) rates[9]	$18.9M[10]
2) Real-time energy use feedback for customers	$3.7M
3) Behavior-based programs	$8.9M
4) Data disaggregation	Integrated with Other Benefits[11]

[8] Utility Dive, Robert Walton (Jan. 13, 2020), available at https://www.utilitydive.com/news/most-utilities-arent-getting-full-value-from-smart-meters-report-warns/570249/

[9] See Executive Summary below for discussion of Time of Use Rates and Demand Response. A single use case, demand response achieved through energy pricing strategies, is not currently cost-effective for Avista, however, this will change by 2025 when the Company will need new capacity resources in place to meet looming deficits. Accordingly, we have already begun initial planning to support development of pilot programs to test the capability and cost effectiveness of this AMI-enabled demand response opportunity.

[10] The Preferred Resource Strategy in Avista's 2020 Electric Integrated Resource Plan calls for substantial new demand response resources, including 29.7 MW through Variable Peak Pricing and later additions through Time of Use Rates. Avista's preliminary estimate of the value of the Variable Peak Pricing, as enabled by our AMI system, approaches $19 million on a net present value basis, but which benefit is not currently included in the project net benefits. The value of these AMI-enabled rate strategies will be further evaluated in pilots leading to full deployment by at least year 2025.

[11] Data disaggregation is already implicit in the analysis of energy-use feedback and behavior-based programs. It will continue to be used as a tool in all future benefit applications.

5) Grid-interactive efficient buildings	$2.6M
6) CVR or volt/VAR optimization	$18.5M

These energy conservation use cases represent, of course, only a portion of the 29 individual financial benefits enabled by Avista's AMI system that are included in determining customer net benefits. By way of comparison, "the only benefits [PSE] has cited are billing functions, voltage management…and remote disconnection capability." according to the Commission. (Id at para 155)

Avista already has plans to maximize the additional value of these use cases, as discussed in this Report. We too share the Commission's concerns that the customers receive the maximum value for AMI — not just the bare minimum necessary to satisfy the "net benefit" test. Avista has had the advantage of early planning and execution (not to mention experience gained) since 2015, with

E. Comparison of Initial and Currently Estimated Project Costs

In our 2016 general rate case the capital cost of deployment in nominal terms was estimated to be $166.7 million. Even though we had substantially refined our estimated costs from our 2015 business case, some parties remained concerned about the potential degree of uncertainty of the estimates. This was particularly true for software applications where estimates are subject to considerable variability. Despite these challenges, however, we are on track to complete the project at an estimated capital cost in nominal terms of $156.6 million. The net present value of capital costs in 2016 was $144.0 million, and the current estimate stands at $122.6 million, as summarized by major components in Table 1-2, below. Accordingly, we will realize a substantial reduction in the net present value of capital costs over the life of the project. the start of the program—and it will continue to build on this experience until it has maximized the value of its AMI system over time (perhaps in ways not yet anticipated).[12]

For purposes of this report, though we sometimes refer to costs and benefits in nominal (or cash) amounts, we predominantly state them as the net present value (NPV) of the stream of annual costs and customer benefits over the project lifecycle (2016 – Q1 2037). The use of net present value normalizes the time value of customer costs and benefits to ensure a meaningful forecast of the cost effectiveness of the investment regardless of when expenditures are made and when benefits are realized. Here, we express net present value in 2016 dollars in order to facilitate a direct comparison with results from our initial business case. Project costs and financial benefits are summarized on a nominal and net present value basis in Table 1-1, below.

[12] The Itron RIVA™ platform is ideal for that purpose.

TABLE 1-1. ACTUAL AND FORECAST COSTS AND CUSTOMER FINANCIAL BENEFITS FOR AVISTA'S ADVANCED METERING INFRASTRUCTURE PROJECT, ESTIMATED IN AUGUST 2020, AND SHOWN ON A NOMINAL (CASH) AND NET PRESENT VALUE (NPV) BASIS.

Nominal	Net Present Value (NPV)
Project Costs $258.3 million[13]	**Project Costs** $169.7 million[14]
Customer Financial Benefits $498.8 million[15]	**Customer Financial Benefits** $221.9 million[16]
Project Net Financial Benefits $240.5 million[17]	**Project Net Financial Benefits** **$52.2 million**[18]

As shown above, whether expressed in nominal or net present value terms, the net benefits quantified thus far, are substantial – without taking into account the non-quantified benefits discussed herein.

TABLE 1-2. ESTIMATED CAPITAL COSTS ON A NET PRESENT VALUE BASIS FOR AVISTA'S ADVANCED METERING INFRASTRUCTURE PROJECT ESTIMATED IN FEBRUARY 2016 AND IN AUGUST 2020 (STATE OF WASHINGTON ELECTRIC AND NATURAL GAS).[19]

Major Cost Components	Capital Cost in 2016 (Net Present Value)	Capital Cost in 2020 (Net Present Value)
Meter Data Management	$11,482,447	$16,940,336
Head End Systems	$12,264,917	$19,582,649
Collector Infrastructure	$28,222,270	$8,609,292
Data Analytics	$4,874,182	$1,716,900
Meter Deployment	$84,635,891	$72,329,996

[13] Total of the actual and forecast lifecycle capital costs of $156.6 million and operating (O&M) costs of $101.7 million on a nominal (cash) basis, as summarized in Table 3-1.
[14] Total Net Present Value (NPV) of the nominal actual and forecast lifecycle capital costs of $122.6 million and operating (O&M) costs of $47.1 million, as summarized in Tables 1-2 and 1-3.
[15] Total actual and forecast lifecycle customer financial benefits of $498.8 million on a nominal (cash) basis, as summarized in Table 4-2.
[16] Total Net Present Value (NPV) of the nominal actual and forecast lifecycle customer financial benefits of $221.9 million, as summarized in Table 1-4.
[17] Total net project benefits on a nominal (cash) basis (nominal customer financial benefits - nominal Project costs).
[18] Net Present Value (NPV) of total net project benefits (NPV customer financial benefits - NPV Project costs).
[19] The costs reported for August 2020 are currently based on month-end totals for end of June 2020.

Energy Efficiency	$2,580,754	$3,422,563
Regulatory Process (meter deferral)	$0.0	$0.0
Totals	**$144,060,460**	**$122,601,736**

Operations and maintenance costs estimated in 2016 had a nominal and net present value over the life of the project of $123.4 million and $71.1 million, respectively. These compare with our current estimates of the nominal and net present value of $101.7 million and $47.1 million, respectively. The substantial reduction in operating costs, summarized in the table below, reflects the elimination of considerable uncertainty associated with the initial estimates, and our success in providing applications support through a more efficient integrated operations model, described later in this Report.

TABLE 1-3. ESTIMATED LIFECYCLE O&M COSTS ON A NET PRESENT VALUE BASIS FOR AVISTA'S ADVANCED METERING INFRASTRUCTURE PROJECT ESTIMATED IN FEBRUARY 2016 AND IN AUGUST 2020. (STATE OF WASHINGTON ELECTRIC AND NATURAL GAS).

Major Cost Components	Operating Expense 2016 (Net Present Value)	Operating Expense 2020 (Net Present Value)
Meter Data Management	$9,918,457	$4,033,996
Head End Systems	$11,296,454	$11,310,046
Collector Infrastructure	$16,367,205	$8,013,026
Data Analytics	$10,668,424	$5,701,099
Meter Deployment	$6,646,850	$3,490,301
Energy Efficiency	$4,578,202	$1,716,347
Regulatory Process (meter deferral)	$11,599,623	$12,841,738
Totals	**$71,075,215**	**$47,106,554**

The current net present value of our combined capital and operations and maintenance costs is $169.7 million, representing more than a 20% reduction in total cost compared with our 2016 estimate of $215.1 million.

F. Comparison of Initial and Currently Estimated Financial Benefits

In our 2016 advanced metering business case we estimated the project would produce $510.7 million in quantified financial benefits on a nominal basis, with a net present value of $241.7 million. The initial major areas of benefit, including individual benefits under each area, along with the estimated net present value for each are shown in the table below.

TABLE 1-4. FORECASTS OF ESTIMATED CUSTOMER BENEFITS FINANCIALLY QUANTIFIED IN THE COMPANY'S INITIAL BUSINESS CASE IN FEBRUARY 2016 AND IN AUGUST 2020. MAJOR AREAS OR CATEGORIES OF BENEFITS AND THEIR RESPECTIVE FINANCIAL TOTALS ARE SHOWN IN BOLD FONT. INDIVIDUAL BENEFITS COMPRISING EACH MAJOR AREA ARE INDENTED BELOW. (STATE OF WASHINGTON ELECTRIC AND NATURAL GAS)

Area of Benefit	Expected NPV 2016	Expected NPV 2020
Meter Reading and Meter Salvage	**$75,920,112**	**$75,578,278**
Eliminate Regular Meter Reading	$68,939,150	$60,938,371
Reduce Special Meter Reading	$445,092	$372,120
Net Metering	$4,567,870	$4,627,144
Customer Meter Base Repairs	Not Included in Initial Case	$6,302,323
Natural Gas Meter Module Refresh	Not Included in Initial Case	$3,190,319
Meter Salvage Value	$148,000	$148,000
Local Economy Jobs	$1,820,000	Not Included in Current Case
Remote Service Connectivity	**$24,332,683**	**$22,010,615**
Account Open/Close/Transfer	$11,756,573	$10,352,917
Credit Collections/Connections	$12,180,323	$11,326,484
After-Hours Fees	$395,786	$331,214
Outage Management	**$40,331,781**	**$53,723,041**
Earlier Outage Notification	$32,817,495	$28,009,803
More Rapid Restoration	Not Included in Initial Case	$18,673,199
Reduced Customer Calls	$1,421,119	$1,277,163
Avoided Single Lights Out	$2,935,025	$2,730,472
Reduced Major Storms Cost	$3,158,142	$3,032,403
Energy Efficiency	**$59,384,914**	**$33,686,230**
Conservation Voltage Reduction	$55,014,844	$18,494,601
Customer Energy Efficiency	$4,370,070	$3,655,286
Behavioral Energy Efficiency	Not Included in Initial Case	$8,927,226

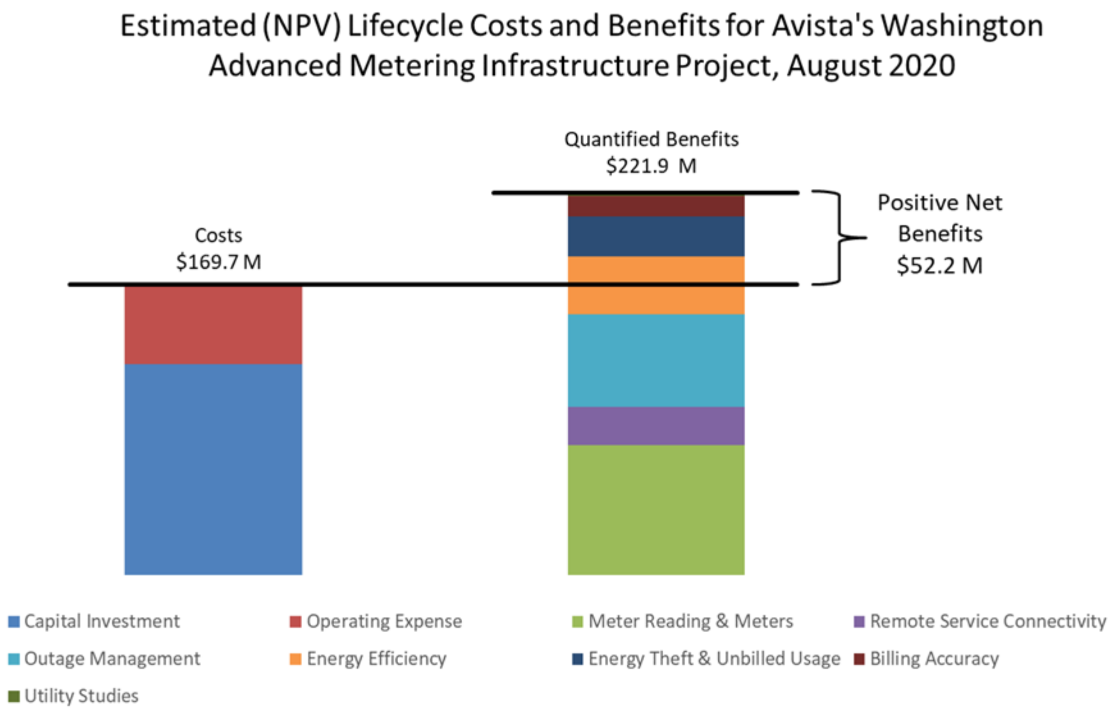
Grid-Interactive Efficient Buildings	Not Included in Initial Case	$2,609,116
Energy Theft and Unbilled Usage	**$28,880,881**	**$23,395,770**
Theft and Diversion	$19,768,167	$4,499,424
Unbilled Usage	$1,912,078	$1,951,970
Slow/Failed Meters	$4,319,220	$3,995,883
Stopped Meters	$2,881,416	$3,558,176
Loss of Phase	Not Included in Initial Case	$9,390,317
Billing Accuracy	**$10,648,127**	**$11,406,347**
Estimated Bills	$5,608,610	$6,783,166
Bill Inquiries	$2,951,711	$2,472,821
Billing Analysis	$1,387,734	$1,138,569
Rebilling	$700,072	$1,011,791
Utility Studies	**$2,201,905**	**$2,050,632**
Retail Load Analysis	$1,154,805	$979,467
Meter Sampling	$1,047,101	$1,071,165
Totals	**$241,700,403**	**$221,850,913**

Even at the very low end of the sensitivity analysis for benefits, as shown in Figure 4-1, net cost/benefit will still exceed $35 million. New areas of benefit are the result of the Company's continuing effort to capture greater customer value from the AMI system, particularly from new energy conservation initiatives. As described a recent report by the American Council for an Energy Efficient Economy, titled "Leveraging Advanced Metering Infrastructure to Save Energy",[20] AMI-enabled energy efficiency opportunities go well beyond the nascent capability of advanced metering touted by the industry, even at the time Avista filed its initial business case. As previously noted, the Commission has recently expressed its interest in making sure utilities implementing advanced metering are on the roadmap to fully capture this customer value.[21] At the present time, Avista has either implemented responsive programs or is in the development phase for each of the conservation use cases described in the Report that are currently cost effective for our customers.

[20] Leveraging Advanced Metering Infrastructure to Save Energy. Rachel Gold, et al. The American Council for an Energy-Efficient Economy (ACEEE). January 2020.
[21] PSE Order, supra.

G. Summary Illustration of Currently Estimated Net Benefits

FIGURE 7-1. ESTIMATED LIFECYCLE CAPITAL AND O&M COSTS AND QUANTIFIED FINANCIAL BENEFITS, ON A NET PRESENT VALUE BASIS, FOR AVISTA'S ADVANCED METERING SYSTEM.



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As noted above, in our 2016 business case we estimated net financial benefits of $26.6 million, compared with our current estimate of $52.2 million. We also completed sensitivity analysis on currently estimated financial benefits, as shown in Figure 4-1. Even if Avista were to only achieve the extreme lower end of the range in variability, which is now highly unlikely, the project would still produce positive net benefits exceeding $35 million, not including any new financial benefits, such as those described for demand response through variable peak pricing and time of use rates. Though we believe the prudence of our investment in advanced metering should be judged on the merits of all customer benefits provided by the system (both quantified and unquantified benefits), our current case clearly demonstrates the cost-effective value delivered for our customers based on existing quantifiable financial net benefits alone.

H. Future Financial Benefits Expected over the Project Life

In addition to the financial benefits described above, Avista is currently implementing or planning for new programs enabled by advanced metering that are likely to provide additional financial value to our customers. One such example already noted above is the use of AMI to enable demand response energy conservation through retail pricing strategies such as variable peak pricing. Our current Electric Integrated Resource Plan identifies looming electric capacity resource needs to be in place by 2025 under current planning.[22] Among the alternatives modeled and found to be cost effective in meeting this need are programs for variable peak pricing and time-of-use rates. The Company's Preferred Resource Strategy in year 2025 includes 29.7 MW of demand response capacity through variable peak pricing rates. Though not included in our current financial benefits, the annual net financial benefit of this program for our customers could exceed $2.4 million, with a lifecycle net present value benefit approaching $19 million. Another example includes the likely expansion of the Company's grid-interactive efficient buildings initiative discussed later in the Report.

I. Customer Benefits Not Financially Quantified

The primary benefits discussed in Avista's advanced metering project are those quantified for inclusion in the financial cost-benefit analysis performed for the business case. Additional benefits, which have real value to our customers, such as safety, power quality, convenience, and service, can be more difficult to assign a financial value but they do need to be included in the consideration of the prudence of our investment. In our 2016 advanced metering business case we briefly noted several areas of customer benefits that were not financially quantified. With our initial experience operating the system, we have identified several additional customer benefits that are being delivered today and that will be offered over the life of the project. These new areas of benefit and their importance to customers are later described in the Report.

J. CONCLUSION: Overall Prudency of Avista's Advanced Metering System

In its Final Order in the Company's 2016 general rate case,[23] the Commission repeated its support from our 2015 case for technologies such as AMI, stating:

> In closing, the Commission's introductory remarks on the subject of AMI in the *Decision* section of Order 05 in the Company's 2015 general rate case bear repeating:
>
> We generally support utilities' provision of technologically advanced service to customers when a utility demonstrates that the investment is used and useful and prudent. We acknowledge that Avista has been a leader among the region's utilities in deploying advanced "smart grid" technologies over the past decade in both the Spokane distribution system and the Pullman area that included both distribution and metering technologies. We expect Avista to continue planning and evaluating carefully the costs and benefits of AMI as its expected deployment date approaches.

Avista appreciates the Commission's acknowledgement of our leadership role in the deployment of smart grid technologies, including advanced metering. We were also mindful of their admonition that we continue planning and carefully evaluating the costs and benefits of advanced metering for our

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[22] New capacity resources must be fully in service by year end 2025 in order to meet deficits occurring in year 2026. Accordingly, these retail pricing strategies must be further evaluated and piloted, and fully deployed well in advance of year end 2025 in order to determine their ultimate capability in meeting a portion of the total capacity additions needed.

[23] Washington Utilities and Transportation Commission v. Avista Corporation, Dockets UE-160228 and UG-160229 (*Consolidated*), Final Order 06, at para. 93, December 15, 2016.

customers. We believe the foregoing summary, and the following Report, demonstrate the quality of analysis and planning developed to support AMI. Avista's Washington advanced metering project meets the Commission's interests of deploying new technology to improve the level and quality of services we provide our customers, and that such investment is cost effective, prudent, and demonstrated to be used and useful as deployed.

Section 1 | Addressing Concerns Raised in Prior Avista Orders

Avista's initial proposal to deploy its advanced metering system was considered by the Commission as part of the Company's electric and natural gas general rate case in 2015 (Dockets UE-150204 and UG-150205, *Consolidated*). At the conclusion of that case Avista's final estimate of net project benefits was $3.5 million over its 21-year life. We also requested the Commission approve deferred accounting treatment for the undepreciated value of our electric meters to be replaced during deployment. The Commission determined that Avista's requests were not ripe for determination, and further noted the refined analysis they would expect to see in support of the project in a future proceeding.

In anticipation of presenting a revised business plan as part of its next general rate case, the Company filed an accounting petition (Docket UE-160100) requesting deferred accounting treatment related to the undepreciated net book value of its existing electric meters. The amended accounting petition was subsequently approved by the Commission in March 2016; however, it was not effective until the Company executed major vendor contracts for the project. Avista's approved deferral accounting was again amended in 2017 to include the undepreciated net book value of retired natural gas meter registers.

In February 2016 the Company filed a revised business case for its advanced metering project as part of its electric and natural gas general rate case (Dockets UE-160228 and UG-160229, *Consolidated*). Avista's estimate of the capital cost of implementation was increased to $166.7 million with an anticipated operations and maintenance lifecycle cost of $123.4 million. The revised project was expected to deliver net financial benefits of $26.6 million. The Commission offered Avista several recommendations related to the project in its final order, however, because it did not adjust Avista's revenue requirements in that case, they did not decide the issues raised in the case concerning the advanced metering project.

In the Orders discussed above pertaining to our advanced metering system, the Commission highlighted several areas of interest and concern and noted those raised by Staff and parties to the cases. In discussing these concerns, the Commission urged the Company to make progress resolving these issues, both before and during deployment of the system, in an effort to reduce the uncertainty and possible contention surrounding cost recovery. We have attempted to diligently address these key issues as briefly described below.

A. Concerns Over Approval of Used and Useful Investments in Advanced Metering

Multiple concerns were raised in the Company's 2015 general rate case over the 'guidance' requested of the Commission by the Company regarding its planned investment in an advanced metering system. Through the course of the 2015 and 2016 cases the Commission stated its policies and practices governing its review and approval for recovery of utility investments. The advanced metering system is now (or soon will be[24]) functionally used and useful, and well before the completion of the Company's next case. We anticipate requesting the Commission's review and approval of this completed project in our next general rate case.

B. Certainty of Project Costs and Customer Benefits

The Commission noted comments of Staff and the parties as well as raising concerns of its own regarding the planning level estimates of project costs and benefits presented by the Company in its 2015 general rate case. Accordingly, we presented improved estimates of costs and benefits for the project in our 2016 case. The refined estimates of project costs included more known information, greater detail and a planning margin for remaining uncertainties to be experienced during implementation. We also refined our projections of financial benefits and estimated a range in potential variability for each area of benefit. With the project now largely completed (98%), the net present value of the final capital and O&M costs (now known) will be much less than estimated in 2016. Likewise, the Net financial benefits quantified today are nearly double our 2016 estimate.

C. Deferral of Undepreciated Net Book Value of Existing Electric Meters

In our 2015 general rate case, we requested the Commission grant the Company deferred accounting for later recovery of the undepreciated net book value in our then existing fleet of electric meters. The culmination of discussion in that case, including issues raised by the parties, resulted in the Company's filing of a separate accounting petition requesting the same. Accordingly, the Company filed a petition in January 2016, which was later amended and approved by Order of the Commission in March 2016. This accounting deferral was again amended by the Company and approved by the Commission in 2017 (Dockets UE-170327 and UE-170328) to include deferral of the undepreciated net book value of existing natural gas meter registers, which were to be replaced with a new communicating module.[25] Avista has since tracked and reported the undepreciated value of retired electric meters and natural gas meter registers each year as required in the Order.

D. Use of Remote Service Switch for Disconnects for Nonpayment

In both our 2015 and 2016 general rate cases the Commission and some of the parties expressed concern over the potential that use of the remote service switch could negatively impact customers by increasing the long-term rate of service disconnections for non-payment. Throughout our history we have always taken care to ensure our customers have multiple opportunities to make a payment or payment arrangements to avoid having their electric service disconnected. Taking advantage of the savings offered by advanced metering, we have been using the remote service switch for these cases in our Pullman service area since 2012. Because we have been concerned about the potential

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[24] Only incidental portions of the natural gas metering need to be installed before the end of Q2 of 2021.
[25] While the manual usage register is replaced with a new communicating module, the natural gas meter itself is not replaced but remains in service.

that use of the remote switch could result in a long-term increase in service disconnections, we have carefully monitored these results as well as any customer complaints associated with remote disconnections. During the 2016 case we showed that customer disconnects had not statistically increased in our Pullman service area since the deployment of advanced metering and that we had received no Commission complaints as a result of this practice. As contemplated by the Commission in 2016, Avista, Staff and the parties engaged in a rulemaking to address various consumer protection issues related to the deployment of AMI, including remote service disconnection (Docket U-180525). This rulemaking process concluded on July 29, 2020 with the issuance of General Order R-600, which amended and permanently adopted new rules in both WAC 480-100 and WAC 480-90.

E. Efficacy of the Interruption Cost Estimator (ICE) Model

The Commission noted the extensive concerns expressed by Public Counsel in our 2015 general rate case regarding the efficacy of the interruption cost estimator model developed by the Lawrence Berkeley National Laboratory for assessing customer costs related to electric service outages. The approach used in the model for estimating the cost to customers for electric service outages has been compared with alternative approaches and found to provide results that are superior to other methods, in a paper sponsored by the National Association of Regulatory Utility Commissioners (NARUC).[26] The concern for Public Counsel focused on a sampling methodology used to estimate outage costs *for only residential customers*.[27] Unfortunately, the witness conflated this methodology with the "actual cost" surveys used to estimate financial losses for commercial and industrial customers.[28] This confusion even found its way into the Commission's Final Order where it referred to the interruption calculator as based on what "…customers would pay to avoid an outage."[29] The contingent value sampling method challenged by the witness, however, was used to estimate less than three percent of the financial costs that are associated with only residential customer outages, while greater than 97% of the estimated costs are based on the actual financial costs experienced by commercial and industrial customers during an outage.

F. Development of a Policy for Customer Opt-Out of Advanced Metering

In our 2016 general rate case, the Commission anticipated there would be customers who would want to opt-out of receiving service from an advanced meter and stated its interest in having the Company present a plan and tariff proposals to provide for the same. After a year of informal discussions, the Commission initiated an inquiry process (Docket U-180117) related to customer choice for advanced meter installation. Avista actively participated with the parties in a workshop established by the Commission and filed applicable comments. The inquiry culminated with the

[26] Evaluating Smart Grid Reliability Benefits for Illinois. National Association of Regulatory Utility Commissioners, A Report for the Illinois Commerce Commission funded by the U.S. Department of Energy. 2011.

[27] Contingent valuation or "willingness to pay" survey methods derive an attribute value by determining a price representing what someone would pay to avoid, in this instance, an electric outage.

[28] Actual cost surveys, gathered through individual customer interviews, document the direct financial losses that are experienced by commercial and industrial customers due to a service outage.

[29] Washington Utilities and Transportation Commission v. Avista Corporation, Dockets UE-150204 and UG-150205 (Consolidated), Final Order 06, at para. 183, January 6, 2016.

publication of a Commission Policy and Interpretive Statement in April 2018. Avista subsequently filed a proposed opt out tariff pilot (Docket UE-180418) and again participated with the Staff and the Parties in a subsequent Commission Open Meeting to discuss the Company's proposal. Avista's amended tariff pilot was subsequently approved by the Commission with an effective date of August 2, 2018.[30] Among other stipulations in the pilot tariff, we are required to track the actual costs for manually reading meters for opt-out customers as a basis for potential amendment of these tariffed costs long term.

G. Customer Privacy Concerns

In its Final Order in our 2016 general rate case the Commission expressed its interest in promoting Avista's careful consideration of customer privacy and protection of personal and proprietary information. We understand the critical nature of protecting our customers' information and interests in every aspect of the conduct of our business, including new technology platforms like AMI. Through the course of deployment, we have taken the necessary steps to address these issues as discussed later in this Report.

H. Cyber Security

In its 2016 Order, the Commission also reiterated its interest in requiring the Company to continue to advance its capability to shield customer data and utility infrastructure from continuing cyber security threats associated with the potential vulnerability of advanced metering technology. Through the course of deployment, we have continued to advance our cyber security capabilities and strategies to protect every aspect of our business from cyber security threats, including our advanced metering system. We also have the benefit of recently-enacted rule changes (WAC 480-100-153) on July 29, 2020, governing customer privacy protections.

I. Due Diligence, Oversight and Documentation

For its part, Commission Staff, in response to PSE's recent request to recover its AMI investments, noted that PSE reasonably determined that it needed to replace AMR infrastructure, reasonably selected AMI from available alternatives, reasonably involved its board and management, and adequately documented its decision-making process. (See PSE Order at para. 139.) Likewise, Avista has also methodically investigated and implemented its AMI system, with active management oversight and documentation.

While much of this Report has focused on the costs and customer benefits of our advanced metering system, we believe it's important to restate how our decision to undertake this deployment serves our customers' overall interests and meets the Company's obligations under the Commission's prudence standard.

Timely Need for this Project – In Section II we describe how our industry and business model are changing and why we believe having AMI is essential to the delivery of service to our customers. As just one example, we explain how this system plays a central role in our achievement of a range of

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[30] Washington Utilities and Transportation Commission v. Avista Corporation, Dockets UE-180418 and UG-180419, Order 01, July 30, 2018.

new energy conservation savings and how it will enable the implementation of new demand response strategies called for in our current Integrated Electric Resource Plan. Indeed, our obligation to acquire new cost-effective capacity resources through measures such as variable peak pricing would be unachievable without the capabilities of our advanced metering system. Similarly, our requirement to focus more on distributed energy resources and non-wire solutions in electric distribution planning are significantly enabled by AMI. Across the Country, utilities responding to these multiple needs for the capabilities of advanced metering are expected to have well over 107 million meters deployed by the end of this year. As recently noted by Puget Sound Energy and the Commission, moving to an advanced metering platform has become the industry metering standard and the operational decision to install AMI now is prudent.

Evaluation of Reasonable Alternatives – The industry's move to adopt the AMI metering standard makes the prima facie case that there is no reasonable alternative technology or combination of technologies that perform the key functions of advanced metering at a similar or lower cost. In our initial business case, we looked at the capabilities of other metering technologies, such as an automated meter reading system (AMR) combined with other applications, as a potential alternative to advanced metering infrastructure. But there was no combination of applications or technologies, even then, that performed the functions of AMI at a comparable cost. Today, advanced metering is more robust and reliable with expanded capabilities such as the edge computing features of the Itron Riva system. More recently in the case of Puget Sound Energy, some Parties cited presumed alternatives to AMI for capturing individual customer benefits, such as conservation voltage reduction, or automated meter reading through AMR, but no other technology alone or in combination provides the central platform essential to meeting our future service needs or cost effectively integrates the multiple range of benefits accomplished by AMI.

Reasonable Involvement of Senior Management – As noted throughout this Report, Avista's senior executives that compose the Executive Technology Steering Committee, which includes among others Avista's President and Chief Operating Officer, have maintained active involvement in the project from its inception. Their involvement includes approval of the project scope, the capital and operating budgets, and presentation of the planned capital investment to the Company's Board of Directors for approval. As described in the Report, the executive steering committee was updated each month by project management staff, which updates included review and approval of analyses of project status, challenges, risks and responses, incremental changes in scope and cost, and recommendations related to technology challenges, such as maturity of the metering hardware and software systems, and any changes in deployment schedules. As noted below, these reviews and approvals have been well documented, and they demonstrate a robust record of the engagement, management, review and approvals of the Company's senior leadership.

Documentation of Decision-Making Processes – Avista project management staff has kept detailed records of key decisions made during the course of the project, including factors leading to key decisions, the associated risks and consequences and support for why these decisions represented the best interests of our customers and the Company. These include records of meetings of project staff for each of the major phases (e.g. communications infrastructure or meter data management system), and meetings for the overall management of the AMI project. Documentation shows how issues identified at the project level were elevated for review and approval by the executive steering committee. These records document topics discussed, and decisions made as appropriate, and include records of proposed changes in project scope and budget, including documentation of the review and approval of the executive steering committee.

Project documentation also includes regular refreshes and updates to forecasts of project costs made during the course of deployment, and updates to estimates of project benefits. In summary, Avista's project documents provide a detailed and comprehensive record of the many key decisions made through the course of deployment by project level staff and the Company's senior leaders, attesting to the prudence of each decision and the project overall.

Section 2 | AMI is a Foundation for the Future

A. The Case for Advanced Metering

So, what's the business case for the smart meter? In short, how does it benefit our customers, what role does it play in Avista's current and future business plans, and why does the timing of our investment make sense? The utility business case for advanced meters often portrays smart metering as a tool enabling a familiar number of disparate functions, producing a range of incremental financial savings and conveniences to customers. What's often neither well understood, nor appropriately valued, is the central role the AMI platform is playing in the utility's changing service model and the relationship we have with our customers. In short, the value of advanced metering is often viewed in the context of the value it provides in the utility's *historic* service model instead of the necessary role it plays in the service model of the future. To better understand the central role of this platform, we believe it's important to first grasp how and why our industry is changing and what it will take to meet the shifting needs and expectations of our customers in a new and dynamic service model.

B. Trending Changes in the Utility Industry

There is a convergence of factors driving an accelerated evolution in our business. For all practical purposes, this new future, while still maturing, is here, *now*. For most of Avista's long history,[31] our access to low-cost hydroelectricity, and our cost control helped us deliver to our customers some of the lowest electric rates in the nation.[32] In more recent decades, Avista weathered changes brought by federal and state utility deregulation, the need to replace cheap energy supplies once available through legacy hydropower contracts with more expensive resources, the Western Energy Crisis, the looming need to replace larger quantities of aging infrastructure each year, and the current drive to further decarbonize our electric resource portfolio.

Beneath these more-obvious challenges, though, were the undercurrents of more potent societal and technological forces we see manifest today. We refer to these forces as foundational because they challenge the traditional regulatory framework within which our industry operates. The forces we face today are often taking place outside this familiar framework. Utilities, emerging service competitors, utility customers, and utility regulators, themselves, are all reacting to capitalize on new opportunities and meet new, and sometimes unfamiliar challenges.

From Avista's perspective, these underlying forces can be aggregated into three groups:

Clean Energy and Conservation: A societal, and indeed, a global response to changes in climate and the desire to significantly and quickly reduce CO2 emissions. Among responses to this call for action has been the societal and legal shift to require a greater percentage of our electricity supply be provided by renewable resources. There are also calls now to actively shift current energy uses met by fossil fuels to clean electricity. The cost of these

[31] Avista was formed under the name 'The Washington Water Power Company' in the Territory of Washington, in March 1889.
[32] Even today, Avista's residential rates are among the very lowest in the nation for investor-owned utilities.

changes is putting greater price pressure on customers and will continue to drive an ever greater need to use electricity more efficiently. Conservation measures, including pricing strategies that were historically not viable because of Avista's low electric rates, will be ever more important.

Enabling Technologies: The rise and maturing of new technologies that are changing the electricity landscape. These include significant reductions in the cost and availability of customer-owned renewable electricity generation, control and storage, coupled with regulatory changes promoting investment in distributed energy resources. The digitization of massive volumes of customer data is now combined with complex, interoperative and integrated control systems, allowing new market players to provide traditional utility customers with a range of energy services their utility provider may not offer, at price that's ever more competitive.

Customer Empowerment: The growing ability of utility customers to exercise greater choice and control over their traditional monopoly utility service. This includes use of technology to help manage and reduce their energy costs, the use of distributed energy resources to reduce reliance on the serving utility, and the growing opportunity to sell their electricity to others outside the utility's control, while otherwise relying on the utility's dedicated infrastructure. Finally, the falling price of electricity storage and management systems, coupled with onsite generation, may soon provide traditional customers a real option to bypass their service utility altogether. Through this all, the utility must stand ready to serve.

C. AMI Enables Service at the Grid Edge

Avista believes the new electricity frontier will increasingly focus at the level of the individual customer, and on the local distribution grid where they receive service. We have referred to this new frontier for some time now as the "grid edge." We understand the long-term success of our business is founded on identifying and meeting our customers' evolving energy services needs at the grid edge. We're working now to not only embrace this change but to incorporate these new realities into a more customer-centric and technology-enabled business model. We simply cannot ignore the changing role of the electric distribution system and must make the necessary investments now to ensure a seamless transition for our customers. Advanced metering is fundamental to addressing these challenges and opportunities.

D. The Need for Greater Energy Conservation

Traditionally, the industry focused on AMI-enabled energy conservation based on customers having very granular and near real-time information on their energy use, representing a big leap forward in customer information. As a result of having this information, combined with helpful analytics and energy saving tips, the expectation was customers would apply this information to implement conservation measures and reduce their energy use. Over time we've learned, however, that simply providing customers the opportunity to view their usage data does not, in and of itself, translate to a significant level of hoped for conservation.

The potential for energy conservation, aided by smart metering, is substantially expanded from this initial model. As noted earlier, The American Council for an Energy-Efficient Economy, in their recent article “Leveraging Advanced Metering Infrastructure to Save Energy,” [33] presents multiple energy efficiency use cases, summarized below, designed to more effectively leverage the value of the AMI platform in helping the utility and its customers reduce energy consumption and lower costs. Avista has already expanded plans from its initial business case for AMI and has either implemented or is actively developing conservation initiatives *for each use case* described in the report. Below we summarize each conservation use case described in the report, followed by a brief overview of Avista’s efforts, explained in more detail in Sections 4 and 6 of this Report.

Targeting Strategies involve leveraging AMI-based load disaggregation or using profile clustering to focus the utility’s conservation engagement on customers most likely to take action to reduce their consumption.

> Avista is currently implementing systems, such as our load disaggregation application, to use data from its advanced metering system to offer personalized and relevant energy saving advice to each customer in a way that avoids the high overhead costs for service-territory-wide blanket energy efficiency campaigns. Advanced metering will allow Avista to better understand which customer populations are most in need of targeted energy efficiency programs and what measures are most likely to be undertaken by these customers.

Energy Use Feedback involves using the advanced metering system to provide customers access to their near-real time energy use to help them better understand and manage their energy use. This use case provided the initial energy conservation push for advanced metering.

> Avista’s advanced metering system is providing customers this granular energy use data, and this capability was included in the Company’s initial and current business case. In addition to providing customers their interval energy use data, we have developed a range of tools and applications, discussed in this Report, to make it easy for them to implement conservation measures on their own. In addition to simply providing use data, however, Avista will leverage its AMI-based load disaggregation analytics to inform a customer, as one example, of higher than normal usage for a major appliance before that energy cost is incorporated into their bill. This will allow the customer address issues with a faulty appliance sooner and thus save them money on their utility bill, and potentially avoid an emergency replacement at failure. Further such uses are described below under behavioral feedback.

Behavioral Feedback Programs involve providing customers with personalized insights based on their interval data to help motivate them to take actions to reduce their energy consumption. The report authors note that these tailored reports are a common application of behavioral feedback in the industry.

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[33] Leveraging Advanced Metering Infrastructure to Save Energy. Rachel Gold, et al. The American Council for an Energy-Efficient Economy (ACEEE). January 2020.

Avista has already experienced success implementing behavioral feedback programs and is now in the process of implementing its own AMI-enabled feedback program. We will use the load disaggregation capability and targeting strategies, described above, to leverage much greater value from energy conservation based on tailored communication and feedback to our customers. As an example, Avista will soon inform individual customers of an increasing 'always-on' load in their residence. This information raises their awareness and provides them with personalized, timely feedback on specific behavioral changes they could make to reduce their energy usage and costs.

Measurement and Verification of conservation savings is made more accurate and timelier by the ability to use smart metering data.

Avista will use advanced metering data to reduce the lag time between the implementation of conservation measures and verification and to provide additional layers of assessment down to the day, or even hour. Those same results can then be shared with individual customers so they can better understand their personalized savings from participating in behavioral energy efficiency programs.

Energy Pricing Strategies allow customers to select how and when they use energy to lower their bill. As an example, smart metering enables the utility to better understand the usage profile of each individual customer and offer rate plans that meet that customer's need, while at the same time saving them money on their utility bill. Examples of this include demand response (DR) events or time-of-use rates that align with the customer's need. "A demand response company can provide more actionable feedback on customer energy usage to help the customer save money while benefitting all customers by reducing the system's peak demand." [34]

Avista has, in the past, evaluated opportunities to implement various demand response and pricing strategies, but because our retail rates were relatively low, because capacity was relatively available and inexpensive, and because differences in on-peak and off-peak electricity prices were relatively small, most demand response options were not cost-effective. Today, however, as the Company is planning to acquire significant capacity resources, its value has increased to the point where demand response options are becoming cost effective. Avista is planning to rely on its advanced metering system to enable demand response strategies to likely meet a portion of our looming capacity needs. The Company is likely to plan a pilot implementation in the near-term to be better prepared for a full deployment of demand response programs that would be fully operational by 2025, when its IRP suggests a load/resource imbalance.

Grid-Interactive Efficient Buildings to expand the role of flexible, controllable electricity loads to improve energy efficiency, system capacity and lower infrastructure costs. Buildings

[34] Ibid.

consume 40% of the nation's energy, and approximately 70% of our electricity is used for heating, lighting and motors, etc.

Avista is currently implementing another demand response approach through the *Grid Interactive Efficient Buildings* initiative sponsored by the U.S. Department of Energy Building Technology Office. While efficiency initiatives for buildings in the past decade have focused on reducing the energy (kWh) used by the *individual* building, the Company's objectives are based on a new and more complex model. In its model, known as the Eco District, the objectives include a focus on minimizing total electricity consumed for all buildings in the development, to flatten the *capacity* (kW) demand being placed on the distribution system, and to shift capacity peaks as much as possible, away from periods of peak demand. Being able to better manage and flatten demand is key to unlocking greater value from our electric distribution infrastructure. Advanced metering infrastructure, including meters and communication networks, provides the platform to design, deploy, and validate such programs.

Pay for Performance Models that reward customer energy savings on a going-forward basis rather than providing up-front payments for conservation investment.

Avista is continuously increasing the number of pay-for-performance incentives for conservation measures. These incentives help maximize the realization of energy savings for difficult and complex measures and ensure that customers receive the incentives they deserve. Traditional efficiency incentives have been made available to customers based on conventional engineering estimates that tend to be somewhat conservative, which can result in a lower incentive received by the customer. Avista's advanced metering system will provide the platform to enable incentives for energy efficiency measures to be based on 'pay-for-performance,' for situations where the load only shows up at a particular time of day. The advanced metering system will be used to measure the potential energy savings over specified periods when peak loads occur. Advanced metering will also help with the important process of matching measured load curves with building load curves.

Conservation Voltage Reduction programs can be made more effective by relying on voltage measurements taken at the customer's service point to help lower the overall voltage level on the feeder. This is an effective approach that reduces the cost of serving electric customers.

Avista has been an industry leader in applications for energy conservation and included customer energy savings from conservation voltage reduction in the original business case for AMI. Since its initial business case, Avista has focused on better understanding and measuring the potential for adopting conservation voltage reduction to all its electric feeders in Washington. While Avista has identified several engineering design and equipment challenges that limit our overall potential for savings, the Company is already actively implementing the program using data from its advanced metering system.

As electricity prices continue to increase for our customers, due to clean energy and other needed investments, Avista's advanced metering system will provide the necessary central platform, as clearly defined in the report by the American Council for an Energy-Efficient Economy, to help realize these savings.

E. Technology Drivers at the Grid Edge

Avista has taken a number of steps over more than a decade to help us better optimize our utilization of the electric distribution system, to lower electricity costs for our customers, to maintain and uphold our system reliability in high-density service areas, to promote the development of electric transportation, and to learn more about how to effectively integrate, utilize, and optimize distributed energy resources. More recently, we have been systematically evaluating the interaction between new technology systems and emerging customer choices and markets at the grid edge through an internal employee team referred to as the Grid Edge Consortium. The goal of this group is to understand and anticipate industry trends as well as_technology advancements so Avista can prepare to meet future customer demands and expectations 'ahead of the curve.' Avista's Grid Edge Consortium has identified a developing future state we referred to as the "shared energy economy," and has developed a comprehensive roadmap identifying technology, infrastructure, regulatory, and a range of other structural and process achievements necessary for its realization. As noted, the deployment of AMI is one of the first essential technology steps required to realize this vision.

Another dynamic at the grid edge is the need to integrate more renewable resources on the electric distribution system, both as a way to help meet clean energy objectives and to help defer the need for infrastructure capacity investments. Increasing the density of these renewable distributed energy resources will create new dynamics on the power system that must be effectively understood and mitigated. Avista's advanced metering system will play a central role in this effort as data gathered from individual meters will enable more advanced planning and analysis capabilities. Engineers can use the data for assessing the viability of new generation in each location, and even develop new strategies to increase the allowable percentage of intermittent generation on our feeders. Without AMI, the traditional engineering assumptions used to ensure grid stability and reliability would limit the allowable amount of distributed clean energy that could be successfully incorporated at the grid edge.[35] In addition to helping integrate more renewable energy, the two-way communications between Avista and our customers, enabled by advanced metering, can be used for communicating critical operational information with small-scale clean energy resources in the future, moving our customers from their current role as consumer to an active partner in managing the clean energy grid.

F. Empowering the Customer

Consumers have access to more information today than ever before and it has allowed them to exercise greater choice in their purchasing decisions. This includes their growing opportunity to bypass traditional utility service and to be more actively involved in decisions on how they both acquire and use electricity. Advancements in technology, the availability of customer data, and

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[35] Traditional methods are based on data typically available at the feeder level, which requires a conservative approach to ensure we have an adequate margin to meet service requirements for individual customers. AMI provides visibility and data for <u>every</u> portion of the feeder and every single customer.

enabling rule changes already allow individual consumers to contract directly with non-utility service providers in an expanding number of ways. It's often noted that the regulated electricity industry has fallen behind other industries when it comes to utilizing and making data available to engage customers and create new products and services.[36] Customers in other regions of the country, most notably in California, have been actively exercising these types of choices, both as individual customers, and through the creation of a new class of energy service providers known as Community Choice Aggregators (CCA). These types of service arrangements are likely to proliferate in a variety of combinations, such as increased customer self-generation and peer-to-peer energy transactions between consumers themselves.

At Avista, we have quickened our pace to be able to expand customer choice in the emerging grid edge marketplace. We anticipate development of these markets will accelerate as the per-kWh-cost of customer-owned electric generation, particularly solar, continues to fall further below the embedded energy cost of our own generating portfolio. This development, more than any other in the near term, will enable our customers to drive wide-ranging commercial changes at the grid edge. We are working to facilitate and lead it in ways that help drive cost-effective added value for our customers. Avista's advanced metering system provides a central platform necessary to keep pace with and to facilitate this transformation.

G. Now is the Time for the AMI Platform

In 2006, leaders at Avista began thinking about advanced metering and what value it could deliver to customers both at that time and into the future. AMI and associated technologies and markets were too immature then to warrant deployment, and the Company continued to evaluate the challenges faced by early adopters, and its growing potential to deliver value. Today, the Company's system is on pace for completion at just the right time to provide the technology platform needed to support Avista's ongoing transformation.

What was once a new technology is now considered mainstream. Since the original concept of smart metering communications technology, huge strides forward have been made in computer chips, radio reliability, and public operator coverage. The falling prices of chips and modules, coupled with their growing capabilities, enabled the industry to consider new ways of bolstering the robustness of networks.[37] Indeed, AMI systems have become the new metering standard in the United States.[38] Itron, Avista's smart meter manufacturer, has seen a continual marketplace transition from non-communicating meters to communicating meters, then to smart meters. Today the market has substantially matured in North America, with 94% of the meters shipped being communicating

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[36] Advanced Energy Economy. (2017). Access to Data: Bringing the Electricity Grid into the Information Age.

[37] How Standards Are Evolving in the World of Smart. Smart Energy International. https://www.smart-energy.com/industry-sectors/smart-meters/how-standards-are-evolving-in-the-world-of-smart/

[38] Pages 48,49, paragraph 153, Final Order in Dockets UE-190529, UG-190530, UE-190274, UG-190275, UE-171225, UG-171226, UE-190991 & UG-190992 (Consolidated).

meters. Smart meters have the highest deployment rates of any smart grid technology, and the global market, although slowing slightly, continues to expand.[39]

The pressure is on utilities to change, with the support of their regulators. The Department of Energy has noted that policymakers should implement foundational policies to enable a data-rich energy environment as soon as possible. Policymakers and regulators should then direct utilities that have not already done so to submit a business case for deployment of AMI to ensure availability of actionable granular energy usage data.[40] On a national level, utilities are encouraged to look to advanced metering as the mainstream answer. The U. S. Department of Energy continues to support grid modernization through research, development, demonstration, analysis, and technology transfer activities. New technologies are driving changes in electric power on multiple fronts. The need for stronger national efforts to modernize the grid for the cost-effective integration of renewable and distributed generation, energy efficiency and demand response, and cybersecurity and interoperability standards are essential. The Department of Energy further urges that grid modernization and consumer engagement remain important national priorities.[41]

H. Advanced Metering Trends Nationally and in Washington State

National trends in advanced meter deployment are a familiar topic in advanced metering business cases, and nationwide trends exceed projections included in the Company's earlier 2016 business case, as shown below in Figure 1-1.[42] As of year-end 2018, electric utilities had installed more than 88 million smart meters, covering nearly 70 percent of U.S. households. Based on survey results and plans approved in 2019, estimated deployments were expected to reach 98 million smart meters by the end of 2019 and 107 million by year-end 2020.[43]

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[39] AMI Penetration in Africa, A Comparison with Global Progress. Smart Energy International. https://www.smart-energy.com/industry-sectors/smart-meters/penetration-in-africa-a-comparison-with-global-progress-advanced-metering/

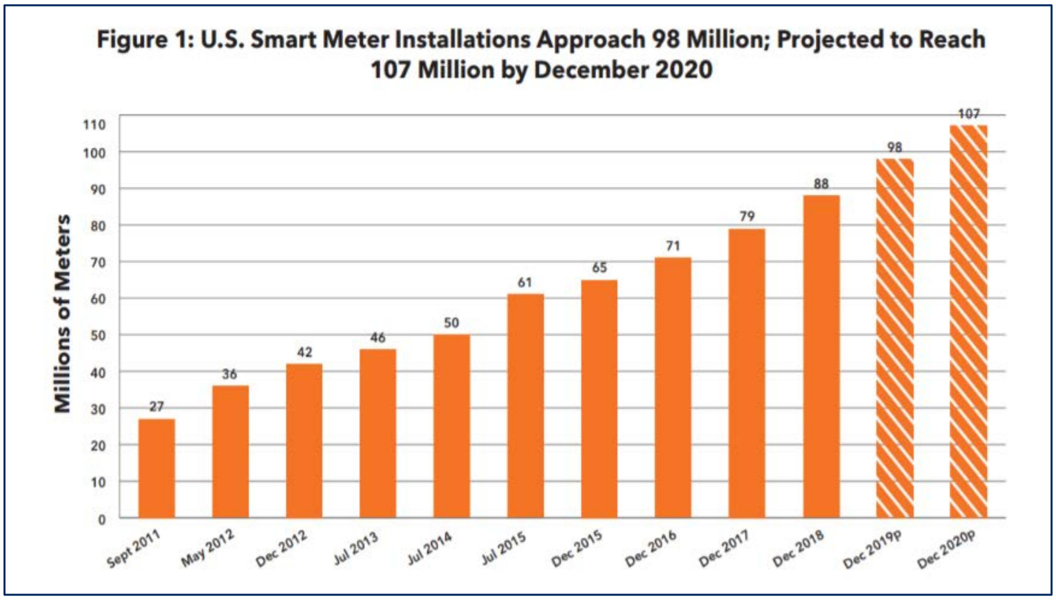
[40] Access to Data: Bringing the Electricity Grid into the Information Age. A 21st Century Electricity System Issue Brief. Advanced Energy Economy. 2017. https://info.aee.net/hubfs/PDF/Access-to-data.pdf

[41] Advanced Metering Infrastructure and Customer Systems. Results from the Smart Grid Investment Grant Program. U. S. Department of Energy. 2016. https://www.energy.gov/sites/prod/files/2016/12/f34/AMI%20Summary%20Report_09-26-16.pdf

[42] In 2016, Avista's business case at page 18 stated: 'Longer term, the penetration of advanced meters in the U.S. is expected to reach 50% to 70% by the year 2020.' As shown in Figure 1-1 the upper level of this projection was reached in 2018.

[43] Electric Company Smart Meter Deployments: Foundation for a Smart Grid (2019 Update). Edison Foundation, Institute for Electric Innovation. 2019

FIGURE 1-1. ACTUAL AND EXPECTED TREND IN DEPLOYMENT OF ADVANCED METERING IN THE UNITED STATES. EDISON FOUNDATION, 2019.



While Washington State lags behind the West Coast in deployment of smart meters, several utilities are in the process of completing system installations, as shown in the table below.

TABLE 2-1. UTILITY DEPLOYMENTS OF ADVANCED METERING IN WASHINGTON STATE.

Company	Dates	Number of Meters Deployed
Puget Sound Energy (PSE)	2017-2023	1.1 million electric meters 800,000 natural gas modules (PSE, 2020)
Seattle City Light	2016-2019	461,496 electric meters (Seattle City Light, 2020)
Tacoma PUD	2018-2022	190,000 electric meters 110,000 water meters (Nhede, 2020)
Inland Power & Light	2013-2015	39,000 electric meters
Avista	2017-2020	249,391 electric meters 160,166 natural gas modules
Total		Electric Meters: 2,039,887 Natural Gas Meter Modules 960,166

Puget Sound Energy was early adopter of automated meter reading (AMR) for its electric customers. Puget began refreshing its aging AMR system with advanced metering in 2016 and is ultimately planning to install over 1.1 million electric meters and 800,000 natural gas meter modules. The refresh project is slated for completion in 2023. Through various regulatory processes, including the most recent Order cited previously, the Commission and affected parties are very familiar with this ongoing implementation.

Seattle City Light claims to be the nation's greenest utility, "providing customers with industry-leading service and reliability while empowering them to make energy-saving choices."[44] Before they began their meter deployment, City Light collaborated with industry experts about interoperability, calling it "the only path that can unlock the value of utility investments in the smart grid, smart metering, and smart cities."[45] Aligning with their belief in interoperability, City Light became the first Green Button Initiative -certified utility in the U.S. in 2014. Seattle City Light has completed its smart meter deployment, but not without its share of challenges, including exceeding their expected budget by $17.4 million. The major driver of the increase was the cost of the meters and their installation.[46] The city's construction boom has added a larger number of households and businesses, which means the department had to purchase more meters than it had anticipated. Additionally, the cost of each individual meter increased from $113 to $122. On top of that, when the City initially budgeted for the new meters, it failed to include the 10% sales tax associated with purchasing the new meters, bumping their final cost to $135 for each of the 422,000 meters. Installation has also been more expensive. The Department of Labor and Industries recently told the contractor installing the meters that it needed a higher ratio of supervisors to workers, which meant adding additional staff."[47]

Tacoma Public Utility District has only recently initiated their meter deployment (2020) and is planning to roll out a range of customer features as installation nears completion in 2022.[48] In addition to citing limiting, old technology, Tacoma claims many of the same customer benefits as other AMI projects as reasons for upgrading to advanced meters. Advanced meter technology also addresses requests received from its customers for additional features. Currently, the only changes for customers will be moving from a two-month billing cycle to a one-month billing cycle. "Based on our research and customer survey data, customers greatly prefer monthly billing."[49]

Inland Power and Light, Avista's neighbor, has already completed deployment of an advanced metering system for its 36,000 customers in Washington and 3,000 customers in Idaho.[50] Inland cited the desire to provide their customers a better understanding of their energy use as driving their initiative to deploy the system. The utility also cited expected operational benefits to improve service and reliability in outage and storm situations, noting the system will notify the utility much more quickly when service is interrupted and allow them to dispatch resources directly to the problem.

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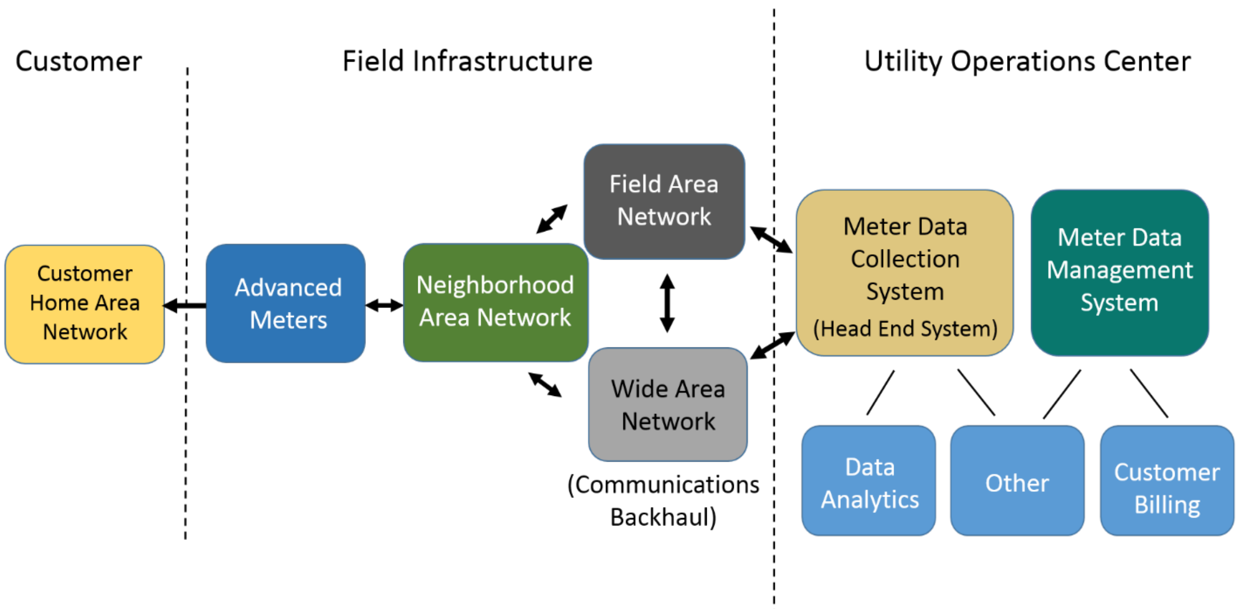
[44] Advanced Metering – Program Update. www.seattle.gov/light/ami/.
[45] Common Questions. www.seattle.gov/light/ami/faqs.asp
[46] City Light's 'Smart Meters' are $17.4 M Over Budget. Kroman, D. 2018, *Crosscut*
[47] Ibid.
[48] Advanced Meter FAQ. www.mytpu.org/community-environment/projects/advanced-meters/advanced-meter-faq/.
[49] Ibid.
[50] https://www.spokesman.com/stories/2013/dec/20/inland-power-to-upgrade-meters/

Section 3 | Project Deployment Overview

A. The Advanced Metering System Described

While there is greater familiarity with advanced metering systems today than when the Company released its initial business case in 2016, we believe it is still helpful in this discussion to provide a brief overview. The diagram below represents the AMI system, including the advanced meters themselves, specialized communications hardware and software (neighborhood, field, and wide area networks) and the head end, meter data management, and data analytics systems. These key components are depicted in the following diagram and are briefly described below.

FIGURE 3-1. DIAGRAM OF AMI INTERCONNECTION WITH CUSTOMERS.



Advanced Meters - Advanced meters[51] can measure the incoming and outgoing[52] flow 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. The many other capabilities of advanced meters in achieving customer benefits are discussed throughout this

[51] 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.

[52] 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").

Report. Advanced meters can also be configured to interface with the customer's Home Area Network. [53]

Metering Communications Network - A specialized and secure communication system is required to carry data and communications between the advanced meter and the utility. 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.[54]

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.

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. [55] The meter data collection system software is designed and provided by the manufacturer of the advanced meters.

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

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[53] A home area network (HAN) is a communication network within the home of a residential customer that allows transfer of information between electronic devices, including, but not limited to, in-home displays, computers, energy management devices, direct load control devices, distributed energy resources, and smart meters (openei.org/wiki/Definition:Home_Area_Network).
[54] This system also works in reverse order to carry information transmitted from the utility to the meter.
[55] These specialized applications perform a range of business functions such as outage management integration, conservation voltage monitoring, and theft detection.

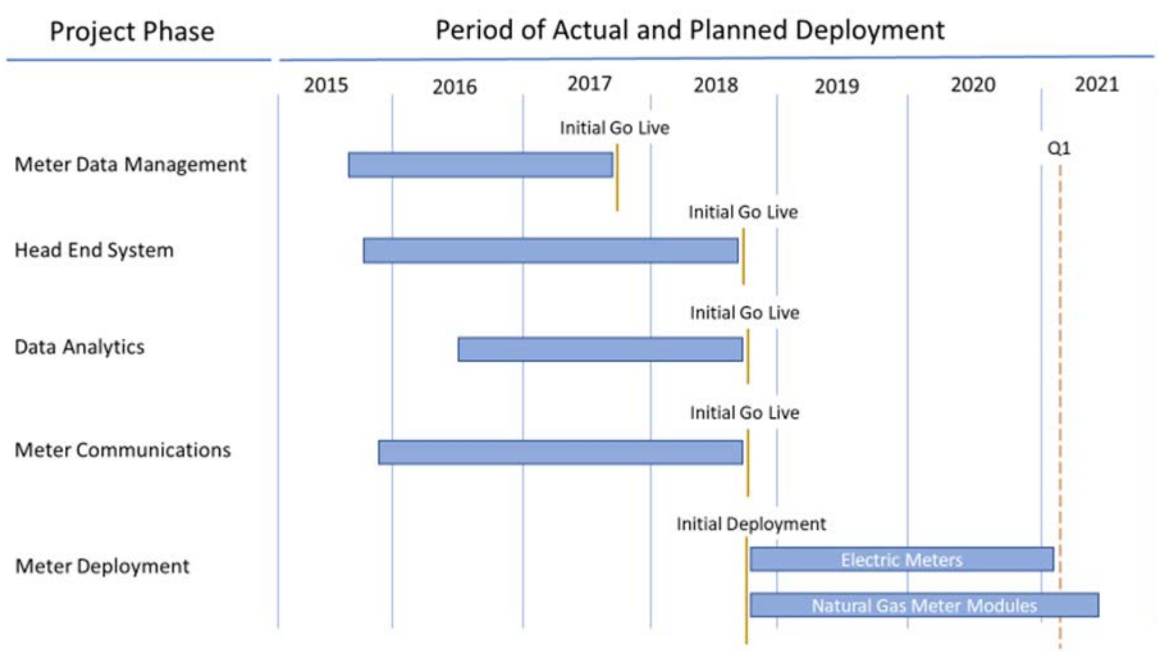
usage data. The system also serves as the 'system of record' for meter consumption data, including out-of-cycle billing and validation.

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, to name a few.

B. Overview of Project Deployment

Avista's advanced metering project consists of the integration of five interrelated projects or phases representing the key systems described above. We employed a project management strategy referred to as an "agile" approach[56] where the overlapping phases were integrated by thoughtful planning and collaboration among multiple internal work groups and outside vendors. Timing of initial implementation for these systems is presented in the Gantt chart below.

FIGURE 3-2. DEPLOYMENT OF AVISTA AMI PROJECT OVER TIME.



While our initial business case in 2016 estimated a nominal capital cost to implement the system of $166.7 million, we are currently on track to complete the project for approximately $10 million under this initial estimate as shown below at the bottom of Table 3-1. After the Company filed its initial

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56 Iterative or "agile" project management breaks down complex projects into multiple iterations or incremental steps toward the completion of a project. Agile approaches are frequently used in software development projects to promote speed and adaptability since the benefit of iteration is that you can adjust as you go along rather than following a linear path.

business case in 2016, it established a slightly lower operating capital budget for the project of $165.4 million. For purposes of this report, however, and comparison of current project costs and benefits with our initial business case, we refer to the initial capital estimate of $166.7 million. Operations and maintenance costs estimated in 2016 had a nominal and net present value over the life of the project of $123.4 million and $71.1 million, respectively. These compare with our current estimates of the nominal and net present value of $101.7 million and $47.1 million, respectively.[57] The substantial reduction in operating costs reflects elimination of the uncertainty associated with the initial estimates, and our success in providing applications support through a more efficient integrated operations model, described later in this Report. Current actual and forecasted capital and operating expenses are presented on a nominal basis for each year of the lifecycle in the table below.

TABLE 3-1. ACTUAL AND ESTIMATED LIFECYCLE CAPITAL (CAP) AND EXPENSES (EXP), ON A NOMINAL BASIS IN $MILLIONS, FOR AVISTA'S ADVANCED METERING INFRASTRUCTURE PROJECT FOR EACH YEAR OF THE PROJECT LIFECYCLE, AS OF AUGUST 2020.

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								$0.3						$0.6	
2016	$8.3		$0.1		$0.7				$0.4		$1.7				$17.5	
2017	$10.0	$0.1	$2.6		$0.8		$0.2		$0.8		$0.6				$22.6	$0.1
2018	$0.2	$0.4	$9.4	$0.3	$1.8	$0.2	$0.4		$9.2		$0.5	$0.1			$21.6	$0.1
2019		$0.5	$10.0	$0.7	$3.3	$0.7	$0.6	0.4	$43.8	$0.5	$0.3	$0.3			$58.1	$3.3
2020		$0.3	$2.0	$0.9	$3.7	$0.7	$0.7	$0.3	$28.5	$0.5	$0.5	$0.3			$35.4	$3.4
2021		$0.3	$0.1	$1.1	$0.8	$0.7	$0.4	$0.3	$2.3	$0.3	$0.5	$0.3		$2.0		$6.8
2022		$0.3		$1.1		$0.8		$0.6		$0.3		$0.1		$2.0		$7.0
2023		$0.4		$1.1		$0.8		$0.6		$0.3		$0.1		$2.0		$7.1
2024		$0.4		$1.2		$0.8		$0.6		$0.3		$0.1		$2.0		$7.1
2025		$0.4		$1.2		$0.8		$0.7		$0.3		$0.1		$2.0		$7.2
2026		$0.4		$1.3		$0.9		$0.7		$0.3		$0.1		$2.0		$7.2
2027		$0.4		$1.3		$0.9		$0.7		$0.3		$0.1		$2.0		$5.5
2028		$0.4		$1.3		$0.9		$0.7		$0.3		$0.1		$2.0		$5.6
2029		$0.4		$1.4		$0.9		$0.7		$0.4		$0.1		$2.0		$5.7
2030		$0.4		$1.4		$1.0		$0.8		$0.4		$0.1		$2.0		$5.9

[57] As shown respectively at the bottom of Table 3-1, and as summarized earlier in Table 1-3.

2031		$0.5		$1.5		$1.0		$0.8		$0.4		$0.1		$2.0		$6.0
2032		$0.5		$1.5		$1.0		$0.8	$0.6	$0.4		$0.1		$2.0	$0.6	$6.1
2033		$0.5		$1.5		$1.1		$0.8	$2.8	$0.4		$0.2		$2.0	$2.8	$6.1
2034		$0.5		$1.6		$1.1		$0.9	$3.3	$0.4		$0.2			$3.3	$6.2
2035		$0.5		$1.6		$1.1		$0.9	$3.4	$0.4		$0.2			$3.4	$6.5
2036		$0.5		$1.7		$1.2		$0.9	$0.8	$0.4		$0.2			$0.8	$1.6
2037		$0.5		1.7		$1.2		$0.9		$0.4		$0.2				
Totals	$18.7	$8.6	$24.3	$25.5	$11.0	$17.8	$2.2	$13.1	$96.3	$7.0	$4.0	$3.3		$26.4	$156.6	$101.7

C. Prudent Controls Help Deliver the Project Within Budget

One of the key factors supporting our successful deployment was the detailed forecasting and budgeting used to develop cost estimates for the initial business case. We understood the importance of developing estimates in our 2016 business case that would help give the Commission and parties greater confidence in the validity of the forecasts. In addition to having greater detail, the project managers were attentive both individually and as a group to managing emerging issues and uncertainties and developing innovative ways to optimize solutions and costs. This provided good financial visibility and controls needed to effectively manage the budget across multiple programs and over the entire deployment period. In this process funds were shifted as needed by project and from year to year to best optimize project costs in meeting milestones and schedules. Budgets developed for individual projects, as well as the overall project budget were refreshed monthly, including the identification of emerging uncertainties, development of plans for managing them, and reforecasting the expected final cost. Any proposed changes in budgeted amounts were presented monthly to the Officer Enterprise Technology Governance Group.[58] During this monthly review, the executive team was apprised of the status of each project, considered and approved any recommended changes to individual project budgets that would impact available contingency funds,[59] and reviewed and approved other key decisions necessary to optimize delivery of the AMI system. The result of this continuous oversight and flexibility to adapt was bringing the project in under what was expected in 2016.

D. Long Term Operations and Maintenance Costs

As noted above, the Company's initial business case included an estimate of $123.4 million for the lifecycle O&M costs to deploy and operate the system. These costs included estimates of the labor

[58] Avista's Officer Enterprise Technology Governance Group is composed of the President and CEO, Senior Vice President (SVP) of Energy Delivery, SVP of Energy Resources, SVP of External Affairs and Chief Customer Officer, Vice President (VP) and Chief Information and Security Officer, VP and Controller, VP and Chief Strategy Officer, and departmental directors representing key technology projects.
[59] Project contingency funds were included in the $165.4 million project operating budget.

requirements and direct expenses. Our experience with the actual costs of deployment, including our initial and current operation of the system, has eliminated the considerable uncertainty we faced when initially forecasting the lifecycle costs. As we continued to evaluate ongoing support and maintenance requirements, we implemented many efficiencies and modifications that decreased the ongoing support costs. A key efficiency was our development of an integrated AMI Operations team. This cross functional, multi-department team is supporting the system much more efficiently than with a traditional departmental support model. This concept was tested during phase one meter deployment and found to be very effective. Ultimately, this approach has allowed us to decrease the need for full-time support staff, helping to drive down costs compared with our estimates in the initial business case.

Another key modification was a change in our approach to supporting the data analytics platform. Initially, the Company expected to purchase a commercially available analytics platform, a fairly expensive system to purchase and maintain. After considerable research and analysis, however, we identified generic tools that were sufficient to meet project needs, allowing for a significant decrease in lifecycle costs.

Finally, our initial estimate of the costs for repairing/replacing failed new meters was based on an expected failure rate of 1% in each year of deployment.[60] After two years of deployment we are experiencing failure rates at approximately 0.25%. This small rate of failure has resulted in a substantial decrease in our long-term estimate of the cost to support and maintain our Itron Riva meters. Based on our actual costs, and a much more accurate forecast of long-term needs, our current estimate of nominal lifecycle O&M costs is $101,684,784, with a net present value of $47,106,554. This is $24.0 million below the 2016 estimate of lifecycle O&M costs, on a net present value basis. This again attests to the value of careful planning and active oversight.

E. Managing the Uncertainties of Major Technology Applications

A well-known characteristic of the installation of large technology applications is the degree of uncertainty reflected in the early stages of project scoping and design. While the Company was diligent in its initial estimates of the cost to implement these systems, given the timeframe in which they were developed, we did experience the common challenges associated with the progressive implementation of these projects. This included the frequent need to revisit issues of scope, requirements, resources and budgets to ensure their successful deployment. Overall, the contingency funding included in the total project budget was sufficient to cover project costs that were initially underestimated, combined with the costs for other projects that came in under budget, in allowing us to deliver the entire AMI system well within the approved capital budget.

F. Meter Data Management System

The initial design phases for the meter data management system were completed in the months following completion of the initial project budget in February 2016. The project budget was increased

[60] This failure rate was based on the Company's experience deploying smart meters as part of our Pullman Smart Grid Demonstration Project.

in August 2016 to $25.3 million based on the refined scope and requirements determined during this phase.[61] As noted above, the proposed increase in budget was reviewed and approved by the Executive Technology Steering Committee. As the meter data management project team continued in the testing and implementation phases, additional needs and requirements were identified that resulted in an increase to the project budget of $1.2 million. Also, based on this work, the initial date identified for the Go Live was pushed out. This decision, which was reviewed and approved by the Executive Technology Steering Committee was based on a review of the financial impacts and risk analyses of different alternatives. As the implementation progressed and all the testing and integration requirements were better understood, the budget was increased by an additional $2.7 million, for a total of $29.2 million, and the Go Live was moved to October 2017. As the project team prepared for this operation, they developed extensive plans for the Go Live process, as well as processes to support and manage issues identified immediately afterward. This more detailed planning identified the need for additional funding in the amount of $2.4 million from the overall project contingency fund. Following the successful Go Live operation of the system, we experienced a greater number of defects to be resolved than was initially estimated resulting in a final budget request to the Executive Technology Steering Committee of $1.9 million, for a final approved budget of $33.3 million. The final capital cost for this system was $33.0 million. Because the new meter data management system supports metering and billing in our other regulated jurisdictions, the final cost allocated to our Washington customers as part of the AMI system is approximately $18.7 million.

G. Head End Systems

This project, which was launched in October of 2016, consisted of the acquisition, installation, and integration of multiple software applications provided by our metering systems provider, Itron. The budget for this project, developed for the initial business case, was based on preliminary forecasts and planning assumptions learned from Avista's Smart Grid Demonstration Project, and prior to selection of our metering systems provider. In September 2016, Avista and Itron initiated the preliminary design phase of the project to validate previous assumptions and better understand the functional and non-functional requirements needed to achieve the customer benefits identified in the business case. The project budget was increased by $1.2 million in December 2016 based on the more detailed understanding of project requirements identified in the design phase. The detailed design was completed in March of 2017, at which time Itron notified the Company of a pending delay in their planned hardware and software releases.[62] Combined with other factors, this delay contributed to a recommendation to Executive Technology Steering Committee to delay timing of the planned meter deployment and to extend the overall project schedule by one year. The extension in schedule impacted the labor costs required for installing the head end systems and, combined with additional requirements identified in the detailed design work, resulted in the recommendation to increase funding by an additional $6.6 million. This request was approved by the Executive Technology Steering Committee in April 2017. In September 2018, as the team completed testing and implementation efforts prior to the phase one meter deployment, several additional scope

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[61] The costs for the meter data management system discussed in this section of the report are for the total project, however, the new system serves all customers in all jurisdictions, which costs have already been allocated to our customers in Idaho and Oregon. Therefore, our initial business case in 2016, and the current case, include only the meter data management system costs to be allocated to our Washington customers.
[62] The delay in release dates and other related impacts are discussed in some detail later in this Report.

requirements were identified as necessary to achieve functionality and security standards ahead of the phase two meter deployments. The Executive Technology Steering Committee approved an increase in the project budget of $0.8 million to complete this work. A final increase in the project budget of $2.3 million was approved in December 2018 to complete the additional scope, functionality, integration and testing requirements identified during phase one meter deployment. The final cost (WA share) for the initial deployment of the head end systems was slightly under the final approved budget of $21.7 million.[63]

H. Meter Collection Infrastructure

The Meter Collection Infrastructure, as represented in Figure 3-1, is a communication backhaul network covering Avista's Washington service territory that carries meter data and specialized command and control communications between the advanced meters and the utility. This network is an integrated system comprised of the Neighborhood Area Network, the Field Area Network and the Wide Area Network. In February 2016, the Company's initial budget for this project was estimated at $27.6 million. This estimate preceded the more detailed scoping, planning and contracting performed in later that year. The budget was revised downward prior to our contracting with Itron for advanced metering systems, which included communications infrastructure. And the project budget was revised again in December 2016 to $20 million based on a better forecast of the work required to complete the network. As the teams continued to develop increasingly more detailed infrastructure and software designs, installation labor estimates were reduced by $5.1million and estimated contracting costs were reduced by $2.4 million. Estimates of hardware costs did increase by $1 million due to unanticipated complexities. The project budget was revised downward accordingly to $11.1 million, which was reviewed and approved by the Executive Technology Steering Committee in April 2017.

The communications deployment plan was organized around the planned meter deployment schedule to ensure we would have a functional communications network at the time meters were installed. Phase one of meter deployment was planned as a small implementation to validate the overall deployment strategy, functionality, scale, network performance, meters, and all the respective systems. It also provided for validation of the overall functionality of the entire solution prior to moving to phase two of deployment. Deployment of the communications infrastructure was only minimally impacted by the delays in Itron software and hardware discussed above. One key issue being actively managed relates to problems with the 'range extender' hardware intended to help extend the communication range of the main network devices. Since deployment in phase one this hardware has not achieved performance expectations, which has been acknowledged by Itron. As a mitigation measure, additional main network devices are being deployed to achieve our required communications performance. Under terms of our contract with Itron, Avista is responsible for the first 10% of costs associated with the need for additional main network devices to achieve the required communications network performance, and Itron is responsible to provide the additional

[63] Following the implementation of the head end systems, Avista made several enhancements to the system that improved its functionality and security. The costs for these enhancements are included as part of the total project costs for the advanced metering system.

infrastructure beyond the 10% threshold at their cost. The currently expected final capital cost for this project is just under $11.1 million.

I. Product Maturity Challenges of the RIVA™ Metering System

In late 2014, Itron announced the launch of its Riva™ metering system. Beyond traditional smart metering capabilities, the Riva system was designed and equipped to support applications and computing capability installed in meters themselves (distributed computing power). Riva represented the next generation metering platform described as a new 'edge intelligence platform' supporting sensing technologies and dynamic applications at the device level. By embedding the operating system and processor into field devices and sensors, the system also had the potential to reduce traffic on our communications networks by reducing the burden of transmitting high volumes of data to our back office for analysis, interpretation and action. In Avista's view of the value of this platform was its potential to support control and analytics for automated decision making at the edge of the grid, key functionality supporting our Grid Edge roadmap. Further, the Riva platform had the potential for integration of third-party devices into the network, creating the future opportunity to unlock the value of 'the internet of things' in support of utility operations and more importantly our customers directly. At the same time, Avista understood the initial releases of such new systems could be fraught with delays, setbacks and disappointments, all of which add costs to a project. Avista weighed the value of implementing the new system with enabling characteristics key to our Grid Edge strategy with the potential costs that could be incurred with delays in a first-generation system and elected in September 2016 to purchase the new Riva system from Itron. The RIVA system, unlike others, will allow Avista to maximize potential applications. The systems purchased by the Company included head end system hardware and software, communications systems hardware and software, the electric meters and natural gas communicating modules and operating software, and some of the data analytics applications implemented by the Company.

Avista experienced its first delay in deliverables with the new system in March 2017, when Itron announced delays in the pending releases of system hardware and software. Combined with other head end and meter data management system challenges, briefly noted above, Avista made the decision to delay the planned meter deployment and to extend the project timeline by one year. This decision allowed us to reduce and manage risks to the project while optimizing the cost impacts associated with the delay. We also used the additional time to continue testing and optimizing the overall advanced metering system and to develop our integrated AMI operations team to support the system once deployed in the field. Apart from the deployment challenges, the need to extend the schedule had a substantial impact on the value of the expected financial benefits (reduced by approximately 15%). Fortunately, these are more than offset by cost savings described elsewhere.

Another impact related to the level of maturity of the Itron product related to complications in consistently gathering and displaying usage data to customers and in executing remote functions, such as the connect/disconnect feature. It has also taken longer than expected to refine the pinging function of the meters, a feature of great importance to the Company in being able to deliver expected service outage benefits. A further complication with these issues is that resolving them takes resources away from other planned work further exacerbating challenges around already tight delivery schedules. In addition, Itron and the Company faced another challenge related to the less than expected communications capability of its natural gas communications modules. Because of this final challenge, Avista is holding back deployment of approximately 20,000 modules in natural gas only areas until the second quarter of 2021. This will allow Itron time to enhance the natural gas-only technology with better coverage in these service areas.

As Avista faced these challenges, the project team engaged the Executive Technology Steering Committee in more frequent bi-weekly meetings and the team modeled the anticipated impacts of these technology challenges on the overall business case. In these discussions with the executive committee the team reviewed progress resolving issues identified and explored alternatives to support Avista's achievement of its business case and priorities. Through this process we evaluated whether additional hardware, software or other vendor solutions could be implemented to better optimize our progress and the customer value of our investment. As part of these discussions, the project team modeled the anticipated impacts of these technology challenges on likely project costs and benefits to ensure we were on track to deliver net financial benefits. In each instance we determined it was prudent to remain on track with Itron as our primary supplier and with the Riva metering system being implemented, compared with options to change products and solutions midstream.

Overall, the Riva system is performing well and is meeting the broad range of key business requirements, such as accurate metering and billing for Avista's customers, voltage monitoring and early notification of outage events. In each instance of these product challenges, Itron has worked with the Company to develop a plan of action to remedy the issues over the short and long term. Avista is continuing to work closely with Itron to ensure we timely achieve expected system performance. The impact of these remaining issues is reflected in the Company's current business case, both in terms of the cost impacts to the project and in the timing and magnitude of benefits we expect to deliver to our customers. The key point is the level of ongoing proper oversight by management to address problems, discuss solutions, and decide on final actions.

J. Meter Deployment

The original scope of the project included the installation of approximately 410,000 smart electric meters and natural gas communication modules. The initial budget for project was estimated at $77.8 million in our initial business case. Since 2016, however, the expected number has increased to approximately 430,000 meters and modules. Since development of the initial budget estimate and the completion of the Itron contract in September 2016, the meter deployment team continued to develop increasingly more detailed plans, which included meter deployment insights from others, revised labor and meter/module costs, increased customer numbers and an increase in the costs for customer engagement and communications. The project team revised upward the budget forecast based on this information to $81.9 million.

As the Company performed the initial planning for the meter deployment phase of the project, the activities were organized into two initiatives: actual meter deployment, and customer engagement and communications.

Meter/Module Deployment The deployment phase covers the physical installation of smart meters and natural gas modules to all Avista customers in the State of Washington.[64] Deployment was planned to include a careful inspection of the electric meter bases and sockets, including the repair of any unsafe or damaged meter sockets identified in this process. We also replaced any obsolete meter sockets (A-Base sockets) that were not capable of receiving a new smart meter without an upgrade. Because the meter base and socket is owned by the customer, who is ultimately responsible for providing a safe and adequate mount for our electric meters, we have included the costs of meter socket repair and A-Base replacements (currently estimated at a net present value of $6.3 million) as both a project cost and a direct customer benefit in our business case, as discussed in Section 4 of this Report.

Customer Communications Avista was familiar with the reported negative experiences of other utilities who had not sufficiently engaged or communicated with their customers prior to AMI deployment. We understood that an inadequate communications effort could result in a backlash that might jeopardize the entire deployment. Accordingly, we developed a robust communications strategy and customer engagement plan discussed later in this section.

When the delay in hardware and software was announced, and the project timeline was extended, the meter deployment team continued planning sessions with other project teams, Itron and meter deployment contractors to develop more detailed planning information and estimates. Two key changes in the meter deployment project were made as a result of this effort: 1) the deployment timeline was reduced from 24 to 20 months, which reduced the estimated labor cost, and 2) additional costs were included to meet communication and programming requirements for natural gas modules, and A-Base change out costs were updated based on project experience to date. As a result of this evaluation, the meter deployment budget was revised downward to $79.5 million, which was approved by the Executive Technology Steering Committee in April 2017.

METER DEPLOYMENT PROJECT MILESTONES AND STATUS

In August 2018, as the team prepared for phase one meter installations, we completed a thorough schedule and budget analysis incorporating all new information gathered since the prior budget revision. Key information included the following:

1. Executing the contract for meter deployment with the firm Wellington Energy, which included updated labor and unit cost estimates for meter base/socket repairs.
2. Finalizing the customer engagement and communication plan, including updated print and mailing costs.
3. Estimating meter socket repair volume and costs and other internal labor costs.

Using this information, the project team revised upward the expected deployment costs to $87 million and requested $7.6 million in project contingency funds to cover these costs. This increase was presented to, and approved by, the Executive Technology Steering Committee in August 2018.

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[64] The project excluded the Goldendale and Stevenson areas where Avista serves natural gas only to approximately 3,000 customers. Meter reading in these areas is already performed wirelessly by mobile van routes, and the cost of upgrading them to AMI was not reasonable given the required costs.

Phase One Deployment Outcome

The intent of phase one was to validate the overall deployment strategy, functionality, scale, network performance, meters, and all respective systems before moving forward into phase two. Before initiating the deployment, the project team carefully reviewed the risks across the entire program, which were grouped in the following sub-areas:

- Requirements and Testing
- Enterprise Technology Capability
- Security
- Wellington Preparation for Deployment
- Business Processes
- Avista Employee Preparedness
- Customer Communications, and
- Operations Support

The team identified existing risks in the Requirements and Testing category for the Head End System and in the Operations Support area, and determined there were acceptable mitigation plans in place. The Executive team approved the project team's recommendation to proceed with phase one on August 30, 2018. Meter and gas module deployments began in September 2018, and the Wellington-Avista team completed 3,858 exchanges on time by the end of October. Electric meter base/socket repair volumes were recorded at 1.5% of total volume and were within estimates. There were no major customer complaints or issues, and both Wellington and Avista call center volumes regarding AMI were negligible. Meter read rates after network mitigation activities achieved an acceptable standard for this phase of the project. In parallel to the deployment, we formed a new "AMI Operations" team to support the back-office systems and the communications network in order to gain better insight into the requirements necessary for a successful full deployment in phase two and long-term operations support.

Phase 2 Deployment Outcome

Following multiple review sessions and detailed identification of and mitigation of potential risks, Avista's Executive team approved phase two deployment of 409,000 meters and modules to proceed, which commenced in March 2019. To date, the deployment activities are proceeding extremely well, with current deployment at 98% complete for electric meters and 95% complete for natural gas meter modules. The overall, deployment schedule and budget are currently on target and are tracking to complete as planned. Wellington Energy, Avista's smart meter deployment contractor, has maintained a customer focus throughout deployment resulting in low customer complaints and claims related to the quality of their work.

K. Data Analytics

Avista's data analytics portion of the project was created to determine the functional requirements, data and analytics that would be necessary to capture the benefits expected from our advanced metering system. The initial estimate of the cost for this project was $9.1 million and was based on the expectation we would likely purchase enhancements from our ultimate meter solutions provider as an alternative to creating the applications in house.[65] Accordingly, Avista planned to purchase grid applications from Itron to support benefits related to outage management and theft/diversion of service. In June 2018, Itron informed Avista that the communications necessary to support these applications would be delayed for release until early 2020. As a result of this delay, and the impact it would have had on our ability to begin delivering some of the customer benefits, Avista did not purchase Itron's outage or theft applications. We focused instead on creating solutions internally to help capture these benefits. In May 2019, the Data Analytics project budget was revised downward to $6.4 million to more accurately reflect the likely costs to accomplish this revised scope of work. The initial Go Live for the Data Analytics project was September 2018, and the overall project will be completed under budget.

L. Customer Data Privacy, Cyber Security and Disaster Recovery

Throughout the deployment of the system Avista has continuously revised, improved and updated its capabilities for protecting the privacy of our customers' personal data, ensuring our infrastructure and business operations are safe from cyber threats, and taking steps to safeguard the integrity of our critical business operations through disaster recovery planning.

(1) CUSTOMER DATA PRIVACY

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 range of data captured and monitored by the system. With advanced metering, the Company collects and stores very detailed data on kWh use, demand, voltage level, meter status, and other service-level information for each customer. Besides using this information for billing and making it available to customers through the web portal, we are using this information for a variety of analyses described in this Report, including heating and cooling equipment diagnosis, and identifying customers for tailored energy conservation programs, as examples. Among many other uses, advanced metering is allowing the Company to send customers text messages based on usage parameters they select, to instantly notify the Company to identify potential problems with the meter, including issues on the customer's side of the meter. Additionally, Avista meter alarms instantly notify us of service outages and allow us to determine when service has been restored to all customers. Customers' energy use data is also available for them to safely and securely download and share with third-party service providers of their choice.

Avista has long been committed to protecting our customers' safety, security and privacy. We recognized early in planning for our advanced metering system that the increase in the volume and flow of customer data would raise privacy concerns about what data would be collected, how it would be used, and how it would be protected. The Commission also recognized the need to update its rules on customer privacy, initiating a rulemaking and workshop process in 2018. Avista has worked collaboratively with the Commission and other parties to develop updated rules that balance a utility's ability

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[65] This budget amount also included the mitigation costs identified in our initial business case for the conservation voltage reduction program that were subsequently included under Data Analytics. For the purposes of this Report to provide a category by category comparison between our initial and current business cases, the conservation voltage mitigation costs have been removed from Data Analytics and are reported separately under the title Energy Efficiency.

to use customer information (both operationally and to drive value for the customer) with customer privacy concerns. Those changes to WAC 480-100-153 were adopted on July 29, 2020 as part of the Commission's General Order R-600 in Docket U-180525. In addition to these rule changes, in 2019 the State of Washington began to consider privacy legislation under the umbrella of the "Washington Privacy Act." Similar to privacy legislation enacted in Europe and in California, these proposals would give individuals rights to their personal information, including the right of access, to correct or delete their personal data collected by commercial entities, and the right to opt out of certain forms of data processing. Although broader than "customer information" in the utility context, this legislation, if passed, will govern the company's use of our customers' personally identifiable information.

In consideration of our stance in protecting our customers' data privacy, the heightened concern of our customers, and the intent of new Commission rules and legislation, Avista engaged a consultant to perform a "gap analysis" and create a roadmap for creating a more comprehensive privacy program, which is currently being implemented. The privacy program will implement robust procedures for the collection, use and protection of customers' personal information, including any personally-identifying information collected from our smart meters. Avista has designated a Chief of Privacy and Data Ethics, who is responsible for ensuring all the Company's privacy policies comply with all applicable laws and regulations, and for implementing legal and ethical training for employees on their role in protecting customer privacy. The privacy program also includes a baseline inventory to identify all personal information being collected and stored. This inventory will help identify any areas that may require additional attention and to help establish processes for responding to customers' requests about their data.

(2) DATA GOVERNANCE

Avista has also developed a Data Governance Program to consolidate existing processes and work functions and establish policies, procedures, standards and accountability necessary to create a sustainable culture of data stewardship, ownership and compliance. The key tenets of the data governance program are to ensure that the collection, usage and sharing of data is legally compliant, that it serves a legitimate business interest, and that it is ethical. As part of the data governance program, a Data Governance Council was established to provide leadership and decision-making on issues relating to data governance, such as requests to share data outside the Company. Data sharing requests are reviewed and approved only with the cross-functional perspective of the leaders on the Data Governance Council. Any requests to share customer information collected from meters will be reviewed by the Data Governance Council and any approvals documented along with any necessary consents and data sharing agreements.

(3) SECURITY CONTROL

As part of implementing the Data Governance Program and privacy program policies, Avista has implemented extensive security controls to ensure the 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 maintained on secure systems with restricted access. All Company employees and contractors acting on Avista's behalf who have access to customer information are required to comply with Avista's privacy and security practices and policies.

(4) CYBER SECURITY PROTECTIONS

Avista's cyber security practices are designed to ensure 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.

Because our advanced metering system can control the delivery of energy, among other key functions, Avista recognized the need to protect these systems beyond requirements for typical back-office systems. Ensuring adequate protections started during the procurement phase where security was embedded in the Request for Proposals (RFP) process and was scored alongside other business requirements. The evaluation criteria included and leveraged resources from NIST, NERC, DHS,[66] and other applicable security standards to help evaluate the security of the proposed vendor solutions. Additionally, after the vendor was selected, Avista took many of the same security elements from the RFP process and turned them into contractual requirements. This established accountabilities for the vendor to deliver on their stated commitments in the RFP process and during and following project implementation. Avista also created a secure network architecture around the AMI head end systems. This secure network was modeled after other energy delivery systems security models and leveraged many of the same controls that are used to protect power systems. Lastly, we will continue to monitor advancements in security safeguards through our participation in industry working groups and other forums, ensuring security is effectively managed throughout the lifecycle of the advanced metering system.

(5) DISASTER RECOVERY

Because the head end systems control the primary communication of meter data from our advanced meters in the field back to Avista, the project and Executive teams developed and approved implementation of a disaster recovery plan to support this critical system. This plan is similar to others we have for critical integrated systems and applications. Essentially, the plan addresses emergencies that could interrupt access to Avista's Spokane data center and would provide the capability to be able to recover and read meters for web presentment and billing. This project defined the enterprise business continuity/disaster recovery process and systems required to continue to meet critical business needs. The required hardware, software, data storage, network communications, and infrastructure, as well as recovery images, were added to our disaster recovery systems in our San Jose data center. Avista now has an updated restoration procedure, combined with daily backups, to ensure the integrity of our head end system's critical functions. The Executive

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[66] National Institute of Standards and Technology (NIST), North American Electric Reliability Corporation (NERC), and Department of Homeland Security (DHS).

Technology Steering Committee approved an initial budget of $1.1 million for this project, which was completed approximately $400,000 under budget.

M. Customer Engagement and Communications

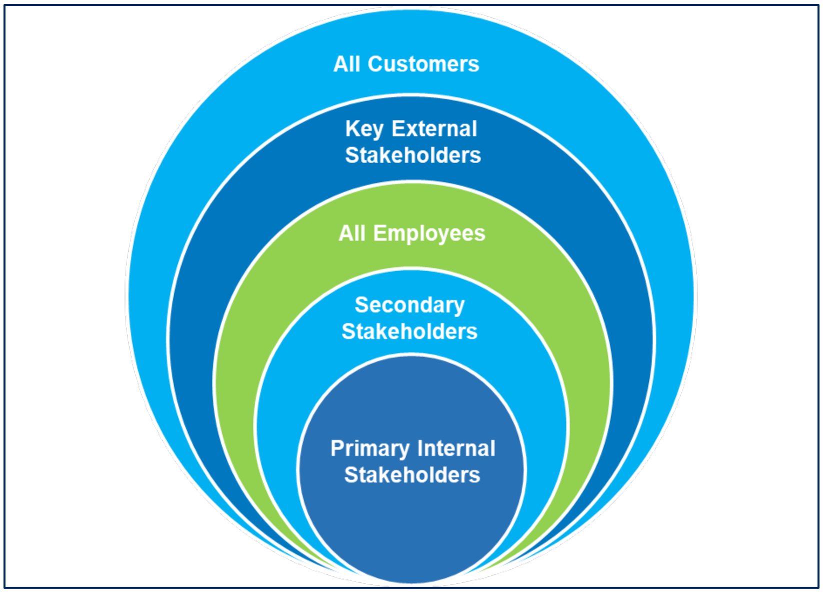
As noted earlier, Avista understood the potential for the rollout of its advanced metering system to be derailed if customers were not somewhat familiar with and comfortable with the technology. We knew from similar deployments gone awry that the stakes were high, and the risks were real. Our public may have already been exposed to negative media coverage from other AMI deployments across the country and, being one of the largest capital projects in Avista's history, public acceptance was a critical element of the program's success. From our experience communicating and working through complex issues with our customers, we proactively trained affected employees to engage, communicate, share information with and work through issues with the multiple internal and external stakeholders whose support would be key to a successful implementation. Appendix A contains a complete discussion of our communications initiatives, actions taken, materials produced and distributed and results of our efforts.

Early in the detailed planning process that followed our initial business case, Avista dedicated a full-time senior communications manager to create and lead a cross-functional communications and outreach team to develop and execute the advanced metering Communications and Outreach Plan. The plan's primary goals included building awareness and support for the technology and creating a positive customer experience around the meter exchange. By building understanding, support and a positive experience, we hope that customers will be more inclined to view their energy usage when it's available and also open to engaging in future offerings the Company may propose after this foundational technology is in place.

The plan covered internal communications, a change management process with directly-impacted employees, community outreach with external stakeholders (e.g., elected officials, community and business leaders), and communication with both commercial and residential customers and media relations. In this process Avista sought to engage customers and help them understand the benefits of this new technology and to be aware of when the deployment of meters was nearing their locale.

To better tailor communications to our customers, the Company conducted an AMI awareness and support survey in 2016. Key findings showed less than one-third of the participants were aware of smart meters; about one third of those customers expressed support of the technology. The survey also helped identify customer concerns, areas in Avista's service territory with the highest and lowest levels of support, and insights about the benefits customers valued most. We also used focus groups in 2016 to test how customers responded to various proposed communication formats, visual content, and messages. Their feedback and preferences informed Avista's communication strategy. For example, participants preferred communication samples that showed a photo of the new smart meter because it looked just like their existing meter. This preference was incorporated into many of the customer communication materials.

One of the top priorities for our strategy was to communicate early and often with customers, sharing factual information, and creating a positive customer experience during the meter installation. Avista intentionally branded the project with the theme "Smarter Together" to set the stage for collaborating with our customers in new ways. Key stakeholder groups and audiences are identified in the diagrams below.



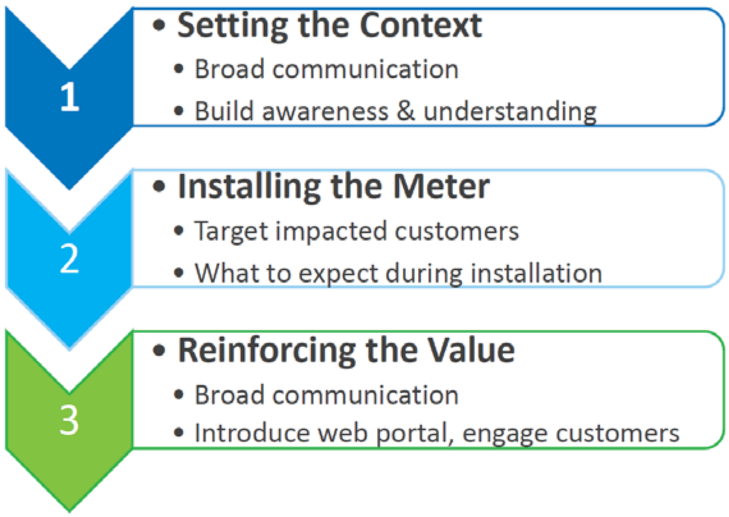
Key stakeholder groups and audiences identified as part of Avista's communication plan for deployment of its advanced metering system.

Audiences	Description
Primary Internal Stakeholders	AMI Project Team Employees
Secondary Stakeholders	Employees impacted by AMI Change Management – How am I impacted?
All Employees	All Employees: Broad Internal Communication – General knowledge of project and benefits
Key External Stakeholders	Community & Business Leaders Elected Officials
All Customers	Customers in WA and ID The media covers and reaches both states

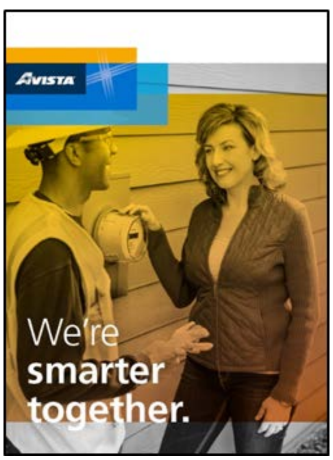
(1) Customer Engagement – A Phased Approach

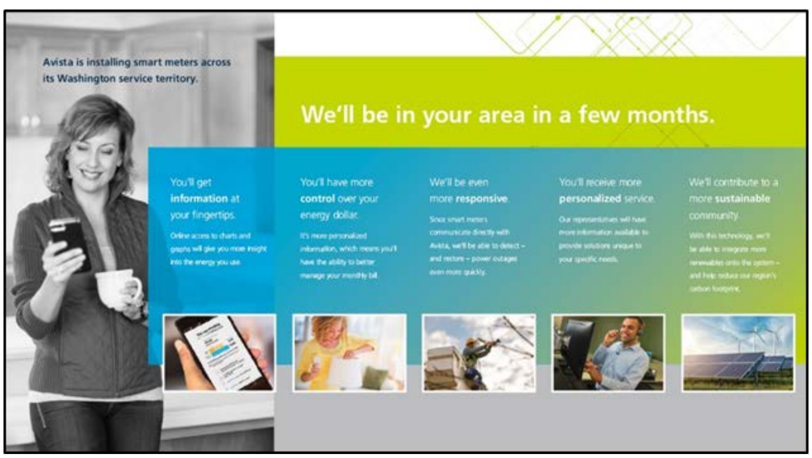
Avista's Customer Engagement Vision was established as the "north star" to strategically guide all external customer engagement efforts through the planned three phases of external communication, as represented in the diagram below: By offering the **right information** to the **right customers** through the **right channels** at the **right time**, we engage customers to make informed energy management decisions and adopt choices that matter most as we prepare for the energy future.

Phases of communication developed for Avista's advanced metering system communications plan.



Phase One: The goal of phase one was to set the context for the project and build awareness and understanding of the technology and the five customer benefits. In this phase a tri-fold direct mail brochure (pictured below) was sent to customers 90 days before meter installation, along with hosting five Smarter Together Community Leader events, holding media events, and creating the *myavista.com/smartmeters* website filled with information to build awareness and understanding about the benefits of AMI.





Phase Two: The goal of phase two was to let customers know what to expect when the meter/module was installed at their home or business. Targeted communication tools included the 60- and 21-day direct mail pieces tailored to residential, business, and multi-property owners. Teams used a variety of door hangers once the smart meter (or non-communicating meter/module for opt-out customers) was installed, or an attempt to replace the meter had been unsuccessful.

Phase Three: The goal of phase three was to introduce the customer to their new energy usage information and how to access it. Avista developed three different communication tools to engage customers with new tools available on the web to help them understand their energy use. To help ensure a positive customer experience, Avista waited until after the meter was installed and certified and had collected at least 30 days of usage data so customers could observe some usage trend information from the prior month. When customers accessed their *myavista.com* account for the first time, a series of slides played automatically to introduce them to the new usage information they could access.

Avista sent a final direct mail communication brochure to encourage customers to access the web portal and to watch the video available on the *myavista.com/smartmeters* website, highlighting the energy use information now available with their smart meter.

(2) Community Leader Outreach

Timed to precede AMI deployment in targeted areas, Avista delivered more than 150 presentations to a variety of community leaders across the service territory between 2018 and 2020. City councils and county commissions learned about smart meters during these presentations, along with over 12,700 customers watching these meetings from home. Overall, the Company reached an estimated 3,300 community leaders and advocates with proactive smart meter information. This outreach included presentations to Chambers of Commerce, civic groups including Rotary and Lions and Kiwanis clubs, tenant associations, retirement communities, and collaborations with community groups including libraries and non-profit coalitions.

(3) Avista's Smart Meter Website

To provide a "one-stop-shop" location where customers would be able to find a wealth of information about smart meters, Avista created a website to serve as a resource for multiple audiences – both internal and external stakeholders alike. The *myavista.com/smartmeters* website contains everything from customer benefits and deployment maps and schedules to FAQs and opt-out information. All the customer and community communication materials include the link to this website so people can easily seek more information if they desire.

In February 2019, Avista conducted a second AMI awareness and support survey to measure awareness and support compared to our results from 2016. Key findings included:

- Awareness of smart meters and smart grids among Washington residents rose to 60%, more than double compared to 27% in 2016 and 22% in 2015.
- Following Avista's February media event, smart meter awareness rose significantly. 53% of customers were aware of smart meters before the event, versus 69% after the media event.

- TV news, newspapers, and radio are the most common source of information for the awareness of customers.
- The extensive, positive coverage of the media events also had an impact. Customers cited their awareness from news sources was 27% before the event, versus 50% after the media event.
- Avista mailers were the second-highest source of customer awareness – 25% before the media event, versus 35% after the event.

The above survey results indicated that Avista's strategy to leverage media relations for broad communication to tell our story had a substantial impact on customer awareness and support for AMI. The direct mail communication materials have successfully contributed to raising awareness levels about smart meters among customers.

(4) Summary of External Communications

There is no question that Avista's communication tools and approaches across multiple channels were successful in reaching critical internal and external stakeholders. The key messages and foundational collateral materials were leveraged across all audiences to ensure consistency. The detailed and thorough planning contributed significantly toward garnering customer acceptance of the technology and the AMI program's overall success. Seventy-five different internal and external communication tools had been created and produced for this project as of April 2020, grouped in the following categories:

- Customer Videos: Smarter Together, Reliability, Meter Installation Process, Energy Usage Information Web Features, Opt-Out Questions.
- Printed Customer Communications: Fact Sheets, FAQ, Deployment Maps, etc.
- Media Events: Graphic elements
- Smarter Together Community Leader Events and Displays (tent events)
- Employee Communications: Pocket cards for field personnel
- Customer Website and Social Media: Small segment content for web and social media format
- Meter Installation Customer Communications: 90-, 60-, and 21-day notifications and door hangers
- Opt-Out Customer Communications: Applications and letters
- Special Mailings: Zone 10/Colville special mailing materials and promotions
- Community Outreach Support Telephone Town Halls: Print ads, email, web, social media promotional materials
- Connections Customer Newsletter Articles: Articles and graphics

Section 4 | Customer Benefits with Quantified Financial Value

A. Overview

(1) Initial Value and Current Expectations for Financial Benefits

As noted in Section 2 of this Report, Avista's advanced metering system provides a central platform necessary to meet a range of strategic objectives in the service of our customers and the operation of our business. In this respect, the value proposition of AMI is much greater than the sum of the incremental financial benefits quantified in the Company's initial business case and this updated Report. Avista does, however, recognize the importance of proving out the financial benefits of the investment. And on this basis alone, our advanced metering system produces positive net financial benefits for our customers.

Across the board, as noted elsewhere in this report, the value of benefits initially estimated was impacted by the year-long delay in implementation described in Section 3. This shift in deployment, though certainly the prudent decision for the project and Avista's customers, delayed the realization of financial benefits. This delay impacted the overall cash value and reduced their lifecycle net present value. As we gained experience during deployment and continued to refine our estimates the expected value of several benefits was further reduced, based on challenges or system limitations identified during deployment. We also experienced greater financial benefits in other areas, however, supported by findings that exceeded our initial expectations including newly-identified areas of benefit. Accordingly, for each benefit discussed in this section, we describe the initially expected value, followed by our current forecast and a brief explanation of the reason(s) for the reduction or increase reported. The categories and order of benefits discussed here correspond with those described in our initial business case, as shown in the table below.

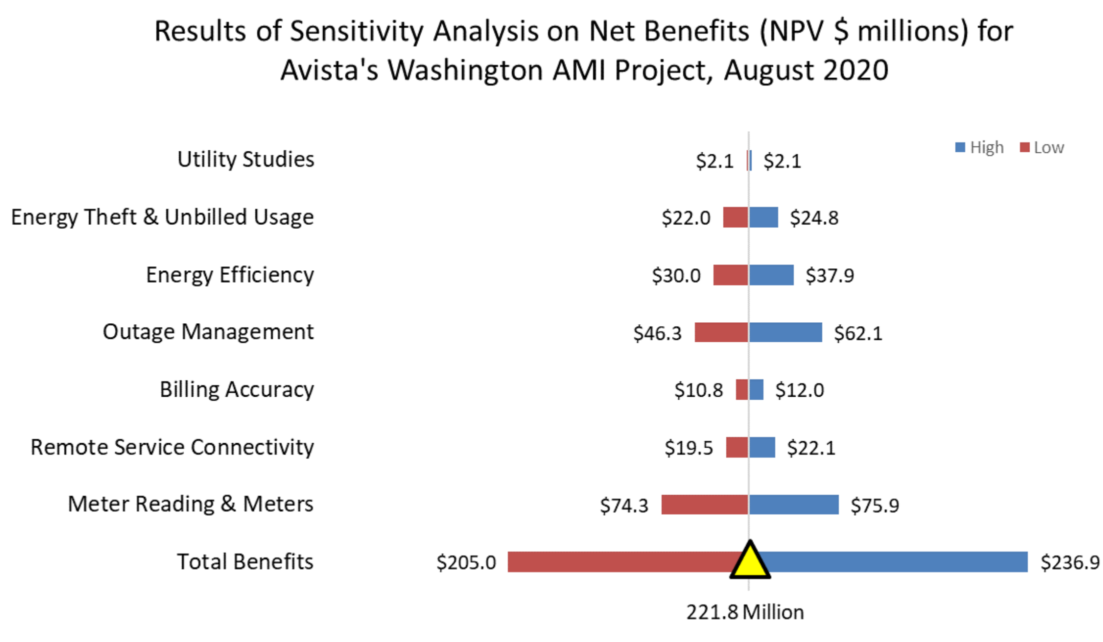
TABLE 4-1. FORECASTS OF ESTIMATED CUSTOMER BENEFITS FINANCIALLY QUANTIFIED IN THE COMPANY'S INITIAL BUSINESS CASE IN FEBRUARY 2016 AND IN AUGUST 2020.

Area of Benefit	Expected NPV 2016	Expected NPV 2020
Meter Reading and Meter Salvage	$75,920,112	$75,578,278
Remote Service Connectivity	$24,332,683	$22,010,615
Outage Management	$40,331,781	$53,723,041
Energy Efficiency	$59,384,914	$33,686,230
Energy Theft and Unbilled Usage	$28,880,881	$23,395,770
Billing Accuracy	$10,648,127	$11,406,347
Utility Studies	$2,201,905	$2,050,632
Total	**$241,700,403**	**$221,850,913**

[For the complete tabulation of benefits that includes subcategories under each of these areas of benefit, please see master table of benefits, Table 1-4 in the Executive Summary]

Nearing completion of the deployment phase, we have gained knowledge and experience allowing us to better understand and reduce much of the uncertainty around achievement of these benefits. Our current estimates of the potential variability for each benefit category are presented in the figure below.

FIGURE 4-1. RESULTS OF SENSITIVITY ANALYSIS FOR QUANTIFIED BENEFITS (NPV $MILLIONS) ESTIMATED IN AUGUST 2020.



As expected, the potential range in benefits for each category, and the range in total, is reduced from our initial estimates. Even if Avista were to only achieve the extreme lower end of the range in variability in benefits ($205.0 million), the project would still produce positive net benefits exceeding $35 million. And this would not even count any new financial benefits, nor many other "non-quantifiable" (but real) benefits such as safety, power quality, convenience, and service.

The currently estimated annual cash value by year for each area of benefit over the project lifecycle is presented in the table below.

TABLE 4-2. ACTUAL AND ESTIMATED LIFECYCLE FINANCIAL BENEFITS FOR EACH YEAR OF THE PROJECT (ON A CASH BASIS IN $MILLIONS) FOR AVISTA'S ADVANCED METERING INFRASTRUCTURE PROJECT, AS OF AUGUST 2020.

Year	Meter Reading & Meters	Remote Service Connect	Outage Management	Energy Efficiency	Energy Theft & Unbilled	Billing Accuracy	Utility Studies	Total
2016	$0.7				$ 0.1		$ 0.1	$ 0.9
2017	$ 0.7				$ 0.4		$ 0.1	$ 1.2
2018	$ 2.9				$ 0.4		$ 0.4	$ 3.8
2019	$ 5.3	$ 0.5		$ 0.5	$ 0.9	$ 0.3	$0.1	$ 7.7
2020	$ 8.1	$ 1.4	$ 1.1	$ 1.3	$ 1.9	$ 0.9	$ 0.1	$ 14.8
2021	$ 4.8	$ 1.4	$ 2.4	$ 1.7	$ 1.9	$ 0.9	$ 0.1	$ 13.3
2022	$ 5.1	$ 1.5	$ 3.8	$ 2.1	$ 2.0	$ 0.9	$ 0.1	$ 15.5
2023	$ 7.0	$ 2.1	$ 5.6	$ 2.9	$ 2.4	$ 1.3	$ 0.2	$ 21.6
2024	$ 7.6	$ 2.2	$ 7.1	$ 3.9	$ 2.5	$ 1.3	$ 0.1	$ 24.8
2025	$ 8.0	$ 2.2	$ 7.3	$ 4.0	$ 2.6	$ 1.4	$ 0.2	$ 25.9
2026	$ 8.5	$ 2.3	$ 7.6	$ 4.3	$ 2.7	$ 1.4	$ 0.2	$ 27.1
2027	$ 9.0	$ 2.4	$ 7.9	$ 4.5	$ 2.8	$ 1.5	$ 0.2	$ 28.3
2028	$ 9.6	$ 2.5	$ 8.1	$ 4.7	$ 2.9	$ 1.6	$ 0.2	$ 29.6
2029	$ 10.1	$ 2.6	$ 8.4	$ 4.9	$ 3.0	$ 1.6	$ 0.2	$ 30.8
2030	$ 10.2	$ 2.7	$ 8.7	$ 5.2	$ 3.1	$ 1.7	$ 0.2	$ 31.8
2031	$ 10.4	$ 2.8	$ 9.0	$ 5.4	$ 3.2	$ 1.7	$ 0.2	$ 32.8
2032	$ 10.5	$ 2.9	$ 9.3	$ 5.6	$ 3.3	$ 1.8	$ 0.2	$ 33.7
2033	$ 10.6	$ 3.1	$ 9.6	$ 5.9	$ 3.4	$ 1.9	$ 0.3	$ 34.7
2034	$ 10.7	$ 3.2	$ 10.0	$ 6.1	$ 3.6	$ 1.9	$ 0.2	$ 35.7
2035	$ 10.9	$ 3.3	$ 10.3	$ 6.4	$ 3.7	$ 2.0	$ 0.2	$ 36.9
2036	$ 11.2	$ 3.4	$ 10.7	$ 6.8	$ 3.8	$ 2.1	$ 0.2	$ 38.3
2037	$2.8	$ 0.9	$2.8	$ 0.8	$ 2.0	$ 0.5	$ 0.1	$ 9.8
Total	$ 164.9	$ 43.6	$ 129.7	$ 77.2	$ 52.7	$ 26.8	$ 4.0	$ 498.8

B. Meter Reading and Meters

(1) Regular Reads

(a) Initial Estimate of Project Benefits

As expected in the Company's initial business case, the deployment of advanced meters virtually eliminates manual meter reading, providing substantial operational savings.[67] Avista's expected savings are based on 2016 operational costs for approximately 41 meter readers in the Washington service area that completed 4.65 million manual reads on regular routes. Costs for manual meter reading included labor, meter reading hardware, and transportation, along with apportioned costs for facilities, administration, and safety-related incidents.

As shown below in Table 4-3, Avista's initial estimate of the financial savings for customers over the life of the project had a net present value of $68,939,150. Savings were based on historical growth in meter reading costs associated with improvements in technology and an increase in the number of customers served, including expected inflation.

TABLE 4-3. NET PRESENT VALUE OF FINANCIAL BENEFITS ESTIMATED FOR METER READING AND METERS IN AVISTA'S INITIAL ADVANCED METERING BUSINESS CASE (2016) AND IN AUGUST 2020.

Meter Reading & Meters		
Category	**Lifecycle Net Present Value 2016**	**Lifecycle Net Present Value 2020**
Regular Reads	$68,939,150	$60,938,371
Special Reads	$445,092	$372,120
Net Metering	$4,567,870	$4,627,144
Customer Meter Base Repairs	Not included in initial case	$6,302,323
Natural Gas Meter Refresh	Not included in initial case	$3,190,319
Salvage Value	$148,000	$148,000
Local Economy Jobs[68]	$1,820,000	No longer included in current estimate
Total	$75,920,112	$75,578,278

[67] Notwithstanding the expensive manual reading of meters required for customers who opt out of having a smart meter or module installed at their home or business.

[68] Although Avista documented a much greater local economic benefit than initially estimated, no financial value for this benefit is currently included in the business case.

(b) Currently Expected Benefits

Avista has revised its estimate of the value of financial benefits for regular meter reading, as shown above in Table 4-3, based on our experience to date. We revised downward the initial starting budget for meter reading (the baseline for project savings used in the initial business case), based on several accounting adjustments and to reflect the lower-than-expected costs created by an increase in turnover among meter reading employees leaving for other positions in the Company (replacement new hires start at lower wages, accrual of personal leave and overheads, etc.). Potential savings were revised upward slightly during deployment to correct an inadvertent double-counting of manual meter reading expenses incurred during the transition from manual to automated meter reading. Finally, as noted above, the level of benefit was negatively impacted by the yearlong delay in deployment.

(2) Special Reads

(a) Initial Estimate of Project Benefits

Also documented in Avista's initial business case was the need for meter readers to perform an average of 7,740 special meter reads each year. The need for these special reads arose from many instances where the usage on the meter had to be field verified between the regular reading cycle. While special reads were a small fraction of the overall reads gathered, they represented a significant cost since they were often not part of the meter reader's regular assigned route. In addition to the time spent gathering the read, there were added costs for driving to and from the individual premises, and for the customer service representative's time spent setting up the read and then updating the customer information after the read was complete. The need for special reads is nearly eliminated through advanced metering since the meter can be remotely queried at any time for a current read. This, of course, excludes the regulatory provision for customers to choose to not be served by an advanced meter (opt out), thus requiring the regular use of very inefficient manual meter reading. The Company's currently estimated cost for reading an opt out service is $56; however, we believe this cost can be reduced somewhat once deployment is complete and opt-out customer meter reading routes have been optimized. Avista anticipates the excess costs required to manually read opt-out meters, which is currently not being collected from those customers, will be trued up at the conclusion of the Company's pilot opt out tariff. Avista's estimate of the financial savings for customers over the life of the project had a net present value of $445,092 as shown above in Table 4-3.

(b) Currently Expected Benefits

Avista has slightly revised its estimate of the net present value of financial benefits for special reads meter reading, as shown above in Table 4-3. In addition to the delay in deployment, the expected reduction in special reads did not immediately materialize during deployment as a result of checks necessary to resolve a range of new meter issues. Avista is now experiencing the expected benefits, however, as deployment proceeds and outstanding meter issues are resolved.

(3) Net Metering

(a) Initial Estimate of Project Benefits

Customers who install distributed energy resources in Washington, such as solar panels, have been required to install two meters for their electric service: one meter measures energy consumed as well as net energy flowing back onto the grid (bi-directional net meter), and the other measures just the energy produced from the generating resource (production meter). Prior to our deployment of advanced metering, the meters used in net metering cost significantly more than the advanced meters in place today. In addition to the meter costs, there were costs associated with a service person's visit to the premise and meter installation. The advanced meters eliminate the need and cost to install special metering because they are fully capable of meeting the required net metering functionality. Customer savings were based on eliminating the need to install production meters at the customers' premises and the forecasted growth in net metering in Avista's Washington service area. Avista's initial estimate of the financial savings for customers over the life of the project had a net present value of $4,567,870, as shown above in Table 4-3.

(b) Currently Expected Benefits

The early trend in annual solar installations has been tracking with the Company's initial forecast, which is expected to continue to accelerate through 2028. Avista is unsure at this point whether the current global pandemic, which is causing widespread economic upheaval, will materially impact the annual number of net metering installs. As noted in the Company's initial business case, external factors such as the economy, and state and federal government policies, are expected to impact the ultimate number of customer-owned generators installed, and therefore, the total benefit achieved. As a result of the delayed meter deployment, Avista has revised lower its estimate of the present value of financial benefits for customers implementing net metering, as reflected above in Table 4-3.

(4) Customer Meter Base and Socket Repair

(a) Overview of the Program

Part of Avista's preparation for installing advanced meters was understanding the challenges documented by other utilities who had deployed the technology. A consistent theme we heard from utilities and their meter deployment contractors was the need to plan for assessing and handling repairs required on customer meter bases and sockets.[69] In other parts of the country, up to 10% of customer-owned sockets required repairs to safety install new metering technology. Based on our experience in the Smart Grid Demonstration Project completed in Pullman, WA in 2011, we anticipated that approximately 3% of the meter sockets would require repairs. We viewed the deployment as a good opportunity to address these safety concerns for all our Washington

[69] The meter socket is the point of connection for the electric meter, which is an integrated part of the meter base. It is the meter base that is physically attached to the customers' residence or business.

customers since we would be visually inspecting and testing every customer's meter base and socket.

Working with Wellington Energy, our meter deployment contractor, a meter socket safety assessment process was conducted before every installation. Specialized equipment was used to verify the meter socket was safe and the worker was required to take pictures before and after installation. In addition to the socket test, the installer also performed a visual inspection of the overall meter base to verify there were no visual indicators of potential safety concerns. The new advanced meter was installed if the meter base passed the visual inspection and socket test. When potential safety issues were identified, Wellington referred the service to a team of qualified electricians who completed necessary socket repairs for the customer so the advanced meter could be safely installed on a subsequent visit. All costs associated with meter base and socket repairs were included as a cost of meter deployment and the repair costs are also included here as a direct customer benefit. This benefit arises because it is the customer's responsibility to provide an adequate and safe meter base and socket, and it is the customer who bears the costs associated with the consequences of any failure in the meter base or socket. Beyond this direct benefit to customers of making their equipment safe, we were able to perform the repairs for them at a lower cost than they would have been able to procure, and we also helped ensure they would avoid potentially greater long-term risks with their service.

(b) Initial Estimate of Project Benefits

We had not identified this need in our initial business case and, accordingly, did not include any financial benefits for our customers related to this program.

(c) Currently Expected Benefits

To date we have inspected over 98 percent of our electric meter base/sockets and we expect to repair approximately 5,300 of them by the end of deployment based on the current failure rate of approximately 1.9%. The net present value of the estimated total cost and the customer benefit is $6.3 million as shown above in Table 4-3.

(5) Avoided Replacement Costs for Natural Gas Meter Modules

(a) Overview of the Program

Prior to deployment of our advanced metering system we had widely deployed communicating natural gas meter modules[70] in many remote 'gas-only' parts of our Washington service area. These modules are not connected to an energy source and rely on batteries to power their wireless communication. As many of these units were reaching the end of their useful service life, based in part on the need to replace the internal batteries, we had budgeted the capital costs necessary to refresh this system. Since these gas meter modules are being replaced as part of our advanced

[70] Often referred to as an Encoder/Receiver/Transmitter or "ERT."

metering deployment, we will avoid the incremental capital costs of the planned replacement program.

(b) Initial Estimate of Project Benefits

We had not identified the benefit of this avoided cost in our initial business case and, accordingly, did not include any financial value for our customers related to this program.

(c) Currently Expected Benefits

The $3.2 million net present value of this benefit represents the direct avoided costs of the planned capital replacements, shown above in Table 4-3.

(6) Meter Salvage Value

(a) Initial Estimate of Project Benefits

As described in Avista's initial business case, the mechanical meters replaced during the advanced metering deployment required disposal because there is no longer any market for these meters. As a way to help defray these disposal costs, Avista investigated the recycling value of the metal and glass contained in these meters and found it was sufficient to warrant recycling. Further, recycling the old meters aligns with the Company's environmental and sustainability objectives. As shown above in Table 4-3, the Company's initial estimate of the financial savings for customers over the life of the project achieved a net present value of $148,000.

(b) Expected Benefits

Avista's estimate of the financial value of this recycling benefit has not changed, based on the avoidance of disposal costs, as shown above in Table 4-3.

(7) Local Economy / Jobs

(a) Initial Estimate of Project Benefits

As identified in Avista's initial business case, the deployment of advanced meters and their enabling systems increases local economic activity, which indirectly benefits our customers. The initial economic impact of the added employment was based on an independent estimate of the new direct and indirect labor required for deployment activities and ongoing management and maintenance of the new systems. As shown above in Table 4-3, our initial estimate of the financial benefit for customers over the life of the project had a net present value of $1,820,000.

(b) Currently Expected Benefits

At the time of Avista's initial estimate of the economic impact, the Company had not yet selected its primary AMI systems provider, so economic activity associated with the development of AMI software systems or metering and communications hardware had not been included as a local economic benefit. With the Company's selection of Spokane based Itron, the localized economic impact of advanced metering deployment was reevaluated. Among other benefits, additional economic value included service contracts and licensing localized through Itron and others. Also included was the economic impact of local hiring of the labor force needed to deploy the meters themselves. The overall net present value increased to approximately $17 million, however, none of these benefits is included in the Company's current estimate of net financial benefits for the project, as shown above in Table 4-3, even though there is at least some indirect benefit to customers in our service territory over time.

(8) Range in Overall Value for Meter Reading and Meters

The financial value over the life of the project for this group of benefits was initially expected to be in the range of $74M to $77M on a present value basis. The total point estimate of value is $75,961,452, is nearly identical to the amount initially estimated.

C. 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 by an employee to the physical service location. In Avista's initial business case, the Company reported 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 customers using advanced metering is much more rapid than with physical service calls. Remote connectivity produces significant cost savings by reducing the number of personnel, transportation, and other expenses required for conventional field service activities.

(1) Account Open / Close / Transfer

(a) Initial Estimate of Project Benefits

As shown in the table below, the Company's initial estimate of the financial savings for customers for these service process savings over the life of the project had a net present value of $11.8 million.

TABLE 4-4. NET PRESENT VALUE OF FINANCIAL BENEFITS ESTIMATED FOR REMOTE SERVICE CONNECTIVITY IN AVISTA'S INITIAL ADVANCED METERING BUSINESS CASE (2016) AND IN AUGUST 2020.

Remote Service Connectivity		
Category	**Lifecycle Net Present Value 2016**	**Lifecycle Net Present Value 2020**
Account Open/Close/Transfer	$11,756,573	$10,352,917
Credit Collections/Connections	$12,180,323	$11,326,484
After Hours Fees	$395,786	$331,214
Total	$24,332,683	$22,010,615

(b) Current Expected Benefits

Avista has revised lower its estimate for the value of the account open/close/transfer function enabled by remote service connectivity, as shown above in Table 4-4. Avista tracked over 10,000 meter connects and disconnects and 16,000 unbilled accounts in the baseline period, accounting for 94% of the costs identified in the initial business case, in order to arrive at this revised estimate.

(2) Credit Collections/Connections

(a) Initial Estimate of Project Benefits

As shown in Table 4-4, the Company's initial estimate of the financial savings for customers over the life of the project had a net present value of $12.2 million.

(b) Current Expected Benefits

Avista has revised lower its estimate of the financial benefits for the credit/collections function enabled by remote service connectivity as shown above in Table 4-4. This revision is based on the delay in scheduled deployment of meters and the actual experience of avoided service trips. The Company expects this function to be on track with the initial estimate over the life of the project. As noted earlier, the Commission recently concluded a rulemaking to address issues related to the historically-allowed use of remote service disconnection (U-180525). We anticipate that new constraints on use of the remote service connectivity feature will be accounted for as a new customer service cost allocated from the advanced metering benefits included here.

(3) After Hours Fees

(a) Initial Estimate of Project Benefits

Under the Company's current tariff, when a service person is physically dispatched to disconnect and reconnected service, customers are charged a tariffed reconnection fee of $16 during regular business hours and $32 for after-hours service. Since remote service connectivity allows the Company to eliminate the cost for all customers of dispatching service personnel, we had expected to modify the tariff to remove these reconnect fees. Based on the Company's initial schedule for meter deployment with an accompanying tariff change the direct savings for customers was estimated to be $395,786, as shown above in Table 4-4.

(b) Current Expected Benefits

Avista has revised lower its estimate of the net present value of financial benefits, as shown above in Table 4-4, for the avoidance of reconnect fees based on our expectation of being able to modify our tariff and have it approved before year-end 2021.

(4) Range in Overall Value for Remote Service Connectivity

In the Company's initial business case, it was noted that the actual financial benefits would vary from the point estimates reported, based on conditions yet to be experienced during deployment and operation of the metering system. The financial value over the life of the project for this group of benefits was expected to be in the range of $22.5 to $26.2 million on a net present value basis. The total value of currently estimated benefits is $22,069,491, which is near the lower-end value of the initial range.

D. Customer Benefits from Improved Outage Management

(1) The High Cost of Service Outages

It is a well-established fact that interruptions in service cost electric customers money. The degree of the direct financial losses they experience is related to many factors, some of which include the time of day or night and season of the outage, its duration, whether the customer received advanced notice, whether they have a backup generator, and the type of customer impacted (residential, commercial, industrial, etc.). A key determinant of the financial losses customers experience is the length of time (outage duration) they are without service. For outages up to a range of 16 hours in duration the direct cost impact to residential customers is relatively small. Though unusual, longer duration outages have an increasing financial impact on residential customers, however, as they experience food spoilage and loss of heat in winter, as examples, or need to pay for overnight accommodations, etc. Outage impacts to commercial and industrial customers, by contrast, are immediate and far greater in magnitude. They experience financial losses because they can't transact with customers, operate equipment such as gas pumps, or continue manufacturing, etc. Interruptions of some industrial processes, even if brief, can be financially very costly. Further, commercial and industrial customers are often paying idled employees and they are uncertain whether to send them home or to cancel the next shift if they don't know the expected duration of the outage event. In Avista's experience estimating our customers' financial costs for loss of service, it's common for residential customers to account for less than three percent of the total financial losses, with commercial and industrial customers comprising the other 97%.

To estimate the electric outage costs experienced by our customers, Avista uses an industry standard model known as the Interruption Cost Estimator.[71] The model, developed by Lawrence Berkeley National Laboratory, uses customer cost information from 39 individual utility value of service studies[72] conducted across the Country to estimate the cost to customers resulting from electric outages of varying types, times and durations, among other factors. Customer costs from the individual cost of service studies are integrated in the interruption cost estimator model and are adjusted to account for a range of socio-economic and other factors reflective of different regions of the Country. These customer costs from the model are combined with (for Avista as an example) socio-economic factors from our service territory, our actual customer class composition, our customers' annual energy consumption, and the history of actual outage events experienced by our customers. The interruption cost estimator calculates the outage costs for individual classes of Avista customers, which are combined into a weighted average hourly cost for the historic outage events experienced on our system. The result is an average cost for all customers for one hour of outage time. Multiplying this value by the total number of outage hours experienced by customers on our system yields the total cost of all outages for that year. As noted earlier, this approach for estimating

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[71] http://www.icecalculator.com/ice/

[72] Value of Service studies conducted by an individual utility will include surveys and interviews of the utility's individual customers to determine the costs those customers would experience for electric service outages of different times of day, days of the week, outage duration and other factors. The costs derived from these surveys and interviews are then applied to the utility's historical outages (using the same algorithms included in the Interruption Cost Estimator Model) to compute the customer losses for that utility for the outages experienced during the year.

the cost to customers for electric service outages has been compared with alternative approaches and found to provide results that are superior to other methods, in a paper sponsored by the National Association of Regulatory Utility Commissioners (NARUC).[73]

For the preceding five-year average ending in 2019,[74] the average weighted hourly cost for all customers and all outage events on our system was $116.15. Multiplied by the total average number of customer outage hours for each year (937,507) yields total outage losses of $109,219,533. Accordingly, reducing customer outages and outage duration by 1% has a direct annual financial benefit to customers of $1.1 million. In this manner, results from the interruption cost estimator are routinely used to compare the cost effectiveness of proposed reliability alternatives or to calculate the financial value associated with a single investment or a change in utility operations that will reduce outage impacts experienced by our customers (either in avoided outages or reduced duration for outages that do occur).

Earlier in Section I, this Report addressed criticism of the use of the ICE calculations in Avista's 2016 analysis by Public Counsel, noting that those criticisms, even if accepted at face value, only address 3% of the total universe of costs experienced by all customers.

(2) The Role of Advanced Metering in Outage Management

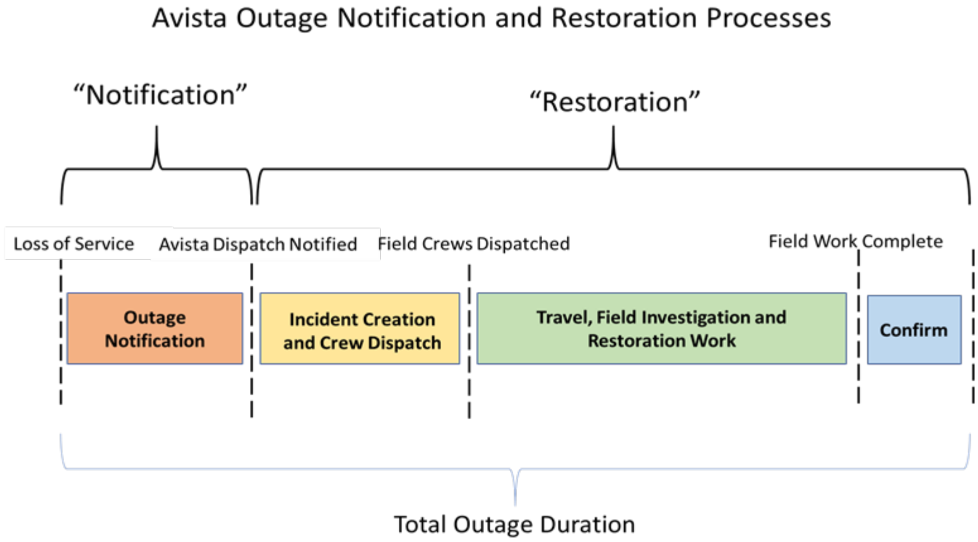
Advanced meters are constantly sensing meter function and communicating with the utility's data systems to alert any changes of status at the meter. This includes the knowledge in near real-time of whether power is being supplied to an individual customer's meter. When this service is disrupted, the advanced meter sends an alarm indicating an outage at the customer's premise. In our initial business case, we planned to integrate these outage alarms with our outage management system to provide earlier notice of an outage event,[75] and as a result, to be able to respond to outages more quickly on average. The diagram below represents the generalized outage management lifecycle, starting with the loss of service and our initial notification of the outage event ("notification" process).

[73] Evaluating Smart Grid Reliability Benefits for Illinois. National Association of Regulatory Utility Commissioners, A Report for the Illinois Commerce Commission funded by the U.S. Department of Energy. 2011.

[74] In calculating this average Avista excluded results for year 2015 because of the record storm events that year that would have skewed the customer cost estimates much higher.

[75] Without the advanced metering system, the Company was typically notified of a customer outage only when a customer contacted Avista to report their loss of service.

FIGURE 4-2. AVISTA OUTAGE NOTIFICATION AND RESTORATION PROCESS



We also noted, based on the experience of other utilities, that smart meters provide a more complete picture of overall system outages. With better visibility of the many isolated outages caused by a very large outage event, Avista expected our field restoration processes to be more efficient, resulting in a reduction in the direct labor and equipment costs required for service restoration. Since deploying our advanced metering system and initiating the development of supporting outage management tools, we have gained experience, evidence and clearer insights about the likely long-term financial benefits our customers will experience from a significant reduction in outage hours enabled by our advanced metering system.

(3) Reduced Outage Duration from Earlier Outage Notification

(a) Initial Estimate of Project Benefits

Without advanced metering, we must typically rely on customers contacting the Company to notify us of an outage event. Depending on how quickly customers call, and whether they speak with a service representative, use our automated phone system or report online, this 'notification' time can range from minutes up to much longer periods depending on the time of day and number of customers impacted by the outage. In our initial business case, we expected the immediate outage notification provided by advanced meter alarms would allow us to reduce the average time duration between the actual outage and our dispatch personnel being notified of the event, as shown in the diagrams below.

FIGURE 4-3. AVISTA CONVENTIONAL OUTAGE NOTIFICATION

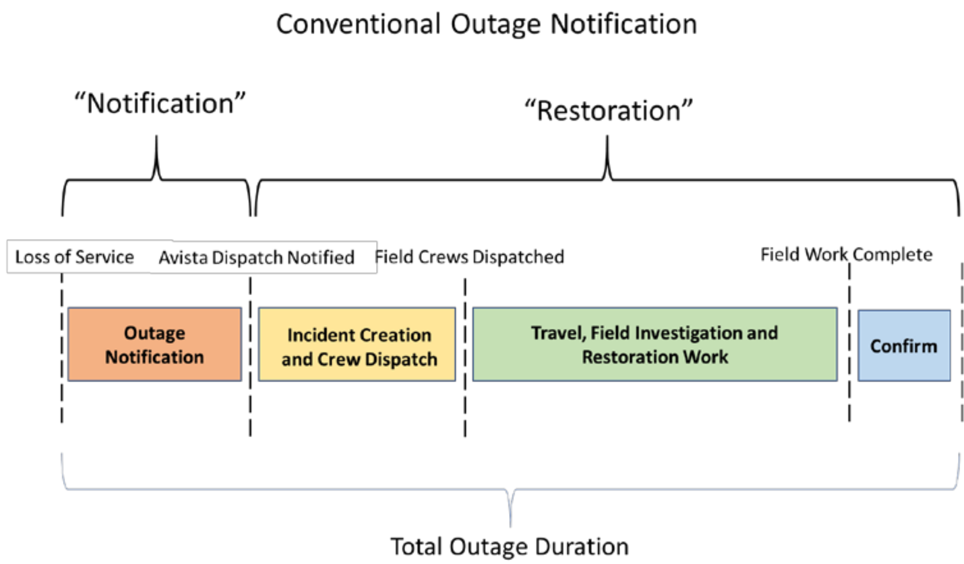
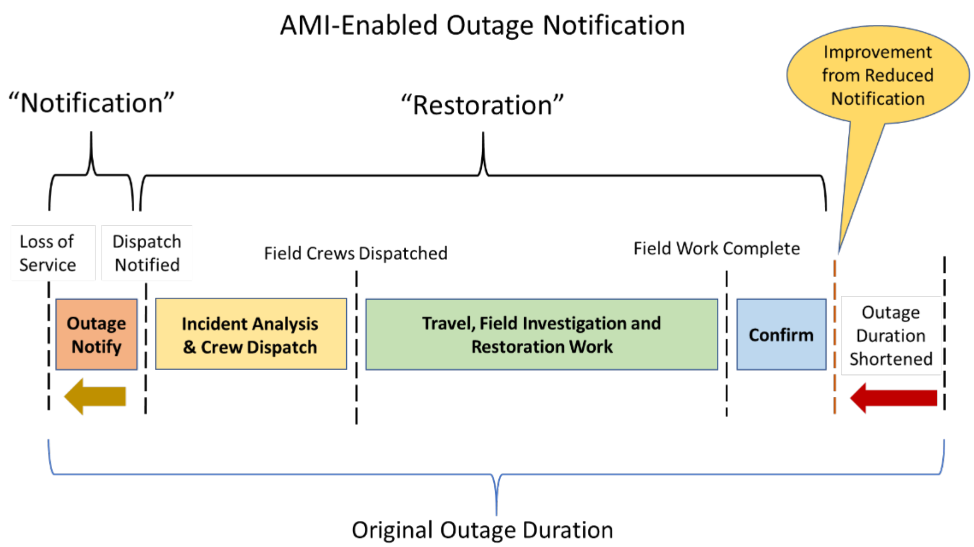


FIGURE 4-4. AVISTA AMI-ENABLED OUTAGE NOTIFICATION



In both diagrams, even though there was no assumed reduction in the time required for the "restoration" process, the overall outage duration experienced by customers is reduced by the amount of time saved in the front end "notification" process.

From our initial evaluation in 2016, we expected the earlier notification of outage events described above to result in a 5% reduction on average in the overall outage duration experienced by our customers. The interruption cost estimator was used to determine the weighted average financial value of $10.56 per customer associated with a 5% reduction in outage duration. The total annual customer avoided financial losses were estimated to be $2,622,924, which had a net present value of $32,817,495 over the project life, as shown in the table below.

TABLE 4-5. NET PRESENT VALUE OF FINANCIAL BENEFITS FOR CUSTOMER SAVINGS ASSOCIATED WITH MORE EFFICIENT MANAGEMENT OF ELECTRIC SYSTEM OUTAGES ESTIMATED IN AVISTA'S INITIAL ADVANCED METERING BUSINESS CASE (2016) AND IN AUGUST 2020.

Outage Management		
Category	**Lifecycle Net Present Value 2016**	**Lifecycle Net Present Value 2020**
Earlier Outage Notification	$32,817,495	$28,009,803
More Rapid Restoration	Not included in initial case	$18,673,199
Reduced Customer Calls	$1,421,119	$1,277,163
Avoided Single Lights Out	$2,935,025	$2,730,472
Reduced Major Storm Costs	$3,158,142	$3,032,403
Total	**$40,331,781**	**$53,723,041**

(b) Currently Expected Benefits

As part of the process of verifying the benefits estimated in the initial business case, the Company has been measuring the difference in time between when an outage alarm from a meter is first received and when the customer associated with the meter calls in to report the service outage (or the first customer to call in for an outage involving a group of customers). As described briefly above and in the initial business case, Avista assumed the alarm capability of the meters would reduce our customers overall outage duration by 5%, which in 2016 translated to an average difference of 7 minutes advanced notice with advanced metering. To date, the Company has documented an average advanced notice on the order of 20 minutes, nearly three times the value used to estimate the benefit in our initial business case. If this 20 minute advanced notice benefit is sustained and effectively translated into an equivalent reduction in outage duration, the annual financial benefit for customers would be far greater than initially estimated. For currently estimated customer avoided financial losses, Avista is assuming a conservative 6% reduction in outage duration (8.2 minutes) due to the advanced notification provided by smart meters. This translates to an annual financial savings for customers of $3,190.670 and a lifecycle benefit of $28,009,803, as shown above in Table 4-5. But, as noted, this is a conservative estimate and is likely to be much higher.

In our 2016 business case we calculated the customer benefit based on a percentage reduction of the overall outage costs experienced by our customers for all types of outage events. Using that same approach, the calculated annual financial benefit for our current case (6% reduction in outage duration) would have been $4,522,698, considerably larger than the $3.2 million figure stated above. This reduction in value is the result of two steps we took to make the estimate of customer financial value more conservative. First, instead of applying a percentage to the total annual customer financial costs, we used a tool in the interruption cost model for "estimating the value of a reliability improvement." This approach holds the number of outage events constant and calculates the customer benefit based on the improvement in outage duration alone. Secondly, we eliminated all outage events from the calculation that were the result of Company planned work on the system (planned, maintenance or fill-in events). Our rationale for this change is that our AMI-enabled tools will provide little to no benefit in reducing outage duration for events that result from our work on the system. The first change reduced the total benefits from $4.5 million down to $3.8 million, and eliminating planned outages from the analysis further reduced the annual value to our stated level of $3.2 million.

We also considered the impact of eliminating outages associated with Major Event Days from the calculation of our customers' outage costs. The calculation of major events thresholds and exclusion of outages associated with major event days is a common industry practice intended to normalize the reporting of results for comparison among different utilities. The rationale for this practice is to present reliability statistics that more or less represent the reliability of the system as it was designed to perform under a range of 'normal' conditions. While the exclusion of outages associated with major event days is a reasonable practice for comparing reliability performance among utilities and for reporting performance under a normal range of conditions, our customers actually experience these major event day outages and the financial consequences associated with them. From our customers' perspective, it is legitimate to include outages associated with major event days in the calculation of the financial value of reduced outage duration as enabled by advanced metering. Including outages associated with major event days in this calculation increases the calculated annual customer benefit from $3.2 million to $6.8 million for the early notification benefit alone (from $28 million to approximately $60 million in lifecycle benefits). While Avista believes this is a reasonable approach for calculating customer avoided financial losses due to reduced outage duration, we are, for the present time, continuing to evaluate that option, and remaining with the conservative calculation of the annual financial value of $3.2 million.

(4) Reduced Outage Duration from More Efficient Restoration Processes

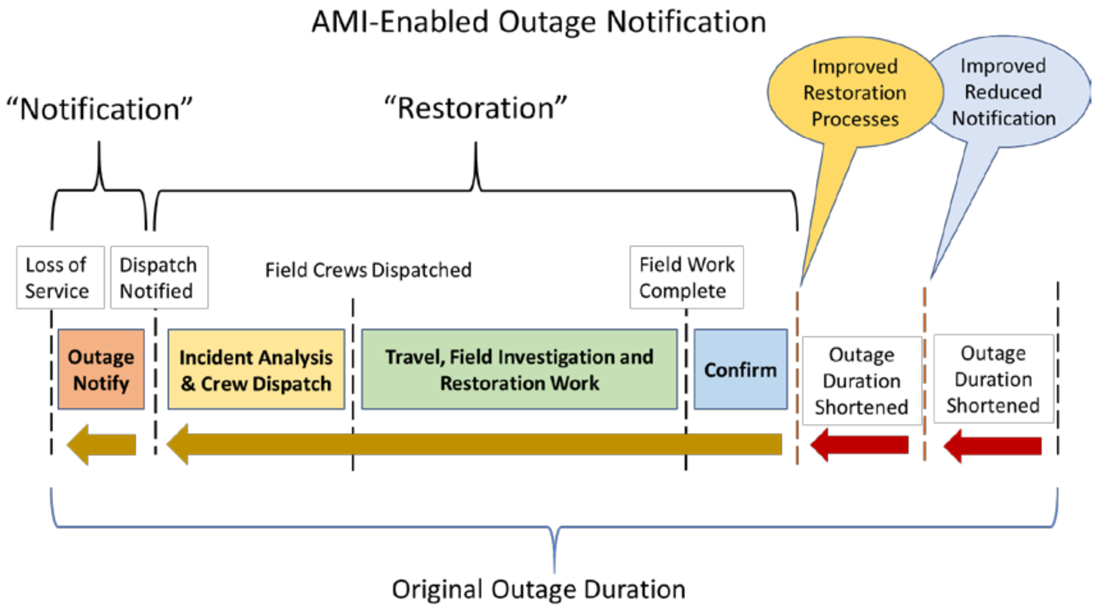
(a) Initial Estimate of Project Benefits

The Company did not have an estimate in its initial business case for financial benefits related to a reduction in customer direct financial losses associated with reduced outage duration achieved through more efficient restoration processes.

(b) Currently Expected Benefits

In addition to the benefit of earlier notification, described above, Avista has focused on developing additional outage management tools and processes, all enabled by advanced metering. These tools are improving our outage restoration processes, which will result in additional reduced outage duration and avoided financial losses for our customers, as represented in the diagram below.

FIGURE 4-5. AVISTA AMI-ENABLED OUTAGE NOTIFICATION



Avista's new outage management tools and processes to accomplish this reduction in outage restoration time are briefly described below.

- **Meter Pinging Capability:** Avista and its metering supplier, Itron, have been working together to implement the "pinging" capability on advanced meters. This feature allows Company dispatchers to ping or essentially query a meter to determine its 'power on' status. Pinging can be used to verify an outage alarm, to help determine whether a customers' outage is on their side of the meter, and to confirm that a customer's service has been restored following repairs. Avista's dispatchers use pinging for individual meters and groups of meters depending on the needs of the outage situation.
- **Alarm Viewer:** The alarm viewer allows outage dispatchers to view the outage notifications delivered by the Company's advanced meters. The application is integrated with Avista's GIS-based facilities management system to provide an exact location of the meter in question and aggregates the alarms from related meters.[76] The tool automates what was previously a manual process of analysis conducted by the dispatcher using outage information called in by customers. Since not all customers call in their outage, and at least not immediately after the outage, this manual analysis is time-consuming and often based on incomplete information.
- **Auto Generator:** This application automates the next tier of manual processes of reviewing the individual outages, analyzing the likely outage event, and creating an incident order for dispatching crews. The auto generator receives the outage data from the alarm viewer, and in combination with Avista's outage management system, identifies the most likely piece of

[76] Meters in the vicinity of the initial alarm that might be related to the cause of the initial outage.

equipment (e.g., transformer or fuse) or location of a fault or other incident on the line. The generator then automates the next step of creating an outage incident dispatch order.

- **Rollup Tool:** The rollup tool provides the next level of automation for outage restoration by "rolling up" the individual outage incidents into prioritized groups of incidents based on the opportunity to most quickly restore service to the largest number of customers associated with the outage. The prioritization created by the rollup tool is more accurate than historic practices because every service in the outage is identified, and it saves considerable time by eliminating the manual processes previously required to best aggregate incidents into an outage restoration strategy.

With these tools, Avista has the capability for all outages, not just storm events, to: 1) create an outage incident much more quickly and accurately than historically; 2) enable a more rapid dispatch of resources than prior to AMI; 3) to more quickly and accurately assess the most efficient grouping of incidents to be restored; and 4) more quickly and accurately identify the overall highest priority outage incidents for a more effective strategic response. During the restoration process, the Company will be able to "group ping" the meters associated with a local outage incident to ensure all the services have power before dispatching crews to a new outage location. Pinging will also be used to identify when the remaining outages in an incident can be restored by a service person instead of a full line crew. Again, this allows the Company to ensure all customers are restored, and to move crews more quickly to the next priority incident(s). These tools will also help eliminate the need for post-restoration patrols of an incident, which was our prior process of driving through the impacted area to visually determine to the extent possible whether service had been restored to all customers.

More importantly, Avista expects to achieve reductions in outage duration for a much wider range of outage events on the system, not just major storms. The Company's ability to reduce outage duration for a range of events, using the automated processes described above, represents a capability not envisioned to be in operation in our initial business case. Currently, Avista conservatively expects to reduce overall outage duration by an additional 4% based on more efficient restoration processes. This value is in addition to the reduction in outage duration gained by earlier notification. Based on the five-year average outage costs for our customers, the annual value of customer avoided losses for more efficient restoration processes is $2,127,113, with a lifecycle net present value benefit of $18,673,199 (as shown above in Table 4-5), to be phased in as the Company's tools and processes are refined and expanded.

(5) Reduced Customer Calls

(a) Initial Estimate of Project Benefits

As described in Avista's initial business case, 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 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, the Company plans to use the AMI system to enable new processes that will make it less likely that customers will need to speak with a customer service representative in the future.

In addition to having fewer inbound customer calls, the average duration of calls received is expected to 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 and time required for calls was expected to allow Avista to reduce the number of customer service representatives required to maintain the Company's grade of service during outage events, which would lower the cost of providing service to customers. In addition to reducing costs, the automated notification of the outage will help improve the customer's experience and satisfaction. As shown above in Table 4-5, the Company's initial estimate of the financial savings for customers over the life of the project had a net present value of $2,935,025.

(b) Currently Expected Benefits

Avista has slightly reduced its estimate of the financial value for reduced customer calls related to outage management, as shown in Table 4-5, based on the delayed deployment schedule for the project.

(6) Avoided Single Lights Out

(a) Initial Estimate of Project Benefits

Historically, when a customer called the Company to report an outage, and in the instance where it appeared to be a single outage event, the customer service representative would try to help the customer determine whether the outage was the result of a loss of service to the meter or an issue with the service panel (or any other issue on the customer's side of the meter). The representative would attempt to determine the meter state by asking the customer specific questions to help diagnose the cause of the outage. In the event the cause of the outage appeared to be Avista's service, or more often, was undeterminable, a service person or crew would be dispatched to the customer's home to investigate, and if need be, resolve the problem.

In its initial business case, Avista reported that each year, on average, it dispatched field personnel 1,681 times to respond to service outages that were ultimately determined to be the result of electrical problems on the customer's side of the meter. In these cases, known as "false positives," the Company's service personnel were unable to repair the problem, and the customer had to call a commercial electrician to provide the needed repairs. The Company expected that with advanced metering, it would be able to query or ping the meter in question to determine whether there is power to the meter for individual customer outages. This would reduce the likelihood of dispatching restoration personnel in response to a false positive. Reducing the number of false positives reduces time spent on the phones, entering data, and dispatching service to the customer's home. It also avoids a poor customer experience and allows customers to more quickly schedule an electrician to repair the problem. Though the Company believed it could eventually eliminate more than 80% of these false positives, that value was initially used as the assumed reduction, which produced an initial annual savings value of $219,500.[77] As shown in Table 4-5, the Company's initial estimate of the financial savings for customers over the life of the project achieved a present value of $2,935.025.

(b) Currently Expected Benefits

Avista has slightly reduced the estimate of the net present value of financial benefits to $2,730,472, as shown above in Table 4-5, based on the delayed deployment schedule for the project. Based on experience with advanced metering in this area of benefit, however, the Company expects to exceed an 80% rate at avoiding the costs associated with false positives for single light out events, with a corresponding increase in the value of the customer benefits (not included in the current financial benefits).

(7) Reduced Restoration Expenses for Major Storm Events

(a) Initial Estimate of Project Benefits

In our initial business case, we expected advanced metering would provide better visibility of the many isolated outages during very large (storm) outage events,[78] allowing us to restore outages more efficiently and quickly. In our review of utility literature on this capability of advanced metering, we noted results reported by the Electric Power Board[79] showing a 40% reduction in outage duration per customer,[80] and a Florida Power and Light Company report showing a 21% improvement. For its initial case, Avista estimated a more conservative savings of a 10% reduction in restoration time for only large outage events. Although these efficiencies would reduce the overall customer outage hours for large events, we did not include any estimate of the value for avoided customer losses (as described earlier in this section). The initially estimated financial benefits were based solely on an expected reduction in labor hours, lodging, meals and vehicle and equipment operating costs. We assumed there would be no change in the amount of damaged infrastructure that had to be repaired or replaced. For a 10% reduction in restoration time for very large outages, the associated reduction in labor and expenses (which averaged 59.5% of the average cost for storm restoration) was estimated on average to be $248,000 per year. As shown in above in Table 4-5, the Company's initial estimate of the financial savings for customers over the life of the project had a net present value of $3,158,142.

(b) Currently Expected Benefits

As described above, the Company has developed outage management tools that will improve our outage restoration processes for a wide range of outage events, including especially outages associated with very large events. We are conservatively estimating for all types of outage events

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[77] 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.
[78] Very large outage events are associated with major storms in our service area, including those caused by high winds, and heavy ice and snowfall.
[79] Headquartered in Chattanooga, Tennessee.
[80] As measured by the utility standard index "System Average Interruption Duration Index" or (SAIDI).

that we will be able reduce outage duration on average by 4%. For very large outage events only, we expect outage duration to be reduced by a much larger percentage, such as in the statistics cited above. At present, however, we are continuing to use an estimated reduction of 10% in storm restoration costs for very large outage events. In our current forecast we have reduced the overall value for reduced storm expenses based on the delayed deployment schedule for the project, as shown above in Table 4-5.

(8) Range in Overall Value for Outage Management

In the Company's initial business case, we noted that the actual financial benefits would vary from the point estimates reported, based on conditions yet to be experienced during deployment and operation of the metering system. The financial value over the life of the project for this group of benefits was expected to be in the range of $31.9M to $48.7M, on a net present value basis. The total value of currently estimated benefits of $53,723,041 is just above the upper end of the initial range.

E. Energy Efficiency Enabled by Advanced Metering

In our initial business case, we estimated the financial value expected for two different areas of customer benefit including conservation voltage reduction and customer actions to improve energy efficiency based on the availability on interval energy use data and accompanying tools. Since then, as described in Section 1 of the Report, we are implementing new energy conservation use cases that make more comprehensive use of the capabilities of our advanced metering system. Accordingly, we are now including financial benefits for new behavioral energy efficiency programs (which rely in part on the load disaggregation, targeting and measurement and verification use cases) and grid interactive efficient buildings. We also discuss pending energy pricing strategies as a conservation use case, though we do not include the estimated financial benefits in the current cost/benefit analysis.

(1) Conservation Voltage Reduction

(a) Initial Estimate of Project Benefits

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., electric motors vs. lighting) are constantly in flux, causing variation in the actual voltage level on the feeder throughout the day. Since Avista is required to maintain a minimum line voltage over time, and along the entire feeder, the voltage range adjusted at the substation regulators is set at a higher level than is required to ensure that there is an adequate buffer to account for the variation in loads, length of the circuit and subsequent voltages. 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.

We noted in our initial business case that we had already been using smart grid technology to dynamically adjust the voltage on a feeder based on readings taken from devices along the feeder, and from customer services where we had already had smart meters in service. Output from these voltage sources was integrated with the distribution management system to send voltage control signals to the regulator in the substation in near real-time. This capability allowed the range of the buffer to be reduced, thus lowering the amount of energy required to maintain the required line voltage. In addition to monitoring the voltage at the customer level and adjusting the feeder voltage accordingly, the Company had also identified those services where a particularly low voltage (such as caused by the operation of a large electric motor) was limiting the overall reduction in voltage that could be achieved on the entire feeder. Avista installed line devices or reconfigured secondary services at those locations to boost the service voltage to a level that allowed the setting for the entire feeder to be reduced. The Company reported an average energy savings of 2.02% in its CVR deployments in Spokane and Pullman, as validated by an independent study, and estimated an additional 2% savings was possible based on pilot studies using customer-level voltage data provided by our advanced metering system in Pullman.

Based on the estimated reductions in feeder level voltage that could be achieved on different types of feeders on the Company's system, and the anticipated schedule of deployment, Avista presented an initial estimate of the financial savings for customers over the life of the project of $55,014,844, as shown in the table below.

TABLE 4-6. NET PRESENT VALUE OF FINANCIAL BENEFITS INITIALLY ESTIMATED FOR ENERGY EFFICIENCY IN AVISTA'S ADVANCED METERING SYSTEM (2016) AND IN AUGUST 2020.

AMI Enabled Energy Efficiency		
Category	**Lifecycle Net Present Value 2016**	**Lifecycle Net Present Value 2020**
Conservation Voltage Reduction	$55,014,844	$18,494,601
Customer Energy Efficiency	$4,370,070	$3,655,286
Behavioral Energy Efficiency	Not included in initial case	$8,927,226
Grid Interactive Efficient Buildings	Not included in initial case	$2,609,116
Total	**$59,384,914**	**$33,686,230**

(b) Currently Expected Benefits

Since our initial business case, we have continued to identify the potential for conservation voltage reduction as a foundation for developing implementation plans. During these evaluations, Avista engineers revealed a range of engineering, design, and equipment issues that significantly impacted the potential savings identified by the pilot studies reported in our initial business case. Key findings are summarized below.

- Avista found the potential to reduce feeder voltages in the Spokane operations area was minimal, even though pilot studies suggested an additional 2% savings was achievable on these feeders. The reason for this difference is that the locale where additional CVR savings were studied and validated is characterized by customers served by individual secondary service lines from the transformer. In the Spokane area, it is very common for customers to be served from "open secondary" districts. In this design, groups of customers are served from an extended secondary voltage system. It is an efficient and effective way to serve customers as a historical utility practice. The problem for conservation voltage reduction is that line voltage can drop substantially over the open wire secondary system, leaving little, if any, capacity to reduce the voltage on the feeder to achieve conservation voltage savings. This limited capacity in the area of our highest electric loads resulted in a 40% reduction in Avista's initial estimate of potential savings.

- Another limiting finding is related to the characteristics of power transformers installed in our rural substations. Rural feeders are typically much longer (circuit miles) than urban and suburban feeders; typically, the longer the feeder, the greater the voltage drop experienced at the end of the line. As a result, Avista's historic practice was to set the voltage output of the power transformer in the substation at a high level to ensure the line voltage met the minimum requirements for the last customers served on the line. Because of this practice, it became standard to install power transformers set for higher voltage output, which has limited the flexibility to reduce voltage levels. While this practice made good engineering and utility sense, it means that the voltage on many of the Company's rural feeders cannot be reduced to achieve conservation voltage reduction savings. This barrier has also substantially reduced our initial estimate of potential savings.
- Another issue that impacts the savings potential on rural feeders (those without substation transformer limitations) is the moderating impact of midline voltage regulators on longer feeders. The midline regulators typically serve to boost voltage along the line, again, to ensure customers at the end receive the minimum-allowable service voltage. Customers served on the feeder beyond the midline regulator are already typically at the minimum voltage level, so any conservation voltage reduction would not materially lower the voltage on the portion of the feeder 'downstream' from the midline regulator. Avista determined that approximately 6% of its customers are served on feeder sections beyond midline regulators, so the value of the initial CVR savings estimate was also reduced by an equivalent percentage.
- The current global pandemic has impacted this program by delaying the adoption of conservation voltage measures on 36 feeders that were slated for completion this year.

As a result of these impacts, the Company has revised downward its initial forecast of project savings to $18,494,601, as noted above in Table 4-6.

(2) Customer Managed Energy Efficiency

(a) Initial Estimate of Project Benefits

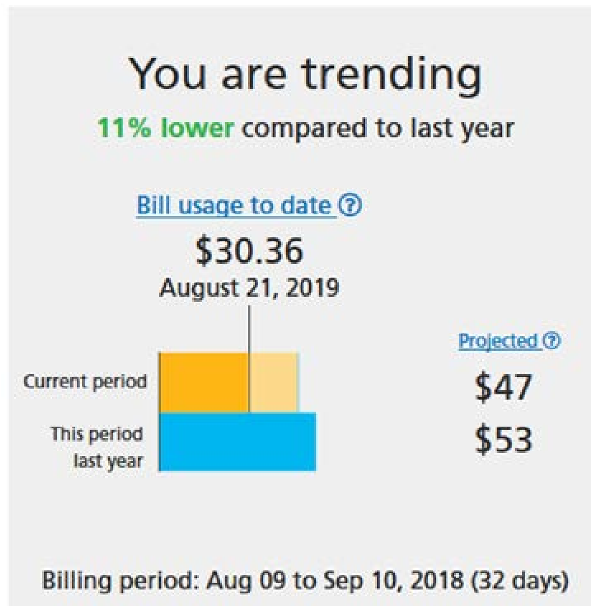
When customers have access to detailed and timely energy-use data, coupled with utility-provided information and education on energy conservation, customers will have new and advanced tools to undertake structural and behavioral changes to reduce their energy use and costs. In the initial business case, Avista estimated that three percent of its customers would take additional steps to save energy as a result of having access to their interval energy use data and would reduce their energy consumption by an average of three percent. In addition to customers simply having access to their interval use data, Avista developed web-based analytical tools that customers can use to help them better understand and interpret their data, as well as communications that provide energy efficiency education and awareness, helpful insight and advice, and tools and tips on how to save energy.

As described above, the Company's nominal estimates were based on providing energy use feedback alone and did not include any potential benefits associated with an accompanying behavioral feedback program (described below). The Company's initial estimate of the financial savings for customers over the life of the project had a net present value of $4,370,070, as shown above in Table 4-6.

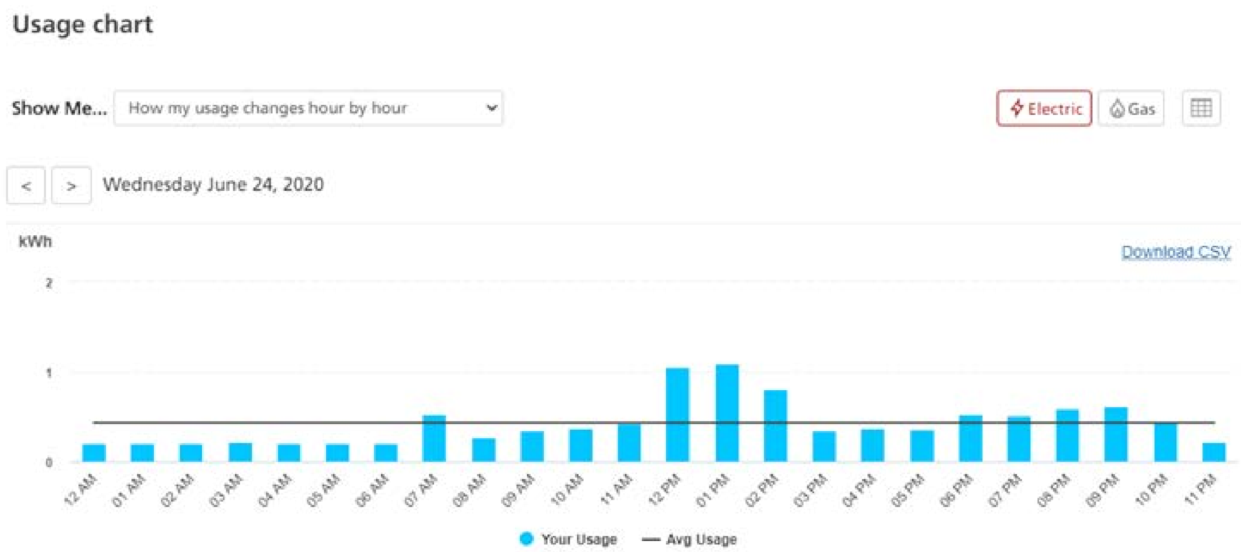
(b) Currently Expected Benefits

During the advanced metering project, Avista has focused on developing the customer energy management tools referred to in our initial business case. We noted that these new tools would help ensure customers could make the best use of their new granular energy usage data to achieve the conservation savings initially estimated. Some of these new tools are briefly described below.

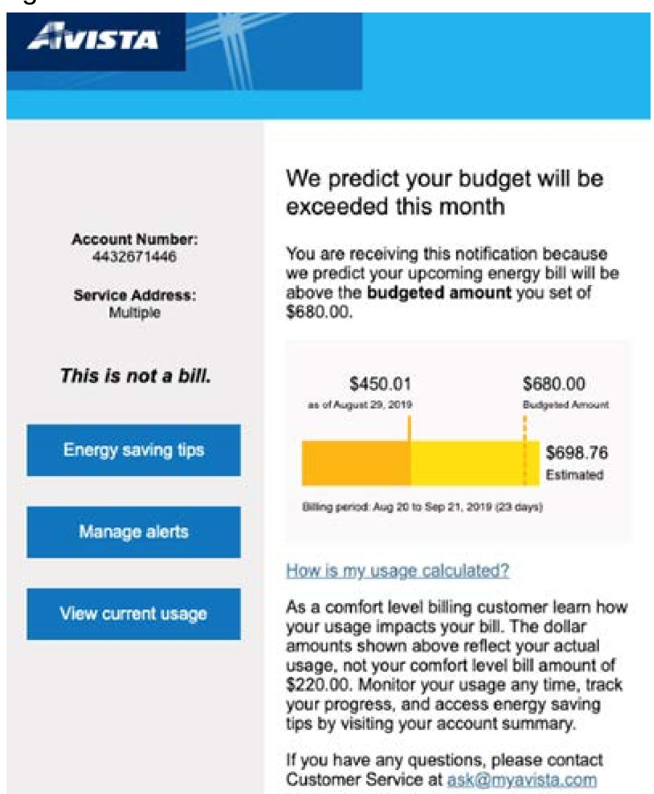
- **Bill-to-Date:** The bill-to-date application enables customers to understand their energy use to date and the accompanying bill amount for that usage.
- **Bill Trending:** The bill trending tool informs customers of the estimated billing amount based on their usage to date and their historical pattern of usage. It also compares the current billing period with that of the same period in the prior year. In addition to overall usage information, the tool provides customers easy access to their interval energy use data and lists actions they can take to reduce their energy bills. It also links customers to other energy conservation tools on the site. A screenshot of Avista's Bill-to-Date and Bill Trending feature on *myavista.com* is shown at right.



- **Detailed Energy Usage Charts:** Once logged into *myavista.com*, the application provides customers a granular look at their energy use data by five-minute intervals, hour, day, and month. Additionally, the usage charts provide a comparison of current and prior periods chosen by the customer. As of July 2020, an average of approximately 10,000 customers per month are viewing their detailed usage charts on *myavista.com*. A screenshot of an hourly view of electric usage is shown below.



- **Download Energy Data:** Customers can download their usage data for their own use in comma-separated value (CSV) format, which is viewable in all common spreadsheet software applications, as well as in "Green Button" format. The Green Button format allows uploading data to third-party service providers. Third-party Green Button download tools also provide the customer with energy conservation insights based on their usage data and links to other energy-saving actions and tools.
- **Budget Alerts:** Avista is finalizing the development of another tool, to be ready for application by December 2020, that allows customers to set a budget alert threshold and then receive a push alert in the event the trending tool predicts they will receive a larger bill than their budget amount. The application provides customers with easy access to their interval energy use data, points them to other energy conservation tools on the site, and lists steps they can take to reduce their energy consumption and lower the amount of their bill. At right is a draft email 'Budget Alert' enabled by our advanced metering system that will be available to our customers in the fall of this year.



Avista has revised lower its estimate of the net present value of financial benefits, as shown above in Table 4-6, for customer energy efficiency based on energy use feedback, based on our experience to date with the delayed deployment schedule for the project.

(3) Behavioral Feedback Energy Efficiency Programs

(a) Initial Estimate of Project Benefits

The Company did not have an estimate in its initial business case for financial benefits related to any program for energy efficiency based on behavioral feedback.

Currently Expected Benefits

As noted above, we are providing customers feedback on their energy use accompanied by web-based analytical tools to help them better understand and interpret their data. While these tools are available to the customer now, we consider them to represent only the initial stages of maturity and will continue to add new capabilities and enhancements over time. As the next step, Avista is now launching a complementary initiative focused on achieving much greater conservation savings through personalized behavioral feedback programs, which use case was described briefly in the Executive Summary and Section 2 of this Report.

Avista's advanced metering system is the foundation for these behavioral programs because the granular usage data it collects can be separated into groups based on the type of load being served, as shown in the diagram at right. This analytical capability is referred to as "load disaggregation." Analyzing loads in this manner provides the opportunity to tailor energy efficiency programs around the type of use presenting the greatest savings opportunity. It also supports the targeting of individual customers who may have the greatest likelihood of taking actions and the greatest opportunity to save money by doing so. Further, advanced metering provides the data and analytics for the measurement and verification of conservation savings.

The Company already has experience implementing one behavioral program through a third party and is familiar with the range of achievable energy efficiency savings.[81] Recently, Avista has finalized a contract with a vendor who will provide the analytical platform for load disaggregation tools that will be used by internally and by our customers. Testing and validation of the analytics platform and our internal processes is scheduled to start in the Fall of this year. We expect to launch our first behavioral campaign, titled "Always On"[82] in late 2021 to show customers what their always-on devices are costing them each month, and to share information and actions they can take to reduce these parasitic loads.

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[81] Avista completed an engagement with Opower, a behavioral energy conservation services provider, as part of meeting its requirements for annual energy conservation savings in Washington. https://www.oracle.com/industries/utilities/products/opower-energy-efficiency-cloud-service/

[82] Always On loads represent the energy consumed by devices, such as computers, internet devices, charging cords, and many others that are using electricity whether or not the device is currently being used.

Additional targeted behavioral campaigns are planned for rollout in subsequent years with annual program savings expected to reach $1.4 million in 4-6 years. The expected lifecycle benefit for behavioral conservation savings, enabled by advanced metering, is $8,927,226, as shown above in Table 4-6.

(4) Grid Interactive Efficient Buildings

(a) Initial Estimate of Project Benefits

The Company did not have an estimate in its initial business case for financial benefits related to any program for energy efficiency based on grid interactive efficient buildings.

(b) Currently Expected Benefits

While efficiency initiatives over the past decade, such as the net-zero designation, have focused on reducing the total amount of energy (kWh) used by *individual* buildings, Avista has added the objectives of minimizing the aggregate energy used by multiple buildings in a development, flattening the *capacity* (kW) demand being placed on the distribution system, and shifting capacity peaks away from periods of peak demand as much as possible. In this research, the Company has focused on identifying how much 'elasticity' there is in its electric distribution supply system. The term "elastic" refers to the capacity to work with customer-partners to remove load and demand for limited peak periods and to shift electric demand away from these peak periods of use.

Being able to better manage and flatten demand is key to unlocking greater value from the electric distribution infrastructure. This is possible because everything in the feeder system, from conductor size to the wide range of equipment employed, including meters, is designed to provide the needed capacity to deliver power safely and efficiently during the peaks in demand on the system. This capability is a fundamental requirement even though peak demand periods may not occur every day and may often last for only a few minutes or up to an hour at a time. Flattening the demand is a way to defer the need for future upgrades required to meet growing use and loads on the system, which reduces the Company's investment needs and saves customers money. Advanced metering infrastructure provides an essential platform to help enable the achievement of these results.

South University Eco-District

Recently, the Company engaged with commercial partners in the City of Spokane's South University District to create a new energy services platform that incorporates emerging elements of the evolving service model at the Grid Edge, noted in Section 2 of this Report. In this particular effort, McKinstry Inc.[83] is partnering with the Company's unregulated subsidiary, Avista Development, to design, build, and finance a development consisting of highly efficient smart buildings, distributed generation, and electric and thermal energy supplied through a centralized plant. This project, referred to as the "Eco-District," aspires to capture the value of using a central plant to take advantage of the operational

[83] The development will be owned by the commercial developer McKinstry Inc. LLC with Avista Corporation's unregulated subsidiary, Avista Development, as a minority partner.

flexibility of serving the conditioning needs of multiple buildings while responding to signals from the grid to operate the buildings as a whole in a what Avista refers to as a “Grid Optimal” manner. In this development, Avista and its partner aim to achieve the following objectives:

- Develop commercially-viable buildings and districts that can achieve certifications of “net-zero,” and “carbon-free” buildings managed to operate based on signals from the distribution system to achieve a grid-optimal operation.
- Deploy new sensor technologies that enable building assets to be monitored and optimized by smart building systems, creating a zone referred to as the “smartest five blocks.”
- Pilot and perfect the eco-district station to efficiently provide thermal energy services behind the meter and to optimize the use of the local electric distribution network for the benefit of all customers.
- To host a research and development platform to be used by Avista Utilities to experiment with future utility business models and 3rd party energy services, which are translatable across our service area.

The eco-district concept is a technology-enabled renewal of the old central-station heating plant, with the innovation of centralizing the heating, ventilation, and air conditioning (HVAC) infrastructure for each of the buildings in a central eco-district “HUB” building. As envisioned, the eco-district station will provide each of the buildings constructed in this district with the thermal energy (heated and chilled water in a closed-loop system) required for adequate climate control. In addition to the energy for space heating and cooling, the station will provide sub-metered electric service from a 480-volt bus and switchgear to meet the plug, lighting, and fan loads of each of the buildings. Finally, the development will likely include the installation of distributed solar electricity generation that is to be used to meet the load requirements of the development and potentially support generation needs on the local grid during periods of oversupply.

The initial buildings in the development are well under construction and slated for completion in the fall of 2020. The partners anticipate that independent building developers and owners will undertake the remaining build-out of the district over the next four years. In addition to hosting the eco-district station’s electrical, mechanical, and thermal equipment, the HUB building will house a research and development laboratory to be occupied by Avista Utilities, and mixed-use office space for other tenants. From this energy innovation laboratory Avista will model and evaluate multiple combinations of operations for the individual buildings, the central station equipment, the onsite distributed generation, local peer-to-peer energy markets, and the grid-optimal needs of the local distribution system. Individual customers that are part of the eco-district will realize financial savings because they will be better able to optimize the integration of services provided by Avista with the capabilities of their own distributed energy resources. They will also save money because the conditioning equipment in the HUB will optimize the various loads and demands of the multiple buildings in the development to reduce the demand and energy otherwise required for each building. Both the eco-district customers and all of Avista’s other customers will save money, because the Grid Optimal operation of the eco-district will flatten the peak electric demand placed on the feeders serving the development, as well as on the ancillary services required to serve the load.[84] These savings will be achieved because the grid-optimal operation will defer the need for new capital investments to meet capacity needs. From this research, we will be able to optimize the financial benefits for customers in the development and for Avista's electric customers in general. Results of this research will be used to refine our calculation of the direct financial benefits of this energy conservation strategy. Avista has developed an initial conservative estimate of the financial savings for customers, which has a net present value of $2,609,116.

(5) Energy Efficiency – Range in Overall Value

In the Company's initial business case, it was noted that the actual financial benefits would vary from the point estimates reported, based on conditions yet to be experienced during deployment and operation of the metering system. The financial value over the life of the project for all AMI enabled energy efficiency was expected to be in the range of $46.7M to $63.3M, on a net present value basis. While the total value of currently estimated benefits of $33,686,230, is well below the lower value of the range, it's worth noting nearly all of the reduction is attributable to our revised forecast for conservation voltage reduction. Our estimates for customer managed energy efficiency were stable and we added substantial financial value since the initial business case through the addition of our behavioral energy efficiency and grid interactive efficient buildings programs.

F. Energy Theft and Unbilled Usage

(1) Theft and Diversion

(a) Initial Estimate of Project Benefits

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 alert the utility in the event a person attempts to circumvent the metering of energy. In our initial business case, we relied on our own experience and a range of estimates reported by the utility industry to estimate the percentage of revenue likely diverted through theft of service. In most of the literature we surveyed, the potential benefit of thwarting diversion was reported to range between 1 and 3 percent. While in some business cases for advanced metering projects, the opportunity to address theft represented the single largest benefit among those evaluated,[85] Avista believed its savings opportunity was likely on the lower end of industry-reported results. Accordingly, the Company estimated the opportunity at 0.43% of total revenue, just above the lowest incidence of 0.4% reported in the literature we surveyed. Several research studies, business cases, and anecdotal conversations with other utilities supported this as a reasonable assumption. As shown in the table below the Company's initial estimate of the financial savings for customers over the life of the project had a net present value of $19,768,167.

[84] Avista's initial modeling of the benefits of this project forecast a reduction in the morning and afternoon peak demand on the feeder(s) in the range 15 to 25%.

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

TABLE 4-7. NET PRESENT VALUE OF FINANCIAL BENEFITS INITIALLY AND CURRENTLY ESTIMATED FOR AVISTA'S ADVANCED METERING SYSTEM FOR THEFT AND UNBILLED USAGE.

Energy Theft and Unbilled Usage		
Category	**Lifecycle Net Present Value 2016**	**Lifecycle Net Present Value 2020**
Theft and Diversion	$19,768,167	$4,499,424
Unbilled Usage	$1,912,078	$1,951,970
Slow/Failed Meters	$4,319,220	$3,995,883
Stopped Meters	$2,881,416	$3,558,176
Loss of Phase	Not included in initial case	$9,390,317
Total	**$28,880,881**	**$23,395,770**

(b) Currently Expected Benefits

During deployment of our advanced meters we expected to discover some instances of theft and diversion, *though at a much lower rate than was occurring beforehand*. This expectation was based on the multiple waves of communication we provided our customers well in advance of the pending meter replacement, especially as work was nearing their locale.[86] Certainly, customers who were diverting service had plenty of warning and time to properly restore their service before the meter installers arrived at their residence or place of business. Still, the instances of theft/diversion we discovered during new meter installs was lower than we expected, and as a result, we felt it was prudent to reduce our estimate of the financial benefit from 0.43% to 0.10%. As a result, the currently expected benefits are substantially reduced from the initial estimate shown above in Table 4-7, to a revised value of $4,499,424.[87]

(2) Unbilled Usage

(a) Initial Estimate of Project Benefits

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 identify with conventional metering, and consequently, it can take several weeks to several months before an issue is identified and resolved. In the initial business case, we anticipated that advanced meters would be used to remotely disconnect service when an account is closed to prevent unbilled usage or send an alarm when usage was occurring during a period when there was no active customer account. In either event, the amount of unbilled usage that could not be assigned

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[86] For a detailed description of the overall customer AMI engagement plan, including the series of communications to individual customers, please see Appendix A and attachments.

[87] As part of the Data Analytics project, Avista has created a new algorithm that is run each day on electric meters to help detect potential theft. This new tool is integrated with the meter data management system and evaluates low-side voltage levels on internally disconnected meters to ensure there is no voltage on the customer side of the meter. Because the internally disconnected meter can still measure service level voltage, it can be used to identify potential problems with a meter or the occurrence of some modes of theft (in addition to meter alarms that signal when a meter has been removed from its meter base/socket.

to a customer would either be eliminated or substantially reduced.[88] As shown above in Table 4-7, the Company's initial estimate of the financial savings for customers over the life of the project achieved a net present value of $1,912,078.

(b) Currently Expected Benefits

Even with the delay in deployment of the system, Avista expects to fully achieve this benefit, as shown above in Table 4-7. Additionally, we will be able to dispatch manual disconnects for natural gas meters when we see usage on the meter when no customer account has been assigned. This will reduce the unbilled revenue and lower the cost for field service visits compared with our historical experience.

(3) Slow/Failed Meters

(a) Initial Estimate of Project Benefits

Avista identified in its initial business case that electromechanical meters can slow down over time (i.e., register less energy used than the actual usage) because of wear on the internal moving parts. Depending on the degree of error, slow and failing meters were difficult to isolate with conventional metering. The longer the meter was not functioning properly, the more complex the issue became to resolve. This sometimes created a significant underbilling issue for customers and placed the underbilled revenue at risk for recovery. Advanced meters do not slow down or fail gradually in the same manner as electromechanical meters. They are equipped with alarms to indicate meter failures, largely eliminating these under or overbilling issues. As shown above in Table 4-7, the Company's initial estimate of the financial savings for customers over the life of the project had a net present value of $4,319,220.

(b) Currently Expected Benefits

During large-scale meter deployments it is common to have a very small percentage of newly installed meters fail, known in asset management parlance as infant mortality.[89] During our deployment, alarms from failed meters have been very effective in identifying the failure of a meter shortly after it occurs. This experience has bolstered our assessment of the likely effectiveness of smart meters in avoiding our historic losses associated with slow and failed mechanical meters. As a result of the delay in our meter deployment, however, we have lowered our initial estimate of the value of the benefit, as shown above in Table 4-7.

(4) Stopped Meters

(a) Initial Estimate of Project Benefits

Historically, when a conventional meter appeared to have stopped recording energy use, it was flagged for investigation by the Company's meter technicians. Unfortunately, the great majority of

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[88] During winter months, due to the potential damage of freezing pipes, etc., the service may not be suspended between customer accounts.

[89] These failures can have many different contributing factors that may be related to the manufacturing process or component failures.

the time meters were reported as potentially stopped, there had simply been no use at the premises and the meter was actually working properly. This instance is known as a "false positive." Avista identified in its initial business case that these false positives occurred in 85% of the investigations for electric meters and 95% for natural gas meters. Reducing the number of field visits to investigate these false positives with advanced metering represents the core savings associated with stopped meters. As shown above in Table 4-7, the Company's initial estimate of the financial savings for customers over the life of the project had a net present value of $2,881,416.

(b) Currently Expected Benefits

As the Company has continued to document the incidence of stopped mechanical meters, the rates for false positives for natural gas and electric meters have been confirmed at 96% and 83%, respectively. In addition to updating these rates, we have continued to refine the cost savings associated with avoiding field service visits for false positives. The Company has also confirmed the reduction in field visits for stopped meters with its sister utility, Idaho Power Company. As shown above in Table 4-7, Avista has revised upward its estimate of the expected financial savings for its customers over the life of the project.

(5) Identification and Repair of Loss of Phase

(a) Initial Estimate of Project Benefits

The Company did not have an estimate in its initial business case for financial benefits related to the detection and remediation of Loss of Phase incidents.

(b) Currently Expected Benefits

Unlike single phase residential electric service, our commercial customers (and larger) often require what is referred to as three phase service. In addition to being served from all three phases on the feeder, metering for these heavier loads can require additional equipment including use of Current Transformers (CT) to reduce the current to safer and more manageable levels and measure the amount of electricity used. Over time, these metering installations may be subject to what is referred to as a "loss of phase," a condition where one of the three phases becomes disconnected from the metering at the service. This loss of phase may result from a failure in the wiring or equipment, a fault on the system, or in less frequent instances, issues with the current transformers. When this occurs, it can result in a portion of the electric use not being registered on the meter. This loss of meter registration (unmetered usage) may range from a small percentage of the electricity used up to 67% or more! This lack of registration results in a loss in billed revenue ultimately paid for by other customers, and results in a very poor customer experience when discovered (because their bill increases by the percentage of registration that wasn't captured by the meter). Without advanced metering, detecting a loss of phase was very difficult using processes that were based on a monthly meter read. Often the only way these issues were discovered was during a manual inspection of the service, which period between inspections could be 10 years or longer.

Using the alarm capabilities of our advanced meters we can detect loss of phase and voltage irregularities and report these events as they happen in real time. Field personnel are now dispatched to inspect and remediate these issues in a matter of days. Based on the rate of issues already detected and repaired, we have estimated a lifecycle financial value of $9,390,317 for the rapid detection of and avoidance of the impact of loss of phase, as shown above in Table 4-7.

(6) Range in Overall Value for Energy Theft and Unbilled Usage

In the Company's initial business case, it was noted that the actual financial benefits would vary from the point estimates reported, based on conditions yet to be experienced during deployment and operation of the metering system. The financial value over the life of the project for this group of benefits was expected to be in the range of $20.7 to $37.1 million, on a net present value basis. The total value of the currently estimated benefits is $23,395,770, toward the lower end of the initial range.

G. Billing Accuracy

(1) Estimated Bills

(a) Initial Estimate of Project Benefits

Because energy-use information is available from the advanced meter to the utility on an interval basis, and by interrogation, Avista is no longer required to estimate bills for missing meter reads or for the processes of opening, closing, or transferring utility service. The Company's initial business case reported an average of approximately 92,000 transactions each year in our Washington service areas that required customer service representatives to estimate metered usage and the billing amount. In addition to eliminating the need to estimate usage, the availability of detailed energy-use information equips customer service representatives with timely and meaningful usage data to assist customers during billing inquiries, providing both the information and convenience valued by Avista's customers. As shown in the table below, our initial estimate of the financial savings for customers over the life of the project had a net present value of $5,608,610.

TABLE 4-8. NET PRESENT VALUE OF FINANCIAL BENEFITS ESTIMATED FOR IMPROVEMENTS IN BILLING ACCURACY IN AVISTA'S INITIAL ADVANCED METERING BUSINESS CASE (2016) AND IN AUGUST 2020.

Billing Accuracy		
Category	**Lifecycle Net Present Value 2016**	**Lifecycle Net Present Value 2020**
Estimated Bills	$5,608,610	$6,783,166
Bill Inquiries	$2,951,711	$2,472,821
Billing Analysis	$1,387,734	$1,138,569
Rebilling	$700,072	$1,011,791
Total	**$10,648,127**	**$11,406,347**

(b) Currently Expected Benefits

Based on our experience to date we have revised upward our estimate of the value of financial benefits for the avoidance of estimating bills, as shown above in Table 4-8. The value in the initial business case was based on an estimated time of 6.5 minutes on average for the customer service representative to calculate each estimated bill, which we have tracked at 9 minutes per estimated bill. Based on this information, as well as our experience using the AMI system to avoid estimated billing, we have calculated the lifecycle financial benefit for our customers at $6,783,166.

(2) Bill Inquiries

(a) Initial Estimate of Project Benefits

Without advanced metering, customer service representatives responded to customer bill inquires without any ability to know or obtain a current reading of the customer's metered usage, or to have the customer's historical usage normalized to the month, or to analyze any bill trends or usage anomalies. The steps required to provide even a rudimentary answer a customer's billing question involved estimation, assumption, and a substantial amount of a customer service representative or billing analyst's time to assemble. The Company's initial business case reported that our customer service representatives received an average of over 650,000 calls each year, of which approximately 43%, or 277,000, were billing related. Based on the estimated time required for the manual processes needed to resolve each of these billing inquiries, that would now be avoided with advanced metering, the estimated financial benefit for customers over the life of the project was estimated to have a net present value of $2,951,711, as shown above in Table 4-8.

(b) Currently Expected Benefits

While we have not materially revised our initially estimated savings, we do expect to expect them to exceed the annual and lifecycle value presented here. The opportunity for greater benefit is provided by a new application we are currently installing that will automate the analytical process that is done manually today. The new application, which is planned to go live at the end of this year, uses advanced "load disaggregation" analytics to help identify the bill drivers such as changes in weather or customer usage patterns. The automated analysis will further reduce the time required for customer service representatives to effectively resolve billing inquiries, focusing on the conversation in place of gathering and evaluating the data. The report relied on by the customer service representative can also be shared with the customer to help them better understand and manage their energy use. Until we have experience with the new application, we have revised lower the expected benefits for bill inquiries based on the Company's experience with the delay in meter deployment, as shown above in Table 4-8.

(3) Billing Analysis

(a) Initial Estimate of Project Benefits

Historically, Avista employed billing analysts who reviewed 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 included abnormally high or low monthly bills, referred to as 'exceptions.' Each exception was flagged and evaluated by analysts who decided whether to send a meter technician to test the subject meter. In the Company's initial business case, the deployment of advanced metering was expected to eliminate much of the review process for these types of bills because diagnostic algorithms in the metering system would enable analysts to better determine whether there was an actual problem with the meter. The estimated reduction in effort associated with billing analysis was estimated to have a financial value for customers over the life of the project of $1,387,784, as shown above in Table 4-8.

(b) Currently Expected Benefits

Avista's meter data management system is equipped with a meter health monitoring system that alerts our meter shop of any potential issues with the meter. The application uses a daily meter read, combined with other meter health indicators, to identify potential meter anomalies. As expected, this tool has substantially reduced the number of meter exceptions that need to be evaluated by an analyst. This monitoring system also provides predictive information to identify meter issues prior to failure, further improving customer satisfaction and experience. While we believe the meter health monitoring system will increase the financial savings related to billing analysis estimated in our initial business case, we have not included any additional financial value until we have more experience with this system. Accordingly, we have revised lower our estimate of the net present value of lifecycle financial benefits to $1,138,569, as shown above in Table 4-8, related to the delayed deployment of our system.

(4) Rebilling

(a) Initial Estimate of Project Benefits

Another area of benefit identified in the Company's initial business case, enabled by advanced metering, was a reduction in the work process known as "rebilling". Historically, a range of instances could lead to errors in the initial bill sent to a customer, particularly from the need to estimate the billing amount, requiring a subsequent adjusted bill to be generated and sent to the customer. We noted the Company's annual rebills numbered about 15,300 for our Washington customers, most arising from the need to estimate bills. We anticipated that eliminating the estimation of bills would reduce the need for customer rebilling by 80%.[90] Based on an estimated five and a half minute processing time for each rebill that would be largely avoided with AMI, the financial value for customers over the life of the project was estimated at $700,072, as shown above in Table 4-8.

(b) Currently Expected Benefits

Avista documented an unanticipated increase in the number of rebills during the initial meter deployment that was caused by an integration problem between our customer care and billing system and the new meter data management system. This issue has been resolved and we are experiencing the expected reduction in the number of rebills. The lifecycle value for this area of benefit has been revised downward slightly to $1,011,791, based on this integration issue and the delay in meter deployment, as shown above in Table 4-8.

(5) Range in Overall Value of Billing Accuracy

The Company's initial business case noted that the actual financial benefits would vary from the point estimates reported based on conditions yet to be experienced during deployment and operation of the metering system. The financial value over the life of the project for this group of benefits was expected to be in the range of $9.6M to $11.7M on a net present value basis. The total value of

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[90] The continuing number of rebills in Idaho where Avista has no AMI system supports this forecast.

currently estimated benefits is $11,406,347, which is above the initial point estimate and at the upper end of the value range.

H. Utility Studies

(1) Retail Load Analysis

(a) Initial Estimate of Project Benefits

In our initial business case, we reported the requirement every five years to conduct a study of the electrical "demand" placed on our system by each of our groups or classes of customers (e.g. residential, small commercial, etc.). This information is used as part of the Company's cost of service analysis developed for each customer class. We explained that this demand data was historically collected at hourly intervals from a sample of customers using approximately 700 specialized meters that were placed in the field solely for this purpose. Installing these meters and moving them periodically, as well as providing them with communication capability, represented a substantial portion of the cost of these studies. With the deployment of advanced metering, each of our customers' meters has the capability to record and communicate demand information, doing away with the need to purchase and deploy specialized meters or incur their communication costs. As shown in the table below, the Company's initial estimate of the financial savings for customers over the life of the project achieved a present value of $1,154,805.

TABLE 4-9. NET PRESENT VALUE OF FINANCIAL BENEFITS ESTIMATED FOR UTILITY STUDIES IN AVISTA'S INITIAL ADVANCED METERING BUSINESS CASE (2016) AND IN AUGUST 2020.

Utility Studies		
Category	**Lifecycle Net Present Value 2016**	**Lifecycle Net Present Value 2020**
Retail Load Analysis	$1,154,805	$979,467
Meter Sampling	$1,047,101	$1,071,165
Total	**$2,201,905**	**$2,050,632**

(b) Currently Expected Benefits

As expected, the specialized meters described above, and their associated costs, have been removed and replaced by Avista's advanced meters. The Company has revised its estimate of the present value of financial benefits for retail load studies, as shown in Table 4-9, based on the delayed deployment schedule for the project.

(2) Meter Sampling

(a) Initial Estimate of Project Benefits

Avista explained in its initial business case that meter technicians field-tested a sample of meters each year to determine whether the overall population of meters in service was performing reasonably. The population of electric meters was 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 were constantly changing. As a result of this flux we reported 835 single-phase/network meter families and 208 poly-phase meter families in our Washington service area. The number of meters in the sample that we tested each year was approximately 1,900. This large sample size was necessary to capture an adequate number from each of the meter families to be statistically valid. We noted with the deployment of advanced meters, there would be a nearly uniform population of meters, meaning the sample size to be tested each year would be considerably reduced. The financial savings in the business case were directly tied to the labor and associated costs required for testing what was a large number of meters each year, much of which would now be avoided. As shown above in Table 4-9, the Company's initial estimate of the financial savings for customers over the life of the project had a net present value of $1,047,101.

(b) Currently Expected Benefits

As expected, this aged population of multi-family meters has been removed and replaced by Avista's advanced meters, and the sampling requirements have been reduced as expected. We have revised our estimate of the net present value of financial benefits for meter sampling, as shown in Table 4-9, based on our experience with the delayed deployment schedule for the project.

(3) Range in Overall Value for Utility Studies

The Company's initial business case noted that the actual financial benefits would vary from the point estimates reported, based on conditions yet to be experienced during deployment and operation of the metering system. The financial value over the life of the project for this area of benefit was expected to be in the range of $1.98 to $2.42 million, on a net present value basis. The total value of currently estimated benefits lies at the lower end of this initial range.

Section 5 | Summary of Customer Benefits Currently Not Quantified

A. All Benefits Are Important to Our Customers

As described in the prior section, the majority of benefits identified in the Company's advanced metering system are quantified financially for inclusion in the project cost-benefit analysis. Additional benefits that have value to our customers but are often difficult to quantify should be properly included in the consideration of the prudence of our investment. As an example, providing customers a range of convenient payment options is often neither cost-effective nor financially valued. Still, it is the right thing to do for customers and the cost to provide these benefits is viewed as reasonable. The same is true for many of the customer benefits provided by advanced metering, such as providing them with information and tools they appreciate or improving their overall experience and satisfaction with their service. Avista is highlighting these areas of benefit, showing how they have shifted not only how Avista performs its work, but also the Company's relationship with its customers. As noted in Section 2 of this Report, the advanced metering platform is allowing Avista to build a partnership with customers as they share greater influence and participation in our overall system.

B. Improving Customer Convenience, Experience, and Satisfaction with their Service

Since the program's beginning, new benefits that were once impractical or impossible to achieve are now being implemented through new capabilities provided by the AMI system. The following is a brief description of benefits now being delivered to our customers.

(1) High and Low Service Voltage

AMI meters provide interval voltage data at each customers' service and alarms indicating whether the voltage levels supplied to a customer are too high or too low. Historically, these service issues would go undetected unless reported to Avista by the customer as a potential power quality issue or observed by chance by field personnel performing unrelated service work. Access to interval data and meter alarms now allows the Company to proactively address issues when voltage is outside defined service standards included in Avista's strategic reliability objectives. There have already been numerous instances where meter voltage alarms have prompted Avista to dispatch a service person to evaluate voltage issues. In some cases, voltage problems were easily corrected through an adjustment on a transformer setting. In other cases, the alarm indicated a transformer was beginning to fail. These investigations prompted a change out of the transformer before it caused further voltage issues or failed in service, resulting in a longer outage. In addition to transformer issues a common reason the service voltage may be too low is the secondary service line between the transformer and the customer's meter. Even 'smart' transformers cannot detect these secondary voltage issues.

(2) Neutral Connection

Three-phase meters typically include a neutral connection.[91] Avista has already experienced several instances where irregular voltage fluctuations and alarms helped identify a problem with this neutral connection. In some cases, the neutral connection could be tightened, while in others, installation of a new neutral wire was necessary. In one case so far, the alarm helped us identify a wiring problem on the customer's side of the meter. Had this issue continued to go undetected, voltage fluctuations could have potentially damaged the customer's equipment. Like high and low voltage issues, the Company is now equipped to proactively detect and resolve these issues instead of waiting for the customer to experience serious equipment problems before calling us.

(3) Intermittent or Partial Power

The typical residential or small commercial service is served from our transformer by three conductors (wires). Two of the wires, each referred to as one 'leg' of the service, each supply electricity at 120 volts (V), and the third wire is referred to as the neutral. In the customers' electric panel, some circuits are served by one of the legs at 120V, while other circuits combine both 120V legs together to serve 240V. Heavier loads like electric ranges and water heaters are usually served at 240V, while 120V is used for light appliances, lighting and plug load. In the course of service, instances can arise where one of the legs of service can lose connection with the transformer, referred to as a "partial power." This results in the loss of 240V service (and some of the 120V circuits) inside the home or business, which is often not immediately discernable to the customer. This is especially the case if the problem connection is intermittent in nature. It's also not common for the customer to think of calling Avista because they still have electric service, even though their 240V appliances will not function properly, or not at all. Avista can now proactively identify these issues using alarms from its advanced meters and quickly repair them for the customer. As of today, we have identified over 80 of these cases using smart meter data.

(4) High Bill Complaints

Historically, when a customer had a high bill complaint our customer service representative had only limited tools to help identify the cause. Today, our customer service representatives have access to smart meter interval data, which gives them much greater information and tools for resolving high bill complaints during the initial customer call. The speedy resolution of the customers' concern provides a real enhancement to their experience and satisfaction with their service. It also helps avoid expensive field testing of the customer's meter, as discussed elsewhere in the Report. As we continue to develop and release load disaggregation functionality, enabled by our advanced metering system, this conversation with our customers will be further improved by our ability to more specifically pinpoint and quantify the specific loads contributing to the customer's billed usage. This will further empower the customer to better understand how they use energy, how that use impacts their bill, and what steps they can take to reduce their energy consumption and save money.

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[91] Neutral wire is the return conductor of a circuit; in building wiring systems, the neutral wire is connected to earth ground at only one point.

(5) Meter-Type Errors

Providing a range of different services to our multiple classes of customers requires an array of types of metering equipment and applications deployed to our several hundred thousand customers. While mistakes in these classifications are rare, the Company occasionally finds instances of work process errors that result, for example, in the wrong class of electric meter being installed for a customer. These instances can result in a range of issues for both the customer and the Company, which worsen over time between the installation and detection of the problem. Understandably, these situations often result in a very poor experience for the customer. Alarms from the advanced metering system have already proven helpful in catching these types of issues shortly after installation, resulting in the avoidance of what had been in the past a negative experience for our customers.

(6) Defective Meters

During large-scale meter deployments, it is common to have a small percentage typically much less than 1% of meters fail, a common asset phenomenon known as infant mortality. AMI meter alarms have proven helpful in these instances by alerting Avista of a meter defect shortly after installation, resulting in little to no impact to the customer. Historically, we had to experience a complete failure of the meter in order to identify a problem, which often resulted in the need to back-bill customers for unmetered usage. Again, this capability allows us to quickly identify and resolve a problem and to avoid a potentially very negative experience for our customers.

(7) Customer Access to Interval Energy Usage Data

Customers can use the Avista web portal to view and analyze their energy use to learn more about how they use energy and partner with Avista in energy conservation. The availability of this data provides customers information and value and improves their experience and satisfaction *even if they are not immediately inclined to take specific actions to reduce their energy use*. The availability of this information is also expected to reduce the number of customer calls to Avista based on billing concerns, though we have not attempted to quantify any financial benefits at present.

(8) Load Disaggregation

Building on customers' access to interval energy use data, we are now entering an age where we can demonstrate to our individual customers what is driving the energy-use patterns at their home or business. This new insight is enabled by our load disaggregation tool using data from our advanced metering system. While this tool supports our achievement of financial benefits through behavioral energy efficiency and billing analysis, it will also provide our customers a more robust understanding and effective opportunity to better manage their energy use over the availability of interval usage data alone. This capability will improve the service experience and satisfaction of our customers, above and beyond the value of any quantified financial benefits.

(9) Energy Alerts Selected by Customer

As described above and in Section 4, under customer-managed energy efficiency, the Company has already developed several applications that allow customers to request alerts for services, including bill amount thresholds, trending of bill size, and use comparison. Customers can select from a range of tools and alerts to customize the combinations of notifications they can receive to help them better manage their energy use.

A new alert ready to be launched by the Company is known as the 'midcycle bill update.' This tool addresses a common customer concern that "my bill is a surprise to me every month." These alerts will give customers the ability to set a personalized "budget threshold," identifying an amount the customer expects to pay each month and notifying them if their energy use is expected to exceed the threshold they have set. Notifications are sent via text or email and give customers their current bill balance as well as their projected energy cost for the month. In a survey of Avista customers, 89% supported receiving notifications providing feedback on their expected energy use. Clearly our customers value this service option now enabled by our advanced metering system. The availability of these tools improves the satisfaction and experience of our customers.

(10) Customer Home Area Network Interface

As consumer technologies continue to evolve, the home area network interface to real-time energy use data may continue to play a role in the development of smart homes and businesses. Avista believes a great potential for energy conservation, beyond the estimates included in our current business case, lies in the possibility of enabling home energy savings applications and systems that work behind the scenes to automate processes to save customers energy and money. Advanced metering provides the central platform for this transformation as these technology systems continue to evolve.

(11) Customer Privacy

Advanced metering does away with the need for meter readers to be on the customer's property each month to read their electric and natural gas meters. This change improves our customers' privacy and gives them more control over access to their property.

(12) Advanced Metering Improves Customer Experience and Satisfaction

Our customers are beginning to experience more of the direct benefits of AMI as a result of proactive actions taken by the Company based on information received from our advanced metering system. As one example, below is a customer email explaining how Avista used the meter alarm to detect their service outage and to dispatch a crew and have it repaired before the customer was even aware of the event.

> *Message: Our power went out while we were out of town last week due to an old buried line that is not in conduit. Not knowing the issue, I called my electrician to look at it, who by chance, arrived at the same time as Shane did (via smart meter) to see what the problem was. Shane determined it was Avista, coordinated a crew, and let me know what was going on. Big thanks to Jeremy, and whoever was with him, who had to dismantle our deck, dig a 3' [trench] down to fix the line, and put the deck back together All in the cold and dark. When we got home Monday, I would not have even known they were there except the utility lines had been marked. We appreciate the work they did and keeping us informed.* ***- Satisfied Customer***

C. Improving Customer and Utility Employee Safety

Avista is using its advanced metering system as initially planned, and in new innovative ways to reduce risk to our customers and our employees, and in some instances to reduce the costs of ongoing operations. Following are several examples of these improvements.

(1) Customer Meter Base/Socket Repair

Part of Avista's preparation for installing advanced meters was understanding the challenges documented by other utilities who had deployed the technology. A consistent theme Avista heard from utilities and their meter deployment contractors was the need to develop a plan for assessing and handling repairs required on customer meter bases and sockets.[92] While our repair of meter bases and sockets provided our customers a direct financial benefit, which is described and included in Section 4 of the Report, there is also a reduction in risk for the customer and the Company that was not financially quantified for our analysis. This reduction in risk provides our customers and employees a direct safety benefit as well as avoiding the inconvenience of a service outage resulting from the failure of equipment.

(2) Backfeed

Except for net metering applications, electric current should always be moving in one direction, from our system to the customer's service point. In certain instances, however, including service outages when a customer may improperly connect a backup generator to keep their lights on, the electric current may be moving from their service onto the grid. This situation is known as "backfeeding" and it can pose a significant safety hazard to field personnel working on the distribution system. Advanced meters are equipped to send 'reverse energy' alarms, that if not associated with a distributed energy resource, allows us to investigate the cause of the potential backfeed. In a recent example, a meter technician determined that a customer had an uninterruptible power supply

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[92] The meter socket is the point of connection for the electric meter, which is an integrated part of the meter base. It is the meter base that is attached to the customers' residence or business.

backfeeding onto Avista's system. He contacted the customer and explained the hazard to utility personnel, who was able to reconfigure the power supply to function correctly. Ultimately, the Company will configure alarms to operate during service outages to identify when customers' generators could be backfeeding onto the distribution system.

(3) Miswired Service on Customers' Side of Meter

Recently, a meter technician was dispatched to investigate a report of backfeed on a line, and he was able to trace the issue to a wiring malfunction on the customer's side of the meter that was backfeeding to the load side of the meter. During this investigation, the meter technician discovered a secondary issue creating another safety hazard. As a result, the customer was able to have the wiring corrected and the safety hazard removed from their home.

(4) Unregulated Solar Generation Systems

Solar generation system installations are becoming more prevalent across Avista's service territory and we have established a program for customers to register their solar installations with the Company. This process allows an engineering review of the installation to ensure a safe and proper installation. When systems are installed correctly, the solar panel inverter is specifically designed not to backfeed onto the grid in an outage scenario. However, if customers do not follow this process, there is potential for an incorrect installation that allows the solar system to backfeed onto the system during an outage. In a handful of instances, reverse energy alarms from our smart meters have helped identify solar installations not properly registered. Meter technicians have been dispatched to these locations to consult with customers and educate them on the proper steps to ensure a safe installation.

(5) High Current

Services to Avista's customers are designed to accommodate the load anticipated at the time of the initial installation. Over time, customers many add equipment and loads, and at times to the point where the capacity of their installed service has been exceeded. Ideally, the customer will notify Avista of substantial change in their installed load, and the service can be evaluated and upgraded if needed to ensure they have sufficient capacity. But much more often customers add load incrementally and never think of calling Avista. Advanced meter alarms can now detect when a customer's load has exceeded the capacity of their service, and we have already used these alarms to identify the need to revamp their service. Having the visibility to detect these instances provides an important safety measure for the customer and the system and promotes improved reliability for neighboring customers as well.

(6) Potential Wire Down

When a broken or downed primary conductor (wire on the feeder line) contacts a partially insulated object like a tree branch or highly resistive soil, there may not be enough current in the fault to operate the protective devices on the distribution system. This can be extremely dangerous because the energized primary conductor may be close to or on the ground and remain energized. In these instances, the utility has no way of detecting the problem until either someone observes the problem and calls it in or there is a complete fault and a resulting service outage. Avista's early experience with its advanced metering system shows that voltage alarms from advanced meters can be useful in detecting these issues. Though infrequent, early detection and repair of these issues would significantly reduce the potential of this safety hazard.

D. Operational Awareness of System Health

The following examples show how Avista's advanced metering system is providing and will continue to provide even greater benefits for customers related to field operations efficiency, distribution system management, design services and engineering, and billing.

(1) Detecting Equipment Problems

Advanced meters can now be used to supplement voltage monitoring, not just at a customer's service point, but across the entire distribution system. While most voltage issues are related to a specific location, as described above, there are instances where a voltage issue on the system impacts multiple customers. We have already used this capability to identify and remedy system issues such as a problem voltage regulator. We have also detected faulty fuses causing a regulator not to function properly, as well as configuration settings in voltage regulators, corrected by adjusting the regulator. Historically, because there was no way to sense and monitor system or service-level voltages, these issues would not have been detected until they resulted in the failure of Company or customer equipment.

(2) Overloaded Transformers

Like the instance above where a single customer's load had increased to the point where the capacity of their service equipment has been exceeded, it's also the case that the aggregate load of multiple customers on a single transformer can sometimes exceed its capacity. Interval data from advanced metering is used to aggregate the load from all meters served by an individual transformer and alarms monitor these loads to identify transformers potentially overloaded. Low service voltage, reduced service life, and transformer failure, resulting in an outage for multiple customers, can result from overloading. Avista has already used these new tools to identify several overloaded transformers, which were proactively replaced with a unit capable of serving the existing load. As we gain more experience with this monitoring and alarming feature, we will be able to better define thresholds used to systematically monitor and signal the need for a transformer change.

(3) System Visibility for Employees in the Field

Field workers now have access to information in the field that was not possible before advanced metering. When a line worker responds to a power outage, the outage/restoration status for the service is accessible from their mobile computer. Avista has already quantified the value of using AMI data to improve outage response. Beyond outages, however, interval voltage data is also available to field personnel for troubleshooting issues in the field. The future holds real opportunity for financial savings related to the expansion of these digital tools and associated training for field personnel, resulting in optimized field troubleshooting.

(4) Mismapped Services

Avista's outage management system relies on a 'connectivity model' that displays the mapping of individual customer services to transformers and transformers to the proper phase on the feeder. This model is important when an outage occurs because this connectivity helps ensure the extent of the outage is understood, the likely cause is identified, and crews are dispatched to the proper location to restore all customers associated with the outage. In cases where customers' services have not been properly mapped to the correct phase, there can be delays in determining the extent of the outage and slower restoration efforts. Avista's connectivity model is highly accurate, but some factors can result in errors in the model. One such instance occurs during emergency restoration, after large storms, when services sometimes need to be reconfigured for quicker restoration but may not be updated in the system model. During phase one of advanced meter deployment, Avista identified over 60 meters that were not tracking consistently with the mapping in the system. As these instances arise, corrections are made to ensure the model is more accurate. In the future, Avista will evaluate the capability to apply more advanced analytics to proactively identify and correct instances of incorrect mapping.

E. Design Services and Engineering

(1) Transformer Sizing

When additional load is added to an existing transformer, the field designer uses the 'transformer loading tool' that uses monthly energy usage to perform a statistical load allocation for determining proper transformer and wire size for the attached services. In the future, this tool will be supplemented by aggregated load data from each meter to give an actual reading of peak loading on the transformer rather than a statistical load allocation that was in the past only an approximation.

(2) Load Analysis

Design services and engineering have historically had very little granular data available to support decision making. As previously discussed, individual smart meter data can be aggregated up to the transformer level, and many other similar aggregations are being configured for better analyzing our system now that data is available for every individual meter. As one example, a Company engineer for our Spokane Downtown Network area needed to determine the least impactful time to schedule a building outage. Historically this would have been estimated based on the aggregated monthly load of the multiple meters serving the building. In this instance, however, the engineer aggregated the load of the entire building using AMI interval data, and the true optimal time was chosen to perform the required work.

(3) Distribution Planning

As noted throughout this Report, utilities are experiencing the increasing penetration of electric vehicles and customer-owned distributed generation that, at some threshold, will affect the performance and predictability of their electric distribution systems. These new dynamics impact the applicability of conventional engineering and asset management models currently used to evaluate system performance and plan for future infrastructure needs and investment. The availability of advanced metering data provides an entirely new toolset for the distribution planning process, a step necessary to meet the rigorous planning requirements enacted by the Washington State Legislature (RCW 19.280.090 – Distributed Energy Resource Planning). The granular data of AMI allows Avista to generate customer class usage curves, allowing for much more accurate time-based analytical capabilities. These customer class usage curves are essential for conducting contemporary distribution planning analysis and planning. The data provided by advanced metering will also help engineers better understand the new ways customers are interacting with the system, and to more accurately model current and future system performance and needs. This capability will result in the more efficient deployment of capital to meet all the integrated system needs.

Section 6 | Expected Future Trends in Customer Benefits

A. Support of Asset Management Planning

As one example, prior to having interval data from advanced metering, Avista used historical service life/failure data to forecast the average expected life of equipment, such as distribution transformers. In a recent internal report, written in cooperation with students from Washington State University, we developed an algorithm that uses loading data from smart meters to determine how overloading impacts the expected life of the transformer. This much more accurate information improves the quality of our asset data overall and also informs when a transformer should be replaced before it fails.

B. Support of Electric System Planning

(1) Planning Studies

Avista's advanced metering system, when fully deployed, will provide "just in time" data necessary to meet a range of new system planning requirements in Washington.[93] Integrated planning for electric distribution systems has received considerable attention in recent years as the Commission has worked through rulemaking and legislative processes to best incorporate distribution planning into the Company's Electric Integrated Resource Planning process. Among other objectives, these discussions have focused on understanding the degree to which investments in alternative or "non-wires"[94] solutions can be used to cost-effectively supplant traditional improvements in utility infrastructure. Similar to the objectives described in Section 4 on Grid Interactive Efficient Buildings, a key goal of system planning is to use higher quality interval data from advanced metering to evaluate alternatives for mitigating capacity issues on the Company's electric feeders.

Traditionally, the electric utility industry (and Avista) used limited load data approximating the total load for all customers on a feeder to identify when capacity improvements might be required to avoid overloading the system (e.g., conductor, power transformers, regulators, fuses, etc.). Traditionally, these improvements focused on increasing the electric carrying capacity of the system to meet measured or anticipated periods of peak demand. The range of tools available to system planning has expanded in recent years, however, as management of the distribution system has become much more sophisticated, now enabled by communications, remote sensing, measuring, voluminous data, monitoring, and automation. Among these, AMI data has the greatest potential for evaluating and expanding non-wire solutions. We can now understand the precise loads being placed on each

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[93] Among other needs, House Bill 1126, which was passed by the Washington Legislature in 2019, outlines Distributed Resource Planning requirements. The Washington Utilities and Transportation Commission is currently engaged in rulemaking.

[94] Non-wires solutions can be generally grouped into distributed energy resources installed by the customer or utility, energy storage systems, such as batteries, located at strategic points on the feeder or system, and distribution management systems with automated equipment, such as integrated volt-var compensation systems, that operate as needed to improve the electrical efficiency and capacity of the system.

part of the system by every customer on the feeder. The advent of advanced metering data and analytic platforms can be used to disaggregate and analyze loads from wide-ranging end uses to accurately determine what loads in what locations are driving the timing and magnitude of peaks in demand on the system. This data can also be re-aggregated by categories of end uses across all customers on a feeder to identify potential solutions most effective in reducing or shifting the peak in demand (instead of the traditional response of reinforcing the physical capacity of the infrastructure). This analysis can also be used to determine how to deploy non-wires solutions for gird-optimal effectiveness.

(2) Electric Vehicle Planning

Avista is continuing to update its plans to accommodate the pending greater penetration of electric vehicles (EV) in our service area. Using interval from our system Avista will use load disaggregation to identify households charging electric vehicles. As a next step we would offer time of use pilot programs and other tools to these customers to help move vehicle charging away from periods of peak demand. Overall, AMI enabled tools will help us better optimize long term electric vehicle loads with the infrastructure capability our electric system.

C. Enabling Energy Pricing Strategies

In our initial business case for advanced metering, we noted energy prices, including the difference between heavy and light-load hours, and our limited requirement for capacity resources, constrained the need and cost-effectiveness of retail pricing strategies in our resource portfolio. As the Company plans to meet its clean energy plans and clean energy legislative requirements, we face a substantial shortfall in capacity resources in the next five years. This need for capacity resources is driven by several factors, including expected load growth, the planned termination of the energy supply contract for the Lancaster combined cycle combustion turbine, the end of load service for customers from the Colstrip generating station, termination of regional hydroelectric resource contracts, and the retirement of the Northeast combustion turbine.[95] In planning to meet this need, retail energy pricing strategies enabled by advanced metering are now a cost-effective way to provide demand response capability.

As part of its 2020 integrated resource planning process, Avista retained the firm AEG to study the potential of alternative demand response strategies to meet future capacity requirements for the 25-year planning horizon, 2021 – 2045. The purpose of the study was to develop reliable estimates of the magnitude, timing, and costs of demand response resources likely available to Avista for meeting both winter and summer peak loads. Among the alternatives considered were rates options that could be implemented to provide a demand response resource to help offset our capacity needs. For example, the study forecasts an average of 40.4 MW of load reduction available as early as year 2022 through a time of use[96] and variable peak pricing rates, increasing to an average of 58.25 MW by year 2030. Although, as noted earlier in the Report, our deficits may not occur until November

[95] Avista Electric Integrated Resource Plan for 2020, page 1-1; page 11-3,4.
[96] Time of use rates offered as an 'opt out' option.

2026,[97] these programs require a sufficient lead time for pilot testing and to recruit enough participation to make certain we have sufficient capacity available.[98] Practically, these rate strategies have to be in place and fully evaluated prior to the future capacity shortfall. Implementation of these rate mechanisms fundamentally relies on the capabilities of our advanced metering system.

Avista is planning to release a request for information in late 2020, seeking information, statements of capability, and possible pricing strategies on capacity resources to meet its expected future needs. These potential capacity resources would be evaluated and selected in a subsequent request for proposal (RFP) process. The Company expects to supplement this review in 2021 by retaining a firm specializing in the evaluation of non-resource capacity alternatives (e.g., rates options for demand response, etc.), designing potential pilot programs, and supporting Avista in any accompanying regulatory processes. In addition to AEG's modeling of capacity needs and resources for an integrated resource plan, Avista is compelled by the new Washington clean energy legislation to acquire all cost-effective demand response and rates programs. The Company anticipates using the information from this engagement to support the filing of a Washington clean energy implementation plan by January 2022. Among other details, this filing will identify the rate programs likely to be implemented to meet Avista's identified energy conservation targets.

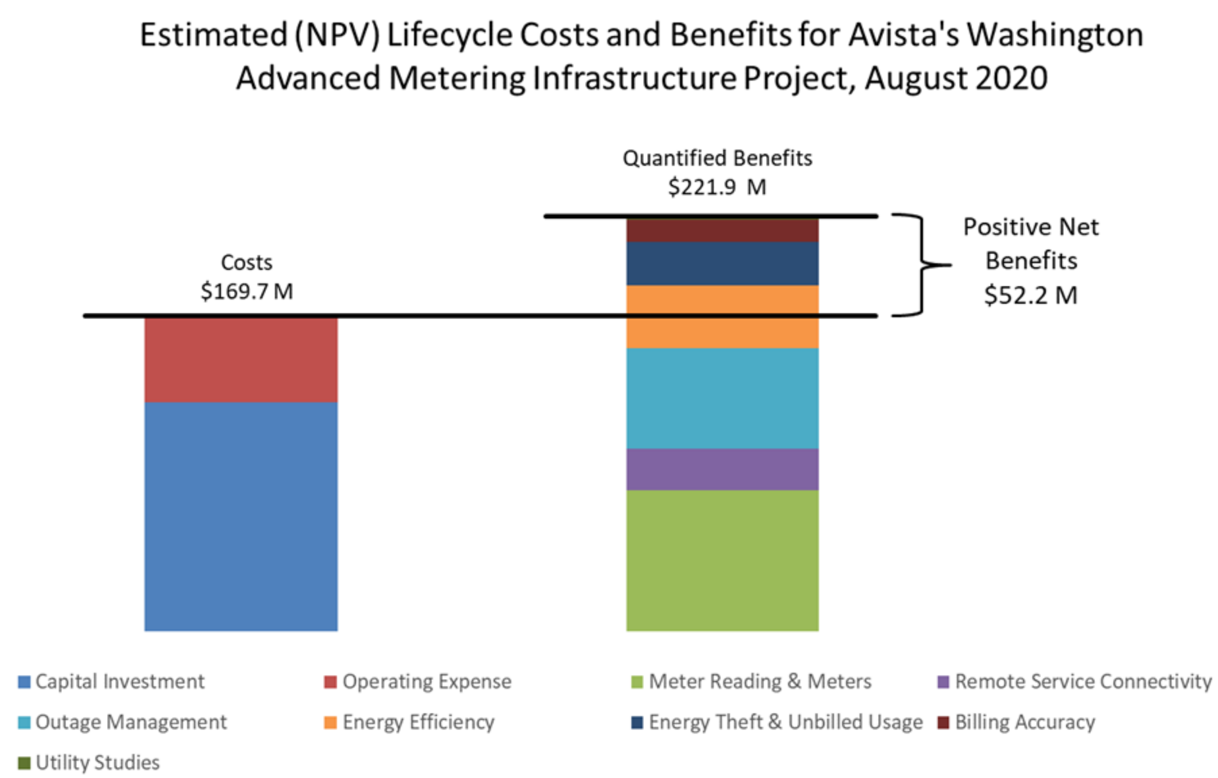
Currently-Expected Benefits: Avista's Preferred Resource Strategy for year 2025 includes 29.7 MW of demand response capability from variable peak pricing.[99] Using the expected new resource avoided costs and costs to achieve demand response from variable peak pricing, the net benefits of this resource in year 2026 would exceed $2.4 million per year, with a lifecycle net present value approaching $19 million.

[97] Avista's capacity shortfall timing will depend on the ultimate future of Colstrip and the process of evaluating new resources from its Renewable RFP.
[98] Id at page 11-8.
[99] Id at Table 11.3, page 11-9.

Section 7 | Conclusion: Comparison of Project Costs and Benefits

Descriptions of project costs in the Executive Summary and in Section 3 include the actual capital and operating expenses incurred and the expenditures planned over the remaining project lifecycle. By the close of the deployment phase in 2021 we anticipate the total capital cost to reach $156.6 million, well under the initial cost of $166.7 million estimated in 2016. Likewise, our estimated operations and maintenance costs are now forecasted to total $101.7 million over the project lifecycle, well below our 2016 estimate of $123.4 million. The net present value of the current lifecycle capital and operating costs is $169.7 million, as shown below in Figure 7-1, which represents more than a 20% reduction from the same estimate made in 2016 ($215.1 million).

FIGURE 7-1. ESTIMATED LIFECYCLE CAPITAL AND O&M COSTS AND QUANTIFIED FINANCIAL BENEFITS, ON A NET PRESENT VALUE BASIS, FOR AVISTA'S ADVANCED METERING SYSTEM.



Quantified financial benefits described in Section 4 include a point estimate of the expected net present value when fully realized (in 2016 dollars), based on the timeline anticipated for achievement of the full value of each benefit. In cash value these benefits are expected to reach $498.8 million over the project life, compared with a total estimated in 2016 of $510.7 million. On a net present value basis, current benefits total $221.9 million as shown above in Figure 7-1, compared with an estimate of $241.7 million in 2016. Though the net present value of currently estimated benefits is roughly 10% less than estimated in 2016, the lifecycle net benefits are $52.2 million, as shown above in Figure 7-1, nearly double the net benefit of $26.5 million estimated in 2016. Even if one was to assume net benefits based on the lowest end of the current sensitivity analysis (See discussion at Section 4(A)(1)), the worst case would still produce net benefits exceeding $35 million, before including financial benefits yet to be included or quantified. Though we believe the prudence of our investment in advanced metering should be judged on the merits of all customer benefits provided by the system (both quantified and unquantified benefits), our current case clearly demonstrates the cost-effective value delivered for our customers based on the financial net benefits alone.

Appendix A: Avista Communication Plan