Naperville AMI Business Case and Implementation Plan: Final Report

Prepared by West Monroe Partners for the City of Naperville

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1. BACKGROUND & CURRENT LANDSCAPE

Naperville's Department of Utilities ("DPU") provides water and electric service to the Naperville community as well as some unincorporated areas in the region. DPU-Water currently outsources the manually intensive meter reading function, as opposed to the automated technology utilized within DPU – Electric. DPU-Water faces ongoing issues with manual meter reading:

- The current meter reading contractor (Alexander's) is unable to read all water meters on a consistent basis, so DPU-Water regularly estimates customer bills
- Meter reading is a highly-manual, error prone, and hazardous job, which DPU-Water pays a premium for
- The existing Alexander's contract is set to expire in 2021, at which point the vendor will not renew the agreement, and the City will be required to build out a meter reading group internally

The City of Naperville recognizes the importance of accurate, timely bills and desires to provide DPU-Water customers with a higher level of service. This includes reducing estimated bills, proactively identifying and notifying customers of leaks, and providing a more granular view of water use so customers can self-manage their water consumption and corresponding bill.

Following the success of electric and gas advanced metering infrastructure ("AMI") deployment in the region, including a deployment by DPU-Electric, DPU-Water is evaluating the feasibility of water AMI throughout the service territory, which would fully automate the DPU-Water meter reading process. Naperville engaged West Monroe Partners ("West Monroe") to assist with an AMI assessment for DPU-Water.

AMI uses a telecommunication network to relay water consumption data multiple times per day. To deploy AMI, each water meter is equipped with a battery-powered AMI radio, which communicates interval usage and event data. AMI is used to reduce the volume of bill estimations and also provides numerous customer and operational benefits. For example, hourly interval data can be used to troubleshoot high bill questions (e.g., pinpointing usage to 800 gallons at 4:00am 3x/week, indicating a sprinkler system). AMI data analytics can also identify high or continuous consumption (leaks) and proactively notify customers in hours or days versus weeks or months. Additional indirect benefits of AMI, such as improved safety, reduced greenhouse gas emissions, and advanced rate design, can also be achieved.

An additional meter reading solution Naperville explored was automated meter reading ("AMR"), which is used for a small portion of meter reading at DPU-Water today. AMR uses mobile radio frequency ("RF") collectors to obtain meter reads. With AMR, utility personnel drive a truck equipped with a mobile collector in the region of Naperville where AMR is deployed. If AMR were deployed on a greater scale, this would assist in automating meter reading activities, however AMR does not offer ongoing, real-time data collection; rather, it yields meter reads as often as the routes are driven for collection.

To determine if an advanced metering system is feasible for Naperville, West Monroe assessed four options: (1) Deploy AMI on a shared, mesh network currently in use by the electric utility, (2) Deploy

AMI on a new, low-site point to multi-point ("PtMP") network, (3) Deploy AMI on a new, high-site PtMP network, or (4) Deploy AMR.

The general AMI timeline is depicted in Figure 1.

Figure 1: Estimated Timeline of Full-Scale Deployment

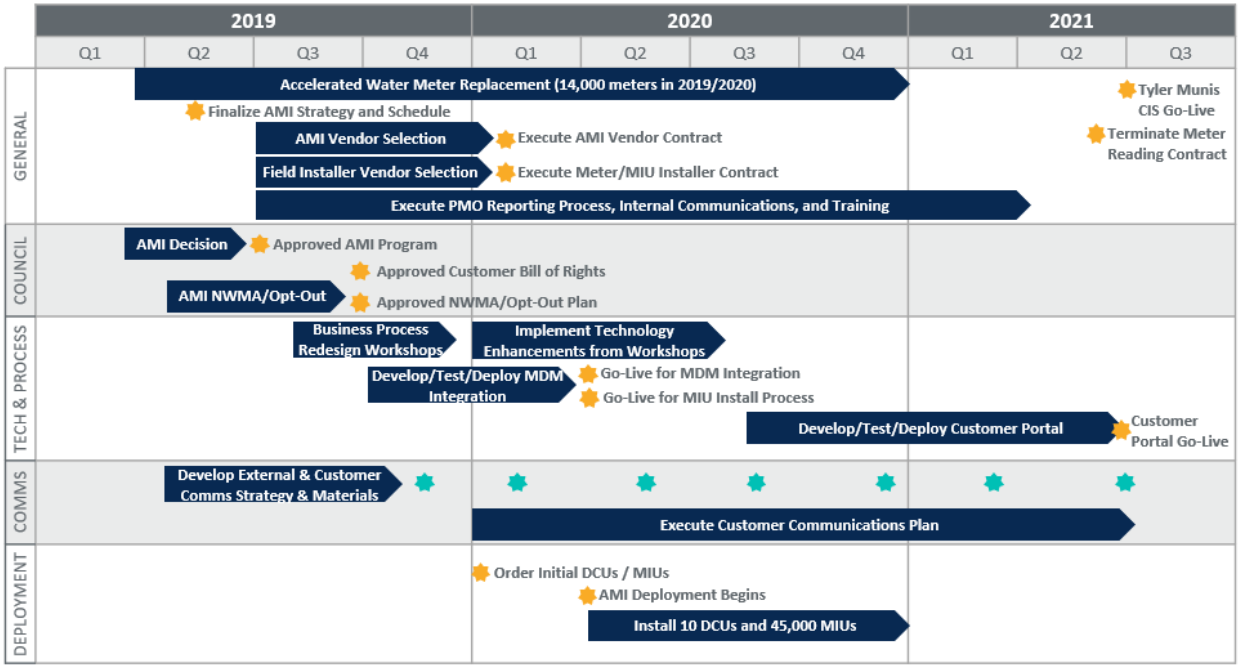
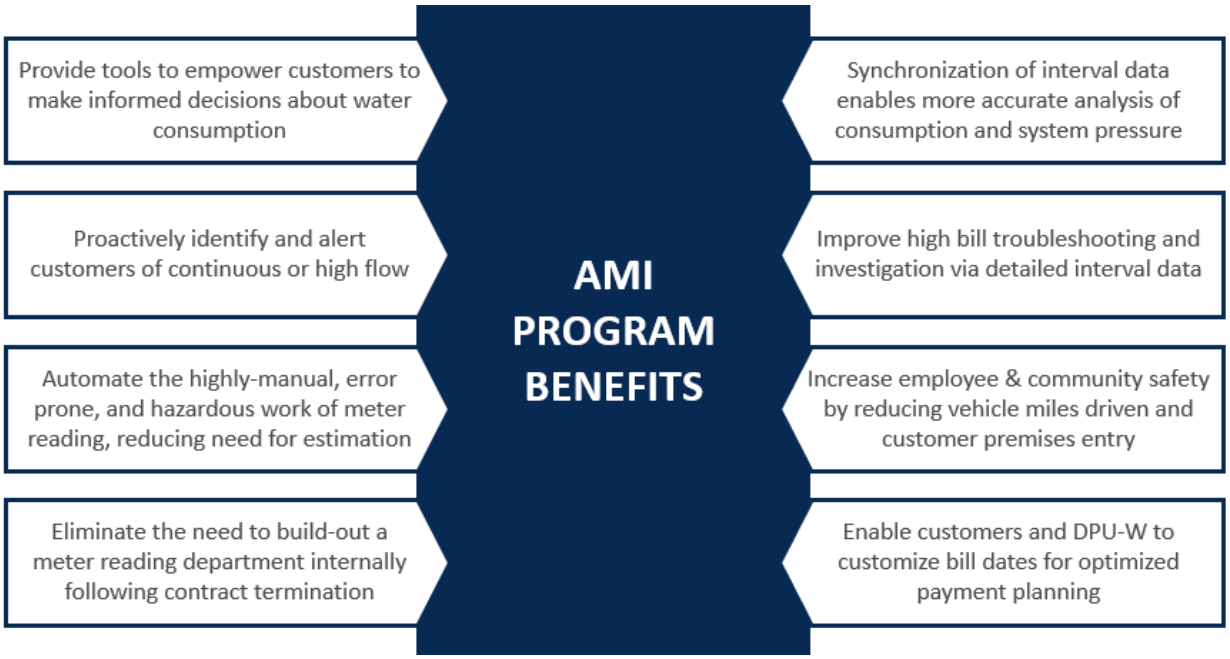


Figure 1 represents full-scale deployment of an AMI solution. This is the most optimistic implementation plan, optimized by leveraging the existing electric AMI network's infrastructural footprint. With this design, Naperville would integrate the existing meter data management ("MDM") system with the customer information system ("CIS"). Once these back-office system deployments and integrations are complete, Naperville would then transition to mass AMI deployment in the field.

2. BENEFITS OF AMI (TANGIBLE AND INTANGIBLE)

AMI results in both tangible and intangible benefits. Tangible benefits have a direct financial impact to Naperville and are quantified in the AMI business case. Intangible benefits are not quantified, yet still have positive customer service and operational impacts on Naperville, Naperville's customers, and society as a whole.

Figure 2: Benefits Associated with Deploying AMI



The following tangible benefits are quantified in the AMI business case:

- Reduced meter reading costs: By deploying AMI, Naperville will avoid the labor and vehicle costs associated with manual meter reading activities.
- Reduced service order labor: As AMI enables real-time data access, Naperville will see a reduction of up to 95% on certain meter reading service orders, resulting in labor savings and vehicle cost savings.
- Reduced billing exception labor: As AMI reduces the frequency of estimated bills, negative consumption and no-read exceptions will decrease significantly, yielding avoided labor and overtime costs.
- Reduced call volume due to improved self-service capabilities: As more customers enroll on the portal and take advantage of self-service activities, such as viewing consumption history, Naperville will see a modest reduction in call volume.
- Reduced cost of annual drive-by/AMR device maintenance: The expense of AMR drive-by devices will be eliminated with AMI. Meter reads will be transmitted via AMI, rather than collected using a device in the field.

In addition to the tangible benefits Naperville and its customers will see, AMI will also produce indirect or intangible benefits:

- Improved customer service: Transitioning from monthly meter reading and estimation cycles to hourly interval data will help Naperville improve their customer service by providing customers with proactive leak notifications, consumption/conservation alerts, and better data during phone calls with DPU-Water representatives. Rather than having to wait for a bill or a service order, customers will have access to this data nearly real-time with hundreds of meter-reads per month, as opposed to the single read offered today over a 30-day period. For customers who

historically received estimated bills, AMI will provide an increase in billing accuracy. Data availability will improve customers' ability to monitor and adjust their water consumption, potentially lowering their water bill.

- Improved customer leak detection: Hourly interval data from water meters, analytics, and a customer portal/mobile application could proactively identify leaks and notify customers – reducing the risk of water waste and catastrophic property damage.
- Improved conservation opportunities: Hourly meter data will help empower Naperville customers to make educated decisions about their consumption and conservation habits.
- Improved safety for staff and customers: Transitioning to advanced metering infrastructure will reduce safety risks that meter readers encounter in the field, eliminating the need to access a resident's property to read the meter. Additionally, reduction in driving miles associated with AMI will reduce road congestion and the likelihood of car accidents – making roads safer for both customers and Naperville staff.
- Reduced greenhouse gas emissions: Fewer truck rolls – attributed to AMI deployment – will reduce Naperville's greenhouse gas emissions. 95% of mileage associated with meter reading activity and certain meter reading service orders is expected to be eliminated via AMI.
- System and operational benefits: Synchronization of interval data enables more accurate analysis of consumption and pressure across the system.

Figure 3: Intangible Benefits Associated with Deploying AMI Functionalities

3. AMI STRATEGIC CONSIDERATIONS

There are several existing circumstances that require Naperville to move forward with the AMI program in an expeditious manner:

- Contracted meter reading is expected to cease in 2021 with the termination of Alexander's metering contract. At this time meter reading would have to be brought in-house, which is not a long-term sustainable solution. In any form, manual meter reading will likely result in ongoing bill estimations.
- Naperville is deploying a new customer information system in 2021. If AMI deployment is not complete in advance, DPU-W will incur additional costs to duplicate integrations for AMI supporting software.

AMI will impact nearly all areas of Naperville. The following roles are expected to support AMI deployment and operation.

Table 1: Roles Supporting AMI Deployment and Operation

Department	Responsibilities
Customer Service & Billing Rep	• Create and lead water AMI training for Customer Service / Billing • Develop / update call center scripts based on AMI questions • Update call center staff on AMI deployment progress • Address customer service escalations related to AMI • Troubleshoot AMI billing issues
Field Operations / Project Management / Engineering	• Assist in AMI vendor selection, field deployment vendor selection, and vendor QA/management activities • Assist in propagation studies & network design as needed • Oversee day to day contractor management / deployment • Update meter reading routes/bill cycles (as required) • Maintain network hardware & devices in the field
IT – General / Integrations / Software Maintenance	• Provide deployment & ongoing support for technical AMI hardware (e.g. servers, disaster recovery, log monitoring, technical change management, etc.) • Provide network monitoring & maintenance • Provide deployment & ongoing support for new water portal (and analytics?) • Develop and support new system integrations with MDMS (if non-Elster)
Program Management/ Change Management/ Training	• Manage water AMI program • Lead vendor selection & contracting activities • Create & execute change management plan • Create & execute training plan
Communications / City Management	• Communications plan and AMI training • Support the AMI deployment from a political perspective, including design of an opt-out program, Council memos, vendor selections and escalated resident inquiries
Legal	• Provide legal guidance and support for opt-out program and Bill of Rights

Establishing an AMI program will require heavy involvement from information technology and back office staff in 2019 and 2020. During this timeframe, IT and back-office staff will deploy and integrate software and redesign impacted business processes. Field staff availability will be impacted during the mass deployment year.

4. KEY ASSUMPTIONS

West Monroe conducted stakeholder interviews and workshops and provided input and best practices from prior experience to help Naperville determine assumptions for an AMI program. These assumptions are used as inputs to the AMI business case:

- AMI will be deployed over a one-year period due to contracted meter reading constraints and the approaching CIS replacement. All 45,000 endpoints will be converted to AMI with the option for a non-wireless metering alternative ("NWMA") program for those customers who choose to opt-out of AMI services.
- AMI benefit realization will not begin until the AMI fixed network is activated.
- The primary costs associated with AMI deployment are radio and network equipment, labor to conduct installations, billing and customer service operations, and technology/software costs. Projected costs and corresponding assumptions were developed based on anticipated deployment scenarios, industry benchmark data, West Monroe's past experience, and data made available from Naperville as part of this assessment.
- AMI installations will be completed primarily by contractors, though DPU-Water will assist with installations as is feasible with their current workload, and with installations for large commercial and industrial customers.
- West Monroe applies inflation to all expenses over the 20-year business case.

5. NETWORK FEASIBILITY ANALYSIS

West Monroe evaluated four telecom network designs to determine viable options for Naperville's water AMI program. The telecom network consists of data collectors and other communications equipment to relay the data collected from the field to Naperville's back office. The three options evaluated are: (1) expanding upon Naperville's existing electric AMI network, (2) building a new, point to multi-point network with low-site data collection, (3) building a new, point to multi-point network with high-site data collection, and (4) expanding the mobile AMR network.

- **Expanding upon Naperville's existing electric AMI network:** Naperville would build upon DPU-Electric's existing AMI network. This involves installing and maintaining incremental data collectors to relay data from meters to Naperville's head-end system. With this design, water AMI endpoints relay consumption data via electric endpoints and data collectors. Due to the existing electric AMI footprint, Naperville's staff is already experienced in building and maintaining the network, which could allow an accelerated AMI rollout and decreased capital investment, increasing the attractiveness of this option.
- **Building a new, point to multi-point AMI network:** Naperville would build, own, and maintain their own DPU-Water telecommunications network. This involves installing and maintaining new base stations / data collectors and a compatible backhaul network to relay data from collectors to Naperville's head-end system. This telecommunications network option spans AMI solutions 2 and 3, low-site and high-site. Low site data collectors are typically ~30 feet high, located every

square mile, whereas high site data collectors are ~150-190 feet high with fewer sites required. Water AMI endpoints relay consumption data via one or more of these data collectors.

- **Expanding the mobile AMR program:** This solution does not utilize a fixed network. DPU-Water would purchase radio frequency units for data collection and hire meter readers to drive the collection routes each billing cycle. Not a true network, meter reads would return once monthly rather than providing near real-time data availability.

6. AMI BUSINESS CASE

Prior to assessing AMI feasibility, Naperville established a baseline option – the cost of continuing business as usual with manual meter reading, implementing none of the advanced metering technologies presented above. This "do-nothing" scenario required Naperville to project the costs of bringing meter reading in-house due to the expected termination of the meter reading contract with Alexander's in 2021.

Figure 4: Cost Summary for the Baseline Option: In-House Manual Meter Reading

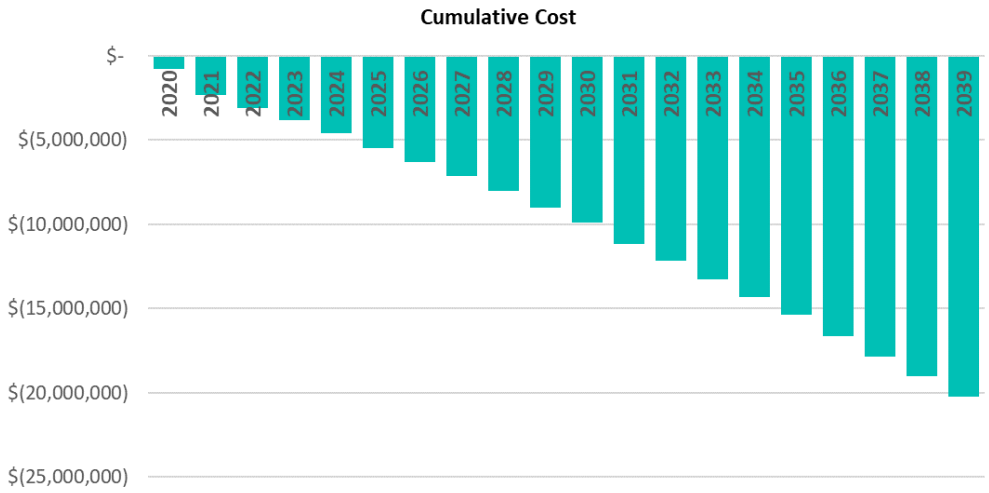
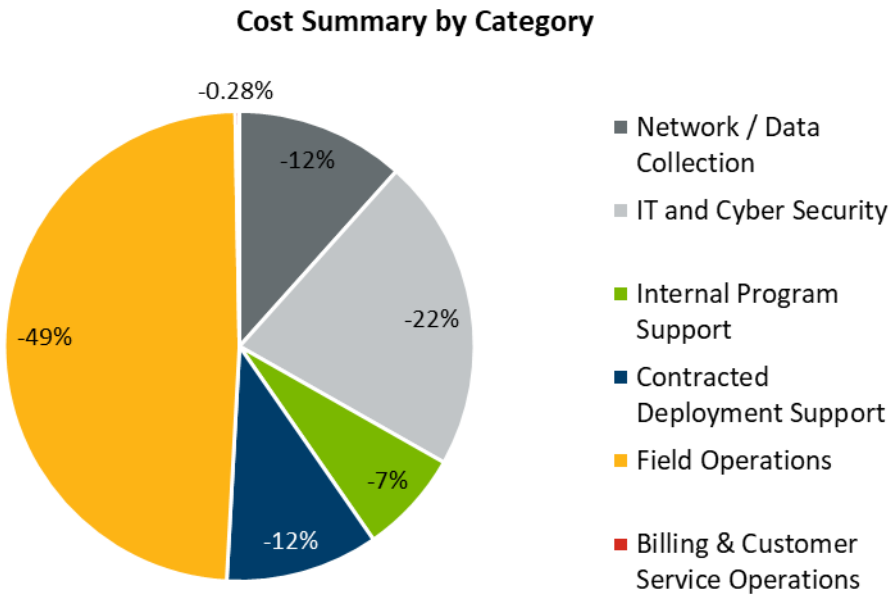


Figure 5 shows that continuing manual meter reading and bringing meter reading in house would cost Naperville $20.2M over the course of 20 years. The bulk of this is attributed to labor costs. Manual meter reading would yield no incremental benefits or savings that AMI could provide. With an AMI program, Naperville could proactively identify and alert customers of continuous or high flow, reduce the need for bill estimation, enable more accurate analysis of consumption and system pressure, increase employee and community safety by reducing miles driven and customer premises entry, and enable bill date customization for optimized payment planning. These customer service and operational changes, among others, are to the benefit of Naperville, Naperville's customers, and society as a whole.

To avoid manual meter reading costs, improve customer service, reduce estimated bills, and provide proactive leak detection, Naperville evaluated the costs and benefits of AMI. Naperville's AMI business case is based on the assumptions listed in section three, strategic AMI decisions from Naperville, as well as industry data and relevant benchmarks. The following analysis assumes Option (1): Utilizing the existing DPU-Electric AMI network. This is the most cost-effective approach for Naperville that also provides necessary customer service and operational improvements.

The AMI business case is viewed over a 20-year duration. Figure 6 shows that almost half of the costs associated with deploying AMI meters are field operation costs, such as endpoint hardware and installation. IT and Cyber Security needs also account for approximately 22% of costs. The cumulative cost over a 20-year period for implementing AMI technology amounts to $18.7M.

Figure 5: Costs Summary for Option (1): AMI – Naperville Network



- **Network**: network hardware, installation, and maintenance costs
- **IT and Cyber Security:** one-time installation costs for software/systems, plus ongoing licensing and hardware costs
- **Internal Program Support**: internal field operations, legal, regulatory, and customer service support required during and post-deployment
- **Contracted Deployment Support**: external field operations support (AMI installation)
- **Field Operations**: AMI radio hardware and ongoing maintenance costs
- **Billing & Customer Service Operations**: labor to support increase in call volume (deployment only) and costs for program engagement/marketing materials

Figure 7 shows that 86% of savings associated with AMI deployment are in Field Operations, primarily attributed to a reduction in service order labor and truck roll costs and the avoided cost of an in-house meter reading fleet. The cumulative savings over a 20-year period for implementing AMI technology amount to $22.0M, with net savings of $3.3M.

Figure 6: Savings Summary for Option (1): AMI – Naperville Network

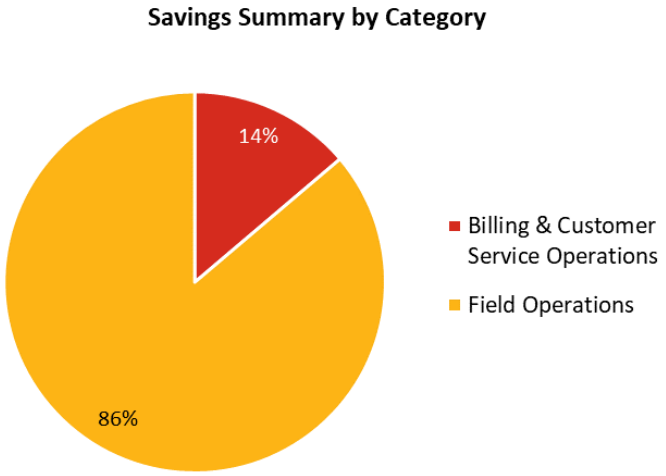


Table 2: 20-Year AMI Business Case Costs and Savings

Item	20-Year Business Case Total ($ in Millions)
Costs	
Network / Data Collection	$(2.2)
IT and Cyber Security	$(4.0)
Internal Program Support	$(1.3)
Contracted Deployment Support	$(2.0)
Field Operations	$(9.1)
Billing & Customer Service Operations	$(0.05)
Total Costs	**$(18.7)**
Savings	
Billing & Customer Service Operations	$3.0
Field Operations	$19.0
Total Savings	**$22.0**
Net	**$3.3**

The following graphs represent an estimated investment and savings schedule, as well as cumulative cash flow.

Figure 7: AMI – AMI Cost and Savings Schedule

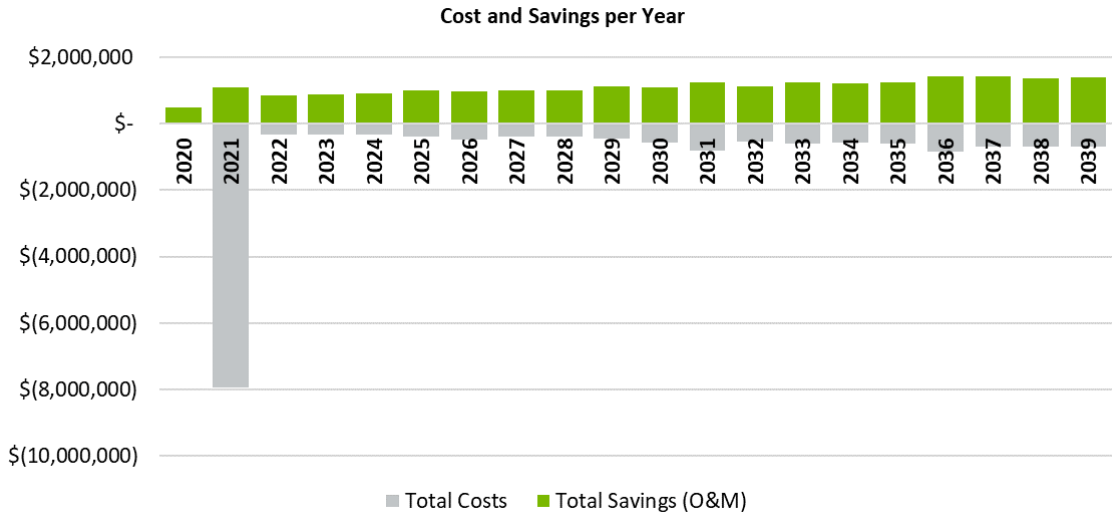


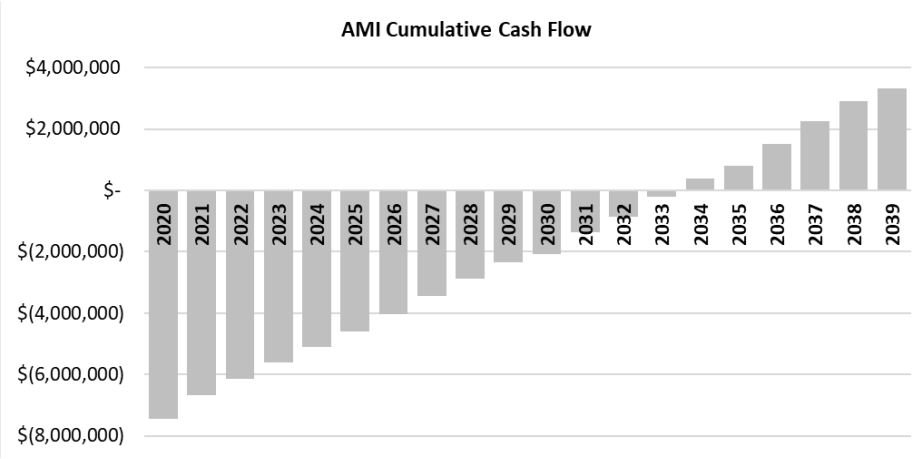
Figure 8 shows approximately $7.9M of the $18.7M AMI program costs will be incurred during the year of deployment. A peak in costs will be seen in year 1, when Naperville will expand upon DPU-Electric's AMI fixed network and procure/install all AMI endpoints. Savings are primarily attributed to reduced labor expenses for meter reading, service orders, and call center volume.

Field Operations, IT and Cybersecurity developments account for 22% of incurred costs. Investments in headend and meter data management system ("MDMS") software and integrations, data collection units, analytics setup and provisioning, water portal setup, and ongoing network maintenance are required. If Naperville pursues an AMI solution beyond expansion of the existing fixed network, additional IT costs are incurred. These would include a separate headend system, new network devices, and additional network education, security solutions, and data center capacity.

Any AMI solution will require equipment to be refreshed over time. Hardware such as data collectors and repeaters require 10-year replacement and integration costs, while workstation and network infrastructure costs as well as handheld readers and programmers must be replaced after five and four years, respectively. In contrast to using DPU-Electric's network, a new PtMP network would require refreshed data center capacity and security costs every seven years and headend software upgrades every two years.

The cumulative cash flow over a 20-year period of implementing AMI totals to +$3.3M. Naperville will see a payback period of 14 years, whereas continuing business as usual without the deployment of an AMI program would cost $(20.2M) as seen in Figure 9 below. Additionally, several intangible benefits exist with the deployment of an AMI program, which will not exist if Naperville continues with manual meter reading or AMR.

Figure 8: Cumulative Net Costs for Baseline vs. AMI – Naperville Network Deployment



7. RISK MITIGATION

To prepare for full-scale implementation, Naperville should address the following risks and considerations to program timing, technology availability, and customer communication.

- Deploying AMI concurrently with the accelerated meter replacement program may lead to high bill inquiries incorrectly associated with AMI.
  Recommended mitigation: Naperville should communicate with the public about concurrent accelerated meter replacement program (14k meters between 2019 and 2020), meter testing and accuracy, and AMI deployment to mitigate the risk of misidentified high billing causation.
- Naperville has a variety of city-wide initiatives underway, such as an upcoming Tyler Munis CIS implementation and release of the electric customer portal. Completing the water AMI deployment prior to these technical deployments will avoid duplicate integration efforts.
  Recommended mitigation: Naperville should work closely with City Council and the selected vendors to optimize the timeline of AMI deployment in advance of the CIS transition, with consideration to the concurrent deployments of the electric and water customer portals.
- Naperville's upcoming City Council election will intersect with the approval and progress of the AMI program – dependent upon Council understanding of AMI, incremental alignment and education workshops may delay the estimated timeline in Figure 1.
  Recommended mitigation: Naperville should engage in active communication with the sitting Council and interested candidates to evaluate the extent of workshops and educations required to facilitate a smooth transition and program understanding.
- Detailed planning will be required between Naperville and the AMI installation vendor. Field activities will be happening concurrently and the work order and work management practices must be coordinated.
  Recommended mitigation: Naperville teams should coordinate closely with Billing to confirm MIU installations do not happen during billing blackout periods and work with the MIU installation vendor to develop best practices for installation (e.g., new MIUs should not go on old meters).
- Electric AMI deployment improved customer service, reliability, and efficiency, but rates/cost of service continue to go up. Similarly, the water AMI program will provide numerous operational

and financial benefits, but will not prevent future rate increases.
Recommended mitigation: This should be acknowledged and communicated proactively to relevant stakeholders, such as City Council and Naperville's customers.

- Electric AMI deployment faced customer concerns such as health, privacy, and program costs, leading to the development of the NWMA / opt-out program and electric Customer Bill of Rights.
  Recommended mitigation: Naperville should continue and adapt the NWMA program developed by electric AMI for customers who elect to opt-out of water AMI technology as well as update the Customer Bill of Rights and develop a clear communications strategy that explain how the AMI technology works and compares the AMI RF emission levels to common household devices (e.g. baby monitor, garage door opener, cell phone, Wi-Fi router, etc.).

Key risks surrounding technology performance and availability inform the recommendation that Naperville should use a competitive bidding process for vendor selection. Naperville has an existing AMI mesh network through DPU-E that could be leveraged for DPU-W; however, Naperville should still conduct a request for proposal (RFP) process to confirm competitive pricing and long-term vendor viability, as the Naperville network vendor is more prominent in the electric space than water. Additionally, Naperville should address expected battery life in AMI vendor contracts, with guarantees on minimum performance. Key service level agreements should also be included (e.g., read rate, network uptime). Each vendor should be assessed across a consistent set of evaluation criteria (including reference checks and on-site demonstrations), selected based on all quantitative and qualitative factors.

8. SUMMARY OF FINDINGS

To implement advanced metering systems at Naperville, West Monroe assessed four options: (1) Deploy AMI on a shared, mesh network currently in use by the electric utility, (2) Deploy AMI on a new, low-site PtMP network, (3) Deploy AMI on a new, high-site PtMP network, or (4) Deploy AMR. Based on the analysis above, option (1) presents the greatest benefit to cost ratio. Furthermore, based on Naperville's difficulty in maintaining a manual meter reading contract and obtaining sufficient read rates, implementing AMI will reduce the volume of estimated bills and avoid the high cost of bringing meter reading activities in house. Manual meter reading is not a sustainable, long-term solution to provide the level of customer service that Naperville customers expect.

AMI is a significant expenditure, but provides operational, customer, and societal benefits – including reduced meter reading costs, improved data accessibility and leak identification, and reduced greenhouse gas emissions. Naperville's 20-year AMI business case totals to $(18.7M) in costs and $22.0M in savings, with a payback period of 14 years. Continuing business as usual and bringing meter-reading in-house would cost Naperville $(20.2M) and provides no additional customer benefits.

Should Naperville decide to move forward with an AMI program, a robust vendor selection process should be undertaken to validate the business case cost estimates and AMI system performance assumptions. Naperville would then complete back-office systems integrations and network build-out.

9. APPENDIX A: BUSINESS CASE SCENARIO COMPARISON

Table 3: 20-Year Business Case Scenario Comparison

	AMI – Naperville Network	AMI – PtMP (Low)	AMI – PtMP (High)	AMR – Mobile
Financial Metrics				
NPV – 3.5% Discount	$94,771	-$4,398,816	-$5,309,787	$297,048
NPV – 2% Discount	$1,102,630	-$4,121,892	-$5,038,907	$1,178,630
ROI	18%	-14%	-17%	18%
Deployment Capital	-$7,741,563	-$8,498,911	-$9,700,322	-$6,521,965
Capital and O&M Costs				
Network / Data Collection	-$2,175,088	-$6,062,847	-$4,732,225	-$2,418,681
IT and Cyber Security	-$4,036,113	-$6,871,062	-$6,919,763	-$1,374,856
Internal Program Support	-$1,334,914	-$1,334,914	-$1,334,914	-$1,264,064
Contracted Deployment	-$1,967,505	-$1,967,505	-$1,967,505	-$1,967,505
Field Operations	-$9,134,714	-$9,215,707	-$11,421,119	-$9,378,842
Billing & Customer Service	-$53,082	-$53,082	-$53,082	-$53,082
Total Costs	-$18,701,416	-$25,505,116	-$26,428,607	-$16,457,029
Capital and O&M Savings				
Billing & Customer Service	$2,987,466	$2,987,466	$2,987,466	$2,879,819
Field Operations	$19,029,990	$19,029,990	$19,029,990	$16,621,121
Total Savings	$22,017,456	$22,017,456	$22,017,456	$19,500,940
NET Costs / Savings (-/+)	$3,316,040	-$3,487,660	-$4,411,151	$3,043,911

10. APPENDIX B: ABOUT WEST MONROE PARTNERS

West Monroe Partners is a business and technology consulting firm headquartered in Chicago, Illinois. West Monroe is a firm of over 1,100 consultants and a dedicated energy and utilities practice with over 90 professionals. West Monroe has conducted dozens of advanced metering infrastructure readiness assessments and business case analyses for investor-owned and municipal water, electric, and gas utilities over the past 10 years. These efforts include assessing the current and future states, evaluating related technology, data and system needs, along with completing a comprehensive business case and execution plan for AMI implementation.