

Application for Federal Assistance SF-424

* 1. Type of Submission: ☐ Preapplication ☒ Application ☐ Changed/Corrected Application		* 2. Type of Application: ☒ New ☐ Continuation ☐ Revision		* If Revision, select appropriate letter(s): * Other (Specify): 	
* 3. Date Received: Completed by Grants.gov upon submission.		4. Applicant Identifier: LCLUQVAP1WU4			
5a. Federal Entity Identifier: LCLUQVAP1WU4			5b. Federal Award Identifier: 		
State Use Only:					
6. Date Received by State:		7. State Application Identifier:			
8. APPLICANT INFORMATION:					
* a. Legal Name: Cristabel Dykstra					
* b. Employer/Taxpayer Identification Number (EIN/TIN): 86-6000238			* c. UEI: LCLUQVAP1WU4		
d. Address:					
* Street1:		975 E. Armstrong Way			
Street2:					
* City:		Chandler			
County/Parish:		Maricopa			
* State:		AZ: Arizona			
Province:					
* Country:		USA: UNITED STATES			
* Zip / Postal Code:		85286-0000			
e. Organizational Unit:					
Department Name: Public Works & Utilities			Division Name: Utilities Administration		
f. Name and contact information of person to be contacted on matters involving this application:					
Prefix:		* First Name:		Mrs. Cristabel	
Middle Name:					
* Last Name:		Dykstra			
Suffix:					
Title: Utilities Admin Support Manager					
Organizational Affiliation: City of Chandler					
* Telephone Number: 4807823581			Fax Number:		
* Email: cristabel.dykstra@chandleraz.gov					

Application for Federal Assistance SF-424

* 9. Type of Applicant 1: Select Applicant Type:

C: City or Township Government

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

* Other (specify):

* 10. Name of Federal Agency:

Environmental Protection Agency

11. Catalog of Federal Domestic Assistance Number:

66.202

CFDA Title:

Congressionally Mandated Projects

* 12. Funding Opportunity Number:

EPA-CEP-01

* Title:

EPA Mandatory Grant Programs

13. Competition Identification Number:

Title:

14. Areas Affected by Project (Cities, Counties, States, etc.):

CityLimits.pdf

Add Attachment

Delete Attachment

View Attachment

* 15. Descriptive Title of Applicant's Project:

Advanced Metering Infrastructure (AMI)

Attach supporting documents as specified in agency instructions.

Add Attachments

Delete Attachments

View Attachments

Application for Federal Assistance SF-424**16. Congressional Districts Of:*** a. Applicant * b. Program/Project

Attach an additional list of Program/Project Congressional Districts if needed.

Add Attachment

Delete Attachment

View Attachment

17. Proposed Project:* a. Start Date: * b. End Date: **18. Estimated Funding (\$):**

* a. Federal	990,000.00
* b. Applicant	0.00
* c. State	0.00
* d. Local	4,500,000.00
* e. Other	0.00
* f. Program Income	0.00
* g. TOTAL	5,490,000.00

*** 19. Is Application Subject to Review By State Under Executive Order 12372 Process?**

- ☐ a. This application was made available to the State under the Executive Order 12372 Process for review on .
- ☐ b. Program is subject to E.O. 12372 but has not been selected by the State for review.
- ☒ c. Program is not covered by E.O. 12372.

*** 20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes," provide explanation in attachment.)**☐ Yes ☒ No

If "Yes", provide explanation and attach

Add Attachment

Delete Attachment

View Attachment

21. *By signing this application, I certify (1) to the statements contained in the list of certifications and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)**

☒ ** I AGREE

** The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

Authorized Representative:

Prefix: * First Name:

Middle Name:

* Last Name:

Suffix:

* Title: * Telephone Number: Fax Number: * Email: * Signature of Authorized Representative: * Date Signed:



CITY OF CHANDLER

JURISDICTION BOUNDARY MAP

November 23, 2022

The City of Chandler Development Services Department makes no warranties, written or implied regarding the information on this map.



City of Chandler Incorporated Area
65.68 Square Miles as of November 23, 2022
Source: City of Chandler Development Services Department.

LEGEND

- AIRSTRIPS
- RAILROADS
- FREEWAYS
- MILE STREETS
- COUNTY (UNINCORPORATED AREA)
- MUNICIPAL PLANNING AREA

BUDGET INFORMATION - Non-Construction Programs

OMB Number: 4040-0006
Expiration Date: 02/28/2025

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. EPA Mandatory Grant Programs	66.202	\$	\$	\$ 990,000.00	\$ 4,500,000.00	\$ 5,490,000.00
2.						
3.						
4.						
5. Totals		\$	\$	\$ 990,000.00	\$ 4,500,000.00	\$ 5,490,000.00

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SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1) EPA Mandatory Grant Programs	(2)	(3)	(4)	
a. Personnel	\$	\$	\$	\$	\$
b. Fringe Benefits					
c. Travel					
d. Equipment	990,000.00				990,000.00
e. Supplies					
f. Contractual					
g. Construction					
h. Other					
i. Total Direct Charges (sum of 6a-6h)	990,000.00				\$ 990,000.00
j. Indirect Charges					\$
k. TOTALS (sum of 6i and 6j)	\$ 990,000.00	\$	\$	\$	\$ 990,000.00
7. Program Income	\$	\$	\$	\$	\$

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SECTION C - NON-FEDERAL RESOURCES					
(a) Grant Program		(b) Applicant	(c) State	(d) Other Sources	(e)TOTALS
8.	EPA Mandatory Grant Programs	\$ 4,500,000.00	\$	\$	\$ 4,500,000.00
9.					
10.					
11.					
12. TOTAL (sum of lines 8-11)		\$ 4,500,000.00	\$	\$	\$ 4,500,000.00

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 990,000.00	\$ 247,500.00	\$ 247,500.00	\$ 247,500.00	\$ 247,500.00
14. Non-Federal	\$ 4,500,000.00	1,125,000.00	1,125,000.00	1,125,000.00	1,125,000.00
15. TOTAL (sum of lines 13 and 14)	\$ 5,490,000.00	\$ 1,372,500.00	\$ 1,372,500.00	\$ 1,372,500.00	\$ 1,372,500.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT					
(a) Grant Program		FUTURE FUNDING PERIODS (YEARS)			
		(b)First	(c) Second	(d) Third	(e) Fourth
16.	EPA Mandatory Grant Programs	\$ 990,000.00	\$	\$	\$
17.					
18.					
19.					
20. TOTAL (sum of lines 16 - 19)		\$ 990,000.00	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges: Equipment	22. Indirect Charges:
23. Remarks: Funding will cover direct charges related to equipment and services for installation for equipment to be operational.	

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Preaward Compliance Review Report for All Applicants and Recipients Requesting EPA Financial Assistance

Note: Read Instructions before completing form.

I. A. Applicant/Recipient (Name, Address, City, State, Zip Code)

Name:

Address:

City:

State: Zip Code:

B. Unique Entity Identifier (UEI):

C. Applicant/Recipient Point of Contact

Name:

Phone:

Email:

Title:

II. Is the applicant currently receiving EPA Assistance? ☐ Yes ☒ No

III. List all pending civil rights lawsuits and administrative complaints filed under federal law against the applicant/recipient that allege discrimination based on race, color, national origin, sex, age, or disability. (Do not include employment complaints not covered by 40 C.F.R. Parts 5 and 7.)

IV. List all civil rights lawsuits and administrative complaints decided against the applicant/recipient within the last year that alleged discrimination based on race, color, national origin, sex, age, or disability and enclose a copy of all decisions. Please describe all corrective actions taken. (Do not include employment complaints not covered by 40 C.F.R. Parts 5 and 7.)

V. List all civil rights compliance reviews of the applicant/recipient conducted under federal nondiscrimination laws by any federal agency within the last two years and enclose a copy of the review and any decisions, orders, or agreements based on the review. Please describe any corrective action taken. (40 C.F.R. § 7.80(c)(3))

VI. Is the applicant requesting EPA assistance for new construction? If no, proceed to VII; if yes, answer (a) and/or (b) below.

☐ Yes ☒ No

a. If the grant is for new construction, will all new facilities or alterations to existing facilities be designed and constructed to be readily accessible to and usable by persons with disabilities? If yes, proceed to VII; if no, proceed to VI(b).

☐ Yes ☒ No

b. If the grant is for new construction and the new facilities or alterations to existing facilities will not be readily accessible to and usable by persons with disabilities, explain how a regulatory exception (40 C.F.R. 7.70) applies.

- VII. Does the applicant/recipient provide initial and continuing notice that it does not discriminate on the basis of race, color, national origin, sex, age, or disability in its program or activities? (40 C.F.R 5.140 and 7.95) ☒ Yes ☐ No
- a. Do the methods of notice accommodate those with impaired vision or hearing? ☒ Yes ☐ No
- b. Is the notice posted in a prominent place in the applicant's/recipient's website, in the offices or facilities or, for education programs and activities, in appropriate periodicals and other written communications? ☒ Yes ☐ No
- c. Does the notice identify a designated civil rights coordinator? ☒ Yes ☐ No
- VIII. Does the applicant/recipient maintain demographic data on the race, color, national origin, sex, age, or disability status of the population it serves? (40 C.F.R. 7.85(a)) ☒ Yes ☐ No
- IX. Does the applicant/recipient have a policy/procedure for providing meaningful access to services for persons with limited English proficiency? (Title VI, 40 C.F.R. Part 7, *Lau v Nichols* 414 U.S. (1974)) ☒ Yes ☐ No
- X. If the applicant is an education program or activity, or has 15 or more employees, has it designated an employee to coordinate its compliance with 40 C.F.R. Parts 5 and 7? Provide the name, title, position, mailing address, e-mail address, fax number, and telephone number of the designated coordinator.

Title VI Coordinator: Niki Tapia, Diversity, Equity, & Inclusion Manager, 480-782-2214, niki.tapia@chandleraz.gov, Mail Stop 605 PO BOX 4008 Chandler, AZ 85244-4008

- XI. If the applicant is an education program or activity, or has 15 or more employees, has it adopted grievance procedures that assure the prompt and fair resolution of complaints that allege a violation of 40 C.F.R. Parts 5 and 7? Provide a legal citation or applicant's/recipient's website address for, or a copy of, the procedures.

<https://www.chandleraz.gov/government/city-managers-office/diversity-equity-inclusion/title-vi>

For the Applicant/Recipient

I certify that the statements I have made on this form and all attachments thereto are true, accurate and complete. I acknowledge that any knowingly false or misleading statement may be punishable by fine or imprisonment or both under applicable law. I assure that I will fully comply with all applicable civil rights statutes and EPA regulations.

A. Signature of Authorized Official

Completed by Grants.gov upon submission.

B. Title of Authorized Official

Deputy City Manager/Chief Financial Officer

C. Date

Completed by Grants.gov upon submission.

For the U.S. Environmental Protection Agency

I have reviewed the information provided by the applicant/recipient and hereby certify that the applicant/recipient has submitted all preaward compliance information required by 40 C.F.R. Parts 5 and 7; that based on the information submitted, this application satisfies the preaward provisions of 40 C.F.R. Parts 5 and 7; and that the applicant has given assurance that it will fully comply with all applicable civil rights statutes and EPA regulations.

A. *Signature of Authorized EPA Official

B. Title of Authorized Official

C. Date

General. Recipients of Federal financial assistance from the U.S. Environmental Protection Agency must comply with the following statutes and regulations.

Title VI of the Civil Rights Acts of 1964 provides that no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. The Act goes on to explain that the statute shall not be construed to authorize action with respect to any employment practice of any employer, employment agency, or labor organization (except where the primary objective of the Federal financial assistance is to provide employment). Section 13 of the 1972 Amendments to the Federal Water Pollution Control Act provides that no person in the United States shall on the ground of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under the Federal Water Pollution Control Act, as amended. Employment discrimination on the basis of sex is prohibited in all such programs or activities. Section 504 of the Rehabilitation Act of 1973 provides that no otherwise qualified individual with a disability in the United States shall solely by reason of disability be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. Employment discrimination on the basis of disability is prohibited in all such programs or activities. The Age Discrimination Act of 1975 provides that no person on the basis of age shall be excluded from participation under any program or activity receiving Federal financial assistance. Employment discrimination is not covered. Age discrimination in employment is prohibited by the Age Discrimination in Employment Act administered by the Equal Employment Opportunity Commission. Title IX of the Education Amendments of 1972 provides that no person in the United States on the basis of sex shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance. Employment discrimination on the basis of sex is prohibited in all such education programs or activities. Note: an education program or activity is not limited to only those conducted by a formal institution. 40 C.F.R. Part 5 implements Title IX of the Education Amendments of 1972. 40 C.F.R. Part 7 implements Title VI of the Civil Rights Act of 1964, Section 13 of the 1972 Amendments to the Federal Water Pollution Control Act, and Section 504 of The Rehabilitation Act of 1973.

Items "Applicant" means any entity that files an application or unsolicited proposal or otherwise requests EPA assistance. 40 C.F.R. §§ 5.105, 7.25.

"Recipient" means any State or its political subdivision, any instrumentality of a State or its political subdivision, any public or private agency, institution, organizations, or other entity, or any person to which Federal financial assistance is extended directly or through another recipient, including any successor, assignee, or transferee of a recipient, but excluding the ultimate beneficiary of the assistance. 40 C.F.R. §§ 5.105, 7.25.

"Civil rights lawsuits and administrative complaints" means any lawsuit or administrative complaint alleging discrimination on the basis of race, color, national origin, sex, age, or disability pending or decided against the applicant and/or entity which actually benefits from the grant, but excluding employment complaints not covered by 40 C.F.R. Parts 5 and 7. For example, if a city is the named applicant but the grant will actually benefit the Department of Sewage, civil rights lawsuits involving both the city and the Department of Sewage should be listed. "Civil rights compliance review" means: any federal agency-initiated investigation of a particular aspect of the applicant's and/or recipient's programs or activities to determine compliance with the federal non-discrimination laws. Submit this form with the original and required copies of applications, requests for extensions, requests for increase of funds, etc. Updates of information are all that are required after the initial application submission. If any item is not relevant to the project for which assistance is requested, write "NA" for "Not Applicable." In the event applicant is uncertain about how to answer any questions, EPA program officials should be contacted for clarification.



EPA KEY CONTACTS FORM

OMB Number: 2030-0020
Expiration Date: 06/30/2024

Authorized Representative: *Original awards and amendments will be sent to this individual for review and acceptance, unless otherwise indicated.*

Name:	Prefix: Mrs.	First Name: Dawn	Middle Name:
	Last Name: Lang	Suffix:	
Title:	Deputy City Manager/Chief Financial Officer		
Complete Address:			
Street1:	175 S. Arizona Avenue		
Street2:			
City:	Chandler	State:	AZ: Arizona
Zip / Postal Code:	85225	Country:	USA: UNITED STATES
Phone Number:	480-782-2000	Fax Number:	
E-mail Address:	dawn.lang@chandleraz.gov		

Payee: *Individual authorized to accept payments.*

Name:	Prefix: Mr.	First Name: Robert	Middle Name:
	Last Name: Steele	Suffix:	
Title:	Accounting Senior Manager		
Complete Address:			
Street1:	175 S. Arizona Avenue		
Street2:			
City:	Chandler	State:	AZ: Arizona
Zip / Postal Code:	85225	Country:	USA: UNITED STATES
Phone Number:	480-782-2324	Fax Number:	
E-mail Address:	robert.steele@chandleraz.gov		

Administrative Contact: *Individual from Sponsored Programs Office to contact concerning administrative matters (i.e., indirect cost rate computation, rebudgeting requests etc).*

Name:	Prefix: Mrs.	First Name: Cristabel	Middle Name:
	Last Name: Dykstra	Suffix:	
Title:	Utilities Admin Support Manager		
Complete Address:			
Street1:	975 E. Armstrong Way		
Street2:			
City:	Chandler	State:	AZ: Arizona
Zip / Postal Code:	85225	Country:	USA: UNITED STATES
Phone Number:	480-782-3581	Fax Number:	
E-mail Address:	cristabel.dykstra@chandleraz.gov		

EPA KEY CONTACTS FORM

Project Manager: *Individual responsible for the technical completion of the proposed work.*

Name: Prefix: First Name: Middle Name:
Last Name: Suffix:
Title:

Complete Address:

Street1:
Street2:
City: State:
Zip / Postal Code: Country:
Phone Number: **Fax Number:**
E-mail Address:

Project Narrative File(s)

* Mandatory Project Narrative File Filename:

Add Mandatory Project Narrative File

Delete Mandatory Project Narrative File

View Mandatory Project Narrative File

To add more Project Narrative File attachments, please use the attachment buttons below.

Add Optional Project Narrative File

Delete Optional Project Narrative File

View Optional Project Narrative File

Community Grants Workplan

Name of Applicant: City of Chandler

Point of Contact: Cristabel Dykstra

Project Title: Advanced Metering Infrastructure (AMI)

Project Objective(s) and Needs:

The City of Chandler is working on an innovative project that will benefit utility customers. The City will be transitioning from Automated Meter Reading (AMR) to Advanced Metering Infrastructure (AMI). The City currently collects approximately 87,000 monthly water meter reads using drive-by technology through a mobile data collection device. The reads are collected to produce and distribute monthly bills to the City's utility customers. The goal of this project is to get automatic, hourly consumption data via an integrated system of smart meters, communication network, and data management system – known as AMI. The City will be strategically installing a network of devices known as collectors (small antennas). These collectors will be placed atop buildings and/or traffic signal poles (at line of sight) to collect data on a continual basis. With AMI, all customers will be able to view their daily water consumption data via a customer portal which will also help in reducing their utility bill.

The City is requesting \$990,000 as part of the FY22 Community Grants Program for Congressionally Directed Spending (CDS) and Community Project Funding (CPF). The City of Chandler will be covering additional costs of the project estimated at approximately \$4.5 million.

Project Description:

As part of the AMI project initiative, an assessment was conducted in 2020 and completed in January 2021, to evaluate the benefits of transitioning from AMR to AMI. The assessment concluded that the City would greatly benefit from AMI in various areas including but not limited to eliminating the need to capture readings through a driving method (thus reducing fuel cost and vehicle maintenance), leak detections, and providing customers the ability to view and manage their daily water consumption. The assessment also provided a financial analysis for the project. The full assessment report has been included as part of the grant application.

All collectors will be placed on already established structures such as water towers, city-owned buildings, and traffic signal poles. Each collector will have at minimum a one-mile radius to capture reads from meters within that range. Where applicable, older, and already existing meters, will be replaced with new ones to be compatible with the network. All collectors will be placed on already established structures and at no time will there be any type of construction or ground disturbance. The collectors are small and designed for quick installation and can be electrical or solar. An updated propagation study is currently in the works to determine the best possible locations for the collectors.

Milestone Schedule / Scope of Work:

The project is estimated to be a two-year project, starting June 2023 through June 2025. A high-level milestone schedule has been provided as well as an attachment of the detailed project schedule/scope of work.

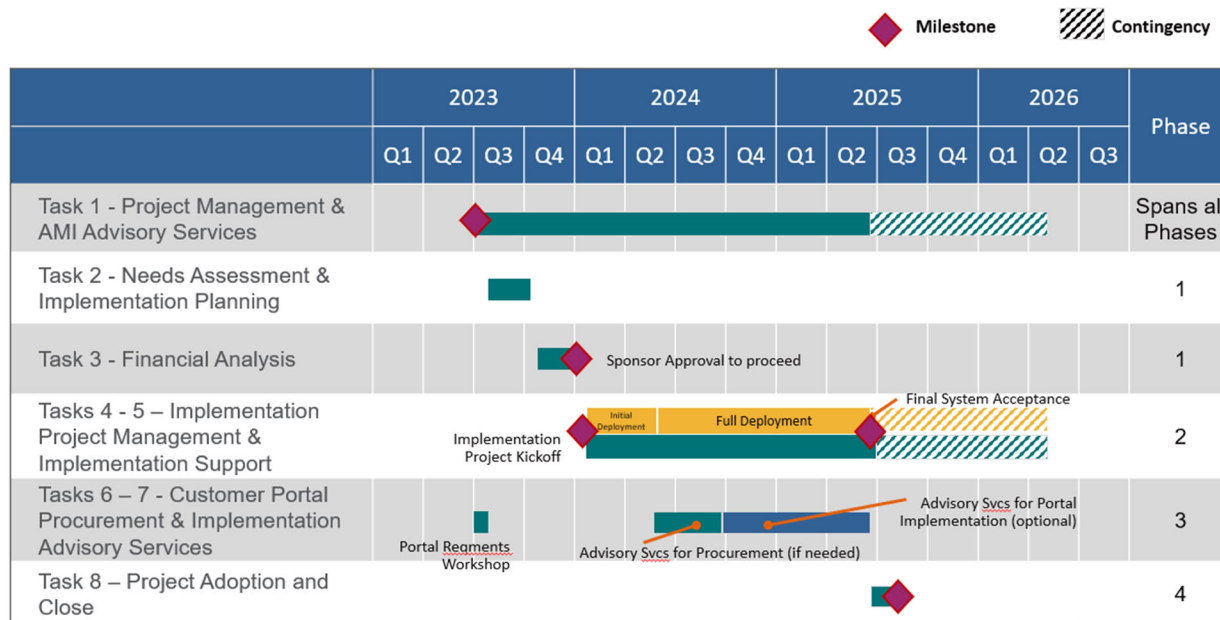


Figure 1: High Level Project Schedule

Environmental Results/Benefits:

The AMI project will have positive environmental impacts with the intent of reducing water loss within our system and at customers' end use. Due to the nature of our desert climate, Chandler has always been a leader in water conservation. With shortage in the Colorado River system, Chandler is looking to enhance water usage analysis to continue ensuring that every gallon of water is accounted for and used efficiently. AMI is the next step in this process and will allow staff and residents to be more vigilant with use and water savings. Customers will be able to log into a customer portal to see their water usage daily. This precision will afford customers to detect leaks or abnormal water usage. As outlined in a report prepared by AMWA (American Water Works Association) in January 2022, studies have shown that customers who sign up for AMI water portals decrease their average daily usage up to 12%. In addition, City staff will also be able to detect abnormal usage and address it immediately. The data collected through AMI will not only help reduce water loss but also improve water resource management.

Workplan Requirements for Identifying Contractors:

The City of Chandler will follow and abide by the competitive Procurement Standards outlined in 2 CFR 200.317 – 2 CFR 200.327 as it pertains to this project. No professional engineering services and/or construction are needed as part of this project. Any professional services as well as any purchases of equipment and installation of equipment will follow EPA's procurement requirements.

Workplan Requirements for Identifying Subrecipients:

This grant award will not have any subrecipients as part of this project.

Attachments:

AMI Assessment

AMI Project Schedule



Advanced Metering Infrastructure (AMI) Assessment Report

January 2021

This document contains proprietary and confidential information. This report shall be exempt from disclosure under the Freedom of Information and Protection of Privacy Act on the basis that it includes information about vendors and their pricing.

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1 Executive Summary

1.1 Introduction

The City of Chandler (City) has been interested in evaluating whether they should consider transitioning to AMI from their current Advanced Meter Reading (AMR) system. To assist in this evaluation effort, the City commissioned Excergy Corporation (Excergy) for services to obtain an analysis of the costs and the benefits of AMI for several different alternatives of interest to the City. This report sets forth the findings of the AMI Assessment (the Assessment) for the City.

1.2 Alternatives Under Consideration

To provide a thorough understanding of the benefits and challenges of AMI compared to other potential options, the City selected three different alternatives to consider with one additional caveat affecting the first two alternatives. The alternatives are summarized below:

AMI System Alternatives

- Alternative 1 – Basic AMI to replace current AMR System:
 - This alternative analyzes installation of a fixed network to move the system from using AMR to using an AMI system.
 - One caveat in this alternative is an evaluation of the timing of the move from AMR to AMI both prior to a CIS upgrade and after a CIS upgrade.
- Alternative 2 – Full functionality AMI, including Distribution Operations endpoints and targeted remote disconnect valved meters:
 - This alternative provides an analysis of the City deploying a full-featured AMI system that includes Distribution Operations endpoints for Pressure Management, Water Quality Monitoring, etc. as well as a population of 4000 targeted remote disconnect meters in specific locations of need (e.g., services that have frequent, one to two times a year, visits for meter on/off activities).
 - This alternative also includes the evaluation of the timing of the move from AMR to AMI both prior to a CIS upgrade and after a CIS upgrade.
- Alternative 3 – Maintain AMR, but consider an alternative (e.g., Flume) to provide usage information to customers:
 - This alternative analyzes the other end of the spectrum by of not deploying AMI functionality, but continuing to read meters using an AMR system and looking at other technology alternatives such as Flume to provide usage data to customers similar to what AMI provides. This alternative would not be connected to billing system data or any other utility systems for data collection.

1.3 Assessment Conclusions

In the water utility industry, AMI has become a reality because of the advancements in communications technology and battery life, coupled with the reduction in the cost of communications components. The City is right to seek a forward-looking strategic plan that offers the potential to transform its operations, and the way in which it interfaces with customers.

The cost/benefit analysis for each alternative over the requested 10-year period, both from a capital standpoint and an ongoing operations and maintenance perspective, as well as the direct and indirect financial benefits are outlined in the Table 1-1 below.

Table 1-1 Cost-Benefit for Each Alternative

Ten-Year Summary Table			
	Alternative 1: Basic AMI System	Alternative 2: Advanced AMI with 4000 remote valves	Alternative 3: Maintain AMR
10-Year Cumulative Direct Benefits	\$2,768,731	\$3,662,421	\$45,233
10-Year Cumulative Indirect Benefits	\$58,579	\$73,709	\$99
10-Year Cumulative OpEx	\$3,997,155	\$3,997,155	\$708,488
10-Year Cumulative CapEx	\$5,282,600	\$6,172,600	\$9,500
Net Present Value (All Benefits)	(\$1,607,645)	(\$969,838)	(\$550,150)

None of the three alternatives offer a positive Net Present Value and are close in total value. As such, all three options are viable for the City to consider. The pros and cons of each are summarized below to assist in the decision-making process.

1.3.1 CIS Version Considerations

The City is evaluating, due to resource constraints, whether they should proceed with a CIS upgrade ahead of deploying AMI. The new CIS version has three main advantages as it pertains to AMI. The considerations for CIS version between Alternatives One and Two are the same.

First, the new version also provides some added functionality relative to meter data management. With the volume of meter data that will be available from the new AMI system, this feature is of value, but the new Neptune 360 AMI Head-End system also provides some of this basic meter data management functionality, so the City could likely get by without the upgrade for this feature only.

Second, the new version includes a customer portal to view interval consumption data. Since the new system will not have a significant amount of consumption data to review until the system has been in operation for a while and because the Neptune 360 system will allow City personnel to view consumption data, this would not seem to be a significant reason to install the new system prior to AMI. Implementing the AMI system before the CIS upgrade would allow City staff the added time to become familiar with the AMI system and the output data before the customer portal is deployed to the customer as part of the CIS upgrade.

If the City decides to install AMI before the upgraded CIS version (V4), the new Neptune 360 AMI system will need to integrate to the existing CIS and then when the updated CIS is installed, a new integration effort would be necessary.

1.3.2 Other Overall Considerations

A clear external stakeholder communications plan and organizational change management plan should be included in the planning cycle and initiated prior to the procurement cycle. A summary of the evaluation for each alternative including implementation approach, timeline, and pros/cons for consideration follows.

1.4 Alternative One – Basic AMI

Because the City has already invested in a Neptune AMR system that is convertible to AMI without the change out of meters or meter interface units (MIUs), the installation of a basic AMI system involves only the installation of a fixed base network to replace the current drive-by approach to the collection of reads and the installation and integration of a new AMI Head-End operating system (Neptune 360).

1.4.1 Implementation Strategy Approach and Timeline

The implementation approach for this alternative would be to install the new Neptune 360 AMI Head-End system in a test environment and integrate it to the test CIS system. The systems would then be tested by first verifying functionality with a test collector and a few meters in the meter shop or at trusted friends and family locations. After the initial verification, an Initial Deployment (IDA) would be established with several collectors installed to read the meters in that area and functionality verification along with read performance in comparison to expected values from Neptune would be evaluated. Once these tests are successful, the system could be moved to production and deployment of the remainder of the collectors could proceed. The

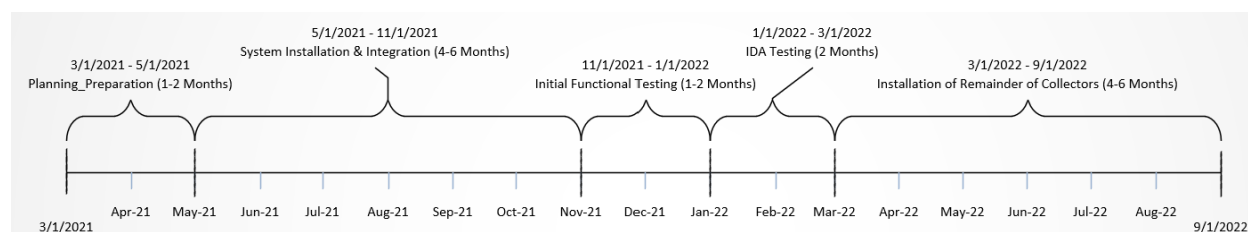


Figure 1-1 Alternative One Timeline

timeline for this effort would be:

1.4.2 Alternative Pros and Cons

The pros of this alternative are that you achieve many of the benefits sought in implementing an AMI for the least cost in the quickest time. Specifically,

- ▶ Once a Customer Portal has been deployed, customers will be able to proactively identify, and hopefully address, their own leaks,
- ▶ The utility will be able to identify meter maintenance issues on an ongoing basis based on receipt of read information,
- ▶ Customers may have access to consumption and billing data online via a customer portal (see Sec. 1.3.1 above concerning CIS version relative to this benefit)
- ▶ The utility will be able to easily retrieve interval usage data and customers and City Staff can see usage patterns together

The cons of this alternative are the costs associated with the installation of a fixed network compared to maintaining the current AMR system and the reduced financial benefits from not having a more robust AMI system capable of providing more information to the utility and customers.

1.5 Alternative Two – Full Featured AMI

Today's AMI systems offer additional features beyond meter reading and basis leak detection. These include the opportunity to use remotely operated valves to disconnect and reconnect customers to receive water as well as distribution monitoring capability to detect line pressure, temperature, and other parameters. This

alternative evaluates the added costs and benefits of including 4,000 remote valves at appropriate customer locations and a sampling of monitors throughout the distribution system for long-term evaluation.

1.5.1 Implementation Strategy Approach and Timeline

The implementation approach for this alternative would be to install the new Neptune 360 AMI Head-End system in a test environment and integrate it to the test CIS system. The systems would then be tested by first verifying functionality with a test collector and a few meters, remote valves, and system monitors in the meter shop or at trusted friends and family locations. After the initial verification, an Initial Deployment (IDA) would be established with several collectors installed to read the meters and monitors and operate the remote valves in that area. The remote valves and monitors would need to be installed once the collectors in that area are installed. Functionality verification along with read performance in comparison to expected values from Neptune would be evaluated. Once these tests are successful, the system could be moved to production and deployment of the remainder of the collectors could proceed with remote valve and monitor installation proceeding once collectors are in place in those locations. The timeline for this effort would be:

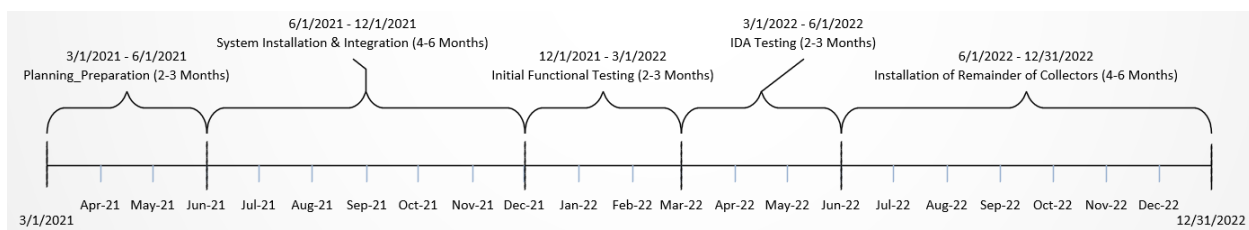


Figure 1-2 Alternative Two Timeline

1.5.2 Alternative Pros and Cons

The pros of this alternative Include all those stated above under Alternative One, but also include:

- ▶ Ability to remotely disconnect/reconnect meters for non-payment or in a move-in/move-out, avoiding previously necessary truck rolls,
- ▶ The availability of distribution system information on line pressure, temperature and other parameters that can improve overall function and useful life of the system components.

In addition to the cons described above in Alternative One, there are operational concerns as to whether there is clearance in meter pits to be able to install remote valves effectively. Relative to distribution operations monitors, it is difficult to quantify the value of the information provided and it may be necessary to install many more monitors at an added cost to fully realize the benefits of the monitoring effort

1.6 Alternative Three – Continued AMR with Customer Consumption Information

Because the City already has a fully functional AMR system today, the alternative evaluates simply maintaining that system and promoting the opportunity for customers to track their consumption through use of a third-party device, such as Flume. Customers would need to pay for these devices themselves at a likely cost between \$150 - \$200, but the City could also consider rebates based on the identification of leaks or some other basis. Such rebates were not considered as part of the cost summary below.

1.6.1 Implementation Approach and Timeline

The implementation approach for this alternative would not require any specific field action by the City. It would involve a marketing campaign to encourage customers to consider the purchase of a flow monitoring device with the possibility/opportunity for a rebate from the City. The timeline for this effort would be:

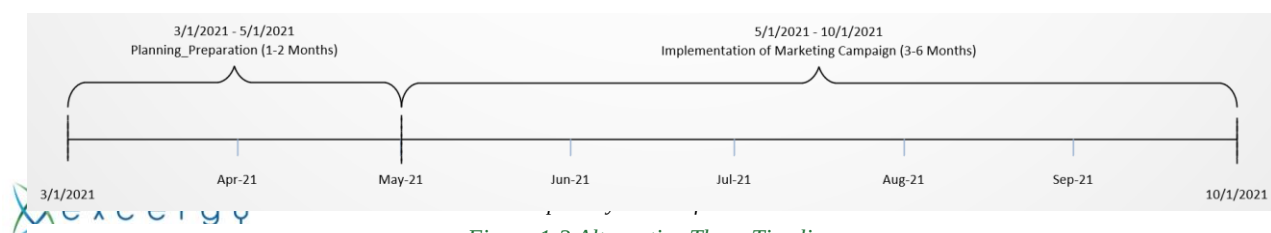


Figure 1-3 Alternative Three Timeline

1.6.2 *Alternative Pros and Cons*

The pros of this alternative are centered on the fact that the City would not be responsible for the capital cost or maintenance of a new AMI system. Interested customers would still be able to see consumption and possible leak conditions and take appropriate actions to resolve them, providing a customer service to them and conserving water resources.

The cons of this alternative are that you lose out on most all of the pros described in Alternatives One and Two above:

- ▶ Only those customers that pay the money for a flow monitoring device will be able to proactively identify, and hopefully address, their own leaks,
- ▶ The utility will not be able to identify meter maintenance issues based on receipt of read information on an ongoing basis but only based on the once per month read,
- ▶ Customers will not have access to consumption and billing data online, and
- ▶ The City will not have the ability to easily retrieve interval usage data and view that data with customers to see usage patterns together.

There are no CIS version considerations for this Alternative. The City could proceed with a CIS version upgrade if they choose to for reasons other than AMI.

2 Study Overview

2.1 Current Environment at City of Chandler

One of the hallmarks of Chandler is the high concentration of hi-tech companies that call the City home. Chandler is known as a “City of Innovation.” To maintain that reputation and continuously improve the customer experience and growing expectations for the availability and access to near-real-time data, the City continues to invest in technology where prudent.

To address the conservation reporting requirements and goals as well as maintaining the City’s innovation reputation, Chandler embarked upon a plan with AMR/AMI provider Neptune to install an AMR system to support meter reading in the early 2000s (2000 with Badger and 2006 with Neptune). In combination with these efforts, the City has continued a conservative and robust meter replacement schedule that ensures that meters are replaced after 15 years of service. The AMR system has continued to grow throughout the years and was architected in such a way as to be easily converted to a fixed-based AMI system with the addition of network collectors and backhaul from collectors. The combination of up-to-date installed meter inventory and a readily convertible AMR to AMI system makes the costs of moving to AMI lower than most other utilities encounter.

Other municipal water utilities as well as electric utilities in the area have moved to fixed-network AMI systems. The City has been closely watching those AMI deployments and have learned many lessons to apply to an AMR to AMI conversion.

In August of 2020, the City and Exergy began to assess the feasibility of implementation of an AMI system for the customer meters. This Assessment presents an analysis of the costs and benefits of an AMI technology and recommendations for the City’s consideration. The impacts considered, include enhancements to Management Utility Services (MUS) and Public Works and Utilities (PWC) workloads impacted by AMI. A positive outcome from the AMI business case analysis was not presumed, and the Assessment was designed to present a clear and defensible analysis.

The Study approach was designed to:

- Leverage City staff members’ experience and existing knowledge of meter reading systems, as well as its own meter reading, meter management, IT, distribution, financial, and customer service practices and meter-to-cash processes
- To provide an independent (vendor-neutral) evaluation of AMI technologies based on the City’s current and future needs for data, so that City managers have a firm basis for their decisions
- Begin with a wide review of alternatives followed by an elimination process
- Help forge consensus and buy-in among City staff, as AMI affects several operating and support areas and requires considerable resources

Existing data collection, staff interviews, and a series of workshops were completed to assist in the technical and financial analysis presented in this report. Exergy conducted workshops with City staff to identify areas of potential improvements from implementing a new metering system, as well as expectations and concerns for a new metering system. Workshops conducted as part of the Assessment included:

- ▶ Workshop to discuss consolidated issues and expectations
- ▶ AMI Situational Analysis and Technology Workshop
- ▶ Customer Service Workshop

- ▶ IT Considerations Workshop
- ▶ AMI Strategic Alternatives Workshop
- ▶ Economic Modeling / Business Case Workshop
- ▶ Business Process Impact Workshop
- ▶ AMI Implementation Planning Considerations Workshop

These discussions were utilized in the development of the recommendations and analysis provided in this report.

2.2 History of AMI

2.2.1 *Early Uses of AMR*

The early stages of AMI were in fact only AMR – or Automatic Meter Reading systems. As early as 1985, the utility industry began to install devices to make the process of meter reading quicker, more accurate, and less costly. The first AMR system simply transferred the meter reading and identification number to a recording device when the device was held near the meter. These “walk-by” or “touch-read” AMR systems provided the same service traditional meter readers provided with a pencil and paper. The early AMR systems required staff to walk a route to collect the consumption data from each metering device. With AMR systems, the reading function became a little faster, and fewer reading errors occurred because the mistake-prone process of manually inputting the read data was eliminated.

As vendors improved the AMR systems, the range of the meter transmitters or Meter Interface Units (MIUs) increased, so the meter could be read by a person walking or driving past multiple meters at one time. Over time, the range of the MIU signal increased from two feet to approximately three hundred feet. Early systems delivered one reading per month to minimize the battery usage on the device. Many of these systems are still in place today and are routinely being replaced with advanced AMI systems.

2.2.2 *Evolving from AMR to AMI*

AMR systems evolved from a monthly meter reading system into AMI systems that provided the capability of collecting hourly or 15-minute intervals of consumption and sending this data daily through radio transmissions to data collection devices installed in the field. Using these fixed-network collection devices and gathering this data daily over the radio network gave utilities a strategic advantage by utilizing the system as a management and operations tool.

¹ According to Cognyst Consulting, industry data on the total number of units shipped of advanced metering devices (AMR or AMI) in North America has been collected in the Scott Report since 2004. Specific quotes from this report are captured below to highlight the industry trend of moving from AMR meters to AMI meters due to improvements in the AMI technology roadmap:

“While the report on 2019 shipments is still being compiled, indications are that that it will be another record year for advanced metering. 2018 cumulative shipments (AMR and AMI combined) to the water industry



Figure 2-1 Meter with MIU for Pit Application

¹ Cognyst Consulting: www.thescottreport.com/scottreport/consulting.htm

exceeded 93 million units and with over 4.8 million new units shipped in 2018. Cumulative water, gas and electric device shipments reached 394 million last year. Notably, water “fixed capable” units have climbed steadily in the water industry from 3.6M units in 2013 to 4.8M in 2018.”

In Comparison to 2004, there were 71.9 million cumulative water, gas, and electric MIU device shipments back then, of which 15.3 million were water. Data for shipped water “fixed capable” units began in 2005, and close to one million were shipped in that year. Refer to Figures 2-2 and 2-3 below for additional data points.

Water Fixed Capable Shipments (CAGR 12.3%)

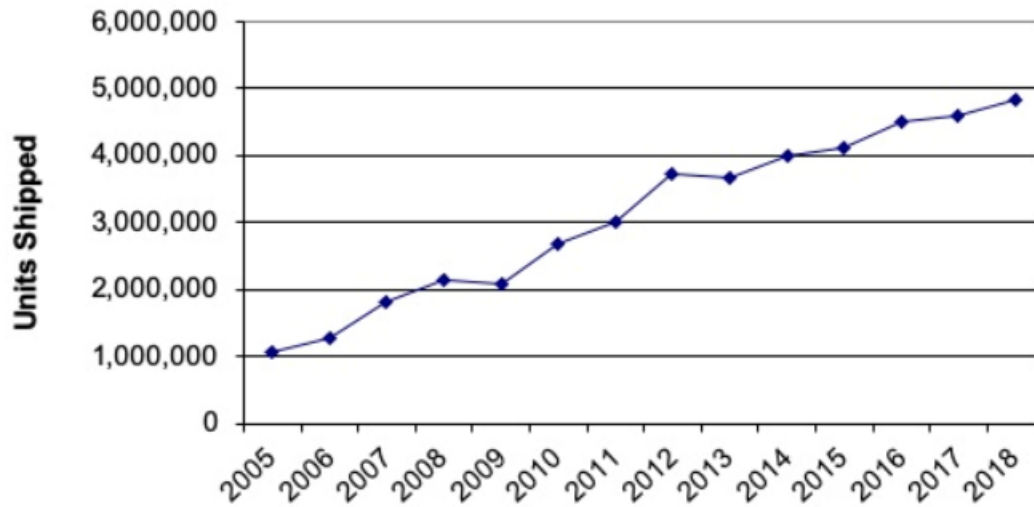


Figure 2-2 Water Fixed Capable Shipments (2005-2018)

Total Water Shipments (CAGR 10.0%)

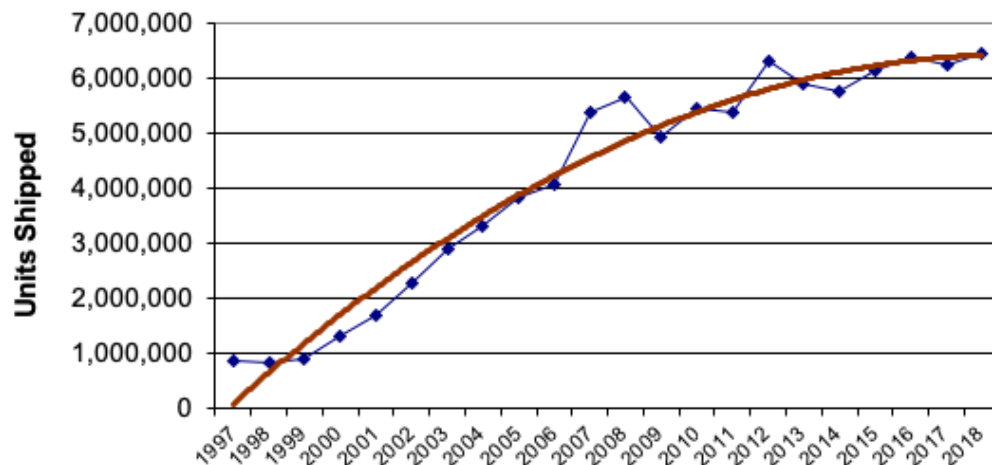


Figure 2-3 Total Water Shipments (1997-2018)

Both of these trends validate Excerpt’s consulting experience over the last five years, as we see clients in the water market largely converting to fixed network (AMI) units except in very rural environments. Both the

industry shipment data and our own consulting experience suggest that most new projects primarily target complete conversion to AMI or some migration path in that direction using “fixed capable” equipment.

2.3 AMI Overview

An AMI system performs meter reading functions through positive-displacement and/or solid-state metering devices (meters) and transmits the consumption information, as well as various status events, back to a central database for billing and/or analysis. The consumption data generates a consumption history and a billing statement for the utility’s revenue sustainability.

In addition to reading meters, AMI systems may also accommodate other devices. Sensors, such as acoustic leak detectors, water quality and pressure monitors can passively gather information and send it along periodically. AMI Vendors are now offering remote shut-off valves that can remotely turn-on or shut-off water service remotely to improve customer service and provide operational efficiencies for service operations on the smaller services.

AMI is:	AMI is NOT:
• A real-time operational communication system • A collection of sensors for utility operations • An informational system that provides data and information to improve operations	• Just for meter reading • Solely used for billing and customer service

Depending on capabilities of the AMI system implemented, AMI can be expected to provide data over the AMI network that can be used to support utility operations and processes. The typical advantages AMI can provide are as follows:

- ▶ Time-synchronized hourly consumption data recorded at the meters and provided (at a minimum) daily to the Utility’s back office systems
- ▶ “Real-time” communications to and from any endpoint for reads or data; the ability to request real-time information from select points
- ▶ Ability to set and change thresholds of alarms, based on business needs
- ▶ Ability to review aggregated data from select points
- ▶ A communication network for collecting information and controlling devices

The benefits of AMI are multi-tiered (see Figure 2-4 and Table 2-1). As a utility initially deploys an AMI system, the first benefits are realized in the efficiencies gained in the meter reading arena, depending on if the utility is manually reading meters, or is converting from an AMR system. The additional benefits AMI can provide are through analysis and access to the extensive and timely data of the customers’ time-synchronized consumption. When utilities begin to change policies, the second and third tier benefits begin to be realized.

Figure 2-4 Hierarchy of AMI Benefits

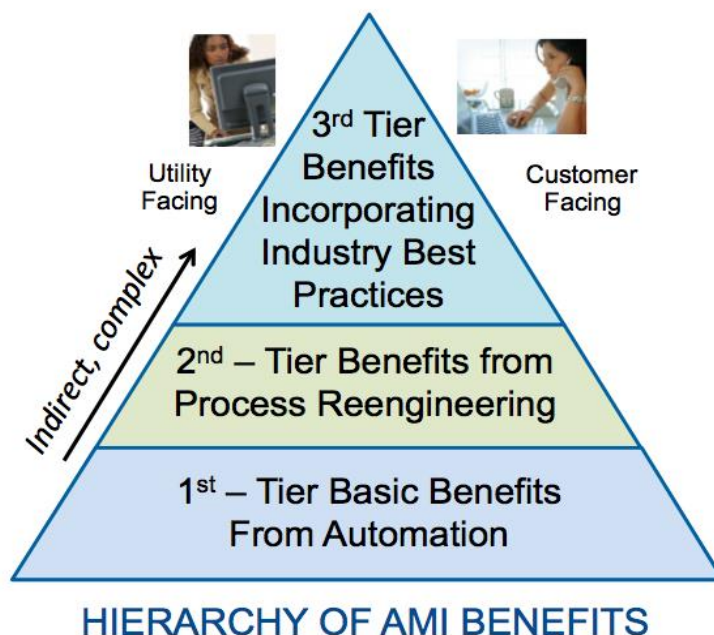


Table 2-1 Steps to Tiered AMI Benefits

1 st Tier Benefits from Automation	2 nd Tier Benefits from Process Reengineering	3 rd Tier Benefits from Implementation of Best Practices
• Reduction in meter reading costs • Improved read accuracy – reduced implausible reads • Reduction or elimination of “estimated” bills • Reduction in read to bill time	• Reduced and quicker resolution to “high bill” complaints • Customer preference billing dates (<i>TBD policy decision</i>) • Reduction in costs for move-in / move-out reads and service transfers	• Reduced losses to theft • Proactive customer-side leak notification, “alert” service • Improved system design and management • Opportunity to provide higher level of pressure management, acoustic leak detection, water quality management • Remote connect/disconnect of small service meters

As shown in Figure 2-5, other third-tier best practices include: system analysis, water loss analysis, and leak detection.

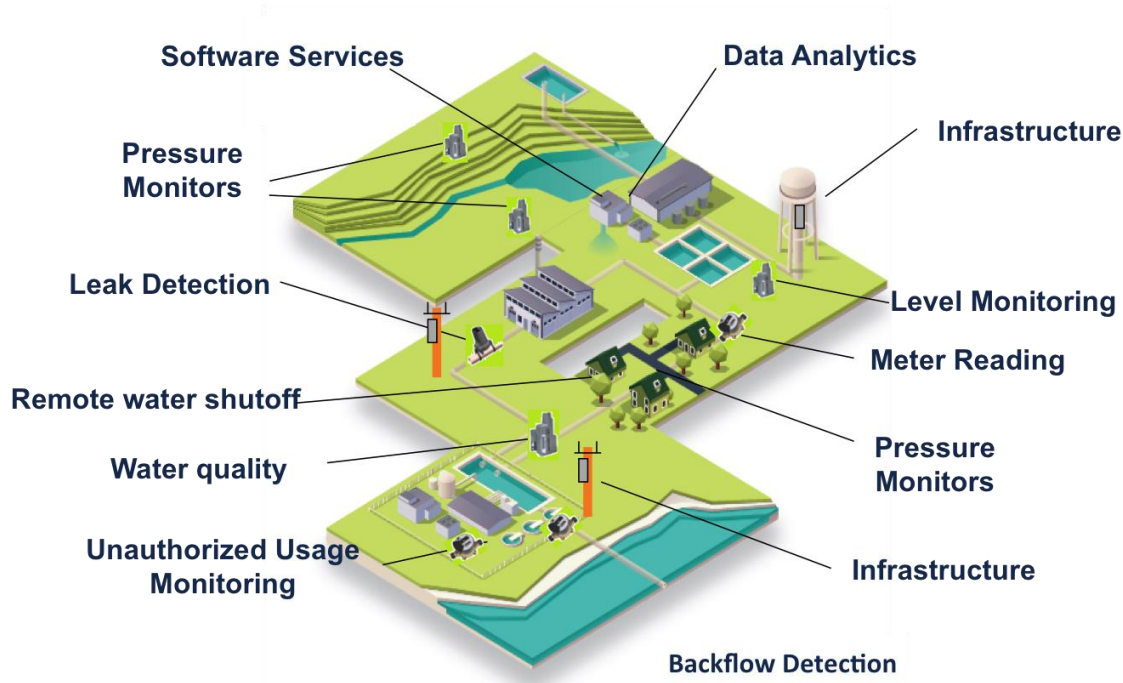


Figure 2-5 Advanced Benefits Realization

2.3.1 *System Analysis*

Time-synchronized data from the AMI can be used to support system modeling. This data can be correlated to production meters, pressure monitors, backflow devices, etc. to gain a clearer picture of water flow and system performance to a level of confidence heretofore unattainable for most utilities.

2.3.2 *Leak Detection*

AMI can support system leak detection through two primary methods. The first is to compare an interval of time-stamped meter consumption data from a specific area against the data from a City metered area/zone (DMA/DMZ) meter. Differences in the consumption and in-flow can be identified as potential system leakage. The second is to deploy acoustic leak detection (ALD) devices and/or institute a leak detection survey program. Note that undetected leaks are typically related to high bill complaints, and that neither of these methods are directly related to “customer-side” potential leak notification, which can be provided using AMI.

2.3.2.1 *Water Losses and Loss Analysis*

AMI has shown the ability to help water utilities improve accuracy in the reporting of unaccounted for water. The AMI can time stamp usage for the meters across the system and provide a tighter window of usage, resulting in a more accurate accounting of water into and out of the system.

2.3.3 *Additional Benefits of AMI*

AMI’s real potential is achieved when a utility expands beyond the reading of meters to utilizing the data and expands the use of the communications network provided by the AMI infrastructure to place AMI communication-enabled devices for operational purposes such as ALD, pressure management, water quality monitoring, and other remote devices for monitoring and system management. The AMI communications

network allows the utility to place such devices where they are needed and utilize the AMI communication network without the expense of having to also install a separate communication network.

3 AMI Vision

3.1 Workshop Results

As part of the Assessment, a vision for Advanced Metering Infrastructure (AMI) at the City was developed to set a baseline of expectations to complete the evaluation. The development of a vision relied upon workshops with City staff conducted to develop the vision for Smart Meters. Employees attending the workshops represented staff from the following work units: Meter Services, IT (Organizational and Departmental), Water Distribution, Water Quality and Management Services (Utility Billing).

Discussion centered on potential efficiencies to be gained and improved communication among Utility personnel, City Department personnel, and their Chandler customer base. This vision for AMI was also integrated with strategic priorities for the City's organizational strategic planning effort as established by City Council to achieve the community's vision.

3.1.1 *Desired Benefits*

Based upon the discussion during the vision workshop, the following desired benefits in priority order related to current challenges on the utility and customer side were documented related to an AMI Program:

Desired Benefits

- Customers to be able to proactively identify, and hopefully address, their own leaks
 - With an AMI system providing hourly consumption data, customers accessing the data will be able to see constant usage patterns that may be indicative of a leak.
 - Customers won't be surprised of leakage conditions that otherwise would only be noticed upon receipt of their bill.
- Ability to identify meter maintenance issues
 - With hourly consumption data, metering personnel will be able to detect issues when such data is not coming in from specific meters and will be able to troubleshoot and resolve the issue in a timelier manner.
 - The meters will provide alerts of cut cable conditions that detect the loss of connection between the meter register and the MIU allowing for immediate correction of such issues.
 - Metering personnel will not have to wait until the lack of available reads during drive-by meter reading to know that there's an issue with the meter.
- Customer access to consumption and billing data online
 - Customers will now be able, through a Customer Portal, to review consumption on an hourly basis and make changes, as necessary, to reduce water consumption costs or improve conservation.
 - Customer portals can provide alerts to customers when their usage or bill has exceeded a preset value so that they are not surprised by receiving a higher-than-expected bill.
 - Access to this data may preclude calls to customer service to complain about high bills.
- Ability to easily retrieve interval usage data
 - In addition to the value of interval usage data provided above, this data provides analytical opportunities for the utility to improve customer service and operation of the system.
 - Analytical opportunities include distribution system leakage determination, water loss calculation throughout the system, and average consumption data on a more precise time scale among others.
- Ability of customers and City staff to see usage patterns together
 - City Customer Service Representatives have limited capability today to assist customers who call with definitive reasons for high bills. This often leads to the cost of truck rolls for

- meter checks that rarely identify problems.
- With AMI interval data, Customer Service Representatives as well as customers can see possible leakage conditions and high use times that the customer may have forgotten about (e.g., when the pool was filled or when family and friends were at the residence for a party).

3.1.2 *Organizational/Operational Concerns*

During the workshop and subsequent sessions, the following issues, bottlenecks, and challenges were noted in priority order and will need to be addressed:

Organizational/Operational Concerns

- IT systems are not at currently available version levels, causing functionality concerns.
- The IT staff, both within the utility and the City, is overwhelmed with various other projects and there is limited staff to support an AMI project.
- IT system reports that require IT support take a long time before they're available for use.
- Disparate data results in lots of manual steps in order to provide a complete picture and make decisions.
- Utility IT personnel have limited authority to implement technology changes.

3.1.3 *Project Concerns*

During the workshop and subsequent sessions, the following concerns/questions on the utility and customer side relative to project implementation were noted in priority order and will be addressed:

Project Concerns

- What additional work will be required of City staff to operate and maintain this new AMI system?
- Will the City IT staff, with limited resources, be able to provide the necessary support to implement and maintain the new system?
- Obtain a clear understanding of the infrastructure necessary to support network deployment, such as additional poles needed as well as the public support for placement of the collector devices throughout the City.
- What City positions will need to be reclassified and/or upgraded to address system implementation, operation and maintenance?
- Will the AMI system result in a reduction in staff, when overall the utility needs additional staff to support all work being done?

3.1.4 *Business Process Enabler & Constraint Key Considerations*

Consideration of the items below that were discussed in the Business Process Impact workshop will greatly improve the success of an AMI project as there are many items to consider when implementing such a system.

Key Considerations

- Enablers:
- Employees
 - Plan for early project needs and related increased staff workloads
 - AMI Provisioning and Meter Changes – training the meter department on the proper MIU activation, dependent on the AMI system technology selected
 - MIU Deployment – understanding the complexities of replacing meters or registers that

are enabled for the AMI Meter Interface Units (MIUs)

- Systems
 - Event Management – How will the City handle events from the meters, including cut-wire alarms, backflow alarms, battery alarms, etc.? Will the data be filtered based upon work orders?
 - Upgrade and Configuration Management – How will upgrades for the AMI software, AMI network devices, and MIUs administered and integrated with other system?
 - Data Management – How will the increased, high volume of data be categorized and prioritized? Will alarms be filtered, or a threshold set to establish a level of action?
 - Customer Engagement – How do we mitigate resistance to using new technology?
- Reporting
 - What reports are needed to maintain the AMI network?
 - Do the AMI and Meter Data Management System (MDMS) vendor(s) have a pre-configured set of reports that can be used?
 - Field Conditions/Annual Inspection – need to have a process for performing regularly scheduled inspections to identify field conditions, uncover meter boxes, etc.
 - Are reporting and business intelligence needs defined?
- Physical Plant
 - Consider Smart Meter Replace Program impact to warehousing & logistics processes
- Constraints
- Organizational Alignment
 - Revise roles and responsibilities as needed and confirm accountability and alignment for streamlined or reengineered processes to ensure RACI alignment
 - Administering/Operating the Headend System (HES) and AMI Network – Are organizational changes needed to administer the AMI HES and other related systems (i.e., MDMS, Customer Portal)?
- Policy Changes
 - Are any new policies needed? For example, how will the City administer the cut-off process for delinquencies and move-ins/move-outs? The following policies will need to be considered:
 - Transfer of Service – will a truck roll be required to obtain visual read and ensure service is still on?
 - Leak adjustment – will AMI provide an opportunity to change or eliminate the leak adjustment policy to encourage customers to sign up for the Portal and get leak and high usage notifications before they result in abnormally high bills?
 - Onsite for activation – in the case of a remote turn-on, is it necessary for City personnel to be present when activation of service is performed? Ensure legal review for position liability issues
 - Timing of move-in/move-out – when will the billing of a transfer of service occur? Will the customer be able to ask for service disconnect at a specified time, or will the billing read on a move-out/move-in be the midnight register read?
 - Notifications – determine criteria and policy for opt-in text messaging or opt-out decisions
 - Need to consider pre-paid policy
- Knowledge Management
 - Will there be a centralized repository across functions to support new and efficient ways of working?
 - What governance structure will oversee accountability, retention, and access policy?

- External Processes
 - Will PWC streamlined processes also improve collaboration with shared services functions and external suppliers?

3.1.5 *Business Drivers for Smart Meter Replacement Program*

As a part of the interactions with the City staff, the following key business drivers were validated for the AMI program to impact customer engagement and efficiency, utility analytics and analysis, environment partnership and operational efficiency strategic objectives:

Driver 1: Customer Engagement & Efficiency

- Seamless customer experience – working with City improved self-service capabilities with less clicks to pay bill, access to usage data dashboards, and better visibility to programs
- Reduction in Meter Reading – quicker and more timely billing on service start/stop requests; reduce truck rolls
- Reduction to Time-to-Bill – improve cash flow; identification of issues; bill closer to actual usage
- Reduced Calls to Customer Care – proactive notice of High-Bill; the ability to identify customer side leaks
- Reduced Hi/Lo Investigation Time – less effort on billing issues, fewer phone calls, bad reads, investigations, duplicated trips, and trips for data logging
- Reduced Shut-Offs – quicker service restoration via ability to turn-on water remotely (remote valve, if used)

Driver 2: Utility Analytics & Analysis

- Access to Quality Near-Time Data – opportunity to cleanse data
 - Time-stamped data to assess trends and develop demand projections to assist with budget planning, rate setting, and resource management and planning involving seasonal and zonal consumption patterns within the water distribution system
 - Time-stamped data for system planning and operational needs, system leakage, preventative maintenance, etc.
 - Improved access to historical data
- Proactive Notice of High-Bill
 - Timelier and more granular data for Customer Service to assist customer
 - Access to customer usage details to address inquiries
 - Near-time data to justify the bill and explain events of usage anomalies, for customer and representative
 - Daily access to reads for billing Off-Cycle needs; final billing

Driver 3: Environmental Partnership

- Water Efficiency – web-portal presentation of usage patterns can change customer behavior leading to conservation as well as limit phone calls and field trips
- Water Quality Monitoring – placement of water quality monitors (if used) on the AMI communications network

Driver 4: Operational Efficiency

- Reduced Start/Stop Read Trips
 - Reduced driving from service orders and rechecks through remotely reading meters – thereby reducing the potential for accidents (vehicle and personal injuries)
 - Reduced need to access meter box with dangerous conditions in the meter box due to foreign objects being put into the meter box, as well as natural conditions such as bees, bug bites, snakes, bad dogs, water in pit, etc.
 - Reduced customer confrontations through remote shut-off valve operations, i.e., remote valve (if used)
 - Reduced duplication and coordination between meter services and after-hour resources
- Reduction in Repairs/Replacements (reduced field orders and truck rolls).
 - Replacement of older MIUs
 - Move to a condition-based meter replacement program
- System Modeling & Analysis
- Pressure Regulation & Management
- Data Analytics for Water Loss Analysis – reporting of water losses
- Distribution System Leak Detection

3.2 The Vision and Roadmap for AMI

During the workshop sessions, a Vision for AMI at the City was developed. Figure 3-1 below shows a graphical representation of the vision for AMI at the City. This vision shows the AMI opportunities the City seeks to improve customer services and realize operational efficiencies. The roadmap highlights a rough timeline for the City to focus on its strategic priorities and transition to its desired state.

During the transitional phase of deployment, potential concerns should be analyzed and mitigated to minimize risk that could hinder operational efficiencies and customer in the near term. However, as deployment moves closer to completion, rolling benefits will be realized that will improve operation and customer service efficiencies.

The following lists detail the various components identified in the Vision Roadmap for AMI at the City. This vision is designed to create transparency, improve communication, maintain reliability and build confidence with the City's internal and external shareholders.

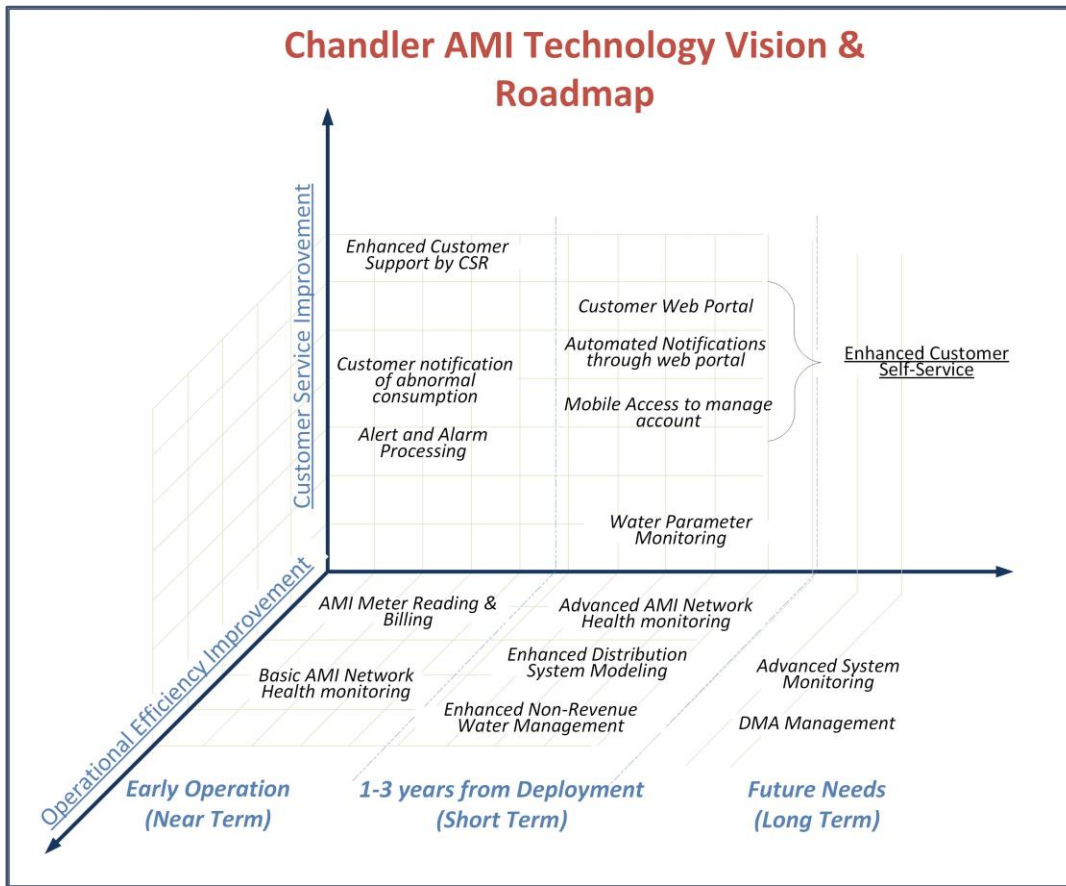


Figure 3-1 Chandler Smart Meter Vision

3.2.1 Foundational Items

The below sections identify the vision for the City as part of the preparation and planning for AMI or can be realized as deployment is proceeding.

Vision for AMI – Culture of Innovation and Tech Advancement

- AMI is the next step in city's progression
- In preparation for, and foundational to, deployment planning
- Equitable distribution of resources
- Planning for deployment
- Risk analysis and mitigation

3.2.2 *Early Operation - Near Term Vision Impacts*

These sections identify the vision for the City that can be realized as deployment is proceeding or upon implementation of AMI.

Vision for AMI – Customer Notification of Abnormal Consumption

(High Customer Service Improvement, realization while deploying)

- Identify abnormal consumption, such as continuous consumption or high consumption, to customers in near real time
 - AMI systems have analytical reporting capabilities
 - Alarms and alerts are sent from the meter or determined from criteria defined within the software
 - Detection of abnormal consumption by analysis provides the ability to alert customers before a high bill is received for irregular consumption
- Some AMI/MDM systems will present an alert when potential leaks are identified
 - These alerts are sent from the meter or determined from a parameter set in the software
 - The leak detection is not intended for instant identification of a leak but is intended on identifying leaks prior to receipt of a high bill for excess usage
- Key requirement to achieve Vision
 - A robust AMI/MDM system with software that has the ability to analyze and report to City staff based on defined parameters
 - The City will need to establish a process to pro-actively notify customers of irregular consumption in advance of a high bill

Vision for AMI – Enhanced Customer Support

(Medium Customer Service Improvement, realization while deploying)

- Support Customer Service staff when dealing with customer inquiries through detailed and time stamped usage information
 - Customer Service staff will be able to analyze and present days of high usage and continuous usage patterns to address customer concerns
 - While the implementation of AMI will initially create the potential for more calls, an ultimate reduction in call volume may be achieved, through the Web Portal providing feedback to customers
 - While there is expected a reduction in the number of calls, there is also the potential that some calls may increase in duration to provide sufficient time to review the extensive data with the customer; however, there is also a potential that some calls may be shortened because the issue can be quickly identified and resolved

- AMI would improve the ability for supporting Water Conservation efforts and assist with education of customers on their water usage
- AMI data will also assist Water Conservation efforts in identifying customers who need help with irrigation scheduling
- Customer Service and customer training and engagement
- Consistency of service levels

Vision for AMI – AMI Meter Reading and Billing

(Medium Operational Efficiency Improvement, realization while deploying)

- Meter Reading through Fixed Network AMI – No longer Drive-By reading required
- More data to help with answering customers question for Contact Center
- Customer Service is improved through shorter time to *bill* for change of service, improved ability for the customer to understand unusual high usage, and a potential reduction in leak adjustments due to earlier notification
 - Reduction of safety issues
 - Reduction of duplicated effort on field and technical front

Vision for AMI – Basic AMI Network Health Monitoring

(High Operational Efficiency, realization while deploying)

- AMI systems software can detect the proper functioning of the AMI network – collectors, repeaters, endpoint communications, etc.
 - The City should expect to have the AMI system provide feedback on the functioning of the network and conditions that need attention such as lost meters and non-communicating meters on an ongoing basis versus only monthly through an AMR system.
 - The City should expect the AMI system to provide tools and instructions on how to troubleshoot, isolate, and mitigate issues on an ongoing basis versus monthly through an AMR system.
 - Through integration to the work order system, processing of any Network alerts and alarms can be automated to trigger an investigation work order to repair. The City should consider establishing a set of actions for the system during development and deployment.

Vision for AMI – Automated Alert and Alarm Processing

(Medium Operational Efficiency Improvement, realization while deploying)

- Identify issues on the system or at the meter. These alerts and alarms identify health of the endpoints, such as low battery or battery failures, cut wires and non-registering meters, and meter tampering etc.
 - The City expects to have the AMI system provide feedback on the functioning of the endpoints
 - Auto-generated reports and automatic notification will minimize City staff time to monitor equipment health and process the alerts and alarms
 - Timely and accurate information to all stakeholders
 - Risk Management
- Key requirement to achieve Vision
 - A robust AMI/MDM system that has the ability to identify meter and endpoint health and report to City staff, through automated notification and ideally, automated work order

creation

3.2.3 *1-3 years from Deployment - Short Term Vision Impacts*

These sections identify the vision for the City in 1-3 years from the end of deployment where additional software is added and utilizes functionality related to historical data from the AMI.

Vision for AMI – Enhanced Customer Self-Service: Customer Web Portal & Automated Notification (High Customer Service Improvement)

- Enhance Customer Web Portal to show customer consumption data. Customers can access their usage presented in monthly, daily and hourly consumption via a dashboard
 - Customer access to their usage presented in monthly, daily and hourly consumption (user friendly to achieve behavior modification)
 - Leak notifications set to alert customers and City staff
 - AMI data to help explain unusual high usage to customers, so the customer will better accept responsibility for usage
 - Improved customer service by providing feedback to the customer on usage patterns and potential high bills
 - A reduction in the number of calls to the Call Center based on customer access to a 24/7 Web Portal supported with the meter data of usage
- Automated Notification
 - Customers can set their own notification parameters for abnormal consumption, such as leaks. Customer notification preferences may be configured to send email, text, phoned depending on software capability. AMI data can be used explain unusual high usage to customers, so customer will better accept responsibility for usage
 - Improved customer service since staff will be able to provide feedback to the customer on usage patterns and potential high bills
 - The number of calls to the Call Center based on customer access Web Portal supported with the meter data of usage should be reduced
- Key requirement to achieve Vision
 - A Customer Web Portal that leverages consumption data from the AMI/MDM system and is available 24/7
 - A Customer Web Portal that has automated notification features
 - Ability for Customer Service staff to view the same information as a customer sees it to facilitate call resolution

Vision for AMI – Advance AMI Network Health Monitoring (High Operational Efficiency Improvement)

- Automatically report and notify City staff when improper functioning of the AMI network – collectors, repeaters, endpoint communications, etc. is detected.
 - Through integration to the work order system, processing of any AMI-network alerts and alarms can be automated to trigger an investigation work order for staff. The City should consider establishing a set of actions for the system during development and deployment
- Requirement to achieve Vision
 - A robust AMI/MDM system that has the ability to identify network health issues and provide feedback to City staff through built-in reporting capabilities and automated notification functionality

Vision for AMI - Enhanced Distribution System Modeling

(Medium Operational Efficiency Improvement)

- Support modeling of the distribution system through analysis of consumption to determine peak flows and use patterns.
 - AMI meter usage data can be used to validate and calibrate the water modeling in the future
 - This data can be used to identify peak periods, low use periods and the overall flow of water during various conditions
 - Data can be used to generate a “digital twin” of the distribution system to provide a digital model precisely modeled after “real-world” operating conditions.
 - Water Flow and pressure
- Key requirement to achieve Vision
 - A robust AMI/MDM system that has the ability to provide time-synchronized consumption for pressure zones, aggregation of customer consumption data from the meters to establish nodes or into a “virtual meter” that represents the aggregated loads
 - Staff time to integrate data into the hydraulic model and perform analysis

Vision for AMI – Enhanced Non-Revenue Water Management

(Medium Operational Efficiency Improvement)

- Protect against water losses by supporting water balance analysis
 - AMI time synchronized data can be utilized to provide support for analysis of leaks on the distribution system. This data is best used by providing customer usage in the City service area, time-stamped and compared with production meters. System wide analysis of usage against production can indicate any leakage on the overall system.
 - The City can review overall usage and determine if there is an opportunity to identify a system wide leak factor and aide in water balance analysis and water audit reporting.
 - The City can use AMI data to evaluate an imbalance between water production and billed consumption. Authorized/unbilled consumption is one cause for imbalance as there is usage but no revenue.
 - Through advanced analytics such as DMAs, other revenue protection issues can be identified such as unauthorized and unaccounted for usage.
- Key requirement to achieve Vision
 - Staff time to review and analyze data

3.2.4 *Future Vision Items*

The following items are benefits identified as potential in the future opportunities for the City

Vision for AMI – Promotion of Smart City Initiatives

(High Customer Service Improvement)

- AMI Communication Network can be utilized to support Smart City initiatives, such as smart street lighting and parking availability.
- AMI Data can be utilized to expand operational efficiencies across City departments by expanding benefits toward street repairs, resurfacing, etc.
- High utilization and optimization of fiber network
- Framework for customer benefits to access data / information – seamless customer experience

(omni-channel apps)

Vision for AMI – Pressure Management

(Medium – High Operational Efficiency Improvements; potential future opportunity)

- AMI systems that have a communications umbrella such as the RF Star networks, can provide opportunity for utilities to use the communications system to deploy devices for pressure management and monitoring easily and without the need for land phone lines. These devices can also be deployed using cellular technology, independent of an AMI system.
 - The City may explore the deployment of pressure monitoring devices in the future and does not anticipate doing this as part of an AMI project.

Vision for AMI – Water Quality Monitoring

(Medium Operational Efficiency Improvements)

- AMI systems that have a communications umbrella such as the RF Star networks, can provide opportunity for utilities to use the communications system to deploy devices for water quality monitoring easily and without the need for land phone lines. These devices can also be deployed using cellular technology, independent of an AMI system.
 - The City may explore the deployment of water quality monitoring devices in the future and does not anticipate doing this as part of an AMI project

Vision for AMI – Distribution Leak Management through Analysis

(High Operational Efficiency Improvements, realization after deployment and operational data available)

- AMI time synchronized data can be utilized to provide support for analysis of leaks on the distribution system
 - This data is best used by providing customer usage in the City service area, time-stamped with production meters
 - System wide analysis of usage against production can indicate any leakage on the overall system
 - The City can review overall usage and determine if there is an opportunity to identify a system wide leak factor and aid in development water audit reporting

Vision for AMI – Sustainable & Resilient Community

(Medium – Operational Efficiency Improvements; potential future opportunity)

- Sustainable and resilient community TBD initiatives
- Foundational tools to improve and proactively maintain City infrastructure
- Long term drought planning

Vision for AMI – DMA Management

High (Operational Efficiency Improvement, Future Needs)

- Support DMAs by providing more accurate data on the customer usage within the DMA

- The AMI data can be aggregated under a “virtual meter” to simulate a DMA; this information can be utilized to improve the hydraulic model
- Consumption analysis via DMAs can be used to improved improve analysis of water losses
- Requirement to achieve Vision
 - A robust AMI/MDM system that has the ability to aggregate consumption to simulate a DMA or export data to be used outside of the AMI/MDM system

4 Customer Service Process Analysis

The City's vision, brand and goals identify a number of customer focused objectives that can be satisfied through improved customer satisfaction. An Advanced Metering Infrastructure (AMI) system further enables the City to meet this objective and increase the value to the customer while supporting what the City of Chandler desires as being an innovation leader.

AMI is a technology that impacts the customer service processes through system-wide, time-stamped interval meter read data not previously available. The City's customer service processes affected by the AMI project were discussed with the City stakeholders in a series of workshops.

While the specific impacts that will be felt by the City post-deployment may vary based on certain strategic decisions and design elements, the Study reviewed and analyzed the following processes shown in Figure 4-1 as they relate to the City's typical meter reading and billing monthly cycle:

The analysis of customer service impacts assessed how an AMI system and the data can improve or impact the processes for the City. These impacts are defined using the following assumptions:



Figure 4-1 Chandler's Monthly Billing Cycle

Customer Service Process Analysis: Assumptions

- All customer meters will be AMI-enabled
- Each AMI meter records consumption in 15-minute or hourly intervals
- The AMI HES would daily collect each meter's register reading and interval data

Each of these processes are addressed in more detail in the following sections.

4.1 Meter Reading

The City currently uses a Neptune Drive-By Automated Meter Reading (AMR) for reading the meters. There are six-meter reading trucks equipped with Neptune MRX-920- radio receiver software and computer hardware that gather the reads monthly by driving by the meters equipped with Neptune MIUs.

With AMI, the need to drive by each account on a monthly basis is eliminated, as the reads will be delivered daily to the AMI head-end software. Impacts include the normal monthly “on-cycle” readings which are required for monthly billing of accounts for normal billing periods, and “off-cycle” reads which are required for when a customer starts or stops service to capture the ending or beginning read for the account. Off-cycle reads are included in the Service Order analysis in Section 4.3.

4.1.1 On-Cycle Meter Reading Process

The “on-cycle” meter reading process begins with a download of all accounts due for billing of the “cycle” into the Neptune software for the mobile meter reading process. The six-meter reading vehicles drive the assigned route to get within range of the meters that are equipped with the Neptune AMR module (MIU) that is broadcasting the current register read. The mobile software receives the register read, which is uploaded to the Infinity Customer Information System (CIS) to be used for the bill calculation.

Although there may be special circumstances where a manual read is required (e.g., when a meter is not communicating), the AMI system will eliminate the need for the monthly drive-by meter reading visit to capture the monthly read. Thus, AMI will:

- ▶ Reduce miles driven, which:
 - Reduces CO2 emissions (Indirect Benefit)
 - Reduces risk of accidents - There is a reduction in risk for accidents associated with meter reading. Injuries, such as slips, falls, and sprains, repetitive strain injuries, as well as vehicle accidents are a direct benefit from implementing AMI as there is reduction in accident risks, workers compensation costs, etc. (Benefit not monetized)
- ▶ Reduce costs for fuel and maintenance on six vehicles by 30%, allowing for some residual costs to account for special needs for reads as necessary.
 - Fuel costs for meter reading costing at ~ \$19,697 annually
 - Maintenance costs for Meter Reading vehicles costing at ~ \$6,048 annually
- ▶ Eliminate current costs for Meter Reading Software for the six meter reading vehicles. *Note these charges are included in costs for OpEx.*

Belt Clip	\$1,125.00
Trimble HH	\$373.00
MRX920	\$4,769.00
Mapping for MRX920	\$3,600.00
Yearly; 3-yr promotion (Neptune 360 AMR)	\$53,800.00

Total Annual Savings

\$63,667.00

4.1.2 *Reduced Meter Reading Costs*

This Study assumes the following:

- ▶ Reduced meter vehicle maintenance
- ▶ Reduced meter vehicle fuel
- ▶ Reduced Meter Reading Software licenses/fees

The Study also reviewed potential growth in the service territory and determined that Water Services would not require any additional meter readers in the life cycle of the AMI system due to growth, and thus there was no cost avoidance applied for an additional meter reader.

The impacts to the Meter Reading process and the associated values used in the financial model to determine monetary benefits related to meter reading assumptions are summarized in Table 4-1.

Table 4-1 Meter Reading Impact and Benefits Assessment

Benefit Area	Existing Metrics	AMI Impact	Estimated % reduction	Estimated Annual Savings with AMI
Meter Reading Vehicle Costs	Meter Reading Vehicles Maintenance \$6,048/year	Reduction in vehicle needs	30%	\$1,814
Meter Reading Vehicle Fuel Costs	\$19,697	Reduction in vehicle fuel	30%	\$5,909
HH Read Devices annual Maintenance	\$1,100	AMI to capture reads	100%	\$1,100
Annual Meter Reading Software License and Maintenance	\$66,523	No Longer needed – use AMI SW (included in cost of model)	100%	\$66,523
Total Annual Meter Reading Benefits				\$90,974

4.2 Billing and Bill Processing

IMPLAUSIBLE READS/BILLS

AMI provides benefits related to the customer billing process through daily access to registration of customer consumption resulting in more timely billing, and the processes surrounding validation of reads. When Billing staff must review bills that appear to be out of normal, the staff will have easy access to hourly read data to validate and confirm if the reading and/or bill is accurate. While there will likely be a reduction of efforts for validation of implausible reads, the study did not monetize this benefit.

BAD DEBT / COST OF COLLECTIONS

Bad debt and delinquent accounts typically are a result of customers running up high bills and/or being unable to pay. AMI can reduce the incidence of “surprise” high bills through providing usage information to the customer through-out the billing period to help customers manage and monitor their usage to reduce an

unexpectedly high bill amount. Currently, the City has a bad debt of approximately \$290,000 per year. While there will likely be a reduction of bad-debt and the costs of collections these savings/reductions were determined too uncertain to validate, thus the study did not monetize this benefit.

4.2.1 *Additional Considerations for Billing*

The following items are some additional options the City can consider when implementing an AMI system to improve processes or service to the customer:

Bill Processing: Additional considerations

- Billing Date Coordination – the presence of an AMI system could enable the City to offer choice of billing date to customers; however, to avoid system bottlenecks, it may be desirable to stagger billing dates among customers
 - This consideration is best applied with a policy that the customer be on paperless billing and online payment only to reduce impacts to the bill mailing process
 - There is still a concern that call volume at the call center may be impacted if too many customers choose the first or last day of the month as their bill date; therefore, steps to mitigate this should be considered prior to implementation of choice of bill date to all customers per TBD Policy

4.3 Field Customer Service Order Impacts

Implementation of AMI heavily impacts field service orders that Customer Service addresses. With AMI interval read data delivered multiple times a day, AMI will reduce the overall number of field service orders by reducing dependence on a field visit for reads, investigations, and other billing and consumption related field service orders. Additionally, the addition of Remote Valves on a portion of the meter population would provide additional benefit at an added cost.

4.3.1 *Service Orders*

The type and general quantities of field service orders handled by Customer Service at the City were discussed at the workshops. The associated impacts were evaluated for benefits that can be achieved for the City. The following sections provide a summary of all the Field Service Orders at the City that would be impacted by implementing AMI and the impact assumed as part of the financial analysis.

Many field service orders would see tangible impacts, which include the following along with the number of each in 2019:

- ▶ Move-In Reads – 3,359
- ▶ Move-Out Reads – 3,569
- ▶ Transfer of Service Reads – 9,800
- ▶ Field Investigation (Water Audit, 2x Consumption, Landscape Consultation) – 761
- ▶ Leak Check – 83
- ▶ Lock-Offs (Delinquent) – 2,217
- ▶ Reconnect – 1,839
- ▶ High Consumption / Leak Check – 2,293
- ▶ Low Consumption – 977
- ▶ Other (Final Bills; Rereads; Read-only) – 1, not considered in the analysis.
- ▶ Meter Change Outs – 4,745 / These are not included in the study.

Each order currently results in a “truck-roll” to address. It was calculated each truck roll cost an average of \$17.50. This amount is applied to the number of truck rolls reduced by using the data provided through the AMI system.

4.3.2 *Move-In Reads; Move-Out Reads*

AMI provides the ability to start/stop service for customers without a need to dispatch a customer service field representative. Due to this capability with AMI, there is a significant reduction in Field Service orders for “off-cycle” reads for move-in and move-out requests. The AMI system provides reads daily, and these reads can be used to generate the start or stop read for a move-in or move-out request thus providing significant benefit. This is a key benefit for any utility implementing AMI. Additionally, AMI enables the City to more quickly respond to these requests as the read data is available without needing to send a field service representative to capture a read. Reduction of these orders for Move-In (3,359) and Move-Out (3,569) is a direct benefit from AMI. The Study identified an **85% reduction** of these trips. The remaining 15% represent times where a read may be missing or special requests for physical reads are required, as well as a conservative approach to the benefit.

4.3.2.1 *Benefit for Remote Valves on Move-In/Move-Out Orders*

The installation of meters with remote operating valves that can be opened and closed remotely is a high benefit option for a water utility. This reduces two visits for any situation that requires operation of the service valve. For areas of high turnover and turn-off for payments, the remote valve can prove a substantial benefit. The study determined that there are approximately 4,000 services that require multiple visits per year and so Alternative 2 in Section 7 was defined to evaluate the benefit of installing remote valve operable devices on these services.

With the addition of remote valves, the Study identified an **92% reduction** of these trips, when applied to the 4000 services with remote capability.

4.3.3 *Transfer of Service Reads*

Transfer of service orders are a combination of Move-Out and Move-In orders (MIMO) when service is transferred without any change in status for the service (i.e., active and inactive). Any order for transfer of service can be completed using the daily read data from the AMI system without a visit to the meter. Reduction of these 9,800 orders is a direct benefit from AMI. The Study identified a **95% reduction** of these trips.

4.3.4 *Inspection / Investigation*

These orders are generated when a read or customer inquiry results in a request to visit the meter for a physical / broken meter, box, etc. It was determined that these orders will likely not be impacted by AMI, and thus no reduction was taken for these.

4.3.5 *Leak Check*

These orders are typically related to leaking meters at the connections, etc. These orders are due to physical issues and not identified as impacted by AMI.

4.3.6 *Lock Off's (Cuts, Locks, Pulls) / Reconnect Orders*

AMI can reduce the number of delinquent accounts by allowing customers to better manage usage via data provided through a Customer Usage Portal. The study did not take any specific reduction for this AMI benefit.

4.3.6.1 *Benefit for Remote Valves on Lock Off/Reconnect orders*

Remote Valves have a substantial impact to field visits (truck-rolls) for turn-on/turn-off type operations and therefore Table 4-3 below shows the reduction in visits and associated savings provided by installing approximately 4,000 Remote Valves on the repeatedly visited services.

4.3.7 High Consumption

These orders are typically generated by a customer call for the City to investigate an issue, primarily high bills. AMI can reduce these orders through the readily available access to hourly consumption data and daily acquisition of register reads. This data will allow for a higher percentage of investigative orders to be triaged from the office, saving a field visit.

An AMI system provides the opportunity to identify customer-side leaks and abnormal consumption that create a situation for a customer to avoid paying and could reduce high bill complaints with proactive notifications. AMI can also identify potential leaks and has been shown to greatly reduce a utilities leak forgiveness loss. Leak adjustments could be reduced as a result of implementing AMI.

Additionally, when 2 times consumption is identified, an order is generated to visit the AMR meter and capture the interval data from the meter. This “data-log” trip can be avoided with AMI because the interval data will be provided on a daily basis, eliminating the need for a trip to capture the interval data.

It was determined that **approximately 45%** of these orders can be avoided during the initial customer call through access to better data as enabled by AMI.

4.3.8 Low Consumption

These orders are typically generated either through the Hi/Lo check during the billing process when monthly consumption is usually low due to slowing/malfunctioning meters. These may increase due to the readily availability to see the non-registering meter, thus a negative benefit was identified, as these orders may increase. The study **identified a 10% increase** in these orders.

4.3.9 Order Reduction Summary Tables

Tables 4-2 and 4-3 summarize the impacts AMI will have on the Field Service orders at the City. Based upon the analysis there is a potential reduction of 16,133 orders attributable to AMI.

Table 4-2 Order Metric and Impact Assessment without Remote Valves

Order Type	Existing # of orders annually	AMI % Reduction / Impact	Estimated Annual # of Orders reduction	Estimated Annual Savings with AMI at \$17.50 per order
Move-In	3,359	85%	2,855	\$49,965
Move-Out	3,569	85%	3,034	\$53,089
Transfer Service	9,800	95%	9,310	\$162,925
Inspection	761	0%	761	\$0
Leak Check	83	0%	83	\$0
Lock-Offs	2,217	0%	2,217	\$0
Reconnect	1,839	0%	1,839	\$0
High Consumption	2,293	45%	1,032	\$18,057
Low Consumption	977	-10%	1,075	(\$1,710)
Other	n/a	n/a	n/a	n/a
Total Annual Order Reduction Benefits				\$119,402

Order Type	Existing # of orders annually	AMI % Reduction / Impact	Estimated Annual # of Orders reduction	Estimated Annual Savings with AMI at \$17.50 per order

Remote Valves have an impact to field visits for turn-on/turn-off type operations and therefore Table 4-3 on the following page shows the reduction in visits and associated savings provided for installing Remote Values.

Table 4-3 Order Metric and Impact Assessment WITH Remote Valves

Order Type	Existing # of orders annually	AMI % Reduction / Impact	Estimated Annual # of Orders reduction	Estimated Annual Savings with AMI at \$17.50 per order
Move-In	3,359	92%	3.90	\$54,080
Move-Out	3,569	92%	3,283	\$57,461
Transfer Service	9,800	95%	9,310	\$162,925
Inspection	761	0%	761	\$0
Leak Check	83	0%	83	\$0
Lock-Offs	2,217	92%	2040	\$35,694
Reconnect	1,839	92%	1,692	\$29,608
High Consumption	2,293	45%	1,032	\$18,057
Low Consumption	977	-10%	1,075	(\$1,710)
Other	n/a	n/a	n/a	n/a
Total Annual Order Reduction Benefits				\$193,190

4.4 Customer Service Operations & Revenue

With implementation of AMI, the Customer Service Call Center personnel will have new tools and data to engage the customer and answer questions concerning the status of the bill, high consumption as well as identifying billing and usage to a specific day. In particular, staff will be able to address concerns for high bills with information of hourly usage that can indicate usage patterns the customer can use to manage their consumption and ultimately their bill. This increases customer satisfaction and provides the City an opportunity to improve customer self-service in timeliness and accuracy. Additionally, enhancing the customer Web Portal to present customers' hourly usage can be very effective in communicating with customers and readily providing the data obtained with AMI. As more customers sign up and utilize the Web Portal self-services, calls to the City will be reduced. The Portal can also be reconfigured for receiving payments in a user-friendly format.

The process for investigating complaints of high bills by customers is a multistep process, which includes City staff gathering information about the requested investigations, scheduling and dispatching field operators to

perform the investigations, gathering data (e.g., data logging), reporting back, and analyzing how to resolve the issue. With an AMI system, it is expected that this process will be managed in a more automated and streamlined manner, creating operational efficiencies as well as greater clarity for customers.

AMI will bring more efficient business processes to bad debt and collections efforts by field personnel to increase billed revenue. With the implementation of remote shut offs, fewer trips would have to be made for non-payment cut-offs of water and for cutting on water when bills are paid. More staff time can be allocated for investigating illegal water usage and meter tampering issues.

In some instances, high bills result in bad debt. An AMI system provides the opportunity to identify customer-side leaks and abnormal consumption that create a situation for a customer to avoid paying and could reduce high bill complaints with proactive notifications. AMI can also identify potential leaks and has been shown to greatly reduce a utilities leak forgiveness loss. Leak adjustments could be reduced as a result of implementing AMI.

AMI is anticipated to increase call time to assist customers in understanding the data. The increased call time was not considered in the financial model as it was determined to be balanced by the reductions in calls over time.

4.4.1 *Customer Portal*

Customer portals with self-service features and functionality are increasingly a focus for many utilities to improve customer engagement and efficiency. The focus on customer experience (CX) is explicitly stated most often in the utilities' goals, followed by vision/mission and value statements. The following factors are frequently cited from utilities that developed a formal CX business case:

- ▶ Reduced contact center volume
- ▶ Decreased cost to serve customers
- ▶ Increased participation in customer service programs
- ▶ Increased first-contact resolution rates
- ▶ Increased customer adoption of self-service channels
- ▶ Lower operating costs
- ▶ Improved customer satisfaction score

Ensuring a seamless customer experience typically is considered for residential customers; however, many utilities have expanded CX efforts to include commercial and industrial customers. The City will need to successfully cascade the importance of CX throughout their organizations to managers and employees. To increase self-service adoption rates for ePortals, customer awareness communication campaigns are often deployed. Clearly, many of the benefits and efficiencies documented in this assessment can be realized by fully utilizing AMI usage data.

AMI provides an opportunity to change or eliminate the leak adjustment policy to encourage customers to sign up for the Portal and get leak and high usage notifications before they result in abnormally high bills.

4.5 *Impacts to Staffing*

Implementation of AMI technology and reengineering business processes would impact and/or repurpose staff within several operational areas after full deployment. These impacts will be related to decisions made concerning the operation of the AMI system, installation of remote shut offs and strategy concerning network deployment and maintenance. Shifting workloads will also provide more time for value-add activities such as doing more maintenance or infrastructure repairs.

There is the potential for the reassignment of some specific duties of Field Technicians/Meter Readers. Some other examples of position reassignments would include retraining of personnel to operate and maintain the

AMI system, mobile meter readers and staff handling meter re-reads, investigations, and customer move-in/move-out work orders being transitioned into technical positions involving AMI maintenance and troubleshooting, along with periodic inspection of meter services for illegal water usage, tampering, and obstruction. Additionally, some field and administrative staff can also be shifted to bad debt collection activities to increase billed revenue.

Due to the variables related to AMI purchase, deployment, architecture, and business process engineering, specifics of these changes are out of scope for this Assessment and should be reviewed and documented during the planning and deployment phase of an AMI system. This is discussed further in Section 9 of the report.

4.6 CIS Impacts

The City is currently using AUS Infinity v3 as the Customer information System (CIS). It has been recommended by AUS, that the City migrate to v4 to take advantage of increased functionality around meter data management and customer web portal capability. The City intends to move to v4 but is considering initiating that upgrade after the move to AMI. This may be necessitated by other Information Technology (IT) priorities and the availability of support personnel to implement the upgrade.

Because, in Chandler's situation, the move to AMI does not include meter or MIU installation/changeout, this might be an acceptable approach especially since the Neptune 360 head end will likely provide sufficient meter data management and customer consumption information for access by customer service representatives until v4 is available to provide that information to customers as well.

One additional impact of moving forward with AMI using v3 of the AUS CIS is that this will require two separate integrations between the AMI Head-End system and the CIS. During the AMI project, the integration would be done to v3, but during the CIS upgrade, it would be necessary to integrate v4 to the AMI system.

5 Distribution Operations Process Analysis

Similar to Customer Service improvements, Automated Metering Infrastructure (AMI) has the capability to impact Distribution Operations. AMI will provide system-wide, time-stamped interval meter read data that can support distribution operations decisions. This type of data was not previously available through Automated Meter Reading (AMR). AMI will also provide an opportunity for the utility to standardize on communication through the AMI network umbrella, providing a secure platform for many distribution monitoring system communications.

The City's distribution operations affected by the implementation of an AMI project were discussed with the City stakeholders in a workshop. The analysis of the impacts assessed how an AMI system and the data can improve or impact the distribution operations for the City. The subsequent analysis assessed how an AMI system and the AMI data can optimize system operations. To ascertain AMI impacts, it was necessary to establish an understanding of the potential AMI environment, which established the following guidelines.

Distribution Operations: Guidelines

- The AMI communication umbrella can be used for future distribution operations, including:
 - Pressure management and monitoring
 - Distribution system water quality monitoring
 - Raw water supply water quality monitoring
 - Supply side resiliency
 - Leak detection
- Customer usage data can be time synced
- Each AMI meter records consumption in hourly intervals
- AMI would collect each meter's register reading and hourly interval data daily
- Data supplied from a meter data management system or other analytic software can supply usage data to the distribution system modeling software

Workshops conducted with City operations staff focused on areas of water distribution operations and discussed potential impacts from implementing AMI. Specifically, the following distribution operations were identified, and impacts discussed:

Distribution Operations: Key Impacts

- Pressure Management
 - Pressure and backflow analysis through AMI meters that are enabled with real-time alerts and time-series measurement data
 - Flexibility in the deployment and use of more extensive pressure monitoring through the AMI communications network
 - Optimization of daily water pumping and hydraulic grade lines to modulate pressure more appropriately through the system
- System Modeling and Planning
 - Use of time-synchronized consumption data to calibrate and refine distribution model and system planning
 - Understand diurnal usage patterns for large use customers that impact supply and demand in the system
 - Water quality management capabilities provide flexibility in the deployment and use of water quality monitoring and system management through the AMI communications network

- System Leak Detection, e.g., water losses and loss analysis
 - Support for reporting of water loss identification and reduction to avoid potential regulatory requirement violations and associated monetary fines in the future
 - Water balancing and zone leakage analysis through time-synchronized consumption data, which enables daily comparisons between flows recorded through City meters with the sum of the measurements from the revenue meters within each City meter’s area
 - For any time period, a significant difference between the two quantities reveals leakage in the area (District Monitoring Zone)
 - Early detection of leakage in the distribution system with proactive monitoring leading to planned repair work versus reactive emergency repairs

5.1 Pressure Management

AMI can provide the benefit of allowing the City to place pressure-monitoring devices throughout the service territory. Leveraging the AMI communication network for monitoring allows the City to reduce the cost of separate communications and benefit from data collection and storage in a single analytic software package. Benefits of having additional pressure monitors in a distribution system include a reduction in pumping when additional pressure is not needed or the identification of areas where reducing pressure would prolong the life of system assets. Input from other utility clients of Excerpt has estimated the cost of adding new pressure monitoring devices with traditional communication (telemetry) is between \$30,000 and \$40,000 with communications being a large portion of the cost. These same devices can utilize the AMI communication network at minimal additional cost and will enable the City to optimize operations with AMI-based pressure monitors. The AMI system will have the flexibility to allow the City to deploy a small quantity of monitors each year; increasing monitoring incrementally over time to optimize overall system performance and better understand pressure variations around the City.

The City can see cost reduction benefits from moving from a “timed” pressure management plan to a “smart pumping” pressure management plan, adjusting pressure and pumping as the system status changes. The following benefits are of interest for the City related to pressure management:

- ▶ Installation of additional pressure reducing valves for high pressure zones that can preserve the life of infrastructure (no direct monetary benefit identified for this study)
- ▶ Optimization of pump run times – reduced maintenance (no direct monetary benefit identified for this study)
- ▶ While a reduction in electric charges can be attributed to Smart Pumping (reduction can be conservatively estimated at 12%²), the study did not take any monetized benefit.

5.2 System Modeling and Planning

The use of time-synchronized consumption (hourly or 15-minute) interval data provided by AMI can be used to support and improve distribution system modeling. This data can be correlated to improve the accuracy of the model through a better understanding of diurnal demand patterns of customers. The distribution model can better depict dynamic water consumption and the distribution system response to those patterns. An improved distribution model helps the City gain a clearer picture of the water flow through the distribution system and understand system performance with a higher level of confidence. Having a more accurate baseline model helps the City to better identify future capital improvements and the results of these improvements on the system. This enhances the City’s ability to make data-driven decisions for future project prioritization and planning.

² Industry has seen 30%

Water quality monitoring within the distribution system helps to further support and improve distribution system modeling, along with provide real-time data for the Water Supply work unit to make decisions on operations and maintenance. AMI will provide flexibility in the deployment and use of water quality monitoring through the AMI communications network. This would allow for placement of water quality monitors throughout the service territory which could be re-located if needed without the need for telemetry connections.

5.3 System Leak Detection

5.3.1 *Water Losses and Loss Analysis*

AMI improves the accuracy and reporting for unaccounted water. A more accurate accounting of water into and out of the system can be obtained through the use of time stamped meter data. Additionally, Distribution Management Areas (DMA) are highly beneficial to analyzing water loss in specific areas. Because AMI provides the detailed time stamped consumption data, the combination of zone metering can provide insight into water loss in the DMAs.

The City currently has DMAs in the system but is interested in furthering the ability to analyze water losses within these DMAs using AMI data as an improvement to the distribution management strategy moving forward. AMI will provide critical support to the City in this effort.

Water audits performed by the City have identified unaccounted water to be in ~5% to 6%, which is very good. Unaccounted water losses are hard to identify without daily consumption data and DMAs. AMI can improve the accuracy of water loss calculations through comparisons of production data and time-synchronized consumption data from the meters. Using time-synchronized data, the City could be able to see additional benefit to identification of water losses through potential leaks in the system with AMI data, however the study did not monetize this due to the current low percentage of losses.

5.4 Recommendations for Distribution Operations

The implementation of AMI supplies the City with time-stamped interval data and a network communication system umbrella that provides benefits to the distribution operations as discussed above. Distribution system optimization based on AMI data will most likely take time and changes in business and operational procedures. Although the City would need time and manpower to fully comprehend the data output and plan for optimization, the City can recognize some cost benefits early in the implementation. In summary, cost benefits considered in the AMI financial model included the following:

- ▶ Reduction in electricity costs through pumping optimization
- ▶ Reduction in the loss of revenue from water leaked out of the system
- ▶ Reduction in staff overtime spent on unplanned and emergency water main breaks

It is also a benefit to the City to utilize the AMI communications network umbrella for deploying water quality monitoring devices on City water supplies and within the distribution system. Furthermore, water quality monitoring within the distribution system can help to reduce customer complaints and improve planning for infrastructure replacement projects. Water quality and flow monitoring within the system may also assist in initiating a flushing program to improve water quality. The City could pinpoint areas that could benefit from flushing due to lack of flow or identified water quality issues and focus on those areas. These benefits were not directly quantified in the financial model.

With the implementation of AMI, collecting and using data to make informed decisions about the distribution system to the maximum extent possible will be important to leveraging AMI's full benefits.

6 Information Technology Impacts

This section provides a review of the Information Technology (IT) components that are typical of an Advanced Metering Infrastructure (AMI) implementation. Workshops with City staff on the current IT systems in place and potential IT configurations with AMI were conducted as part of this Study to assess and determine necessary modifications for effective integration to achieve the benefits of AMI.

AMI systems require more integration with other IT systems than Automated Meter Reading (AMR) technology. AMI systems require software to automate the capture the readings from the network and process read determinants to the Customer Information System (CIS), either directly or through a Meter Data Management System (MDMS).

City of Chandler IT supports projects for the City in development, integration and systems. The City IT department can use virtual server configurations. AMI systems that support virtual servers would fit this strategy best; however separate servers can be supported, if needed. Most Chandler systems are maintained on premise, but on a case-by-case basis when cost and security considerations are addressed, they will allow cloud services.

6.1 AMI HES Considerations

The City AMI HES is Neptune Nsight v5.6. Once the City completes its conversion, outside of the AMI project, to all Neptune meters with MIUs, the plan is to migrate to Neptune 360. Neptune 360 will fully support complete AMI functionality, including data storage and presentment.

6.2 CIS Considerations

The City CIS is Harris Infinity from AUS. The current version 3 addresses all of the basic CIS functionality and includes meter asset management, service order capability as well as a basic customer portal through Infinity Link. The City is planning on moving to Infinity v4 and originally planned to make this transition prior to AMI as v4 provides added functionality around AMI for meter exchanges, a Meter Data Management system and improved customer portal functionality including the opportunity for customers to view AMI interval data. Because of resource constraints within IT, the City is reconsidering whether it might be best to move to AMI prior to the conversion to v4. Because, in Chandler's situation, the move to AMI does not include meter or MIU installation/changeout, this might be an acceptable approach especially since the Neptune 360 head end will likely provide sufficient meter data management and customer consumption information for access by customer service representatives until v4 is available. This would allow time for the City to become comfortable with the data received prior to rolling it out to customers.

One additional consideration relates to integration. If the City was to choose to move forward with AMI ahead of the v4 upgrade, it would require integration between the AMI Head-End system and v3. This integration would need to be redone as part of the CIS upgrade to v4.

6.3 Integration Considerations

AMI requires extensive integration between the software of the AMI (AMI Headend and MDMS), and integration with the CIS. Additionally, the Customer Portal is often integrated to the CIS, or is provided refreshed data from the CIS as often as needed to provide the customer data for the prescribed AMI benefits. The AMI Headend captures the raw read data from the meters and AMI network. The MDMS receives the raw data from the AMI and performs data quality validation and editing and estimating to the read data to provide the CIS with billing determinants for the account for the billing cycle.

There will also be an integration between the MDMS or Analysis software to provide data to the water modeling software, InfoWorks.

Figure 6-1 shows the proposed AMI system integration diagram.

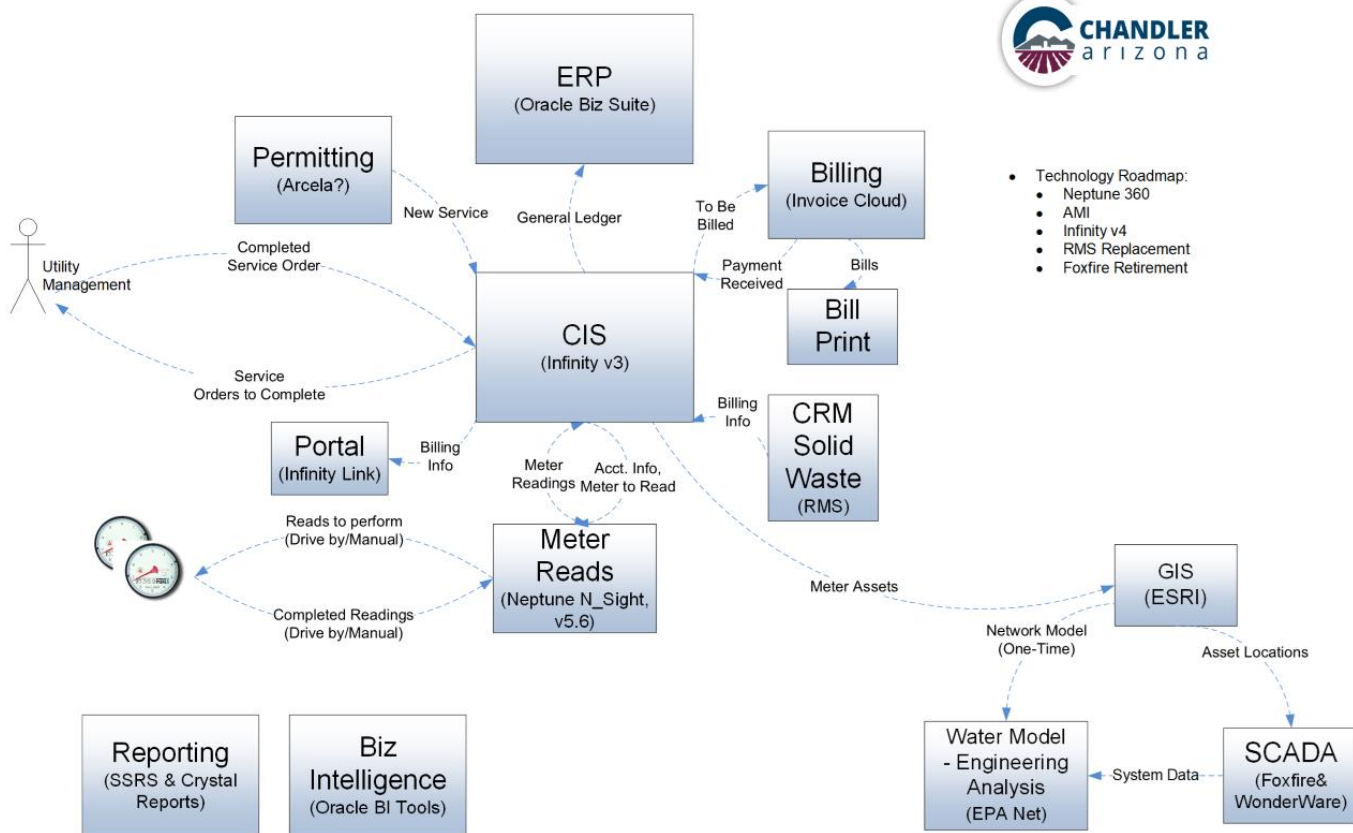


Figure 6-1 AMI System Integration

7 AMI Alternatives

Based on the City's experience with Automated Meter Reading (AMR), as well as business process and Information Technology (IT) considerations, a set of Automated Meter Infrastructure (AMI) alternatives were developed. Additionally, several other implementation factors were considered in developing the alternatives, which include the following:

Strategy Considerations:

- Hosted or owned software solution – e.g., Software as a Service [SaaS] and/or Network as a Service [NaaS]
- Project Management – City will seek a vendor turnkey solution for network installation
- Use of remote-valves is considered in one scenario – installation of valves on high-visit services to provide the most effective return on the additional costs
- Staying with the use of Neptune meters alleviating the need for any meter replacement during this project
- Benefits of AMI over AMR with some other form of customer consumption notification – does AMI provide enough benefit for the added costs?

7.1 Network Replacement Only

The City's Neptune AMR system and meters require only the installation of a fixed based network in order to achieve the benefits of AMI. As such, no meter or MIU replacement was included in the scope nor cost of the project. Any necessary meter and/or MIU replacements necessary to assure the entire meter population is convertible to Neptune AMI has been included as part of an already approved Capital Improvement Project that will be completed ahead of the AMI project.

7.1.1 Network Analysis

Neptune previously performed a propagation analysis for the Chandler area that included a higher elevation set of towers that would lower the overall number of collectors necessary. However, the City is interested in using current assets including light poles and traffic signals at a lower elevation for placement of network collection devices.

Neptune was requested as part of this analysis to perform a new propagation analysis using the following guidelines:

- ▶ Collectors: Best location available
 - Assume 20' height maximum
 - Assume any location is available (street lights)
 - City is not providing any "best" assets – all "found" locations
- ▶ Read success rate
 - 24 hours – 95% min
 - 72 hours – 98.5% min for billable read
- ▶ Meters: (account list with locations and/or addresses)
 - Assume all accounts are to be read by collectors
 - Assume all accounts are v4 R900i (100mW AMR/1W AMI transmission)
 - Assume all accounts are through the lid mount with composite meter lids

This propagation analysis identified the need for 141 collectors to be installed at identified locations throughout the service territory. Costs per collector (\$15,000 per collector), including installation (\$15,000 per installation) were also provided and used in the cost analysis for the Assessment.

7.2 Alternative Scenarios

Based on the City's current state and strategic thinking on how much of the AMI technology can or should be deployed at the City, a set of AMI alternatives were developed. An obvious alternative is to consider moving from the current AMR technology to AMI. However, there were subsequent considerations as to how many of the advanced features of AMI, such as remote valves and distribution operations monitoring capability should be included for consideration. To address the "ends of the scale", the City requested that an assessment be performed with both basic AMI functionality as well as the more advanced AMI functionality.

To further develop the advanced AMI scenario option, consideration was given to the high incidence of trips for move-in/out requests and other customer needs that require a truck roll for operation of the shut-off valve for the service. As part of the vision strategy documented in Section 3, it was determined that an analysis of savings and return-on-investment (ROI) for installation of meters or 3rd party devices that can remotely control the service water flow should be considered. A population of 4,000 meters was set to determine the efficacy of these devices for reduced effort and overall savings, including green-house gases (GHG), fuel, labor, and overall customer service.

One of the main drivers for the project is to provide customers with consumption data. Although possibly not ideal, there are solutions (e.g., Flume) that could work with the existing AMR system to provide this information to customers for their use. As such, this alternative was considered as an option.

While there is a general level of parity for the various AMI systems in regard to basic functions, there is a level of differentiation of functionality and costs that the City desired to be analyzed. Thus, based on the City's organizational and strategic needs, as well as the process analysis and the associated benefits considerations from other tasks in the AMI feasibility study, three alternatives were developed for further analysis and consideration through financial modeling, which are as follows:

AMI System Alternatives

- Alternative 1 – Basic AMI to replace current AMR System:
- This alternative analyzes installation of a fixed network to move the system from using AMR to using an AMI system.
- One caveat in this alternative is an evaluation of the timing of the move from AMR to AMI both prior to a CIS upgrade and after a CIS upgrade.
- Alternative 2 – Full functionality AMI, including Distribution Operations endpoints and targeted remote disconnect valved meters:
- This alternative provides an analysis of the City deploying a full-featured AMI system that includes Distribution Operations endpoints for Pressure Management, Water Quality Monitoring, etc. as well as a population of 4000 targeted remote disconnect meters in specific locations of need (e.g., services that have frequent, one to two times a year, visits for meter on/off activities).
- This alternative also includes the evaluation of the timing of the move from AMR to AMI both prior to a CIS upgrade and after a CIS upgrade.
- Alternative 3 – Maintain AMR, but consider an alternative (e.g., Flume) to provide usage information to customers:
- This alternative analyzes the other end of the spectrum by of not deploying AMI functionality, but continuing to read meters using an AMR system and looking at other technology alternatives such as Flume to provide usage data to customers similar to what AMI provides.

7.2.1 *Alternative 1 – Basic AMI to Replace Current AMR System*

Alternative 1 would implement an AMI solution. The model will reflect SaaS with the City maintaining the communications network. The approach would include a network of devices deployed in the field after initial system design and development. The following are key considerations for this alternative:

- ▶ Network Installation using Neptune/Core & Main
- ▶ The network deployment will be performed on a route-by-route basis including the installation vendor resources and project controls
- ▶ Vendor provides SaaS – whereby AMI Headend System (HES) is hosted at the vendor off-site location and the read data is provided to the City for billing and customer service queries
- ▶ Based upon costs of system equipment and deployment provided by Neptune
- ▶ No Remote Devices are assumed for remote shut-off

The timeline for this effort would be as follows:

- ▶ Planning/Preparation: 1 – 2 months
- ▶ System installation and integration: 4 – 6 months
- ▶ Initial functional testing: 1 – 2 months
- ▶ IDA testing: 2 months
- ▶ Installation of the remainder of collectors: 4 – 6 months
- ▶ Total Time from Start to Finish: 12 – 18 months

7.2.2 *Alternative 2 – Full Functionality AMI with Distribution Operations Endpoints & Targeted Remote Disconnect Valved Meters*

Alternative 2 would implement a fully capable AMI solution. The model will reflect SaaS with the City maintaining the communications network. The approach would include a network of devices deployed in the field including initial system design and development.

This alternative incorporates the installation of Remote Values on estimated 4,000 services. These services are the ones that have had shut-offs of more than two times per year – total of four trips. This is a good data point on which to achieve beneficial savings to offset additional costs of the remote valve service.

Additionally, this alternative incorporates the installation of a sample of Distribution Operations endpoints to support system monitoring.

The following are key considerations for this alternative:

- ▶ Network Installation using Neptune/Core & Main
- ▶ The network deployment will be performed on a route-by-route basis including the installation vendor resources and project controls
- ▶ Vendor provides SaaS – whereby AMI Headend system (HES) is hosted at the vendor off-site location and the read data is provided to the City for billing and customer service queries
- ▶ Based upon costs of system equipment and deployment provided by Neptune
- ▶ Installation of Remote Devices for remote shut-off on ~4,000 services
 - It is assumed these meters may be solid-state meters
 - Installation of Distribution Operations endpoints for monitoring at a small sample of locations.

The timeline for this effort would be as follows:

- ▶ Planning/Preparation: 2 – 3 months
- ▶ System installation and integration: 4 – 6 months
- ▶ Initial functional testing: 2 months
- ▶ IDA testing: 2 – 3 months
- ▶ Installation of the remainder of collectors: 4 – 6 months
- ▶ Installation of the remainder of remote valves and monitors: 5 – 7 months (directly following collector installation in a particular area)
- ▶ Total Time from Start to Finish: 15 – 21 months

7.2.3 *Alternative 3 – Maintain AMR, but Consider an Alternative (e.g., Flume) to Provide Usage Information to the Customer and the Utility*

Because the City already has a fully functional AMR system today, the alternative evaluates simply maintaining that system and promoting the opportunity for customers to track their consumption through use of a third-party device, such as Flume. Customers would need to pay for these devices themselves at a likely cost between \$150 - \$200, but the City is considering possible rebates based on the identification of leaks or some other basis. Such rebates were not considered as part of the cost summary.

The following are key considerations for this alternative:

- ▶ No Communication Network to install – will use AMR MIU's
- ▶ If desired, the City can convert the Neptune MIUs from drive-by to Fixed RF in future
- ▶ The City will need to maintain current drive-by meter reading software

The timeline for this effort would be as follows:

- ▶ Planning/Preparation: 1 – 2 months
- ▶ Implementation of Marketing Campaign: 3 – 6 months
- ▶ Total Time from Start to Finish: 4 – 8 months

All alternatives assume an applicable technology implementation that includes infrastructure improvements, IT enhancements, business process changes, and a package of customer and community benefits.

The economic analysis presented in Section 8 includes capital costs, Operations and Maintenance (O&M) costs, and benefits analysis for each alternative.

8 Economic and Financial Analysis

This section provides an overview of the approach used for the Financial Analysis as well as a summary of the results. Inputs for the model were gathered from multiple sources, including the original data request and conversations with the City staff. The analysis in this section provides snapshots of the current model.

8.1 AMI Financial Impacts

Developing the financial model for the AMI feasibility study at the City requires reviewing strategic areas on which to develop benefits and costs. These are:

- ▶ Network Propagation Analysis to develop parameters for Network Installation
- ▶ Alternatives for Benefit Analysis (Indirect economic benefits)
- ▶ Look at improved cash flow with faster billing
- ▶ Reduction of truck rolls
- ▶ Leak adjustments versus lost revenue
- ▶ Installing 4,000 Remote Valve meters

8.2 Financial Model Design

The financial model used a conservative approach and is presented in a 10-year analysis. Appendix B includes the detailed capital cost estimates for the different AMI systems and configurations as well other inputs to the model.

The model has two main benefit categories, which are classified as direct, and indirect benefits which represent realistic expectations based upon City metrics and industry norms. Direct benefits are associated with a directly measured economic benefit such as those related to labor cost or fuel cost.

Indirect benefits include all other non-economic benefits that are not initially measurable, but nonetheless have some real value over the course of the project. These include items such as improved customer satisfaction through web-enabled services.

The financial modeling monetizes all benefits but separates the various categories. The savings created by AMI for the City are evaluated in terms of how the system can change the current baseline of work and provide operational efficiencies to reduce costs. Operational savings in meter reading and field service that were identified through the workshops are incorporated.

The model includes the following:

Model Design: Program Implementation Costs (One Time Capital Costs)

- Network devices to be installed for AMI
- Meter pit and lids adjustments to allow AMI RF signal to penetrate the box, for remaining few boxes that have metal lids
- Professional services for project
- IT systems and integrations

Model Design: Operational Costs (On-Going Costs)

- Software as a Service (SaaS)
- AMI support personnel
- On-going maintenance and support of devices

Model Design: Direct Benefits captured in the model

- Reduction on Meter Reading costs: software; vehicle fuel and lease
- Reduction in Service Orders and associated truck-rolls
- Reduction in billing audit processes

Model Design: Monetized Indirect Benefits captured in the model

- Customer satisfaction at a rate of \$.05 per meter per month - ~\$4,000/year
- Carbon credits - Greenhouse Gas reduction by reduction of truck rolls - ~\$1,308/year

Model Design: Non-Monetized Indirect Benefits

- Potential reduction in insurance by reduction in miles driven and field accidents
- Reduction in billing audit processes
- Shortened read-to-billing timeframe by 3 days
- Reduced calls to Call center
- Reduction in Bad debt and leak forgiveness
- Reduction in electrical charges through Smart Pumping
- Reduction in unaccounted for water Distribution Leaks through system analysis
- Reduction in Overtime for emergency breaks through proactive analysis

Model Outputs: The model calculates

- Multi-year parameters
- Cost and savings impact (through percentages reductions translated to dollars)
- Cash flow
- Depreciation/residual values
- Net present value (NPV)/Internal Rate of Return (IRR)

8.3 Program Implementation Cost

The total capital cost for each alternative includes network devices, software, installation services, professional services, and ancillary equipment required for end-to-end implementation. These cost estimates based on input from Neptune and experience with similar utilities and vendor organizations in this market space.

8.4 AMI Operations and Maintenance Cost

In addition to the project implementation/capital costs described above, there will also be ongoing O&M costs for operating the system over the 10-year analysis that must be considered.

8.5 Direct Program Benefits

Table 8-1 summarizes the benefits assumed with an AMI project as discussed in Sections 5 and 6 for each of the alternatives. This table is extracted from the model and provides a 10-year view. See Appendix A for additional details.

Table 8-1 Project Direct Benefit Savings over 10-Year Analysis Period

Benefit Comparison (Ten Years Cumulative)			
	Alternative 1: Basic AMI System	Alternative 2: Advanced AMI with 4000 remote valves	Alternative 3: Maintain AMR
Direct Benefits			
Meter Reading	\$990,131	\$990,131	\$0
Meter Operations	\$1,634,851	\$2,528,540	\$16,483
Billing	\$0	\$0	\$0
Call Center	\$0	\$0	\$0
Credit & Collections	\$0	\$0	\$0
Distribution Operations	\$0	\$0	\$0
Revenue Protection	\$143,750	\$143,750	\$28,750
Total Benefit	\$2,768,731	\$3,662,421	\$45,233

8.6 Indirect Program Benefits

Indirect benefits include all other non-economic benefits that are not initially measurable, but nonetheless have real value over the course of the project. These include items related to triple bottom line benefits and costs, e.g., environmental, social, and economic impacts. The financial model monetizes indirect benefits but separates them to provide a transparent view of the approach to the benefits analysis used in the recommendation. Table 8-2 summarizes the savings for indirect benefits for each impacted area.

Table 8-2 Indirect Benefit Savings over 10-Year Analysis Period

Benefit Comparison (Ten Years Cumulative)			
	Alternative 1: Basic AMI System	Alternative 2: Advanced AMI with 4000 remote valves	Alternative 3: Maintain AMR
Indirect Benefits			
Improved Customer Satisfaction	\$48,730	\$58,476	\$0
Carbon Emissions	\$9,849	\$15,233	\$99
Total Benefit	\$58,579	\$73,709	\$99

The City can anticipate certain benefits that do not present readily measurable direct economic benefits with the implementation of AMI. These indirect benefits provide intangible benefits that improve operational efficiency, internal employee satisfaction, customer satisfaction through web-enabled services and/or societal benefits to the community. For example, environmental savings result from the reduction in vehicle

usage; there is a corresponding reduction in greenhouse gas emissions with fewer miles driven. Better leak management reduces the demand for electricity usage for water treatment, resulting in lower power consumption, further reducing the City's carbon footprint.

Industry norms were used to evaluate the potential impact from the indirect benefits the City could realize from an AMI implementation. The benefits included in the model are listed below:

► Environmental Impacts

- Carbon offset value reduction can be calculated for the forecasted reduction in the City's operations (i.e., carbon footprint due to elimination of utility vehicles due to impacts to meter reading, meter operations, etc.). This could result in a reduction in carbon credit purchases in the future.
- 2020 Carbon Credit = \$20 / Metric Ton of CO₂
- Carbon impacts
- Without Remote: 4,549 miles eliminated removing 40 metric tons of CO₂ = \$809 annual CO₂ credit
- With Remote: 7,360 miles eliminated removing 65 metric tons of CO₂ = \$1,308 annual CO₂ credit
- Indirect benefits include:
 - Greenhouse gas reduction through LEED Program, fewer vehicles and less truck mileage
 - Near-time water use data to promote conservation efforts
 - Enhanced non-revenue water calculations and audit capability
 - Proactive demand management, drought management and water conservation
 - Supports responsible battery disposal and related risk mitigation

► Social Impacts

- The ability to deliver more frequent and granular usage information to customers, while enabling them to use self-service functions to resolve potential issues has been documented by the Department of Energy to add real value to consumers and communities
- Perceived value of the City's ability to develop a culture of creating transparency, improving communication, maintaining reliability will build confidence with internal and external shareholders
- Customer satisfaction = # of meters deployed x monthly benefit per meter
- The projected value to the City's customers was established to be \$.05 per meter per month
- Indirect benefits include:
 - Communities benefit from planned reductions to air pollution
 - Overall enhanced customer service including proactive service to reduce high bills, and first call resolution potential
 - Increased customer goodwill via access to better information to inform consumption of resources
 - Safety – morale (soft); hard benefits (Society) – reduced field services injuries
 - Proactive maintenance (car sinking on Wendover Ave)
 - Potential rate design clarity concerning cost of service base on improved data

► Economic Impacts

- Indirect benefits include:
 - Employee morale can drive operational efficiency
 - Less employee visibility in the field can drive operational efficiency
 - Full field audit of connections, accounts and meters (data clean-up)

8.7 Overall Financial Model

By bringing together all elements of the feasibility financial model (direct, and indirect benefits, operating expenses, and capital expenses), the resulting financial information shown in Table 8-3 summarizes the

Table 8-3 10-Year Summary of Three Strategies

Ten-Year Summary Table			
	Alternative 1: Basic AMI System	Alternative 2: Advanced AMI with 4000 remote valves	Alternative 3: Maintain AMR
10-Year Cumulative Direct Benefits	\$2,768,731	\$3,662,421	\$45,233
10-Year Cumulative Indirect Benefits	\$58,579	\$73,709	\$99
10-Year Cumulative OpEx	\$3,997,155	\$3,997,155	\$708,488
10-Year Cumulative CapEx	\$5,282,600	\$6,172,600	\$9,500
Net Present Value (All Benefits)	(\$1,607,645)	(\$969,838)	(\$550,150)

results of the analysis for the four alternatives.

The Excergy team believes that the CapEx, OpEx and benefits assumptions are conservative and leave room for cost improvement and benefit enhancement. While there is some subjectivity involved with the monetization of indirect benefits, there is also little doubt that the project would enable improvement and modernization of the utility operations.

Table A-2 in Appendix A documents detail concerning CapEx and OpEx costs for each alternative. Tables 8-4, 8-5, 8-6 documented below provide Pro Forma Financial detail from the Study's financial model for each of the alternatives:

Table 8-4 Alternative 1, Basic AMI Pro-Forma

Alternative 1 - Basic AMI													10 Year Totals
	<u>2021</u>	<u>2022</u>	<u>2023</u>	<u>2024</u>	<u>2025</u>	<u>2026</u>	<u>2027</u>	<u>2028</u>	<u>2029</u>	<u>2030</u>	<u>2031</u>	<u>2032</u>	
<u>Pro Forma Financials</u>													
Direct Benefits	\$102	\$210	\$216	\$222	\$228	\$235	\$241	\$248	\$255	\$263	\$270	\$278	\$2,769
Indirect Benefits	\$2	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$59
Total Benefits	\$105	\$215	\$221	\$227	\$233	\$240	\$247	\$253	\$260	\$268	\$275	\$283	\$2,827
OpEx	\$256	\$262	\$333	\$339	\$345	\$352	\$358	\$408	\$416	\$378	\$385	\$166	\$3,997
Net Income	(\$152)	(\$47)	(\$113)	(\$112)	(\$112)	(\$112)	(\$111)	(\$154)	(\$155)	(\$110)	(\$109)	\$117	(\$1,170)
CapEx	\$2,641	\$2,641	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$5,283
Cash Flow	(\$2,529)	(\$2,160)	\$416	\$416	\$416	\$417	\$417	\$374	\$373	\$418	\$155	\$117	(\$1,170)
Cum Cash Flow	(\$2,529)	(\$4,689)	(\$4,273)	(\$3,857)	(\$3,441)	(\$3,024)	(\$2,607)	(\$2,233)	(\$1,860)	(\$1,442)	(\$1,287)	(\$1,170)	(\$32,413)
 <u>Financial Metrics</u>	 <u>10-Year</u>	 <i>All values in \$1,000 dollars</i>											
NPV	(\$1,608)												

Table 8-5 Alternative 2, Advanced AMI Pro-Forma

Alternative 2 - Advanced AMI													10 Year Totals
	<u>2021</u>	<u>2022</u>	<u>2023</u>	<u>2024</u>	<u>2025</u>	<u>2026</u>	<u>2027</u>	<u>2028</u>	<u>2029</u>	<u>2030</u>	<u>2031</u>	<u>2032</u>	
<u>Pro Forma Financials</u>													
Direct Benefits	\$135	\$277	\$285	\$293	\$302	\$310	\$319	\$329	\$338	\$348	\$358	\$368	\$3,662
Indirect Benefits	\$3	\$6	\$6	\$6	\$6	\$6	\$6	\$6	\$7	\$7	\$7	\$7	\$74
Total Benefits	\$138	\$283	\$291	\$300	\$308	\$317	\$326	\$335	\$345	\$354	\$364	\$375	\$3,736
OpEx	\$256	\$262	\$333	\$339	\$345	\$352	\$358	\$408	\$416	\$378	\$385	\$166	\$3,997
Net Income	(\$118)	\$21	(\$42)	(\$40)	(\$37)	(\$35)	(\$32)	(\$73)	(\$71)	(\$23)	(\$20)	\$209	(\$261)
CapEx	\$3,086	\$3,086	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$6,173
Cash Flow	(\$2,896)	(\$2,448)	\$575	\$578	\$580	\$583	\$585	\$545	\$546	\$594	\$289	\$209	(\$261)
Cum Cash Flow	(\$2,896)	(\$5,344)	(\$4,768)	(\$4,191)	(\$3,611)	(\$3,028)	(\$2,443)	(\$1,898)	(\$1,352)	(\$758)	(\$470)	(\$261)	(\$31,021)
<u>Financial Metrics</u>	<u>10-Year</u>	<i>All values in \$1,000 dollars</i>											
NPV	(\$970)												

Table 8-6 Alternative 3, Maintain AMR Pro-Forma

Alternative 3 - Maintain AMR													10 Year Totals
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
Pro Forma Financials													
Direct Benefits	\$2	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$45
Indirect Benefits	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Benefits	\$2	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$45
OpEx	\$34	\$34	\$68	\$69	\$70	\$71	\$71	\$72	\$73	\$73	\$74	\$0	\$708
Net Income	(\$32)	(\$30)	(\$65)	(\$65)	(\$66)	(\$67)	(\$67)	(\$68)	(\$69)	(\$69)	(\$70)	\$4	(\$663)
CapEx	\$5	\$5	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10
Cash Flow	(\$36)	(\$34)	(\$64)	(\$64)	(\$65)	(\$66)	(\$66)	(\$67)	(\$68)	(\$68)	(\$69)	\$4	(\$663)
Cum Cash Flow	(\$36)	(\$70)	(\$134)	(\$198)	(\$263)	(\$329)	(\$395)	(\$462)	(\$530)	(\$598)	(\$667)	(\$663)	(\$4,343)
Financial Metrics	10-Year		All values in \$1,000 dollars										
NPV	(\$550)												

8.8 Conclusions

None of the three alternatives offer a positive Net Present Value and are fairly close in total value. As such, all three options are viable for the City. The pros and cons of each are summarized below:

8.8.1 *Alternative One Pros and Cons*

The pros of this alternative are that you achieve many of the benefits sought in implementing an AMI cost for the least cost in the quickest time. Specifically,

- ▶ Customers will be able to proactively identify, and hopefully address their own leaks,
- ▶ The utility will be able to identify meter maintenance issues based on receipt of read information,
- ▶ Customers may have access to consumption and billing data online (see Sec. 1.3.4 below concerning CIS version relative to this benefit)
- ▶ Ability to easily retrieve interval usage data and for customers and City Staff to see usage patterns together
- ▶ The cons of this alternative are the costs associated with the installation of a fixed network compared to maintaining the current AMR system and the reduced financial benefits from not having a more robust AMI system capable of providing more information to the utility and customers.

8.8.2 *Alternative Two Pros and Cons*

The pros of this alternative include all those stated above under Alternative One, but also include the following:

- ▶ Ability to remotely disconnect/reconnect meters for non-payment or in a move-in/move-out, avoiding previously necessary truck rolls,
- ▶ The availability of distribution system information on line pressure, temperature and other parameters that can improve overall function and useful life of the system components.
- ▶ In addition to the cons described above in Alternative One, there are operational concerns as to whether there is clearance in meter pits to be able to install remote valves effectively. Relative to distribution operations monitors, it is difficult to quantify the value of the information provided and it may be necessary to install many more monitors at an added cost to fully realize the benefits of the monitoring effort.

8.8.3 *Alternative Three Pros and Cons*

The pros of this alternative are centered on the fact that the City would not be responsible for the capital cost or maintenance of a new AMI system. Interested customers would still be able to see consumption and possible leak conditions and take appropriate actions to resolve them, providing a customer service to them and conserving water resources.

The cons of this alternative are that you lose out on most all of the pros described in Alternatives One and Two above:

- ▶ Only those customers that pay the money for a flow monitoring device will be able to proactively identify, and hopefully address, their own leaks,
- ▶ The utility will not be able to identify meter maintenance issues based on receipt of read information on an ongoing basis but only based on the once per month read,
- ▶ Customers will not have access to consumption and billing data online, and
- ▶ The City will not have the ability to easily retrieve interval usage data and view that data with customers to see usage patterns together.

9 Deployment and Implementation Planning

9.1 Introduction

The deployment and implementation planning presented in this section provides an analysis and recommendations to assist the City in planning for Advance Metering Infrastructure (AMI) deployment.

9.2 Key Areas of Consideration

AMI implementation involves several coordinated dimensions across technology, people, fluctuating workstreams and activities that need to be holistically managed to ensure successful transformation occurs on time and within budget. Astute implementation planning can mean the difference between a successful, well-accepted project and a poorly performing system. The integrity of the information created during AMI deployment is critical to employee and customer acceptance.

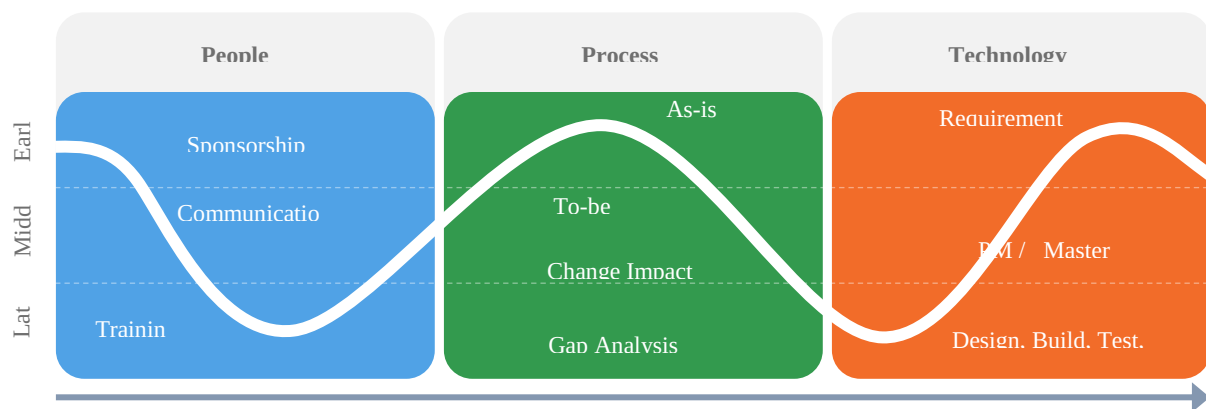


Figure 9-1 People, Process and Technology Working Together

Major elements of successful AMI implementation planning entail:

- ▶ A project schedule and management plan to govern contract management, field inspection, troubleshooting, data audit, and acceptance testing.
- ▶ A network deployment plan.
- ▶ An installation control system to ensure that data is captured correctly, and invoices are correct.
- ▶ An organizational change management plan with activities to prepare, manage and reinforce change impacts for all utility employees involved in installation, managing contractors, operating and maintaining the system, dealing with customers during installation, and using the system data.
- ▶ A meter reading transition plan to ensure all meters are read smoothly as routes are converted to AMI.
- ▶ A stakeholder engagement communications plan for internal employees and external customers, elected and appointed officials, and the general public.
- ▶ An IT integration plan covering key interfaces and initial applications.
- ▶ A quality management plan including quality assurance processes and quality control activities to guide the verification and acceptance of software, contractual obligations, services, and deliverables as individual components and as an overall solution.
- ▶ Operational transition action plans working with, human resources, and training plans to manage the transition of employees to ensure use and adoption of technology and new ways of working during and after the project. This operational transition also includes the specific analysis of the number of staff necessary to operate and maintain the AMI system and provide the necessary support to customers.

Based on the adoption of a recommended alternative with a sound business case, the City should prepare an implementation plan. This should include a project schedule in the form of a Gantt chart that shows the key tasks and milestones for project procurement and deployment. This will help identify the points at which monetary and staffing commitments are required. The implementation plan is typically completed once a vendor is selected and the particulars of the system are known.

9.3 Decisions on Implementation

Several important decisions should be made prior to any AMI project implementation. These include:

- ▶ Use of a Consultant guide the City in an effective implementation process
- ▶ Defined Procurement Strategy: It is important that the core team endorses a clear and practical strategy, especially considering that this will be placed with an existing vendor apart from a competitive bid due to the advantages of using the incumbent system.

9.4 Implementation Considerations

AMI systems often interface with several IT systems within a utility, depending on what systems a utility has implemented or is considering. Typically, an AMI will interface with Customer Information System (CIS), Work Management System (WMS), Asset Management, and potentially SCADA for distribution benefits. An initial analysis of the current system impacts, and a high-level view of the future AMI solution are provided in Section 7.

Excery recommends that the City develop an IT strategic roadmap that includes all IT systems and identifies all the interfaces across the City's enterprise architecture framework in place. The City needs to incorporate AMI into any strategic IT planning designs. For the procurement phase, it will be important to also identify the integration strategy and other relevant IT policies and standards to any prospective vendor and require assurances that the AMI is compatible with the City's environment.

Another important part of IT implementation planning is data management. AMI could inundate the City with data, and a data management plan must be developed to ensure proper data security and quality is maintained. This data management plan should identify the system of record and identify the process to capture (create), maintain (update, delete), and secure (backup and security processes) the data.

Meter operations is another area where AMI will have a large impact. The City must define and document the future process of installing the meters to ensure high-quality customer service and that they are commissioned properly in the AMI Headend system (HES) and the CIS. Each time the meter or Meter Interface Unit (MIU) is changed, a process to ensure proper data alignment must be in place to maintain data quality. The City will need to set up a user-friendly change-out process and limit manual entry to cut down on human error for future meter exchanges.

It is important that the City identifies and reviews all processes impacted by AMI. While this study addressed key customer service processes, meter services and high-level distribution system operational meter-to-cash processes, there are many more overlapping value chain core processes identified across PWC, PWU, and MUS functions that must be reviewed and modified, replaced, or eliminated to streamline and garner the benefits AMI promises.

Excery recommends that the City define processes in concert with the data management design to ensure processes, people, and data are populated at the right time, by the right people, and in the right system.



Figure 9-2 Core Value Processes

9.5 Risk Assessment

An AMI project for the City represents a significant capital investment. A new metering system must deliver mission-critical information reliably. It must operate for over 20 years, during which circumstances (e.g., personnel, politics, economics, technology) can change. An AMI project would likely be high profile and impact a large number of stakeholders, including utility employees and customers. It would rely extensively on new technology and interfaces between information systems. The project would require the coordination of a number of key players: the AMI technology vendor; utility engineering, customer service, and IT staff; and possibly additional technology vendors or service providers (e.g., MDMS, CIS, customer portal).

AMI project risks fall into two broad but interrelated categories:

- ▶ **Technology risks** include obsolescence of the AMI equipment, premature battery failure, flaws in AMI project control software, excessive failure rates of system components, incursions into assigned radio frequencies, incompatibility with future meter registers or communication standards, inadequate performance of the system, insufficient safeguards to secure customer (and company) information, and loss or corruption of critical data.
- ▶ **Business risks** include instability of vendors, lack of employee buy-in, business case assumptions that change or fail to materialize, lack of ongoing system support and maintenance by the utility's staff or the vendors, increased tampering and theft of service, failure to adequately integrate the AMI system with other utility information systems, failure to change business processes to completely take advantage of the technology, failure to reduce staffing and other costs where the system enables it, lack of acceptance by customers, and increased issues caused by reduced visual inspection of customers' premises by City staff. Additionally, poor customer acceptance can be caused by failure to adequately address customer concerns such as health, safety, and privacy concerns, or higher bills due to meter change-outs.

Risk is the product of probability and impact. A high probability failure with a very low impact would carry little risk. A very low probability failure with a high impact may also carry little risk, but caution is advised in reaching such a conclusion since probability is often much more difficult to estimate than impact.

As part of the project planning phase, the specific risks of an AMI implementation that are applicable to the City should be further refined, their likelihood and potential impact assessed, and the potential to prevent or mitigate them evaluated.

Where significant risks exist, potential mitigation measures and contingency plans should be identified as appropriate, and those measures that are reasonably cost-effective in comparison to the mitigated risk should be implemented. The utility may develop preventive measures (e.g., go/no go decision points), mitigation (e.g., changes in the plan if aspects of it do not have the desired results), or decide to simply accept certain outcomes and their attendant cost or delay. Mitigation may be in the form of assignment to another party (e.g., the AMI vendor); but assignment of risk is not always effective, particularly if the assignee is unable to control the conditions that could lead to potential failure or if the risk is too great in comparison to the project benefits for the assignee.

An effective Risk Management Plan should identify risk mitigation measures. Risk mitigation measures include: soliciting expertise; building a thorough business case incorporating reasonable estimates of potential savings and costs (this study); involving all stakeholder groups; following a thorough and unbiased selection process; developing robust contracts and performance measures; providing appropriate safeguards to secure customer and company information through the data transmission process; establishing and maintaining schedules for visual inspections of meters and MIUs; implementing detailed project control procedures; and adopting comprehensive project management and communications plans.

Table 9-1 documents the identified risks and suggested mitigation strategies for the City to use in developing a successful project plan and implementation.

Table 9-1 Technological and Business Risks Associated with AMI Deployment

Risk	Level of Risk	Level of Impact	Mitigation Strategy
Technological Risks			
Technical obsolescence	M	L	Require ongoing support in contract
Lack of standards, interoperability	H	H	Require guarantees of interoperability in RFP and contract.
Bugs or interface problems in application and third-party software	M	H	Design within integration strategy (i.e., use Enterprise Service Bus – ESB – or other integration strategy that provides the speed and functionality required for the requirements). Project gate: acceptance testing
Premature battery failures	L	H	Contract and warranty
Excessive failure rates; system failures, product recalls	L	H	Contract and warranty, including “make whole” provisions
RF incursion	L	L	Sufficiently strong network for unlicensed; Federal protection for licensed
“Future-ware;” untested products.	M	M	Due diligence; validation of verifiable functionality; warranties—particularly Remote Disconnect
Business Risks			
Long-term viability of vendors	L	M	Due diligence; strong software agreements
Lack of internal stakeholder buy-in	H	H	Generate success Organizational Change Management (OCM) and Communications planning
Lack of customer buy-in	H	H	Customer communications; Have questions in annual survey
Business case assumptions don’t hold —too aggressive on benefits	L	H	Have a conservative, yet accurate business case
Delays in project deployment (often due to integration and CIS issues)	M	M/H	Due diligence in integration design, good project management, dedicated IT resources
Lack of ongoing system support and maintenance	L	M	Good process design; identify who is responsible for the system and data

Risk	Level of Risk	Level of Impact	Mitigation Strategy
Institutional capacity to manage the project	M	H	Identify resources needed; staff accordingly. ensure overlapping projects do not create conflicts; outsource project management
Failure to change processes, policies and practices	M	M/H	Effective communications plan and change management plan; Identify policy impacts and allow time to develop, promote and win approval of the changes
Impact of project impinges on the City capital plan and financial health	M	M	Build strong business case; delay or spread the project to fit within CIP prioritization
Labor relations problems with displacements and reclassifications or changes in job content	M	M	Address through HR; provide information and develop a strong change management plan.

10 Acronyms

ALD -	Acoustic leak detector
AMI -	Advanced Metering Infrastructure
AMR -	Automated Meter Reading
AWWA -	American Water Works Association
BPL -	Broadband over power line
CARL -	Current Annual Real Losses
CBIS -	Customer Information and Billing System
CDPD -	Cellular digital packet data
CIS -	Customer information system
CMMS -	Computer Material Management System
CRO -	Customer request orders
CSR -	Customer service representative
CWP -	Customer Web Portal
DCU -	Data collector units
DMA -	Distribution Metering Area
DSS -	Digital Spread Spectrum
EAM -	Enterprise Asset Management
ERP -	Enterprise resource planning
ERT -	Encoder Receiver Transmitters
Esri -	Environmental Systems Research Institute
FRO -	Field Read Order
FST -	Field Service Technician
FTE -	Full time employee
GHG -	Green-house Gases
GIS -	Geographic information system
GPRS -	General packet radio service
HES -	Headend system
HMI -	Human-Machine Interface
ILI -	Infrastructure Leakage Index
IP -	Internet protocol

IRR -	Internal Rate of Return
IT -	Information technology
IWA -	International Water Association
LAN -	Local area network
LED -	Light emitting diode
MDMS/MDM -	Meter Data Management System
MDUS -	Meter Data Unification and Synchronization
MHZ -	Megahertz
MIU -	Meter interface unit (See RTU)
MPLS -	Multiprotocol label switching
MWO -	Maintenance/Repair Work Order
Naas -	Network as a Service
NPV -	Net Present Value
NRW -	Non-revenue water
O&M -	Operations and Maintenance
ODW -	Operational Data Warehouse
OLE -	Object Link Embedded
OPC -	OSIsoft Process Control
OT -	Operations Technology
PD -	Positive Displacement
RF -	Radio frequency
RFP -	Request for proposal
ROI -	Return on investment
RTU -	Remote Terminal Unit (See MIU)
RV -	Remote Valve
SaaS -	Software as a Service
SCADA -	Supervisory Control and Data Acquisition
TBD -	To be determined
UARL -	Unavoidable Annual Real Losses
UHF -	Ultra-high frequency
VDO -	Vacancy Disconnect Order

VPN - Virtual private network
WAN - Wide area network
WMS - Work Management

.

Appendix A. Summary Tables

Table A-1 provides values used in the model and source information for the values.

Table A-1 Business Case Model Source Data

Model Input	Value	Source	Note
Inflation Rate (Annual)	3%	Excergy	Current value
Discount Rate (Annual) for NPV	3%	Excergy	Normal value
Vehicle Maintenance & Fuel (annual)	Annual Vehicle Maintenance \$6,048.35 Annual Fuel Spend \$18,739.49	Data Request	
Neptune Annual Maintenance Cost/License. Tools etc.,	\$66,523	Data Request	
Customer Satisfaction	5-6 cents per Meter per Month	Workshop/Data Review	Using 5c for Alt 1 6c for Alt 2
Carbon Impacts	CO2/gallon of Gasoline=0.008887	US EPA	Calculated gallons saved

Table A-2 provides a summary of costs for each of the alternatives.

Table A-2 Simplified Cost Overview

Simplified Cost Overview—Alternative 1: CapEx					
Description	Quantity	Cost/Item	Total Cost		
Network Devices	141	\$15,000	\$2,115,000		
Device Installation	141	\$15,000	\$2,115,000		
Extended Warranty (Network)	141	\$4,100	\$578,100		
Towers	4	\$10,000	\$40,000		
Outside PM/Integration Support	1	\$425,000	\$425,000		
Software SetUp Fee	1	\$6,500	\$6,500		
Software Training	1	\$3,000	\$3,000		
TOTAL			\$5,282,600		
Alternative 1: Op Ex					
Description	Quantity	Cost/Item	Cost/Year	Total Cost	Comments
Network Device Battery Rplcmnt	141	\$500	\$70,500	\$70,500	One time in years 8 & 9
SaaS Fee	86000	\$2.35	\$202,100	\$2,021,000	Annual
Operator/Technician FTE	1.5	\$80,000	\$120,000	\$1,200,000	Annual
Inflation (3%) over 10 yr. period	NA	\$705,655	NA	\$705,655	
TOTAL (Over 10 year period)				\$3,997,155	
Simplified Cost Overview—Alternative 2: CapEx					
Description	Quantity	Cost/Item	Total Cost		
Network Devices	141	\$15,000	\$2,115,000		
Device Installation	141	\$15,000	\$2,115,000		
Extended Warranty (Network)	141	\$4,100	\$578,100		
Towers	4	\$10,000	\$40,000		
Outside PM/Integration Support	1	\$425,000	\$425,000		
Software SetUp Fee	1	\$6,500	\$6,500		
Software Training	1	\$3,000	\$3,000		
SET Valves (incl installation)	4000	\$185	\$740,000		
Advanced Sensors (incl install)	10	\$15,000	\$150,000		
TOTAL			\$6,172,600		
Alternative 2: Op Ex					
Description	Quantity	Cost/Item	Cost/Year	Total Cost	Comments
Network Device Battery Rplcmnt	141	\$500	\$70,500	\$70,500	One time in years 8 & 9
SaaS Fee	86000	\$2.35	\$202,100	\$2,021,000	Annual
Operator/Technician FTE	1.5	\$80,000	\$120,000	\$1,200,000	Annual
Inflation (3%) over 10 yr. period	NA	\$705,655	NA	\$705,655	
TOTAL (Over 10 year period)				\$3,997,155	
Simplified Cost Overview—Alternative 3: CapEx					
Description	Quantity	Cost/Item	Total Cost		
Software Setup Fee	1	6,500	\$6,500		
Software Training	1	3,000	\$3,000		
TOTAL			\$9,500		
Alternative 3: OpEx					
Description	Quantity	Cost/Item	Cost/Year	Total Cost	
SaaS Fee	86000	\$0.78	\$67,080	\$670,800	
Inflation (3%) over 10 yr. period	NA	\$35,058	NA	\$37,688	

Appendix B. Advanced Metering Technology Review

This memorandum provides an overview of Advance Metering Infrastructure (AMI) technology to enable a common understanding of the potential technology options and considerations for AMI implementation at the City of Chandler.

Much of this information was presented during the kick-off workshops held at City offices the week of September 21st, 2020.

Comparison of benefits between AMR and AMI

While utilities benefited from the convenience of walking or driving by to get meter readings, those readings were only captured once a month or bi-monthly, and more often than not interval readings were not available. With AMI providing readings on a daily basis, there can be a wealth of benefits realized over AMR. The following tables show a comparison of benefits between AMR and AMI.

Benefit Area / Benefit	AMR	AMI
Customer Service / Meter Services Benefits		
Reduction in Re-Reads	✓	✓
Reduced Calls to Customer Care	✓	✓
Reduced Hi/Lo Investigation Time	✓*	✓
Reduced Shut-Offs		✓
Usage Details to address inquiries	✓*	✓
Reduction in Meter Reading	✓*	✓
Operations Benefit Comparison		
Reduced Start/Stop Read Trips		✓
Hydro-Guard Operations		✓
System Leak Detection		✓
System Analysis		✓
Pressure Regulations		✓
Water Quality Monitoring		✓
Reporting of water losses	✓	✓
Customer Facing Benefit Comparison		
Web Presentation of usage	✓*	✓
Usage Details to address inquiries	✓*	✓
Proactive Notice of High-Bill		✓
Customer Choice of Bill Date		✓
Customer side Leak Detection	✓*	✓
Reporting of water losses	✓	✓

Benefit Comparison of Remote Valves

The following table shows the expected benefits as applied to AMI without a Remote Valve option, and AMI with a Remote Valve option.

Benefit Area / Benefit	AMI without Remote Valve	AMI with Remote Valve
Customer Service / Meter Services Benefits		
Reduction in Meter Reading	✓	✓
Reduction in Re-Read Orders	✓	✓
Reduced Hi/Lo Investigation Orders and time of Effort	✓	✓
Reduced Trips for Off-Cycle Read orders	✓	✓
Reduced Shut-Off orders, due to reduced high-bills / Leak notification	✓	✓
Quicker response to Customer turn-off/turn-on requests		✓
Reduced Truck Rolls for Finals		✓
Customer Facing Benefit		
Reduced Calls to Customer Care	✓	✓
Customer side Leak Detection	✓	✓
Web Presentment of usage	✓	✓
Usage Details to address inquires	✓	✓
Proactive Notice of High-Bill	✓	✓
Customer Choice of Bill Date	✓	✓
Operations Benefit Comparison		
Improved accuracy in reporting for unaccounted for water	✓	✓
Hydro-Guard Operations	✓	✓
System Leak Detection	✓	✓
System Analysis	✓	✓
Pressure Regulations	✓	✓
Water Quality Monitoring	✓	✓

AMI TECHNOLOGIES

Fixed Network Technology Types

Fixed network AMI systems are defined as including permanently installed network infrastructure to capture meter interval and register readings. This technology consists of a series of antennas, towers, collectors, repeaters, or other permanently installed network infrastructure to collect transmissions of meter readings from AMI capable meters and send the data to a central computer called the AMI head-end system (HES). A fixed network offers the ability to collect meter reads with minimal effort, labor, or vehicle expense.

It is important to note that while the fixed network AMI technology types described below can be stand-alone systems, some vendors offer the ability to use multiple technology types to deploy a solution that will cover an entire service area.

Star Network

A Star network system is designed for the meter endpoint transmitter, or Meter interface unit (MIU), to transmit its data directly to a collector. An endpoint transmitter's signal may be forwarded by radio frequency or converted to a wired network signal, such as telephone or IP network, to send data to the main collection point, termed a collector. The collector consists of one central hub that acts as a conduit to transmit data to the HES server. The Star Network configuration is shown in Figure STAR AMI Network.

The advantages of having a Star Network in place are that it sets up and expands easily and demonstrates good performance. Furthermore, a single endpoint communication failure (i.e. non-centralized failure) has little impact on the entire network because other endpoints are not dependent on the failed endpoint for communication. Additionally, endpoint failure is easy to detect, and the data is easily sent directly to data collectors without being repeated through another device.

A disadvantage of a Star Network is that if a collector fails, there is a potential that the data from the endpoints assigned to that collector may not be transmitted back to the centralized computer; however, the data is retained in the collector or endpoints until it can be manually downloaded or transmitted after collector repair.

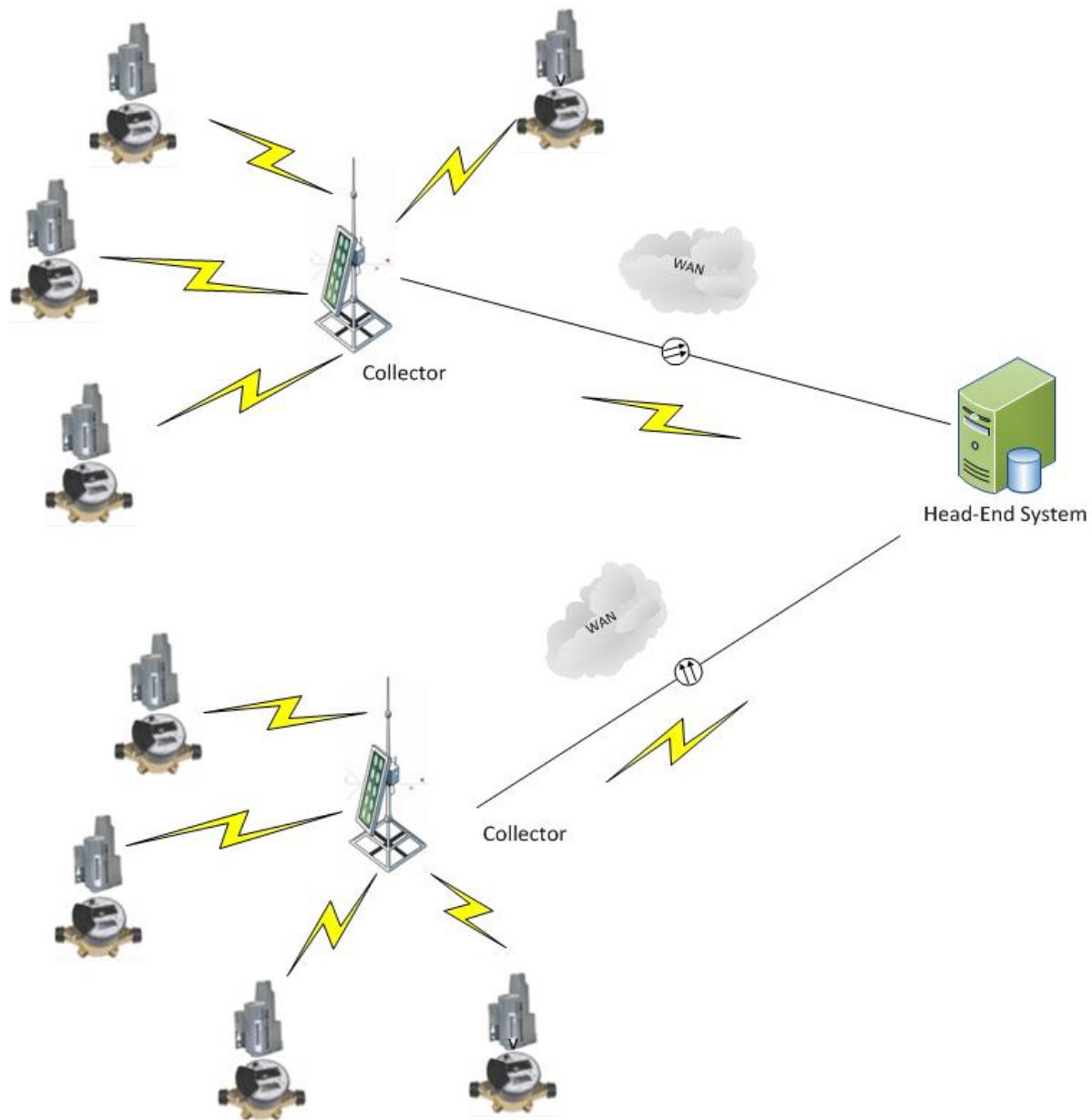


Figure B-1 STAR AMI Network

Star AMI Network: Traits

- Higher power
- Licensed frequencies
- Longer communications distance
- Uses Tower-based (large coverage area) or neighborhood-based units (smaller coverage areas), depending on the vendor

Mesh Network

In a Mesh network system, the meter endpoint transmitter acts as a repeater to pass the data to other nearby meter endpoint transmitters until data arrives at a main collector in a process termed “hops”. Mesh networks allow for connection paths by “hopping” from meter endpoint to meter endpoint until the destination is reached. A Mesh Network is a fully connected network topology by design and differs from other networks in that the component parts can all connect to each other via multiple hops, as shown in Figure B-2.

An advantage of having a Mesh Network is that it is self-healing in that the network can still operate if an endpoint breaks down or a connection fails. As a result, a very reliable network is formed.

A disadvantage with mesh networks is that battery operated, water supporting AMI systems may need more power for the increased frequency of transmitting and performing the transfer of data through the mesh network. Mesh Networks are most effective when deployed with an electric AMI System, using the electric meters as hopping devices due to their available power source. For water systems using mesh

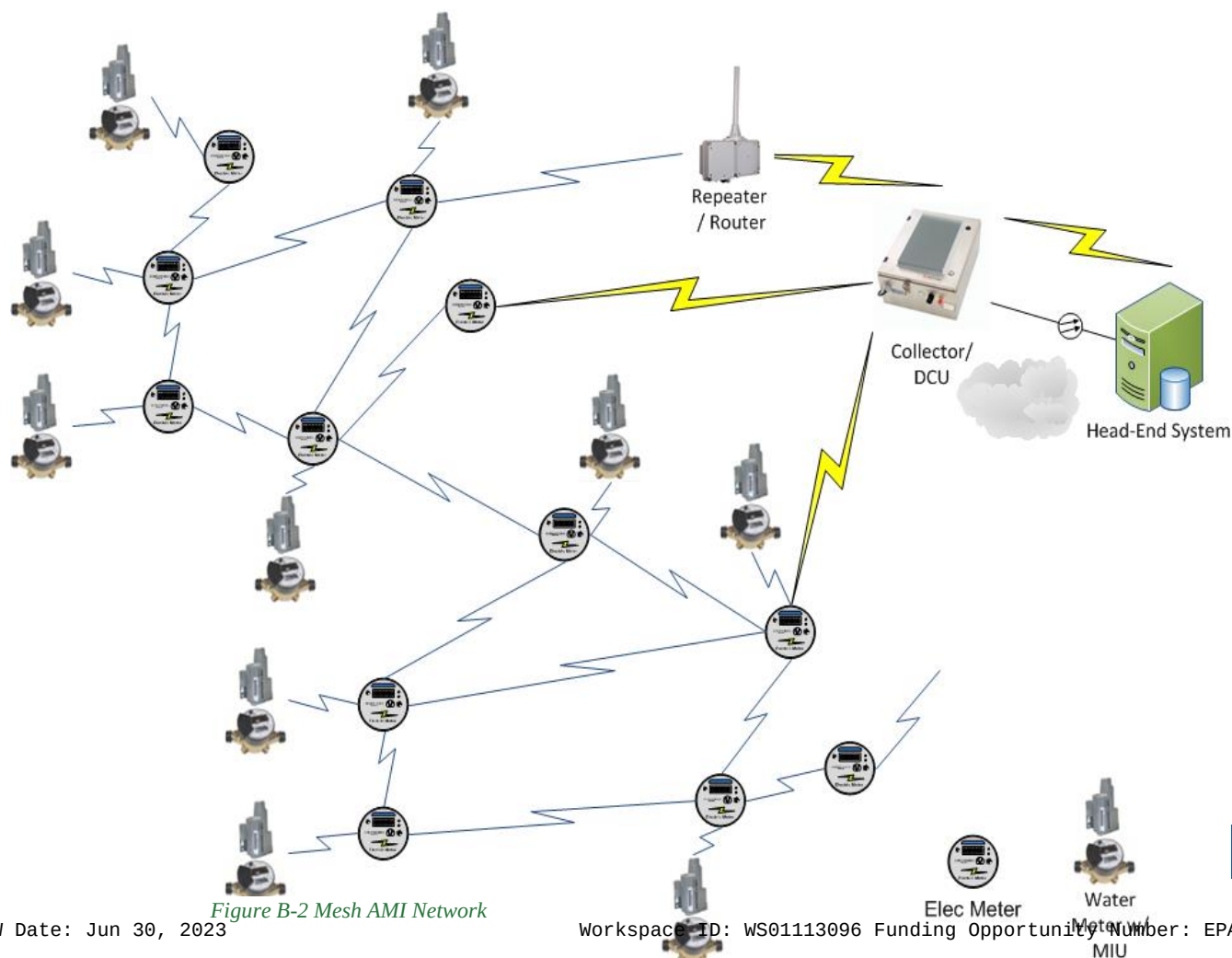


Figure B-2 Mesh AMI Network

technology without the benefit of electric meters as meshing devices, additional collectors and/or repeaters would be required resulting in increased costs and additional maintenance needs.

Mesh Networks: Traits

- Lower power radio
- Uses unlicensed frequency
- Typically, 900 MHz
- Requires more collector and router type devices
- Needs to be able to mesh, with electric meters being the most effective device

Wi-Fi / Cellular Enabled Systems

Systems that communicate using a cellular network or to the Internet via a transmission beacon rather than radio are considered Wi-Fi/cellular enabled (Figure Cellular / Wi-Fi AMI Networks). The method of transferring the data for these systems is much like a Star Network, but the means of data transfer happens through a cell or Wi-Fi connection, rather than through an elaborate transmission system of collectors and receivers. The ability to install an AMI system becomes relatively simple when a city Wi-Fi system exists, as the transmission infrastructure is already in place and simply adding meter endpoints is the only step required. On the cellular side, many providers will offer older cellular network technology (e.g., GSM, 3G, etc.) to utilities, thereby providing a revenue stream for this older technology.

One of the advantages of utilizing Wi-Fi or cellular systems includes the ability to use existing communication infrastructure. In cities that have initiated Wi-Fi communications for city services such as police, emergency medical technicians (EMT), and fire departments, the ability to use their Wi-Fi signals for meter reading is more easily achieved. A disadvantage, as discovered with the City pilot, these types of AMI networks can have spotty coverage in some portions of the service area. Another disadvantage is the ongoing monthly cost for service; however, these additional costs are often offset by the lack of network maintenance costs that mesh or star RF networks require.

For Wi-Fi or cellular, there is a need to ensure that all of the service area is covered. Tests must be done at each endpoint to check the proximity to the routing device so that a signal beacon can be identified. If no signal beacon exists, additional routers or towers need to be added to the system to extend the coverage area.

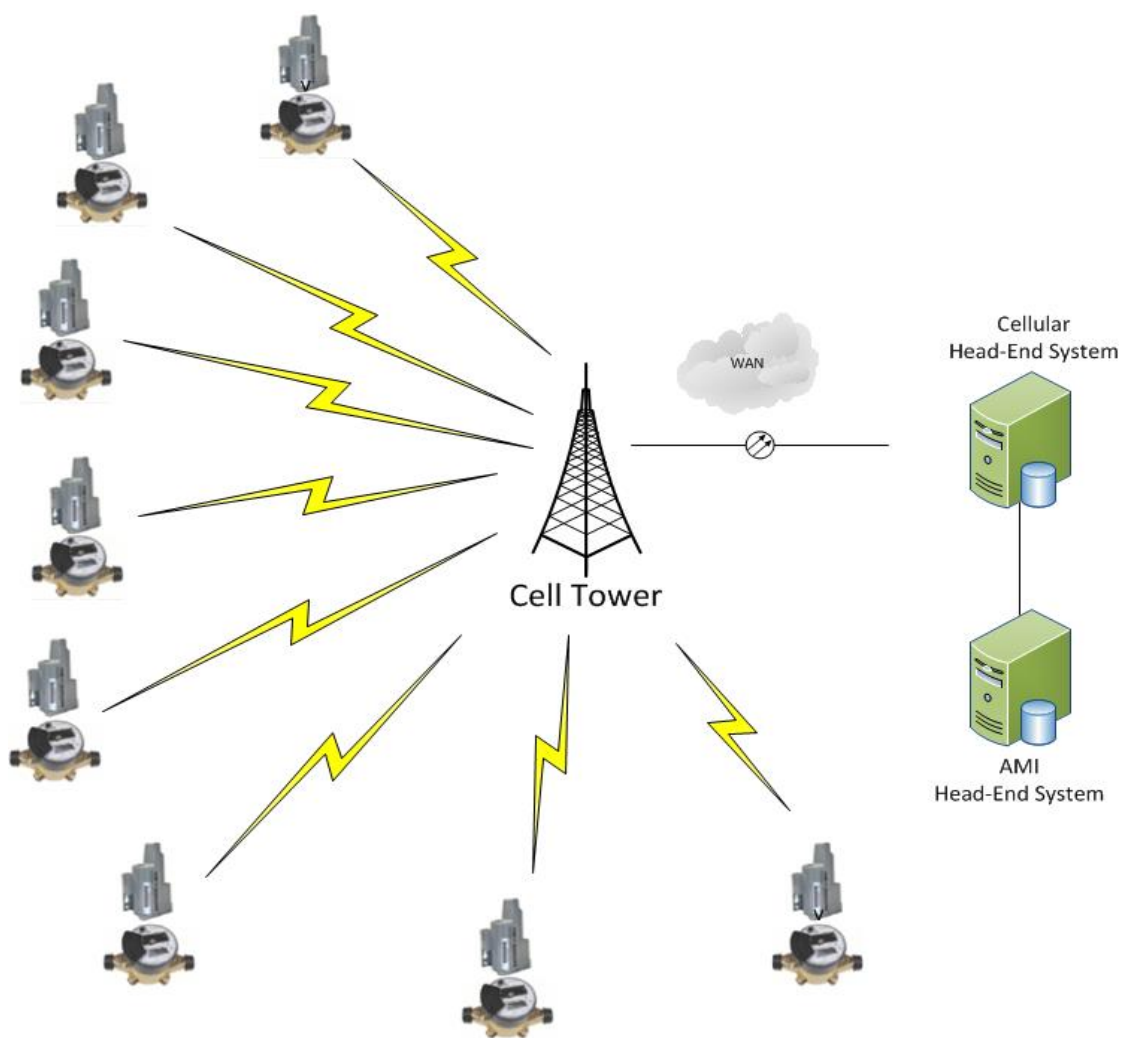


Figure B-3 Cellular/Wi-Fi Network

Wi-Fi / Cellular Networks: Traits

- Leverages existing cellular / Wi-Fi network
- Each MIU has a cellular / IP modem
- Same structure for public network

AMI Software Systems

Implementation of AMI involves the deployment of a communications network, endpoints, and software to manage the network and the data from the endpoints. AMI projects require the integration of systems to provide analysis of the data for billing and management of the messages sent by the endpoints (e.g., alerts and alarms). The following diagram shows a typical integrated AMI system.

AMI Head-end System

The AMI head-end system (HES) is typically provided by the AMI vendor and is used to communicate with, operate, and manage AMI communications network devices and MIU endpoints. This includes the configuration of the MIUs, firmware, and over-the-air updates.

AMI and AMI HES provide:

- Data collection from AMI network
- AMI Network Management
 - Endpoint firmware and configuration, network connectivity
- Data event management (such as tamper alarm, cut wire, etc.)
- Missing read capture
- Providing data to downstream systems, such as customer information systems (Meter Data Management System [MDMS], system modeling, geospatial information system [GIS], Customer Information System [CIS]³, customer portal)
- Supporting additional functions, such as revenue protection analysis, distribution planning support, and prepayment
- Command management (such as turn-on/turn-off)

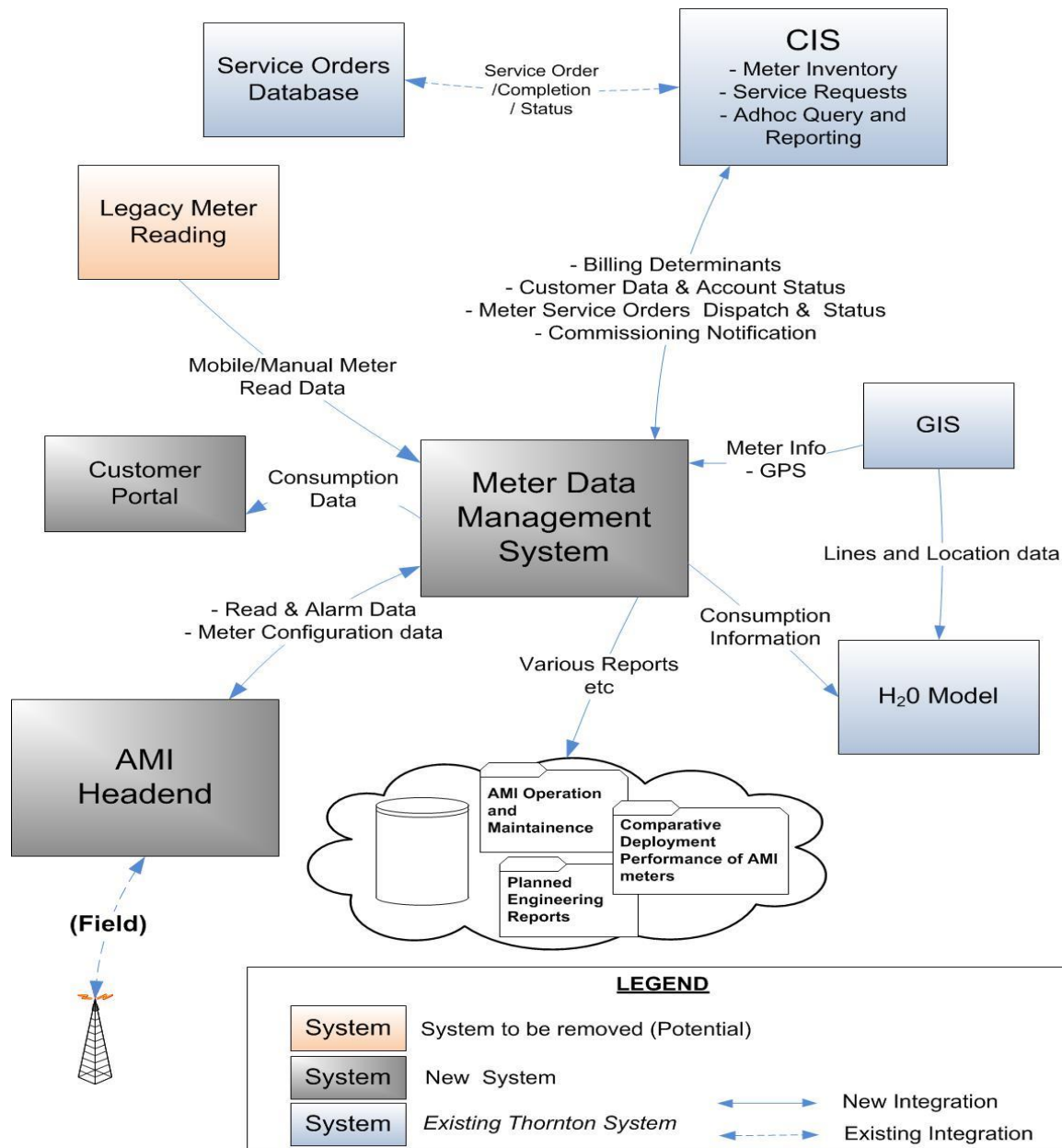
The typical data that is required for the AMI HES is:

- Meter Data
 - Meter number
 - Dial information
 - Location data (GPS, sometimes address)
 - Associated module (Meter Marriage File)
- Module Data
 - Associated meter (Meter Marriage File)
 - Current firmware version for each module
- Network Devices
 - Device firmware/software
 - Configuration

³ Dependent on the AMI / MDMS and Customer Configuration

Meter Data Management System

The Meter Data Management System (MDMS) is the software that manages the extensive data provided by the HES. With meters providing up to 96⁴ interval readings per day, the MDMS will manage the intervals, provide validation, estimation, and editing operations to ensure data is available for billing when the CIS requires.



⁴ Typical water systems are hourly intervals at 24 per day. Meters with 15 minutes intervals provide 96 data points in a 24-hour period.

Meter Data Management Systems provide:

- Data management from AMI HES
- Validation, estimation and editing of reads
- Bill determinant calculation
- Exception management
- Event management (such as tamper alarm, cut wire, etc.)
- Profiling scalar meter reads
- Aggregating meter reads
- Providing data to downstream systems, such as customer information systems (CIS, customer portal)
- Supporting additional functions, such as revenue protection analysis, distribution planning support, and prepayment
- Command management (such as turn-on/turn-off)

The typical data the MDMS contains is:

- General Service Point Info
 - Status (active/inactive)
 - Service requests
- Alarms/Events
- Billing Parameters
 - Rate and channels
- Meter/Device Info
 - Location
 - Meter and module IDs

Figure B-4 Typical AMI Systems and Integrations

Customer Portal

Customer portals provide customers and customer service personnel access to customer interval and usage data which is often provided in a graphical format. The representation of detailed usage data from AMI can be provided to the customer portal from the CIS or MDMS, or often from both. The following pictures present samples of data provided to the customer over a web portal. Note the second picture indicates continuous consumption, indicating possible leak.

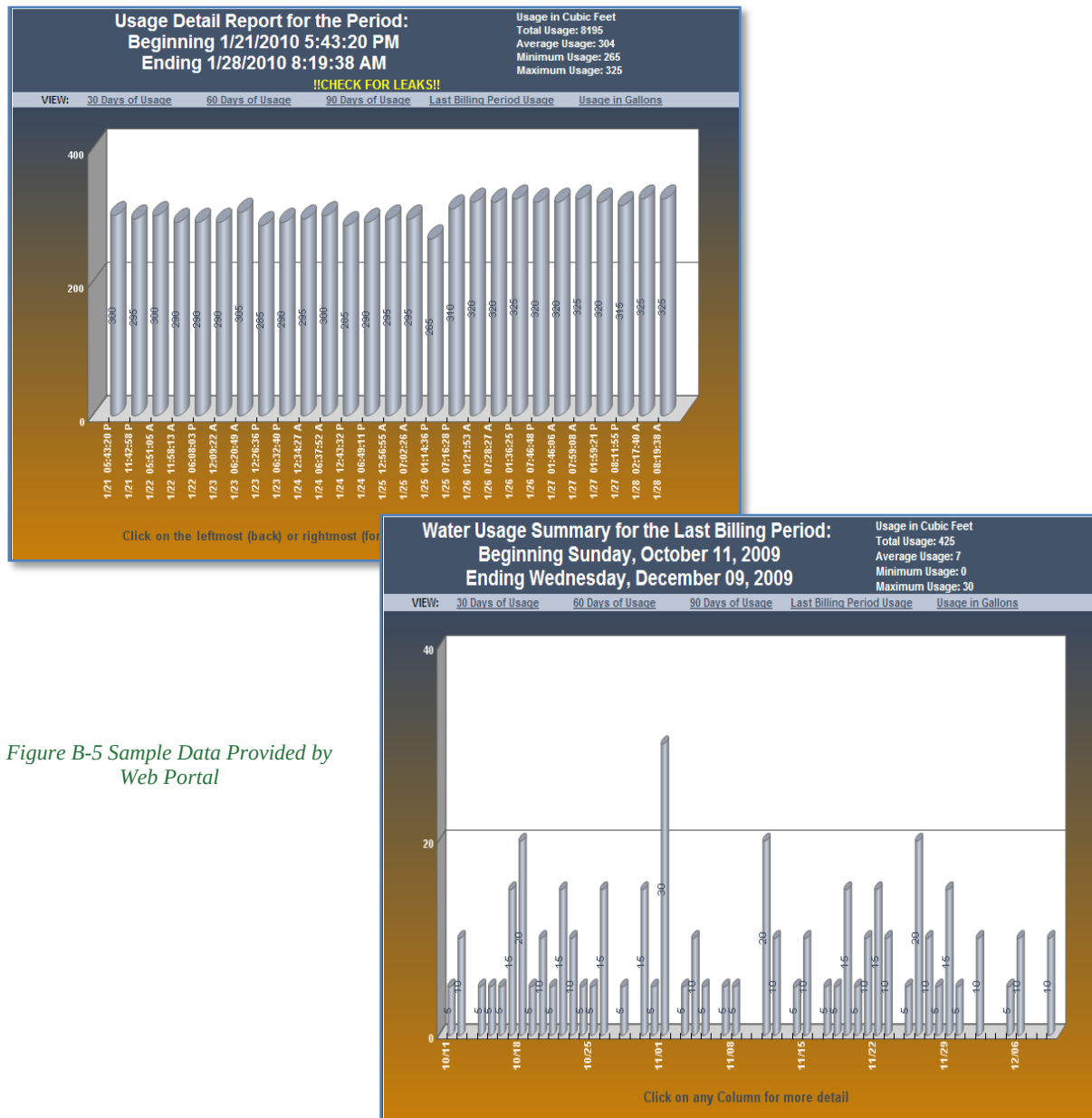


Figure B-5 Sample Data Provided by Web Portal

ID		% Complete	Task Mode	Task Name	Duration	Start	Finish
1		1%		City of Chandler AMI Project	524 days	Mon 6/5/23	Thu 6/5/25
2		100%		Notice to Proceed	1 day	Mon 6/5/23	Mon 6/5/23
3		7%		Task 1 - Project Management and AMI Advisory Services	33 days	Wed 6/7/23	Fri 7/21/23
4		60%		Project Initiation - Planning	13 days	Wed 6/7/23	Fri 6/23/23
5		100%		Planning Meeting	1 day	Wed 6/7/23	Wed 6/7/23
6		0%		Project Communications Plan	1 day	Wed 6/14/23	Wed 6/14/23
7		75%		Develop Project Schedule	5 days	Thu 6/15/23	Wed 6/21/23
8		50%		Develop Action Items/Issue Tracker & Risk Register	3 days	Thu 6/8/23	Mon 6/12/23
9		80%		Establish Project Sharepoint Site	2 days	Thu 6/8/23	Fri 6/9/23
10		0%		Arcadis Team Kickoff	1 day	Fri 6/23/23	Fri 6/23/23
11		0%		Orientation Tasks	16 days	Thu 6/8/23	Thu 6/29/23
12		0%		Provide Information Request	2 days	Thu 6/8/23	Fri 6/9/23
13		0%		Complete Information Request	10 days	Mon 6/12/23	Fri 6/23/23
14		0%		Review Information	4 days	Mon 6/26/23	Thu 6/29/23
15		0%		Meter Inventory Dashboard	18 days	Mon 6/26/23	Wed 7/19/23
18		0%		Stakeholder Interviews	16 days	Fri 6/30/23	Fri 7/21/23
22		0%		Project Kickoff	23 days	Thu 6/8/23	Mon 7/10/23
27		0%		Prepare for Needs Assessment Workshops	18 days	Thu 6/15/23	Mon 7/10/23
29		0%		Task 2 - Needs Assessment	45 days	Tue 7/11/23	Mon 9/11/23
30		0%		Conduct Needs Assessment sessions	14 days	Tue 7/11/23	Fri 7/28/23
35		0%		Implementation Plan	12 days	Mon 7/31/23	Tue 8/15/23
38		0%		Summary Presentation - Needs Assessment	21 days	Mon 8/14/23	Mon 9/11/23
42		0%		Task 3 - Financial Analysis	68 days	Tue 9/12/23	Thu 12/14/23
43		0%		Develop Cost Model	20 days	Tue 9/12/23	Mon 10/9/23
44		0%		Develop Benefits Model	28 days	Tue 9/12/23	Thu 10/19/23
45		0%		Develop BCA Analysis using Alternatives	24 days	Fri 10/13/23	Wed 11/15/23
46		0%		Financial Analysis Summary Report	21 days	Thu 11/16/23	Thu 12/14/23
51		0%		Task 4 - AMI Implementation Support	375 days	Fri 12/15/23	Thu 5/22/25
52		0%		Project Initiation - Implementation	22 days	Fri 12/15/23	Mon 1/15/24
58		0%		Business Process Work	126 days	Tue 1/16/24	Tue 7/9/24

Other Attachment File(s)

* Mandatory Other Attachment Filename:

epa_form_6600_06.pdf

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United States
ENVIRONMENTAL PROTECTION AGENCY
Washington, DC 20460

OMB Control No. 2030-0020
Approval expires 06/30/2024

This collection of information is approved by OMB under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. (OMB Control No. 2030-0020). Responses to this collection of information are required to obtain an assistance agreement (40 CFR Part 30, 40 CFR Part 31, and 40 CFR Part 33 for awards made prior to December 26, 2014, and 2 CFR 200, 2 CFR 1500, and 40 CFR Part 33 for awards made after December 26, 2014). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The public reporting and recordkeeping burden for this collection of information is estimated to be 0.25 hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates and any suggested methods for minimizing respondent burden to the Regulatory Support Division Director, U.S. Environmental Protection Agency (2821T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

4040-0006

EPA Project Control Number

CERTIFICATION REGARDING LOBBYING

CERTIFICATION FOR CONTRACTS, GRANTS, LOANS AND COOPERATIVE AGREEMENTS

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including sub-contracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31 U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Dawn Lang, Deputy City Manager / CFO
Typed Name & Title of Authorized Representative

Dawn Lang 6-16-23
Signature and Date of Authorized Representative

Budget Narrative File(s)

* **Mandatory Budget Narrative Filename:**

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Budget Narrative

Name of Applicant: City of Chandler

Point of Contact: Cristabel Dykstra

Project Title: Advanced Metering Infrastructure (AMI)

The City of Chandler is requesting \$990,000 as part of the FY22 Community Grants Program for Congressionally Directed Spending (CDS) and Community Project Funding (CPF). The City of Chandler will be covering additional costs of \$4.5 million, for total overall cost of approximately \$5.5 million for the AMI project.

As part of the AMI project initiative, an assessment was conducted in 2020, and completed in January 2021, to evaluate the benefits of transitioning from AMR to AMI. The assessment also included a summary of costs associated with the project. The full assessment report has been included as part of this grant application. A budget detail-breakdown has been provided based on the cost analysis provided through the assessment. Funding from the grant will cover direct charges related to equipment and services for installation for equipment to be operational, as outlined in the grant guidelines.

Budget Detail-Breakdown (Estimated Costs)				
Description	Quantity	Cost	Total Cost	Misc
*Network Devices (Collectors)	141	15,000	\$ 2,115,000.00	(quantity subject to change)
Device Installation	141	15,000	\$ 2,115,000.00	
Extended Network Warranty	141	4,100	\$ 578,100.00	
Towers	2	10,000	\$ 20,000.00	(existing towers - no construction)
Outside PM/Integration Support	1	662,000	\$ 662,000.00	
Total			\$ 5,490,100.00	
*Solar Collectors - \$18,000				