City of Santa Barbara

AMI Business Case

Prepared By Westin Engineering Inc.

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Executive Summary

The City of Santa Barbara (City) engaged Westin Engineering Inc. (Westin) to provide a comprehensive and unbiased analysis of the costs, benefits and resources associated with transitioning from the existing manual water meter reading system to a new advanced metering infrastructure (AMI) system.

The cost-benefit analysis was developed in collaboration with City staff through data gathering, interviews and team workshops. This report incorporates the City's specific policies and organizational priorities and also describes the expected customer service, water conservation, meter management and non-revenue water reduction benefits to the City that would result from transitioning to an AMI system. *Section 2 of this report documents the stated goals and objectives the City desires to realize from implementing an AMI system.*

There are two distinct types of AMI systems:

1) *Fixed-Network Systems* - With AMI fixed-network systems, meter reading is accomplished by meter transmission units (MTUs) installed on each meter. The MTUs collect real-time water use readings from the meter and transmit them via radio signals to data collection units (DCUs). The DCUs are permanently located strategically across the service area to relay the collected data to a single, central location where the data is organized in a meter data management (MDM) system database for analysis and reporting.

2) *Cellular-Network Systems* – AMI cellular-network systems utilize cellular endpoints installed on each meter to transmit the meter data via an existing cellular infrastructure to a central database system (hosted or on-premise) for analysis and reporting. *Section 5 of this report further describes the available AMI components.*

A financial analysis model was developed for comparing the implementation of two AMI system alternatives that the City is considering;

1) An Aclara fixed-network system in partnership with Southern California Gas Company (SCG)

2) A hosted Badger AMI cellular system.

The financial model estimates both the annual capital and operations and maintenance (O&M) costs associated with each alternative, as well as the estimated offsetting annual operational savings. The model spreads the capital costs associated for AMI implementation over a fifteen (15) year timeframe to align with the expected replacement intervals of battery-powered AMI components. The anticipated cost savings include savings for increased water conservation, non-revenue water reduction and water production cost avoidance. Other efficiency savings are also expected, including an associated reduction in customer calls and field operational efficiencies. The ability to view real-time meter data will allow the City to make better analysis-based decisions, review individual customer usage, and increase public awareness to improve the City's water conservation efforts. A summary of the results for the two alternatives is provided below including the Return on Investment (ROI) and the Internal Rate of Return (IRR).

Vendor	Capital Cost	Annual Cost	Annual Benefits	ROI	IRR
Aclara Fixed-Network	$7.4 million	$330K	$1.9 Million	5 Years	20%
Badger Beacon AMA	$6.2 million	$535K	$1.6 Million	4 Years	27%

Table 1.1 – Cost Benefit Analysis Summary

As shown in Table 1.1 above, in both scenarios, the resulting analysis demonstrates a strong financial return on investment and internal rate of return for either alternative. Implementing AMI also helps the City achieve other key business goals including increased water conservation, non-revenue water reduction and significant capital cost avoidance in water production and treatment costs. The potential annual cost savings per category are summarized below:

Category	Annual Cost	Improvement	Annual Savings	Notes
Estimated Bills	$ 23,625	90.0%	$ 21,263	Reduces Estimated Bills
Credits and Adjustments	$ 52,660	90.0%	$ 44,990	Reduces Credits and Adjusments
Initial and Final Reads	$ 322,394	90.0%	$ 290,154	Reduces costs ot Initial and Final Reads
Service Investigations	$ 53,830	30.0%	$ 15,330	Eliminate all meter checks and 20% of water checkups
Meter Reading Costs	$ 661,666	10.2960%	$ 68,125	Repurpose Meter Readers and add a Business Analyst
Meter Rereads	$ 145,583	90.0%	$ 124,376	Reduces Pre-Exception Work Orders
Meter Reading Systems	$ 6,713	42.4%	$ 2,845	Reduces maintenance costs of handheld systems
Fleet Costs	$ 52,380	37.5%	$ 19,643	Reduces meter reading fleet costs
Apparent Water Loss	$ 1,810,704	15.2%	$ 274,736	Includes stopped and inaccurate meters
Water Demand Reduction	$ 23,243,303	5.0%	$ 1,162,165	Avoided costs for Water Production and Wastewater Treatment
Total	**$ 26,372,858**	**7.7%**	**$ 2,023,626**	

Table 1.2 Summary of Annual Cost Savings

Water Demand Reduction: AMI systems collect and present detailed usage data to water utility customers, empowering them with the knowledge they need to make informed usage decisions. AMI's two-way communication gives utilities real-time data to give its customers the information they need to conserve water, thereby lowering their water use. Westin's cost benefit analysis assumes as a direct result of AMI implementation. A 5% reduction in water demand due to water conservation therefore resulting in water production and wastewater treatment cost avoidance. This estimate is aligned with the City's Water Conservation Program Decision Support System (DSS) Model using water savings data from water industry observations.

Apparent Water Loss: The City currently has a meter replacement project underway to replace approximately 23,000 of the City's small water meters over an approximate five year period with AMI-capable water meters, which is the standard design for all new meters. This meter replacement program will eliminate the revenue losses assoicated with the City's current stopped or inaccurate meters. Implementation of AMI will further reduce the loss in revenue from unauthorized use and accounting/data handling discrepancies. The addition of AMI will also continue to reduce revenue losses from the City's stopped or inaccurate meters as the new meters age over time.

Enhanced Customer Service: With the current manual water meter reading practices, reading cycles range between 28 and 35 days. Meters being read at longer intervals can potentially push a portion the customers' monthly water consumption into a more expensive tiered water rate. AMI eliminates this problem, since AMI meters can be read at consistent intervals.

Meter Reads and Rereads: Effective implementation and use of AMI also can significantly reduce the costs associated with reading the City's meters, meter re-reads, estimated bills, credits and adjustments, and initial and final reads.

Skilled Staff: Even though the implementation of AMI will eliminate the current meter rounds over a three year implementation timeframe, the City will still require skilled staff to manage the AMI system,

interact with the vendor(s), and provide problem resolution services. Some meters may also still require manually or drive-by reads because of poor AMI coverage in some of the City's remote areas. As such, the City plans to retain its four (4) meter reading staff to perform meter and MTU installation (meter box-mounted data transmitters) inspections during the AMI Implementation project. After the AMI system has been implemented, the City will require approximately 2 ½ staff to continue to service and repair the meters, meter boxes, MTUs and related equipment. . The City will also require a trained Business Analyst to analyze the AMI data, configure the MDM dashboard (computer-based analytics) and provide periodic reports to the stakeholders to take full advantage of the AMI analytic capabilities. Accordingly, Westin's business case has included the additional labor cost of $120,000 per year for the City to engage a new Business Analyst, along with the training and transition of the City's existing meter readers into new positions. The business case also assumes the addition of an additional IT resource. Due to these offsets, the net annual cost labor savings after AMI is implemented is estimated to only be $8,125.

In summary, AMI is a valuable tool for reducing operational costs, conserving water, increasing customer service levels and improving operational efficiency. However, simply installing the hardware and computer systems are not enough to reap the full benefits. To optimize the investment, the City will need to ensure:

- Executive commitment continues to keep the employees focused on the long term program goals;
- Formal process are in place for modifying existing business practices;
- Dedicated resources are focused on achieving the AMI program goals and timelines; and
- Active day-to-day change management is effectively in place.

Section 8 of this report further describes the business case for both technologies.

1. Background

The City of Santa Barbara (City) is located on the southern coast of California, approximately two hours northwest of Los Angeles, and serves water to approximately 27,000 customer accounts. Since the City's current water meter infrastructure is aging past the meter's useful life, the City is underway with a capital project to replace approximately 23,000 of its smaller water meters with AMI-capable meters over a five-year time period.

The City maintains a diverse water portfolio that includes surface supplies, groundwater, recycled water, water purchases and a desalination facility. Water conservation measures are also routinely evaluated by City staff for cost effectiveness based on the avoided cost of additional water supplies.

The City has had a long running successful water conservation program and an active public outreach program. The City is also working to reduced non-revenue water losses, and to better account for revenue water. These efforts have been accelerated by the current severe drought conditions affecting California.

Santa Barbara's AMI Goals

- Enhance water conservation Improve customer service related to accuracy and timeliness of meter reads;
- Enhance customer communication regarding customer water consumption patterns and unusually high water use;
- Greater customer understanding of the amount of water consumed for various uses, particularly irrigation;
- Minimize non-revenue water due to leaks in the distribution system or theft; and
- Improve water system operations and management.

As part of the City's Long- term Water Supply Plan, City Council adopted the City's water conservation policy which is to minimize the use of potable water supplies, meet the requirements of the California Urban Water Conservation Council (CUWCC) Best Management Practices (BMPs), and achieve compliance with SBX7-7 20 by 2020 for per capita water use reduction requirements. In accordance with the City's water conservation policy, AMI is the next significant water conservation measure to consider that meets the city's cost-effective threshold. Based on analysis in the DSS Model, of all the current long-term water conservation measures and potential new water conservation measures, AMI is the most cost-effective and has the most water conservation savings of any one measure. By fully leveraging AMI technology, the City could improve its water conservation efforts, enhance its customer service, better manage its water system infrastructure, improve the quality of its water billing information, and add significant efficiencies to its water meter reading process. As such, City staff has presented AMI technology advancements to the City's Water Commission and City Council, and received direction to proceed with developing a business case to help determine if converting to an AMI metering system makes sound business sense for the City.

2. Project Overview

A review of the City's water meter system was performed including an assessment of the current practices for collecting and managing meter data and accounting for water loss. This information, along with market research, was used to develop a business case for implementing an AMI system for the City's water meters. This business case includes an analysis of the City's current water meter system, customer service and water conservation efforts, as well as existing practices for collecting, managing and accounting for water loss. The business case considers a range of technology options, each with their respective capital and O&M costs, and the resulting benefit to the City.

2.1. Meter Population and Meter Management

The City has approximately 27,000 metered accounts with varying meter sizes and types. Currently, a crew of four (4) meter readers read all of the meters monthly using either hand held devices or using walk-by AMR technology for hard to read locations (e.g., flooded pits, industry, banks etc.). The readings for each cycle are downloaded from the Itron MVRS to the hand-held and AMR systems. At the end of each day, the meter readings are uploaded to the Advanced CIS Infinity billing system in preparation for billing.

The City currently has a meter replacement project underway to replace approximately 23,000 of the City's small water meters over an approximate five year period with AMI-capable water meters. The replacement is targeting all 5/8" and 3/4" meters, as well as all of the 1" meters past their useful life.

Size	Count
5/8"	19975
3/4"	1352
1"	3912
1 1/2"	785
2"	883
3"	35
4"	21
6"	16
8"	3
TOTAL	26,982

Table 2.1 Meter Count

2.2. City Billing and Collection

The Accounting Section of the Finance Department is responsible for reviewing, analyzing and generating approximately 323,400 water bills each year. An estimated 1 ½ percent (almost 5,000) of bills are analyzed for billing accuracy due to high consumption, leaks and other billing related issues. Approximately 100 bills have to be estimated each year when a meter is found to be stuck or broken.

The City's Utility Billing and Water Resources Divisions staff receive and address customers concerns about high bills. Approximately $53,000 per year is adjusted for customers with proven extraordinary water use events outside of their control. The Utility Billing Division uses the Advanced CIS Infinity billing system from Harris Utilities to manage the utility billing and collection process.

2.3. Service Order Management

The City's Utility Billing Divisionand the Meter Reader Section generate the majority of the service orders. Service orders are performed by the Meter Reader Section and include the following service order types:

#	Service Order Type	Annual
1	No. of orders from pre-bill exceptions	4,935
2	No. of orders for investigation (Meters and High Bills)	769
3	No. of orders for stopped meters	1,030
4	No. of orders for initial reads	3,305
5	No. of orders for final reads	3,208

Table 2.2 - Service Order Types and Count

3. AMI Technology

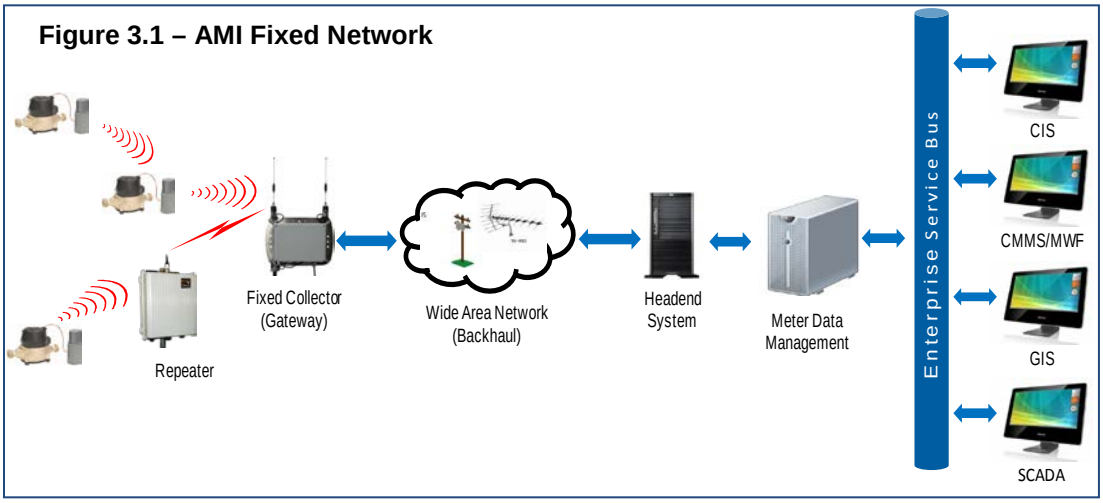
The two most common AMI systems are fixed-network and cellular-network systems. With the AMI fixed-network system, meter reading is accomplished by Meter Transmission Units (MTUs) installed on each meter which collect readings from the meter and transmit them via radio signals to Data Collection Units (DCUs). The DCUs are permanently located strategically across the service area. The DCUs relay the

collected data to a single central location, where it is organized in a Meter Data Management system (MDM) database.

Alternatively, the cellular-network systems use cellular endpoints installed on each meter to transmit the meter data via an existing cellular infrastructure to a central database system (hosted or on-premise) for analysis and reporting.

An AMI System involves automatically transmitting readings from meters to Data Collection Units (DCUs) in the field and then to a utility's computer system. Readings are usually taken at hourly intervals and transmitted to the computer system from one to four times per day. Once received at the computer, readings can be extracted for billing and customer service purposes, as well as analyzed to find potential customer leaks, promote water conservation and determine detailed water usage patterns. Several components are required for a properly functioning AMI system. An example of an AMI Fixed Network and integration with utility systems are also illustrated below.

Figure 3.1 – AMI Fixed Network



If the City chooses to proceed with implementation, a thorough understanding of the technology will be important in order to communicate effectively regarding its objectives and preferences. The following sections describe the various components required for the AMI system.

3.1. Meter Register

Each meter must be equipped with an AMI compatible register that takes usage measured by the meter, displays it for manual reading as needed, and converts it into a digital format compatible with the Meter Transmission Unit (MTU) obtaining AMI readings. The City is currently replacing 23,000 small meters with new ones manufactured by Badger Meter. Each has an encoder register and in-line connector for use with an MTU. The digital reading obtained by the MTU is sensed directly from the position of the register's dials using internal LED light paths to determine the exact position of each number wheel. All other meters have to either be retrofitted or replaced with this same type of register and connector in order to be compatible with an AMI system.

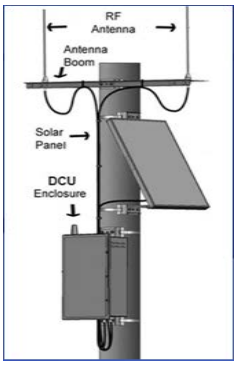
3.2. Encoder

Encoders are attached to new or existing water meters to equip them for an advanced metering infrastructure system. The Encoder is either integral to the meter or attached with visible wiring. The Encoder device offers advanced

capabilities, such as full two-way communications between the meter and utility, and time synchronized interval meter data.

3.3. Meter Transmission Unit (MTU)

MTUs connect to meter registers either through in-line connectors or factory potted wiring. They take readings data from registers and transmit them via radio frequency to DCU or Repeaters. A unique MTU ID number and any necessary notifications are transmitted with readings. Notifications include tamper, potential customer leaks and reverse water flow. The MTU does not collect any personal information. MTUs can be mounted under composite meter box lids without significant degradation of signal strength. Water utilities using the AMI technology are required to replace the existing concrete lids with composite lids and drill through the metal lids to install auxiliary antennas for adequate signal strength.



3.4. AMI Repeaters

Many MTUs in an AMI system transmit their signals directly to a nearby DCU. Terrain, population density and other factors can also require the use of Repeaters, which receive the MTU signals, then intensify and relay them to DCUs. Such functionality allows development of robust AMI systems at reduced cost. Repeaters are usually mounted on utility poles and powered by AC current or solar energy.

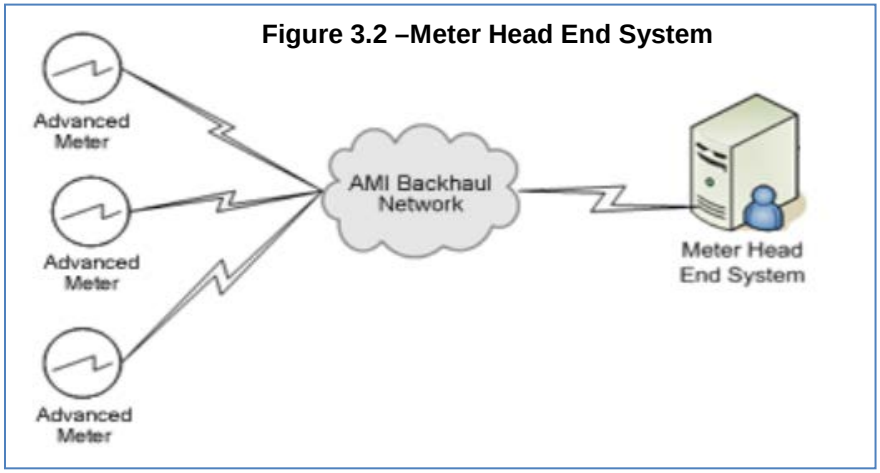
3.5. Data Collection Units (DCU)

DCUs store signals received from MTUs or Repeaters and transmit them over the Fixed Network to the system's Head End Computer. One DCU can manage readings from thousands of MTUs. They are usually mounted on utility poles, rooftops, or water reservoirs and powered by AC current or solar energy.

3.6. Head End System

The Head End Computer controls the AMI system, receives readings and notifications from DCUs and sends programming and other instructions to them. It also initiates on-demand readings upon request. Readings and notifications are provided to an optional Meter Data Management System (MDM).

Figure 3.2 –Meter Head End System



3.7. Fixed Network

The AMI fixed network allows two-way communications between DCUs and the Head End Computer, using options such as Ethernet, WAN, Wi-Fi, or cellular technology. The Head End computer is used by the utility to access the meter data.

3.8. Cellular Network

The Cellular Network utilizes existing cellular infrastructure deployed by telecommunication companies such as Verizon, AT&T or Sprint. The cellular MTUs, or Endpoints, are installed and integrated with meter registers to communicate with the encoder and capture readings and meter status information.

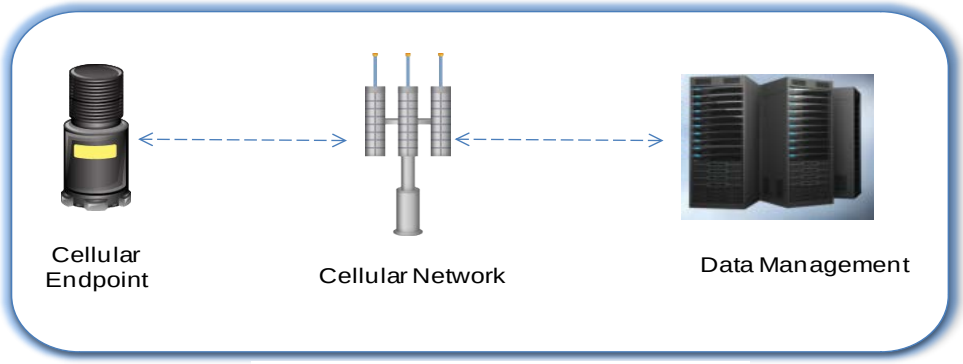


Figure 3.3 - Cellular Network

3.9. Meter Data Management System

The Meter Data Management (MDM) serves as a meter reading and notifications repository for the AMI system. It provides meter readings for billing as scheduled. Analytical capabilities of an MDM system allow detailed usage, customer leak and notification review, water usage patterns, including charts and graphs, which can be extremely helpful when responding to customer concerns. MDM can interface with web portals where customers can log in and securely view their water usage information.

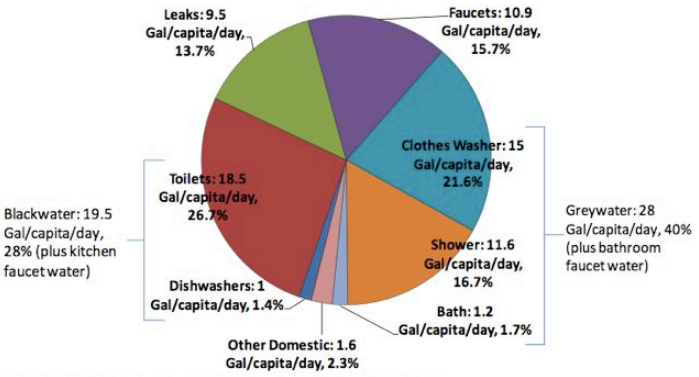
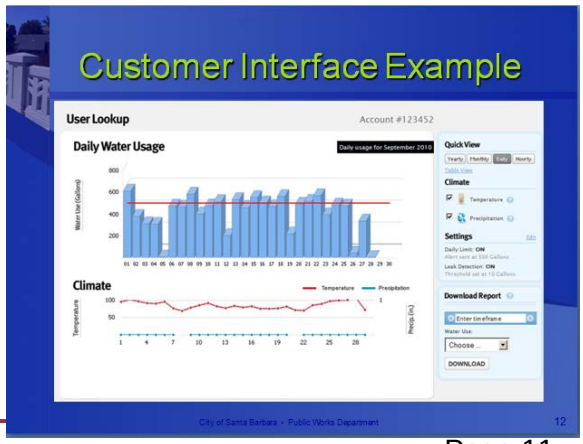


Figure 11. Average indoor residential water usage for 12 North American cities.

Source: Data from AWWA 1999.

3.10. AMI Customer Web Portal

The AMI customer web portal is a web-based interface that provides consumers with a view of their water usage online to better understand their usage, improve usage behavior and communication with their utility. Customers or their utility service provider can configure the web portal to display informational alerts such as leak alerts and budgetary threshold alerts. Easy-to-read graphs and charts help consumers to easily monitor their water usage and costs, review daily water use patterns, and manage their usage.



4. AMI Vendor Technologies

Most water AMI systems in use today were developed by five primary vendors. They use slightly different methods to provide utilities with similar functionality. In general, the AMI devices have battery configurations that provide enough long-term energy to support their higher frequency of data. The City can expect batteries in the AMI system to achieve a full life expectancy of approximately fifteen (15) to twenty (20) years to match the MTU replacement intervals. The Badger BEACON system Endpoint has a ten (10) year life expectancy. However, Badger includes the replacement cost as part of the subscription cost of the AMI system. The replacement warranties offered by the AMI vendors are usually about one (1) year from the shipping date and do not include installation. The City is encouraged to negotiate the warranty terms during contract negotiations. The AMI vendor technologies are described below:

4.1. Sensus FlexNet AMI Technology

Sensus FlexNet AMI is designed to minimize infrastructure requirements of the fixed network. A small number of DCUs are mounted at ground level with remote antennas located on tall towers to provide maximum coverage with few, if any, repeaters required. Sensus MTUs transmit at higher power levels, using a licensed radio frequency, than other vendor systems to maximize signal strength. Sensus Logic Customer Portal is a web based interactive consumer portal which allows consumers to monitor and manage usage.

Sensus leak detection technology is the Permalog+ which uses sound waves to monitor distribution lines and localize leaks. Sensors activate overnight, listening to the distribution system when ambient noise is at its lowest, then report pipeline conditions back to the utility via FlexNet.

4.2. Aclara Star AMI Technology

Released in 1994, the Aclara Star AMI system was the first practical, reliable system on the market. The network does not include repeaters, but usually requires one DCU for each square mile of service area. In order to maximize signal strength, it is generally preferred that MTUs only be mounted inside composite meter boxes and lids, rather than metal.

Aclara has developed the STAR® ZoneScan, an advanced automated detection system that can pinpoint underground leaks in water mains to within just three feet by collecting and analyzing acoustic data, thus helping to speed repair and identify trouble spots before they become major problems. Data from individual leak-intelligence units is automatically correlated to pinpoint the presence and the location of leaks.

The Aclara Customer Portal provides an account summary, water usage and cost information, or promotions and tips to customers that will help them use water more wisely. The data comes directly from the AMI system and can help customers identify periods of high and low usage with real-time data.

4.3. Badger Beacon Automated Metering Analytics

The Badger Beacon Automated Metering Analytics (AMA) system was released in February 2014 and is expected to replace their older Galaxy AMI system. Data is transmitted over cellular radio frequencies, so repeaters and DCUs are not required. The system is hosted by Badger and requires a monthly service charge per meter. Badger provides

various platforms for customers to view and understand their water usage. Customers can view their usage through EyeOnWater Online (desktop application), EyeOnWater App (smart phone/tablet), EyeOnWater eSummary (email notification) or EyeOnWater Summary (printed).

4.4. Mueller MiNet AMI System

Mueller Systems MiNet AMI usually requires larger numbers of repeaters and DCUs than other systems in order to provide full service area coverage. It is a hosted system and requires a service charge per meter.

Mueller's Customer web portal is the Mi.Data system. It is a web portal that collects and stores water usage information and graphically presents the usage data to customers. Customers can monitor their water consumption, compare current usage to previous periods, configure individual alerts, and set budget and water conservation goals.

Mueller's leak detection solution is from Echologics®. It is an acoustic-based technology for water loss management, leak detection and pipe condition assessment.

4.5. Itron Choice Connect AMI

The ChoiceConnect™ Fixed Network for water utilities combines fixed network architecture with Itron's meter data management software to collect and manage frequent consumption and usage meter data. The Choice Connect AMI requires a moderate number of DCUs and repeaters to provide full service area coverage.

100W+ Water Endpoint

Itron Enterprise Edition Customer Care is a Web-based application that presents historical and comparative interval usage and cost data to end-use customers.

Acoustic leak detection is accomplished by mounting their leak sensors on water service lines inside meter boxes and connecting them to meter MTUs for communications with the Head End Computer.

5. Acoustic Leak Detection

Leak sensing devices are mounted on water mains or service lines and listen for sounds or vibrations that are characteristics of water leaks. They send this information daily over the AMI network to allow computer analysis and indication of potential leak locations. Some types of sensors are permanently mounted on water service lines. Others magnetically attach to mains or valves and may be left in place indefinitely or periodically moved to other locations.

The primary objective of either type is to generate early notification of water leaks so they can be repaired promptly to minimize water loss, customer inconvenience and infrastructure damage.

The City has chosen not to include leak detection technology or its associated cost savings in this business case. City staff question whether the leak detection technology is practical and effective for similar-sized water utilities.

6. AMI Benefits and Financial Analysis

The principle objectives for considering a new AMI metering system include improving the effectiveness of the City's meter reading and customer service operations and increased water conservation. AMI benefits include efficiency "soft" savings and "hard" dollar savings described in this section. Usually, the customer service and billing savings are characterized as "soft" or efficiency savings and the savings associated with the reduction in processing service orders, improving unaccounted water loss and cost avoidance are considered hard dollar savings.

6.1. Water Conservation/ Water Demand Reduction

In accordance with the City's water conservation policy, AMI is the next significant water conservation measure to consider that meets the city's cost-effective threshold. Of all the current long-term water conservation measures and potential new water conservation measures, AMI is the most cost-effective and has the most water conservation savings of any one measure AMI provides the ability for customers to view their water use patterns and become educated on how much water they actually consume for each type of water usage, in particular irrigation, as well as timely notification of leaks. The AMI system will read the customers meters on a regular basis (15 minutes to 1 hour intervals) and upload the information through a fixed or cellular network to a MDM System. The customer's consumption data is calculated and is provided to customers via a web portal to view their water usage patterns and identify conservation opportunities. In addition, a system is desired that provides leak and/or high use threshold alerts to web and mobile devices to provide much quicker awareness of water use issues on the property.

The industry-standard water conservation savings estimate for AMI systems is 20% water demand reduction of 20% of customers. City staff is optimistic that more than 20% of customers will achieve water conservation savings from AMI, and perhaps overall savings will be higher. However, City staff feels that there will be a range of savings its customers will achieve (e.g., not all City customers will achieve a 20% savings), so the 20% demand reduction of 20% of City customers is a sound and conservative estimate for use in this business case analysis.

A key factor in determining the economic feasibility of implementing the AMI system involves calculating the cost savings due to the reduction in water demand. The City's avoided cost of water and the demand reduction estimate are key factors in calculations used in the DSS Model. The DSS Model calculates a conservation savings of 0.573347 million gallons per day (MGD), which equals 642.23 acre feet per year, an approximate 5% reduction in the City's overall pre-drought water demand (or 6% of current water demand). This 5% reduction in water demand is consistent with observed industry water conservation reductions and has been incorporated in this AMI business case

As with all water conservation conservation measures, the assoicated water and wastewater revenue generated by the City would be proportionally reduced by the amount of water saved. For the City's AMI program, this is estimated for the water and wastewater revenue reduction to be $1,658,359 per year, and the recycled water revenue reduction to be approximately $39,907 per year. The revenue reduction in water and wastewater revenue have not been included in this model. The City's Long-term Water Supply Plan establishes policy for reduced water demand over the 20 year planning period. The City's current water rate structure is developed to accommodate for reduced revenue due to demand reduction.

6.2. Eliminate Estimated Bills

The AMI system provides real time readings of the customers meters considerably reducing the need to estimate bills. Currently, the City spends an average of $23,625 to generate approximately 100 estimated reads per year ($67.50 per visit). Estimated reads occur when a meter has malfunctioned and must be

investigated and possibly replaced. Estimated reads are based on historical use. An estimated 90% efficency improvement will result in an annual savings of $21,263.

6.3. Consistent Billing Cycles

The City's water billing cycle ranges between 28 and 33 days. The City has a tiered water rate structure. An AMI system would allow for a consistent billing cycle, which would result in improved customer service with regard to utility billing. With current practices, water customers whose meters are read on the 33rd day of the reading cycle could hypothetically be pushed into a higher-tiered water rate for some of their water use. AMI would eliminate this potential problem by providing fair and consistent billing cycles.

6.4. Reduce Credits and Adjustments

Billing credits and adjustments, caused by customer water leaks, currently cost the City an estimated $53,000 dollars per year. With AMI, customer leaks are proactively identified and customers are informed in a timely manner to fix their leaks, thus eliminating the need for adjusting customers bills due to a water leak. A conservative 90% efficiency improvement wouldl reduce the costs associated with adjusting customers' bills due to leaks by $44,990 annually.

6.5. Minimize Cost of Initial and Final Reads

The AMI system provides the capability to read customers meters in real time using an "on-demand read", eliminating the need to generate and perform costly work orders where staff are sent out to the property to obtain initial and final reads. Currently reading the initial and final read for customers is costing the City an estimated $322,394 annually. An estimated improvement of 90% would save the City approximately $290,154 annually for not having to dispatch meter readers to obtain initial and final reads.

6.6. Minimize Cost of Service Investigations

The AMI and Meter Data Management (MDM) system provides customer service staff with customers' water usage patterns and consumption history, which allows staff to assist customers more accurately over the phone and reduces the need for generating work orders for field service investigations. In addition, new meters and accurate AMI readings results in fewer customer concerns. Currently, the City expends $53,830 dollars on customer requests for field service investigations. An estimated 30% improvement will result in $15,341 improvements per year.

6.7. On-Cycle Meter Reading Cost

City staff reads approximately 27,000 water meters each month. With the AMI system covering the entire water service area, manual or drive-by meter reading would be nearly eliminated; although some routes may need to still be read manually, depending on the AMI coverage. Each meter will be read electronically multiple times during the day and uploaded to the Meter Data Management (MDM) system and the Advanced CIS Infinity system for analysis and billing. Currently the City spends an estimated $661,666 per year to read all meters. Over a three year implementation timeframe, the City will still require skilled staff to manage the AMI system, interact with the vendor(s), and provide problem resolution services. Some meters may also still require manually or drive by reads due to AMI coverage. As such, the City plans to retain its meter reading staff to perform meter and MTU installation inspections during the AMI Implementation project. After the AMI system has been implemented, the City will require approximately 2 ½ meter readers to continue to monitor the meters, place door hangers, perform meter rechecks and help repair/replace MTUs. The City will also require a Business Analyst to analyze the AMI data, configure the MDM dashboard and provide periodic reports to the stakeholders to take full

advantage of the AMI analytic capabilities. The remaining meter readers will be transitioned into other utility roles as required. An additional $140,000 in labor costs are included in the financial analysis to account for the hiring of a new Business Analyst, and and an additional $120,000 per year for an additional IT resource. The net annual labor savings associated with AMI after implementation is estimated to be $108,125.

6.8. Reduce Number of Meter Rereads

Currently, the City spends an estimated $145,583 per year to reread or recheck all meters on the pre-billing exception report prior to a bill being sent out. An estimated 90% improvement would result in an annual savings of $124,376.

6.9. Reduce Meter Reading Handheld Equipment Cost

Fewer manual meter reading reduces the need for hand held equipment costs. The partial maintenance or replacement cost of handheld units, plus the opportunity cost pertaining to resale value are included in the savings estimates. The total annual savings associated with converting to an AMI system include an annual savings of $2,845 related to reduced meter reading handheld equipment replacement and repair costs.

6.10. Non-Revenue Water

Non-revenue water (NRW) is water that was produced, but “lost” through the water distribution system before it reaches the customer. Losses can be real losses through leaks, main breaks, or planned maintenance activitie; or apparent losses which are associated with unauthorized water use, meter inaccuracies and data discrepencies. High levels of NRW are detrimental to the financial viability of water utilities, as well to the quality of water itself. The authorized water losses associated with maintenance involving flushing lines or hydrants, testing meters, or repair of water main breaks or service line leaks are calculated and deducted from total water production to accurately calculate the real and apparent water losses. Implementing the AMI system in the City’s water service areas could significantly reduce the non-revenue water.

6.10.1. Apparent Water Loss

Apparent water loss is associated with inaccurate meters, unauthorized water use and data discrepancies. Water meters wear over time, causing the accuracy of the meter’s measurement to decrease, generally leading to a reduction in revenue. The City currently has a meter replacement project underway to replace approximately 23,000 of the City's small water meters over an approximate five year period with AMI-capable water meters. This meter replacement program will eliminate the revenue losses associated with the City’s current stopped or inaccurate meters. Implementation of AMI will further reduce the loss in revenue from unauthorized water use and accounting/data handling discrepencies. The addition of AMI will also continue to reduce revenue losses from the City’s stopped or inaccurate meters, as the new meters age over time. The annual cost savings for apparent water loss is estimated at $274,736 (15.2%) per year.

6.10.2. Real Water Loss

Real water loss is defined a water loss from water mains and services, reservoirs, and water facilities. The City has an annual water main replcement program, whereby it replaces 1% of its water system each year. While this program targets water mains that have outlived their service life cycles, the process of replacing water mains has water loss associated with flushing the new mains. The City also has an

annual fire hydrant flushing program that is performed to flush any accumulated deposits out of the system. Additonally, the City has a reservoir cleaning program that has associated water losses. Water loss associated with planned work and water main breaks is calculated to help account for the City's total Non-Revenue Water.

7. Cost Analysis and Return on Investment

7.1. Key Assumptions, Drivers and Initiatives

As discussed, for the City's Long-Term Water Conservation Program, staff has been using the DSS model. The DSS's annual water demand reduction of 209.27 million gallons for an AMI system-wide implementation has been used in the AMI economic model to calculate the AMI implementation benefits.

To reduce the cost of implementing the AMI system, the City is evaluating options to share the AMI implementation cost with Southern California Gas Company (SCG). Currently, SCG is conducting a pilot study to evaluate the AMI Aclara STAR fixed network technology for commercialization and is actively soliciting other cities to join in this cost sharing initiative. The SCG and Aclara cost sharing model is used in the AMI economic model to calculate the capital cost, O&M cost and the ROI.

The City is also interested in exploring the possibility of implementing a cellular hosted AMI system. The cellular model eliminates the cost and complexity of installing a fixed network including data collectors and repeaters. It utilizes cellular meter endpoints with commercial grade cellular networks to read the meters and provides the meter data to a MDM system for analysis. The Westin AMI economic model includes a cost and benefit comparison of the Badger cellular technology and the Beacon Advanced Metering Analytics (AMA) for comparative analysis.

The AMI system economic model focuses on "hard" cost and benefits that can be quantified in monetary terms in addition to efficiency savings that are "soft" savings. The savings associated with the City converting to an AMI system are evaluated in terms of how the system can improve the annual cost of meter reading and related customer services and billing activities. Operational savings in meter reading, call center operations, billing and field service were incorporated, as were the savings and costs associated with changing out meters in conjunction with AMI deployment. The capital costs and the savings over the life of the project were used to develop the revenue impact to the City's rate payers and are presented in the following sections.

7.2. Meter Replacement Cost

The City is currently replacing an estimated 23,000 5/8" residential meters with AMI-capable meters under a five-year meter replacement program. The cost of replacing the City's approximately 4,000 larger meters (3" and larger) and/or equipping them with AMI compatible registers, and installing MTUs on all the City's 27,000 meters is estimated at $3,705,182, as of prices quoted in 2014.

7.3 AMI Vendors Capital Cost Comparison

The AMI capital cost includes detailed estimates of capital costs for the acquisition, and implementation of AMI. Cost estimates for the AMI system include meters, data collection and implementation management as well as deployment/implementation, training, and integration with other systems. These cost estimates are projected over the three (3) year AMI system implementation. The following graph demonstrates the capital costs from five leading AMI vendors.

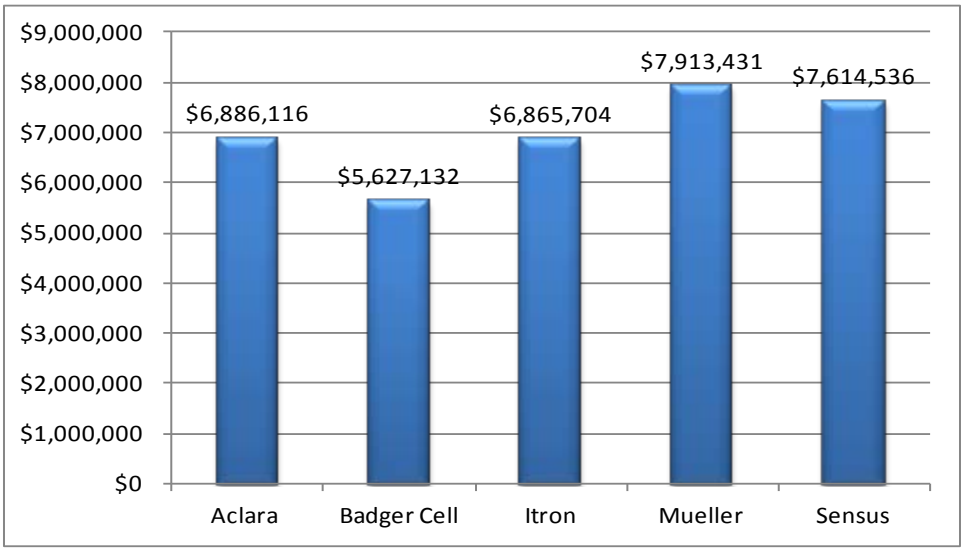


Figure 7.1 Comparison of Vendor Costs

7.3. Operations and Maintenance Cost

The AMI Operations and Maintenance (O&M) estimate includes the operations cost of the AMI system. Costs for expansion of the system to accommodate future system growth are also developed, including the cost of new meters, system components, and increased O&M costs. Technology and business staff resources to maintain the City AMI server(s), develop customized programming and provide analytical reports are included in the O&M cost. These cost estimates are projected over a fifteen (15) year planning period based on the expected economic life of the system.

7.4. Aclara Fixed Network system Capital and O&M Cost

The AMI Aclara fixed network infrastructure capital and maintenance cost is included in the AMI economic model. The cost model includes the potential cost sharing option with SCG Company and includes the following equipment and their costs and assumptions:

Meters and AMI Endpoints

- Water Meters/Registers
- AMI Endpoints (based on 27,000 meters)
- Meter Vaults & Lids (15,000 Lids, 80 Vaults).Assume 5/8" and 1" lids at the cost of $29 each and Vaults at the total cost of $2,555.39.
- Accessories (valves, strainers, yoke/setter, etc.) Strainers for all 3" and larger meters

AMI Fixed Network

- LAN Node/Data Collector
- WAN Communications Equipment
- WAN Communications Infrastructure

Mobile and Handheld Readers

- MTU Programmers
- Project Management, Design, Installation, Testing, Startup, Training, Documentation
- Systems Interface
- Data Conversion - three years
- Network Communication Center Installation, 25k to 100k Services

Personnel and Other Costs:

- Program management/consultant services
- Public information and communication with customers
- New Business Analyst position
- IT Administrative support to provide transmitting maintenance and report development
- City staff support to inspect AMI meter/MTU installations during AMI implementation
- Legal, overhead, and administrative support

	Year 1	Year 2	Year 3	Year 5	Year 10	Year 15
Summary Capital Cost:						
Direct Project Cost	$2,745,139	$2,366,239	$2,236,239	$0	$0	$0
AMI System Growth Cost				$16,965	$16,965	$16,965
Total Capital Costs	$2,745,139	$2,366,239	$2,236,239	$16,965	$16,965	$16,965

Table 7.1. - Aclara Capital Cost

	Year 1	Year 2	Year 3	Year 5	Year 10	Year 15
Summary O&M Cost						
AMI Endpoint Replacements:	$0.00	$0.00	$0.00	$0.00	$38,417	$38,417
Backhaul (WAN) Operations:	$20,084	$20,084	$20,084	$20,084	$20,084	$20,084
Annual License & Maintenance Support:	$31,900	$31,900	$31,900	$31,900	$31,900	$31,900
Additional Staff:	$0	$0	$120,000	$240,000	$240,000	$240,000
Total O&M Costs	$51,984	$51,984	$171,984	$291,984	$330,401	$330,401

Table 7.2 - Aclara O&M Cost

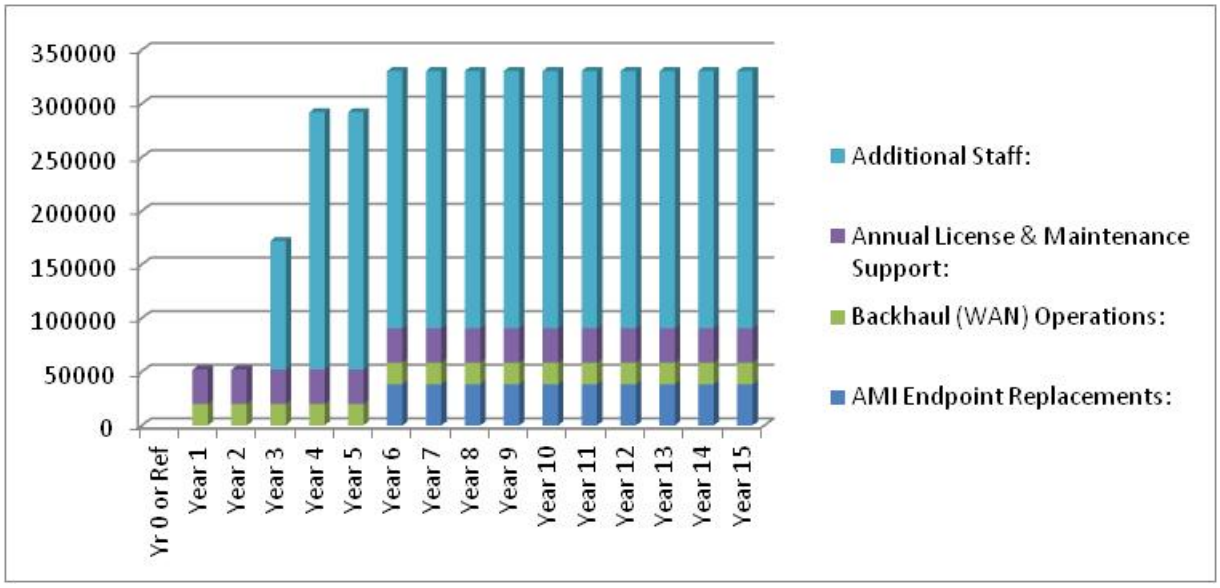


Figure 7.2 – Aclara O&M Cost (Include Equipment and Staff Resources)

7.5. Aclara Business Case and Financial Model

The table below presents the cash flow analysis and ROI for implementing the Aclara AMI system in a cost sharing arrangement with the SCG Company. This includes a fifteen (15) year life cycle with a three-year implementation period.

The total capital cost is estimated to be $7,568,446 spread over three years. The O&M cost is estimated at $51,984 for the first three (3) years during the implementation, and $297,445 per year post implementation.

The annual benefits beginning in years six (6) through fifteen (15) are approximated at $2,023,626. The Net Present Value (NPV) is estimated at approximately at $10.3 million.

The Return on Investment is five years with an Internal Rate of Return (IRR) of 20%.

Total Cost and Benefits		Year 1	Year 2	Year 3	Year 5	Year 10	Year 15
Summary Capital Cost:	$7,568,446						
Direct Project Cost		$2,745,139	$2,366,239	$2,236,239	$0	$0	$0
AMI System Growth Cost		$0	$0	$0	$16,965	$16,965	$16,965
Total Capital Costs		$2,745,139	$2,366,239	$2,236,239	$16,965	$16,965	$16,965
Summary O&M Cost	$3,234,341						
AMI Endpoint Replacements:		$0	$0	$0	$0	$5,458	$5,461
Backhaul (WAN) Operations:		$20,084	$20,084	$20,084	$20,084	$20,084	$20,084
Annual License & Maintenance Support:		$31,900	$31,900	$31,900	$31,900	$31,900	$31,900
Additional Staff:		$0	$0	$120,000	$240,000	$240,000	$240,000
Total O&M Costs		$51,984	$51,984	$171,984	$291,984	$297,442	$297,445
Summary Benefits & Savings:	$29,020,165						
Customer Service:		$0	$15,377	$35,253	$66,253	$66,253	$66,253
Meter Reading:		$0	$144,969	$318,953	$662,655	$662,655	$662,655
Meter Services:		$3,066	$6,701	$10,052	$18,175	$18,175	$18,175
Meter Management:		$0	$0	$0	$19,643	$19,643	$19,643
Conservation - Real Water Loss		$0	$0	$0	$0	$0	$0
Revenue & Cash Management:Apparent Loss		$0	$54,947	$109,894	$219,789	$274,736	$274,736
Avoided Costs		$348,650	697,299.00	1,045,948.50	1,162,165.00	1,162,165.00	1,162,165.00
Total Benefits & Savings	$29,020,165	$351,716	$919,293	$1,520,100	$2,148,680	$2,203,627	$2,203,627
Net Cash Flow		($2,445,407)	($1,498,930)	($888,123)	$1,839,731	$1,889,220	$1,889,217
Accumulative Cash Flow		($2,445,407)	($3,944,337)	($4,832,460)	($1,257,571)	$8,179,911	$17,617,378
Net Present Value	10,324,084.47	(2,445,407)	(1,427,552)	(805,554)	1,513,551	1,217,808	954,183
Internal Rate of Return (IRR)	20%						
Estimated Pay Pack	5 Years						

Table 7.3 – Aclara Financial Model

7.6. Badger Cellular System Capital and O&M Cost

The Badger cellular technology and the BEACON Advanced Metering Analytics capital and O&M cost is included in the analysis. The capital cost includes the following cost and assumptions:

Meters and AMI End Points

- Water Meters and Registers
- AMI Endpoints (based on 27,597 meters)
- Meter Vaults and Lids (15,000 Lids, 80 Vaults) Assume 5/8" and 1" Lids @ $29, Vaults @ $2,555.39)
- Accessories (valves, strainers, yoke/setter, etc.)
- Strainers for all 3" and larger meters

Vendor Services

- Meter and MTU Installation

- Meter Lids and Vaults Installation - 15,000 Lids @ $10 and 80 Vaults @ $1,000
- Small meter boxes for endpoints installed beside large meter vaults 1,780 @ $60
- Systems Transmitting development
- Data Conversion - three years

Personnel and Other Costs

- Program Management/Consultant Services
- Public information and communication with customers
- New Business Analyst Position
- IT Administrative support to provide maintenance and report development
- Staff support to install AMI Cellular endpoint in Year 11, 12, and 13
- Legal, overhead, and administrative support

	Year 1	Year 2	Year 3	Year 11	Year 12	Year 13	Year 15
Summary Capital Cost:							
Direct Project Cost	$1,858,482	$1,811,957	$1,811,957	$234,112	$234,112	$234,112	$0
AMI System Growth Cost				$16,965	$16,965	$16,965	$16,965
Total Capital Costs	$1,858,482	$1,811,957	$1,811,957	$251,077	$251,077	$251,077	$16,965

Table 7.4 - Badger Cellular AMI System Capital Cost

Total Cost and Benefits	Year 1	Year 2	Year 3	Year 5	Year 10	Year 15
Summary O&M Cost						
Annual License & Maintenance Support:	$88,421	$176,842	$294,736	$294,736	$294,736	$294,736
Additional Staff:	$0	$0	$120,000	$240,000	$240,000	$240,000
Total O&M Costs	$88,421	$176,842	$414,736	$534,736	$534,736	$534,736

Table 7.5 - Badger Cellular O&M Cost

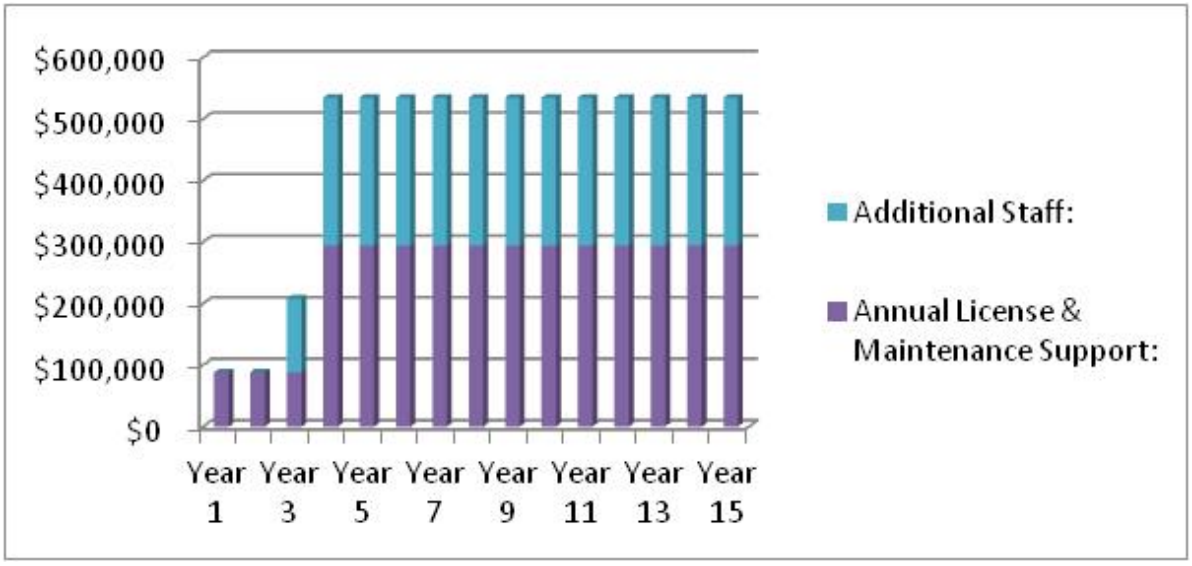


Figure 7.3 – Badger O&M Cost

7.7. Badger Business Case and Financial Model

The table below presents the cash flow analysis and Return on Investment for implementing the Badger AMI system in a hosted environment. This includes a fifteen (15) year life cycle and a three-year implementation period.

The total capital cost is estimated to be $6,237,416 spread over three years. The O&M cost is estimated at $534,736 per year beginning in Year five (5) after the system has fully implemented.

The projected annual benefits beginning in years six (6) through fifteen (15) is approximated at $2,023,627. The Net Present Value is estimated at $9,749,651.

The Return on Investment is approximately four (4) years with an Internal Rate of Return of 27%.

Total Cost and Benefits		Year 1	Year 2	Year 3	Year 5	Year 10	Year 15
Summary Capital Cost:	$6,237,416						
Direct Project Cost		$1,858,482	$1,811,957	$1,811,957	$0	$0	$0
AMI System Growth Cost		$0	$0	$0	$16,965	$16,965	$16,965
Total Capital Costs		$1,858,482	$1,811,957	$1,811,957	$16,965	$16,965	$16,965
Summary O&M Cost	$7,096,830						
Annual License & Maintenance Support:		$88,421	$176,842	$294,736	$294,736	$294,736	$294,736
Additional Staff:		$0	$0	$120,000	$240,000	$240,000	$240,000
Total O&M Costs		$88,421	$176,842	$414,736	$534,736	$534,736	$534,736
Summary Benefits & Savings:	$29,268,290						
Customer Service:		$0	$15,377	$35,253	$66,253	$66,253	$66,253
Meter Reading:		$49,625	$194,594	$418,203	$662,655	$662,655	$662,655
Meter Services:		$3,066	$6,701	$10,052	$18,175	$18,175	$18,175
Revenue & Cash Management:Apparent Loss		$0	$54,947	$109,894	$219,789	$274,736	$274,736
Avoided Costs		$348,650	697,299.00	1,045,948.50	1,162,165.00	1,162,165.00	1,162,165.00
Total Benefits & Savings		$401,341	$968,918	$1,619,350	$2,148,680	$2,203,627	$2,203,627
Net Cash Flow		($1,545,562)	($1,019,881)	($607,343)	$1,596,979	$1,651,926	$1,651,926
Accumulative Cash Flow		($1,545,562)	($2,565,443)	($531,357)	$4,780,527	$18,472,342	$32,164,157
Net Present Value	9,749,651	(1,545,562)	(971,315)	(550,878)	1,313,838	1,064,846	834,335
IRR	27%						
Payback	4 Years						

Table 7.6 – Badger AMI Hosted system Financial Model

8. Installation, Operation and Maintenance

The AMI vendor and their subcontractors will be responsible for implementing the AMI system. During the three-year implementation, the City will require a dedicated project manager and other resources to ensure successful implementation of the AMI system. The business case has included estimated cost for resources to assist the City with following activities associated with the AMI implementation:

- **Project Management** - Manage the day-to-day project activities, technology and implementation contractor(s)
- **IT Administrative Support** – Manage the server installation, technology interfaces including CIS, MDM and Customer Portal
- **Business Analyst** – Track and facilitate process changes and data analysis
- **Stakeholder Communication** - Design and manage communications with all project stakeholders, including customers and staff

The City plans to retain the meter reading staff to provide various field activities. The City will use the current meter reading staff to perform meter and MTU installation inspections during the AMI Implementation project. After the AMI system has been implemented, the City will require skilled technical staff to manage the AMI system, interact with the vendor(s), and provide problem resolution services. In addition, to take full advantage of the AMI analytics and reporting, the City will require a skilled business analyst to analyze the AMI data, configure the MDM dashboard and provide reports to

the stakeholders. The business case has included an additional $140,000 per year for the City to engage a skilled Business Analyst, and an additional $120,000 per year for an additional IT resource.

9. Implementation Considerations

The City should consider the following for its AMI Implementation Program:

- Complete the AMI implementation within three years (most realistic) to gain the optimum benefits that AMI has to offer. Expanding the implementation to more than three years will diminish the business case and requires that staff.
- Engage a consulting firm to develop a procurement strategy and well crafted Request for proposal (RFP) to clearly communicate the City's requirements to the AMI market.
- Negotiate a strong contract with its AMI vendor and a draft of the contract should be included in solicitation documents. The contract should outline installation performance requirements in detail, including coordination with existing Utility systems and acceptance protocols and thresholds. Risks assumed by the vendor should be clearly delineated and incontrovertibly assigned.
- Develop a Risk Management Plan to identify, understand, and mitigate the implementation risk.
- Integrate the AMI Implementation Project with the current Meter Replacement Program to maximize the benefits of AMI.
- Develop a Customer Communication Plan to ensure customer education and acceptance of the AMI system
- Develop a Request for Proposal to broaden the choice of the AMI systems offered by vendors.
- The City's Water Resources Division should include Finance Department, including the Information Systems Division, to sleep in the AMI selection and implementation process to obtain buy-in and support.
- Develop an Organizational Change Management (OCM) Plan to proactively hire new staff or contractors and train and educate them to handle new job opportunities in overseeing AMI installation, analyzing trends and managing the implementation of the AMI system.

10. Conclusion and Recommendations

This analysis clearly demonstrates that the City would economically benefit from the implementation of an AMI system. The business case gathered and quantified the benefits associated with AMI implementation at the City. AMI implementation will also provide the following benefits:

- Reduce water demand;
- Eliminate meter manual meter reading;
- Virtually eliminate estimated bills;
- Normalize billing cycles
- Reduce credits and adjustments;
- Minimize cost of initial & final reads;
- Minimize cost of service investigations;
- Reduce number of meter rereads;
- Reduce meter reading system cost (software, maintenance); and

- Reduce non-revenue water loss.

The analysis of both the Alcara and Badger systems demonstrated a reasonable return on investment and payback period of approximately 4 to 5 years after the implementation period.

The Aclara AMI system in a cost sharing model with the SCG Company demonstrated a strong case for implementing the AMI system. The Aclara AMI capital cost is estimated at $7.6 Million spread over three (3) years. The total fifteen (15) year accumulated O&M cost is estimated at $4.2 Million. The total benefit is estimated at $31.1 Million.

The Cellular Badger AMI system in a hosted environment is another option that is under consideration by the City. The analysis and economic value of implementing the Cellular Badger AMI system also presented a strong case for implementing the AMI system. The capital cost is estimated at a $6.5 Million spread over three (3) years. The total fifteen (15) year accumulated O&M cost is estimated at $6.8 Million and the total benefit is estimated at $31.4 Million.

Based on the above, the City should strongly consider implementing an AMI project throughout its service territory, contingent upon receipt of proposals from vendors which are in line with the economic analysis performed in connection with this business case.

Appendix A

Full AMI Implementation - Online Water Use Software and Leak Detection Customer Notification

Overview

Name	Full AMI Implementation - Online Water Use Software and Leak Detection Customer Notification
Abbr	AMISOFTWARE
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2016
Last Year	2030
Measure Length	5

Measure Life

Permanent	☑

Fixture Costs

	Utility	Customer	Total	Fix/Acct
SF	$70		$670	1
MF	$70		$670	1
BUS	$70		$670	1
IND	$70		$670	1
IRR	$70		$670	1

Administration Costs

Markup Percentage	10%

Description

Full AMI implementation cost for the meter units, radio network, and meter data mngt software. Based on April 2013 Life Cycle Cost Analysis by Delta Engineering. $5 million for fixed network & meter data mngt software and meter unit purchase and installation. Add $1.84 million for meter purchases (left out for now because already being done without AMI implementation). Also cost is for online water consumption software and to call or e-mail customers if there is a leak. Will be as automated as possible by a computer program. Cost based on annual software/licensing and initial set up ($15,000 set up plus $5000/yr for hosting).

Targets

Target Method	Percentage
Same Value Each Year	☑
% of Accounts Targeted / Year	5.00%
Only Effects New Homes	☐

Customer Classes

SF	MF	BUS	IND	IRR	RWE
☑	☑	☑	☑	☑	☐

End Uses

	SF	MF	BUS	IND	IRR	RWE
Toilets	☑	☑	☑	☑		
Urinals			☑	☑		
Faucets	☑	☑	☑	☑		
Showers	☑	☑	☑	☑		
Dishwashers	☑	☑	☑	☑		
Clothes Washers	☑	☑	☑	☑		
Process			☑	☑		
Kitchen Spray Rinse			☑	☑		
Internal Leakage	☑	☑	☑	☑		
Baths	☑	☑				
Other	☑	☑				
Irrigation	☑	☑	☑	☑	☑	
Pools	☑	☑				
Wash Down	☑	☑				
Car Washing	☑	☑				
External Leakage	☑	☑	☑	☑	☑	
Cisterns						

Savings Per Replacement

☑ Saves Hot Water

	% Savings per Account
SF Car Washing	20.0%
MF Car Washing	20.0%
SF External Leakage	20.0%
MF External Leakage	20.0%
BUS External Leakage	20.0%
IND Toilets	20.0%
IND Urinals	20.0%
IND Faucets	20.0%
IND Showers	20.0%
IND Dishwashers	20.0%
IND Clothes Washers	20.0%
IND Process	20.0%
IND Kitchen Spray Rinse	20.0%
IND Internal Leakage	20.0%
IND Irrigation	20.0%
IND External Leakage	20.0%
IRR Irrigation	20.0%
IRR External Leakage	20.0%

Results

Average Water Savings (mgd)	
	0.475098
Lifetime Savings - Present Value ($)	
Utility	$15,524,795
Community	$25,080,767
Lifetime Costs - Present Value ($)	
Utility	$4,448,235
Community	$4,448,235
Benefit to Cost Ratio	
Utility	3.49
Community	5.64
Cost of Savings per Unit Volume ($/mg)	
Utility	$949

Savings Per Replacement

☑ Saves Hot Water

	% Savings per Account
SF Toilets	20.0%
MF Toilets	20.0%
BUS Toilets	20.0%
BUS Urinals	20.0%
SF Faucets	20.0%
MF Faucets	20.0%
BUS Faucets	20.0%
SF Showers	20.0%
MF Showers	20.0%
BUS Showers	20.0%
SF Dishwashers	20.0%
MF Dishwashers	20.0%
BUS Dishwashers	20.0%
SF Clothes Washers	20.0%
MF Clothes Washers	20.0%
BUS Clothes Washers	20.0%
BUS Process	20.0%
BUS Kitchen Spray Rinse	20.0%
SF Internal Leakage	20.0%
MF Internal Leakage	20.0%
BUS Internal Leakage	20.0%
SF Baths	20.0%
MF Baths	20.0%
SF Other	20.0%
MF Other	20.0%
SF Irrigation	20.0%
MF Irrigation	20.0%
BUS Irrigation	20.0%
SF Pools	20.0%
MF Pools	20.0%
SF Wash Down	20.0%
MF Wash Down	20.0%

Costs

	Utility	Customer	Total
2014	$0	$0	$0
2015	$0	$0	$0
2016	$993,819	$0	$993,819
2017	$997,418	$0	$997,418
2018	$1,001,016	$0	$1,001,016
2019	$1,004,615	$0	$1,004,615
2020	$1,008,213	$0	$1,008,213
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$0	$0	$0
2027	$0	$0	$0
2028	$0	$0	$0
2029	$0	$0	$0
2030	$0	$0	$0

Targeted Accounts

	SF	MF	BUS	IND	IRR
2014	0	0	0	0	0
2015	0	0	0	0	0
2016	852	322	132	3	41
2017	855	323	132	3	41
2018	858	324	133	3	41
2019	861	325	133	3	41
2020	864	326	134	3	41
2021	0	0	0	0	0
2022	0	0	0	0	0
2023	0	0	0	0	0
2024	0	0	0	0	0
2025	0	0	0	0	0
2026	0	0	0	0	0
2027	0	0	0	0	0
2028	0	0	0	0	0
2029	0	0	0	0	0
2030	0	0	0	0	0

Water Savings

	Total Savings
2014	0.000000
2015	0.000000
2016	0.115069
2017	0.229958
2018	0.344659
2019	0.459169
2020	0.573347
2021	0.571557
2022	0.569680
2023	0.567727
2024	0.565708
2025	0.563644
2026	0.561511
2027	0.559345
2028	0.557123
2029	0.554830
2030	0.554456

Appendix B

Current Annual Cost Estimates and Potential AMI Benefits

#	AMI Benefit	Description	Annual Cost	Improvement	5% Demand Reduction
a.2	Virtually eliminate estimated bills	Cost of estimated bills	$23,625	90.0%	$21,263
a.3	Reduce credits and adjustments	Credit & adjustments for leaks	$52,660	90.0%	$44,990
a.4	Minimize cost of initial & final reads	Initial reads WO's	$163,598	90.0%	$147,238
		Final reads WO's	$158,796	90.0%	$142,916
		Subtotal	$322,394	90.0%	$290,154
a.5	Minimize cost of service investigation	Service investigations include 108 meter checks and 661 water checkups, totaling 769. AMI will eliminate all meter checks and 20% of water checkups for an estimated 30% reduction.	$53,830	30.0%	$15,330
b.1	Reduce on-cycle meter reading cost	The meter readers will continue to conduct field activities.	$661,666	10.3%	$68,125
		Subtotal	$661,666	10.3%	$68,125
b.2	Reduce no. of meter rereads	Pre-exception WO's	$145,583	90.0%	$124,376
b.3	Reduce meter reading system	Software maintenance	$2,466	0.0%	$0
		Handheld maintenance	$4,247	67.0%	$2,845
		Handheld salvage	$0	0.0%	$0
		Subtotal	$6,713	42.4%	$2,845
b.4	Reduce meter reading fleet costs	O&M cost	$13,980	37.5%	$5,243
		Depreciation expenses	$19,200	37.5%	$7,200
		Vehicle salvage	$19,200	37.5%	$7,200
		Subtotal	$52,380	37.5%	$19,643
f.1	Reduce apparent water loss	Unauthorized use	$86,779	90.0%	$78,101
		Stopped/Inaccurate meters	$1,689,293	10.0%	$168,929
		Accounting/data handling discrepancies	$34,632	80.0%	$27,706
		Subtotal	$1,810,704	15.2%	$274,736
g10	Water Demand Reduction	Water Production Costs	$19,214,496	5%	$960,725
		Wastewater Treatment Costs (1/2 total budget)	$4,028,807	5%	$201,440
		Subtotal	$23,243,303		$1,162,165
		TOTAL POTENTIAL ANNUAL SAVINGS AND AVOIDED COSTS			**$2,023,626**
				Annual Savings	$2,023,626

Water/Sewer Sales from 8/14/14 SB data

a.5 Service investigations include 108 meter checks and 661 water checkups totaling 769. AMI will eliminate all meter checks and 20% of water checkups for a 30% reduction.

g10 Only half FY15 Wastewater budgets would be impacted by a reduction in water usage, the other half is used in processing solids

g10 DSS Model estimates conservation savings of .573347 MGD which equals 209.27 MG per year (5.0% of water sales)

Appendix C

Meter Replacement Cost

Orig Order	Current Meters			Meter Conversion		Replace With:		Component Unit Cost						Cost Estimate		
	Size	Type	Total	Replace	Retrofit	Size	Type	Code	Mtr/Reg	Reg Only	Endpoint	Replace Install	Retrofit Install	Mtr/Reg	AMI	Install
1	5/8"	POD	20,291		20,291	062	POD	062POD	$68.75	$31.00	$60.00	$40.00	$20.00	$0	$1,217,460	$405,820
1.1	5/8"	POD	350	350		062	POD	062POD	$68.75	$31.00	$60.00	$40.00	$20.00	$24,063	$21,000	$14,000
2	3/4"	POD	1,229		1,229	075	POD	075POD	$99.50	$31.00	$60.00	$40.00	$20.00	$0	$73,740	$24,580
3	1"	POD	3,947	2,467	1,480	010	POD	010POD	$121.50	$32.00	$60.00	$55.00	$25.00	$299,741	$315,764	$172,685
6	1-1/2"	POD	805	805		015	POD	015POD	$259.50	$34.00	$60.00	$105.00	$50.00	$208,898	$75,670	$84,525
8	2"	POD	903	903		020	POD	020POD	$344.50	$34.00	$60.00	$140.00	$50.00	$311,084	$84,882	$126,420
14	3"	TRB	32	32		030	TRB	030TRB	$1,667.00	$34.00	$60.00	$300.00	$80.00	$53,344	$3,008	$9,600
18	4"	TRB	20	20		040	TRB	040TRB	$2,637.00	$34.00	$60.00	$500.00	$80.00	$52,740	$1,880	$10,000
23	6"	TRB	16	16		060	TRB	060TRB	$4,500.00	$34.00	$60.00	$700.00	$80.00	$72,000	$1,504	$11,200
26	8"	TRB	4	4		080	TRB	080TRB	$6,400.00	$34.00	$60.00	$900.00	$100.00	$25,600	$376	$3,600
			27,597	4,597	23,000									$1,047,468	$1,795,284	$862,430

Total	$3,705,182

5/8"x1/2"	056	POD
5/8"	062	MUJ
5/8"x3/4"	068	TRB
3/4"	075	CMD
3/4"x1"	087	MAG
1"	010	ULS
1-1/2"	015	OTH
2"	020	
3"	030	
4"	040	
6"	060	
8"	080	
10"	100	
12"	120	
16"	160	
20"	200	
OTH		

Note: Assumes the 23,000 meters now being replaced include AMI registers and will only be retrofitted with MTUs.
The remaining 2,467 size 1" meters will be replaced, including AMI registers and MTUs.
All 1.5" and larger meters will be replaced, including AMI registers and MTUs.
All 3" and larger meter/reg prices include strainers.
All 350 5/8" fireline meters will be replaced, including AMI registers and MTUs.

1" Meter Ages	
0-9 yrs.	1,242
10-19 yrs.	2,704
20-29 yrs.	1
Total	3,947

1.5" Meter Ages	
0-9 yrs.	655
10-19 yrs.	145
20-29 yrs.	3
30-39 yrs.	1
40-49 yrs.	1
Total	805

2" Meter Ages	
0-9 yrs.	628
10-19 yrs.	254
20-29 yrs.	9
30-39 yrs.	11
?	1
Total	903

Appendix D

The City AMI Implementation Cost from Leading Vendors

Item	Description	Aclara	Badger Cell	Itron	Mueller	Sensus
A	**Meters & AMI Endpoints:**	$4,329,496	$3,706,166	**$3,956,936**	**$4,503,101**	**$4,927,206**
a-1	Water Meters/Registers (see Meter Estimate detail)	$1,047,468	$1,047,468	$1,047,468	$1,047,468	$1,047,468
a-2	AMI Endpoints (based on 27,597)	$2,580,320	$1,956,990	$2,207,760	$2,759,700	$3,171,305
a-3	Meter Vaults & Lids (15,000 Lids, 80 Vaults) Assume 5/8" and 1" lids @ $29, Vaults @ $2,555.39)	$639,431	$639,431	$639,431	$639,431	$639,431
a-4	Accessories (valves, strainers, yoke/setter, etc.) Strainers for all 3" and larger meters	$42,752	$42,752	$42,752	$42,752	$42,752
a-5	Acoustic Leak Detectors (25 devices, monitor one section at a time)	$19,525	$19,525	$19,525	$13,750	$26,250
B	**AMI Fixed Network:**	$187,650	**$0**	**$217,000**	**$893,000**	**$168,000**
b-1	LAN Node/Data Collector	$82,650		$34,000	$532,500	$63,000
b-2	LAN Repeater			$78,000	$255,500	---
b-3	WAN Communications Equipment	$30,000		$30,000	$30,000	$30,000
b-4	WAN Communications Infrastructure	$75,000		$75,000	$75,000	$75,000
C	**Mobile & Handheld Readers:**	$10,440	**$0**	**$22,000**	**$16,500**	**$8,400**
c-1	Mobile Data Collector			---	---	---
c-2	Handheld Unit w/Accessories			---	---	$8,400
c-3	MTU Programmers	$10,440		$22,000	$16,500	
D	**Data Center:**	$553,600	$294,736	**$626,038**	**$664,900**	**$655,000**
d-1	AMI Headend Control System (HW/SW)	$33,600		$76,038	$114,900	$105,000
d-2	Meter Reading Management System	---		---	---	---
d-3	Meter Data Management System	$300,000	$294,736	$300,000	$300,000	$300,000
d-4	Software/Portal	$220,000		$250,000	$250,000	$250,000
E	**Vendor Services:**	$1,404,930	**$1,226,230**	**$1,643,730**	**$1,435,930**	**$1,455,930**
e-1	Meter & MTU Installation	$862,430	$862,430	$862,430	$862,430	$862,430
e-1	Meter Lids & Vaults Installation 15,000 Lids @ $10 and 80 Vaults @ $1,000	$230,000	$230,000	$230,000	$230,000	$230,000
e-1	Small meter boxes for endpoints installed beside large meter vaults 1,780 @ $60		$106,800			
e-2	Project Mgmt, Design, Installation, Testing, Startup, Training, Documentation	$210,000	$13,500	$379,800	$270,000	$290,000
e-3	Systems Interfaces	$60,000		$60,000	$60,000	$60,000
e-4	Expenses			$98,000		---
e-5	Data Conversion -Optional three years	$13,500	$13,500	$13,500	$13,500	$13,500
e-4	DCU Installation	$29,000				
F	**Other Costs:**	$400,000	**$400,000**	**$400,000**	**$400,000**	**$400,000**
f-1	Program Management/Consultant Services	$150,000	$150,000	$150,000	$150,000	$150,000
f-2	Public Information	$50,000	$50,000	$50,000	$50,000	$50,000
f-3	IT Support	$50,000	$50,000	$50,000	$50,000	$50,000
f-4	Staff Support	$100,000	$100,000	$100,000	$100,000	$100,000
f-5	Legal, Overhead, Administrative	$50,000	$50,000	$50,000	$50,000	$50,000
	Total Estimate:	**$6,886,116**	**$5,627,132**	**$6,865,704**	**$7,913,431**	**$7,614,536**