

The Next Era for Water Utilities-- Smart Metering Optimization

Presentation for the US Public Health Service

**Presented by:
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UtiliWorks Consulting, LLC.**

November 20, 2012

Experience



UtiliWorks

- Nationally recognized client projects
- AMI, smart metering, Smart Grid experts
- National network of partners
- Critical regulatory relationships
- AMI business process improvement
- Expert cost modeling

Agenda

- What is the current state of technology for water systems?
- How do we manage the data?
- What can be done with the information?
- Cost vs. benefits
- How to get started
- Q&A

**What is the current state of
technology for water systems ?**

Key Considerations

- 60-70% of the value of past AMI projects was left on the table
 - Primarily used for simple meter reading
 - Much valuable data lost in the shuffle
- Today, AMI projects are oriented toward a data centric model
 - No more vendor sales/install model (2-3 days training)
 - Complex data management and analysis systems are being designed to maximize benefits and enable more complex functionality.
 - 10-15% of project costs are now focused on system integration due to the complexity of the system

Current state of technology

- Deployments have been going on for a long time, and we are in 3-5th generation of technology
- Systems are moving way beyond billing information into utility management
- Cost versus benefits in most cases supports moving to the new systems
- Product constraints/environmental issues require better management of **utility** systems
- Advanced metering improves customer relationships

Technology Drivers

- Advanced metering should be an asset management tool in the utility segment
- Become a state of the art manufacturer and distributor
- A significant cost reduction in data collection and customer service
- It offers a significant change in the ability to utilize utility staff and capital based on data driven events (engineering design issues, capital budgets outlays)
- It is a network that is expandable for other city services, or can connect to existing networks

Typical Business Objectives

- Improve and protect revenue
- Reduce customer service calls
- Reduce distribution losses
- Reduce overall account management costs
- Reduce operational costs

Better Business Objectives

- Reduce theft of service by 90% by 2014
- Reduce distribution losses by 50% by 2014
- Reduce customer service OPEX by 20% by 2013
- Reduce customer service costs by 15% per account by 2015
- Reduce meter services OPEX by 25% by 2015

Each Utility Project is Unique

- **Your** needs are not the same as other utilities' needs
- **Your** business drivers determine the final output
- Systems engineering provides perspective to utility projects
- Look at operations holistically to identify challenges and opportunities
- Consider requirements and constraints

What does the system consist of?

- Advanced meters
- Data transmitters
- Data collectors
- Meter data management systems (MDMS)
- Leak detection tool kits
- Customer information portals
- Analytical packages

Water Meters



Residential Mag meters
Life Cycle 18 years
99%+ accuracy



Residential flow meters
Life Cycle 8-18 years
Variable accuracy

Data Transmitters

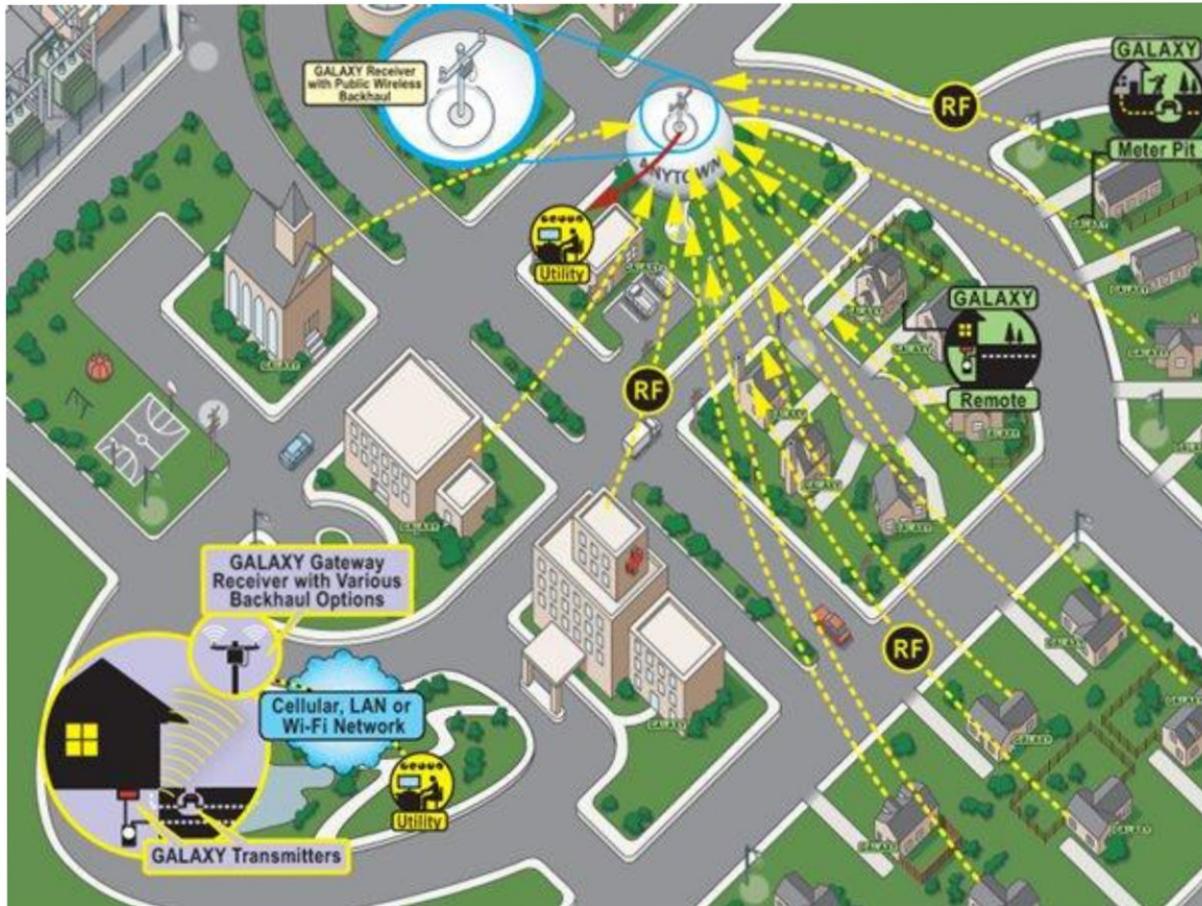


Sensus



Aclara

Network

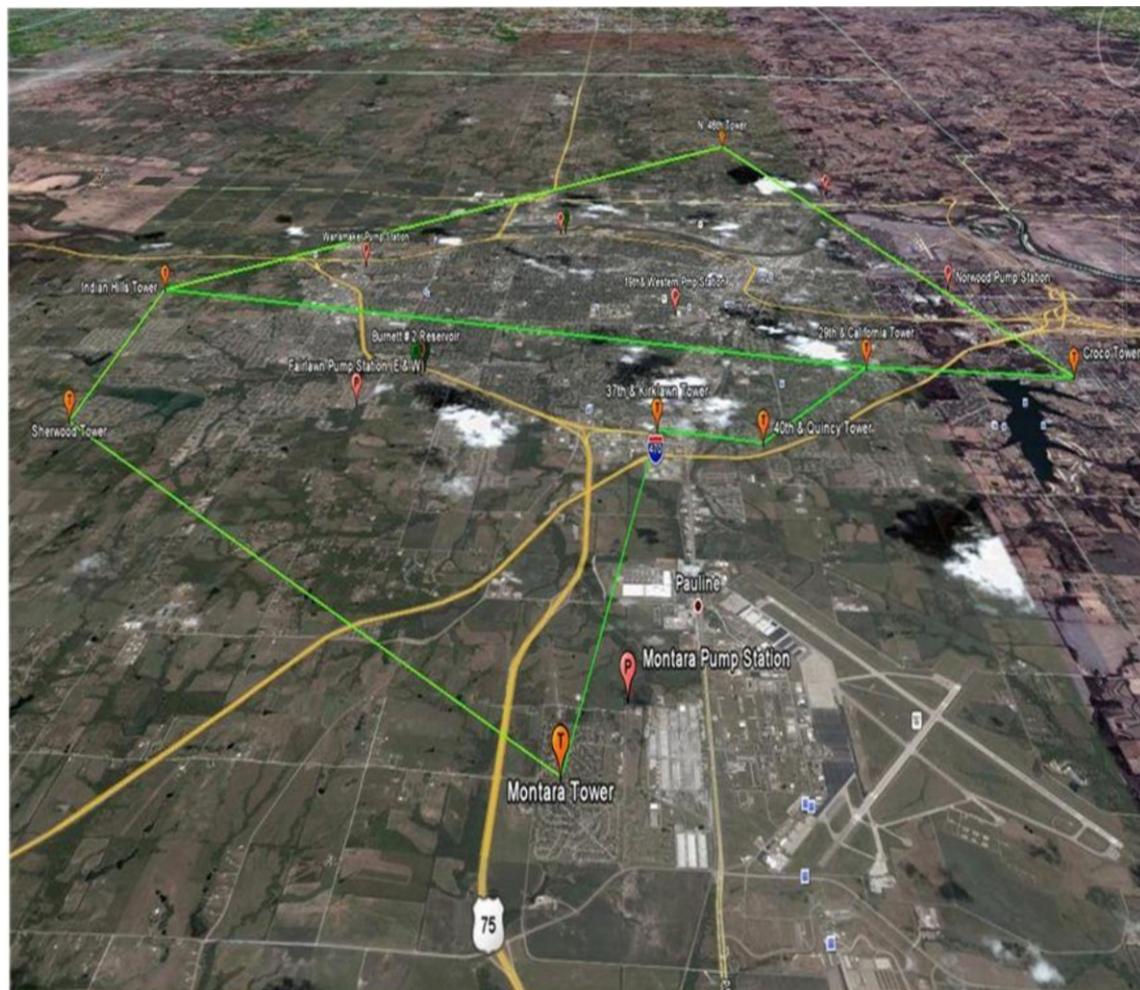
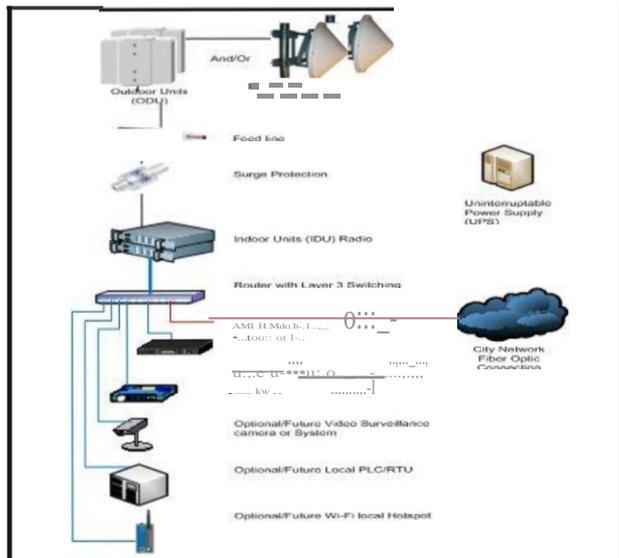


Badger System

Data, Networking and Communications

Communications Design:

- Broadband Point-to-Point Backbone Network
- Designed to facilitate multi-departmental/application use including; SCADA, AMI, Mobile Dispatch, Security, etc.



How to Choose a System

Example - Clear Value Propositions from Managing/Using the Data Correctly

- State of the art 24/7 monitoring of accounts worth over \$65 million in revenue per year and 700+ Million in fixed asset replacement value
- Reduction in customer service costs and service issues by up to 75% within 3 years
- Real time emergency response to account issues
- Elimination of safety issues in reading meters
- Daily sales revenue from key accounts
- Continual improvement on asset performance
- Proactive customer service

So You Want to Move Forward?

- Understand what you want to build
- Business objectives are key to definition
- Don't build what you can buy
- Don't buy what you don't need

Smart Grid Technology Assessment

AMR/AMI Solutions																			
Neutral	●																		
Favorable	●																		
Not Favorable	●																		
Unknown	●																		
		Sensus-Flexnet	Badger-Orion	Badger-Galaxy	Hexagram	Datamatic-Mosaic	Itron Fixnet 2.0	Itron Fixnet 2.5	Itron-Open Way	Mitel (via Nortel)	EKA Systems	Trilliant	Elster-Energy Axis	Elster Evolution	Tantalus	Hunt	DCSI-TWACS	Current Group	PowerOneData
Summary Ratings																			
Company Experience Water		●	●	●	●	●	●	●	2008	●	●	●	●	2008	●	●	●	●	●
Company Experience Electric		●	●	●	●	●	●	●		●	●	●	●		●	●	●	●	●
Proposed Product Maturity		●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●
Proposed Product Functionality		●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●
State of obsolescence		●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●
Applicability to local environment		●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●
Water MIU's (radio)																			
OEM vs Third Party		OEM	OEM	OEM	OEM	OEM	OEM	OEM	OEM	OEM	TP	OEM	OEM	OEM	TP	TP	TP	TP	TP
1-way, 2- way		1	1	1	1	2	1	2		1		2	1						
licensed		Y	N	Y	Y	N	N	Y		?		N	N						
MIU Freq (mhz)		900+	900+	450+	450+	900+	900+	1400		150+		2400	900+						
MIU Power (mW)		2W	10mW	1W	250mW	250mW	100mW?	1W		.1-1		10mW-1	250mW						
RF Type (mesh, p2p, combo)		p2p	p2p	p2p	p2p	Mesh	p2p	p2p		p2p		Mesh	Mesh						
Battery/MIU Warranty (years)		20	20	20	20	10	20	20		10		15	20						
@ xx transmissions per day		5	21600	4	4	1-4	96	12		4		1*	6						
Sealed (non-replaceable) Battery		Y	Y	Y?	Y	N	Y	Y		N		N							
Notes: Mobile, FN-RF, FN-PLC, BPL		FN-RF	Mobile	FN-RF	FN-RF	FN-RF	FN-RF	FN-RF	FN-RF	FN-RF	FN-RF	FN-RF	FN-RF	FN-RF	FN-RF	PLC	PLC	BPL	FN-RF
Electric MIU's (radio)																			
1-way, 2- way		2			2	2	1				2	2	2		2*				2
licensed		Y			Y	N	N			N	N	N		Y				N	
Transmissions (data rate)		hourly			5 min	6 sec	30 sec					1 min	4 hours		5-15min				
MIU Freq (mhz) /electric		900+			450+	900+	900+			900+		2400	900+		900+				900+
MIU Power Output (mW)		2w			250mW	250mW	100mW					10mw-1	250mW		450mW				125mW
RF Type (mesh, p2p, combo)		p2p			p2p	MESH	p2p					Mesh	Mesh		combo				p2p

Defining Goals

Key Questions

Existing Program

Desired Future Program/System

Funding Available

Goal

Functional Areas

Billing

Customer Service

Meter Reading

Field Services

Operations

IT & Communications

Project Planning & Cost Estimate

Figure 3.1 Organization Chart

Topic Area

Cost

AMI Pilot/Production

\$4,659,800

MDM, IWMS, CIS

\$3,584,500

TOU Billing

\$434,600

Servers

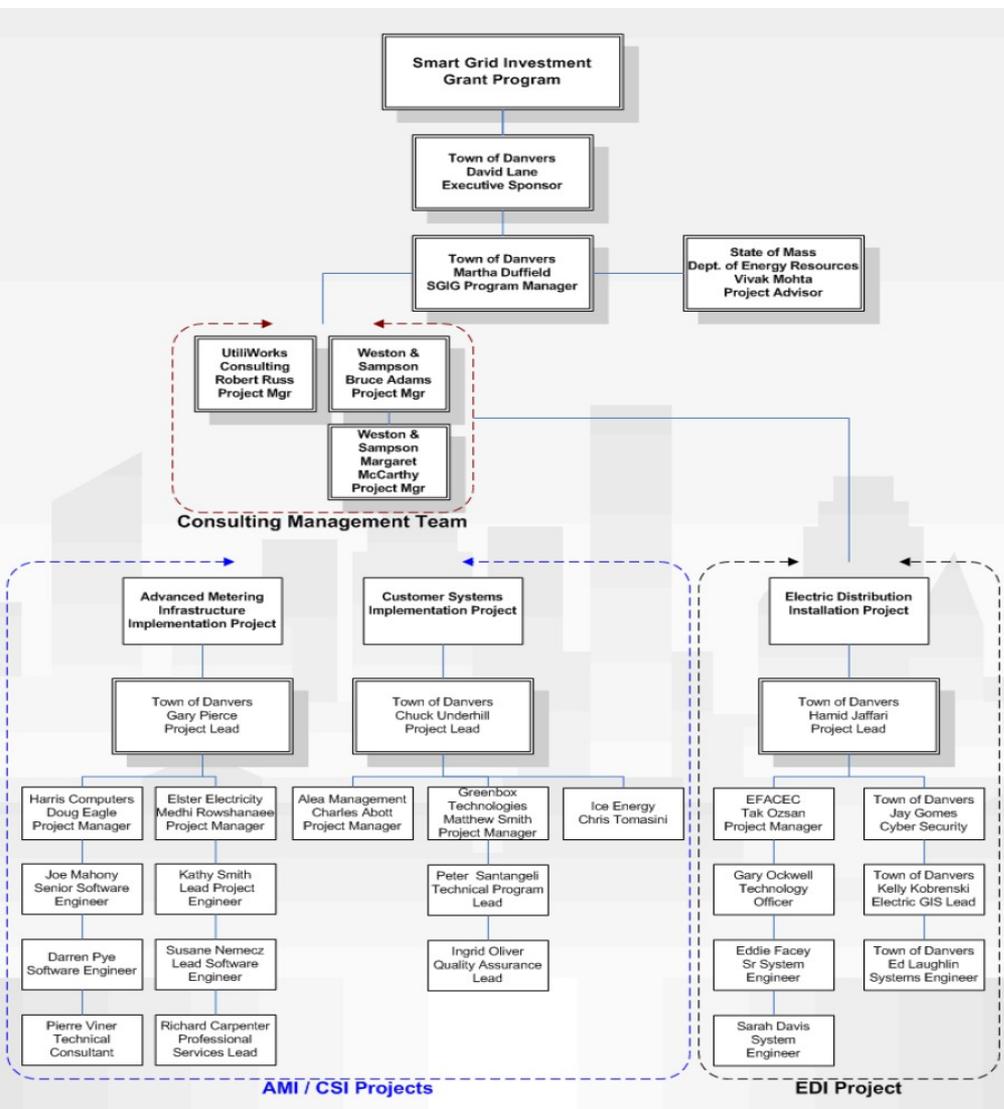
\$47,300

Changes to Staff

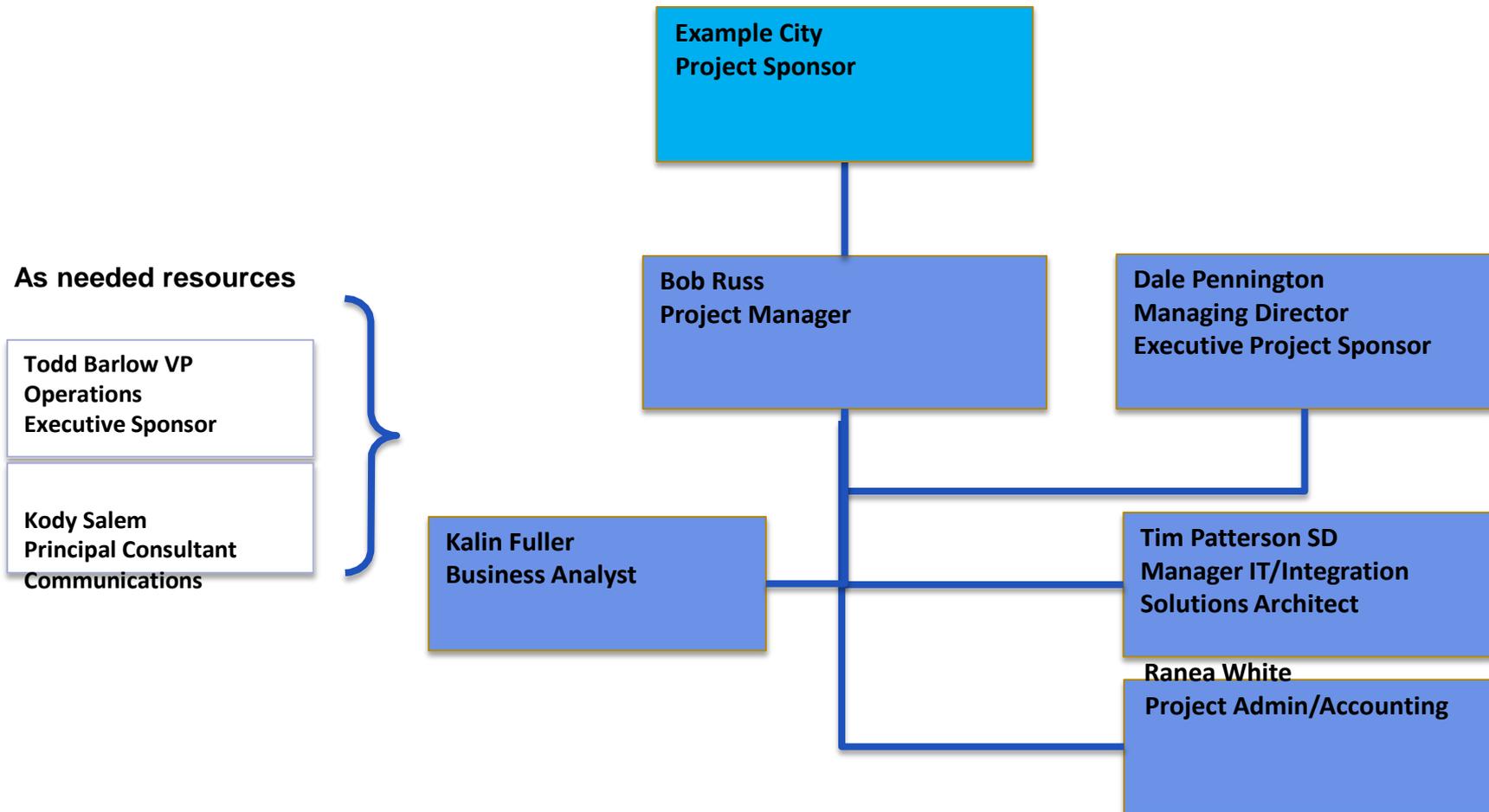
\$220,000

Project Management

\$350,000



Example of a Project Team



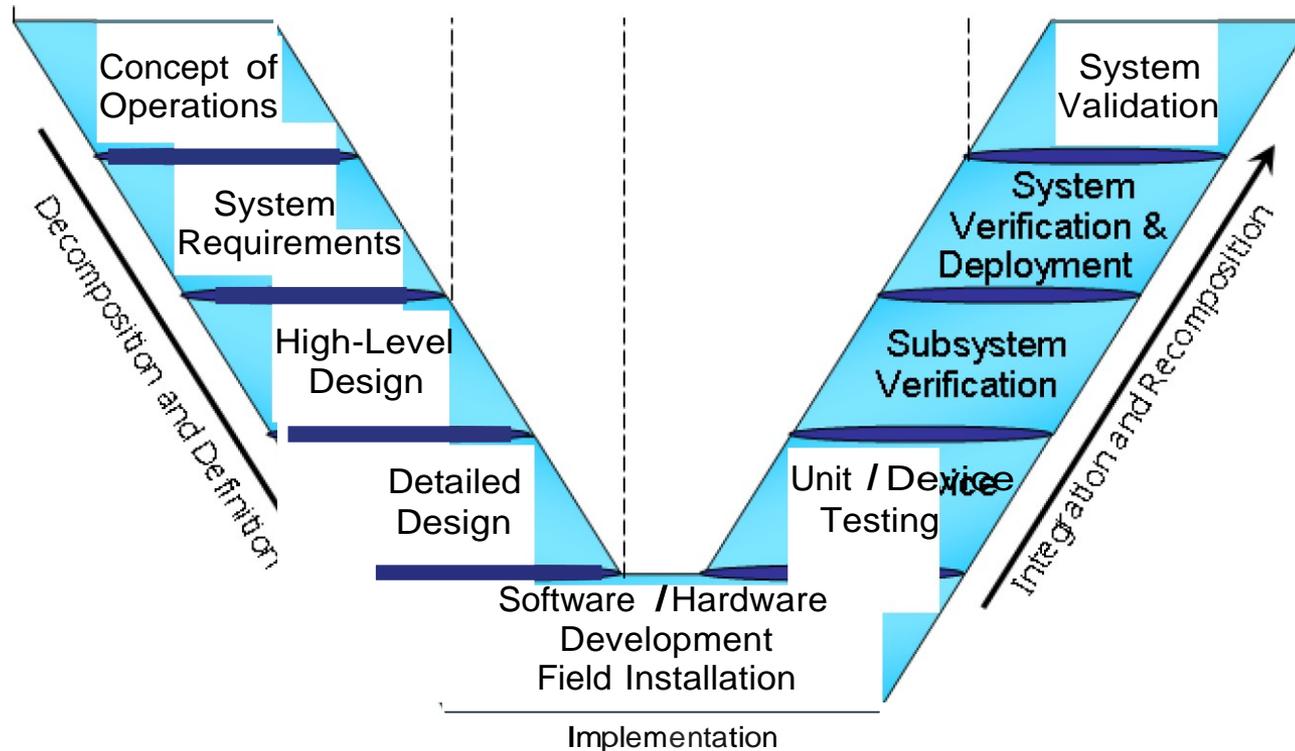
EXPERIENCED PROFESSIONALS WORKING TOGETHER

Building a Successful System

- Consider a 3-legged stool:
 - The stool needs all 3 legs to function as designed
- Smart Meters
 - Very straightforward and easy to procure
 - Essentially a commodity product
- Smart Systems
 - Thoughtful and thorough design provides the system foundation
 - Enables new functionality within the enterprise through data and automation
- Smart Processes
 - Very difficult to accomplish internally in a compartmented organization
 - This is the critical phase. If processes are not designed to manage and utilize the technology, the entire project will be perceived as a failure

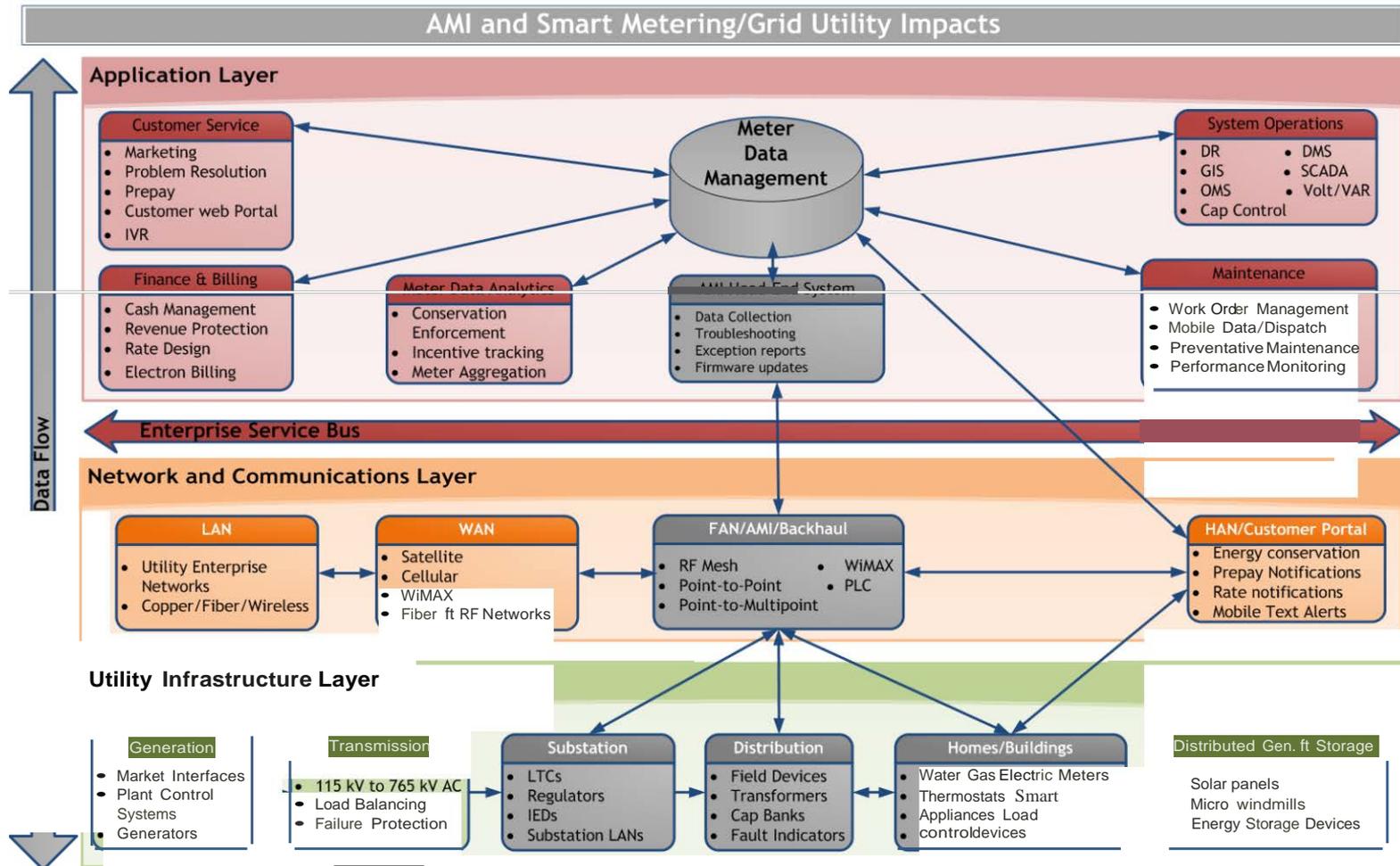
Project Life Cycle

Project Initiation	Preliminary Engineering	Plans, Specs & Estimates	Construction	Project Closeout	Operations & Maintenance
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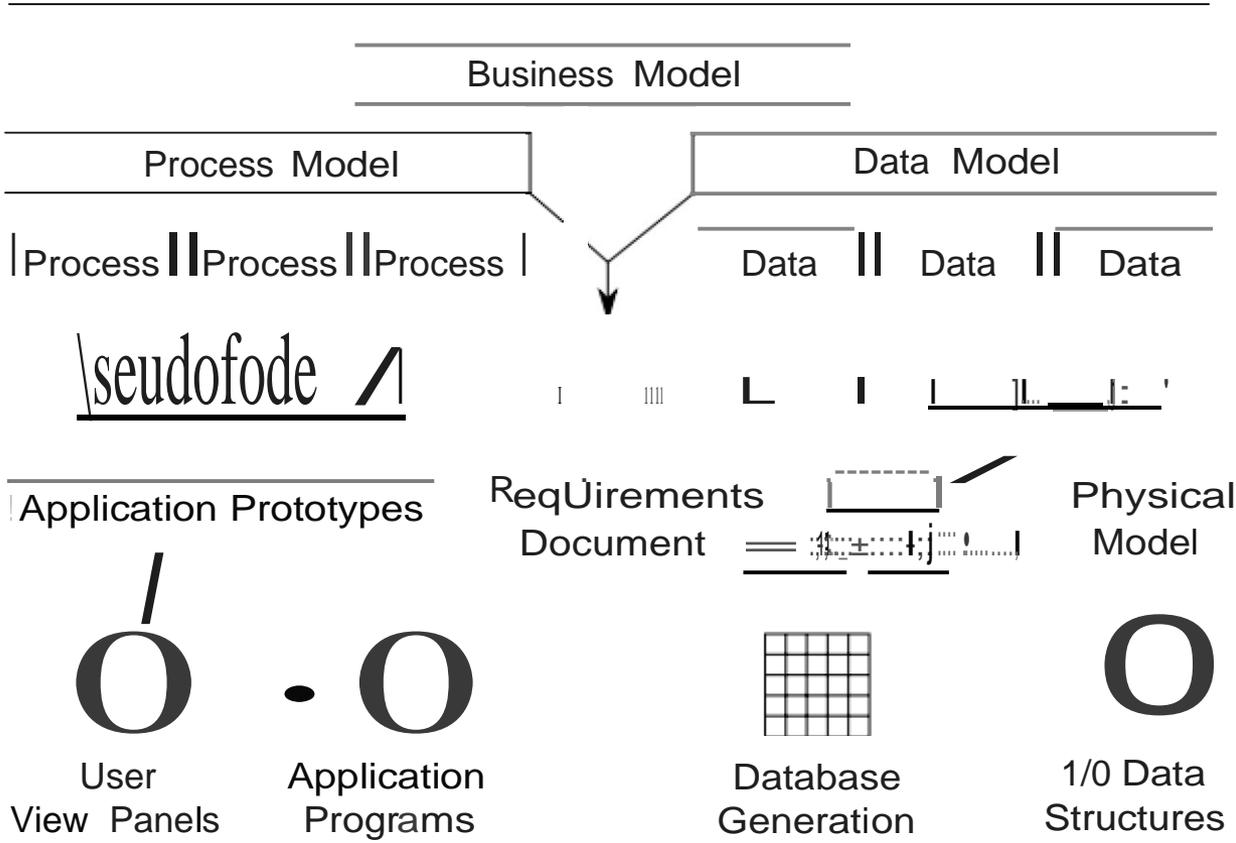
How do We Manage the Data?

What Do We Manage?



Integrating Business and Data Models

Business Model Integration



Using the information

Water MDM Use & Event Analysis

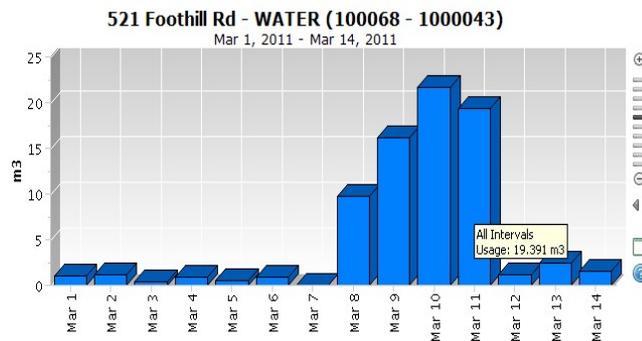
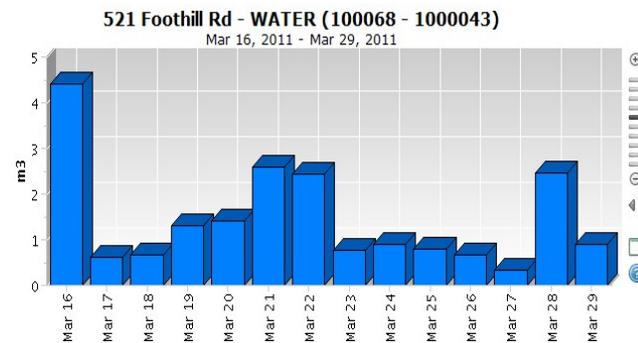


Manage leak alert events

- Map views restriction non-Compliance
- Conservation reporting
- Pressure analysis

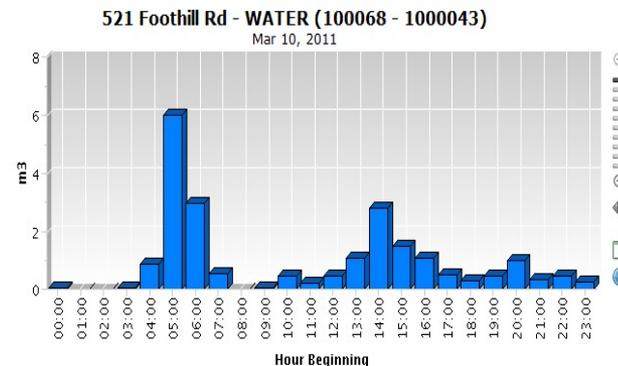
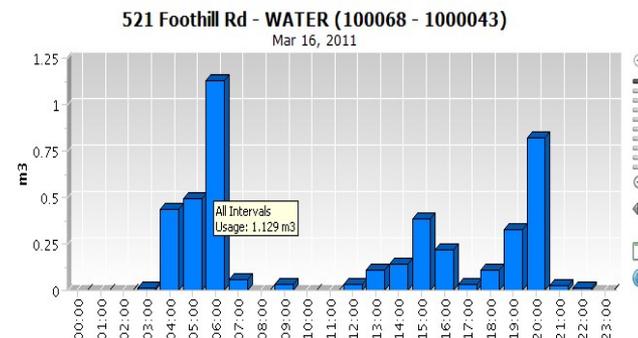
MeterSense
Logged in as CSR | Logout

- Meter Reads
- Peaks Report
- Contributors Report
- Bill Verification
- Price Reports
- Configuration



MeterSense
Logged in as CSR | Logout

- Meter Reads
- Peaks Report
- Contributors Report
- Bill Verification
- Price Reports
- Configuration



Data Mining



tberson@se-sensu logout
 C:\sensu\logk\14_20120330_1129

Previously Viewed Meters

<< W18000028 >> +

571 N Alpine Dr - WATER (W18000028 - 1000028)

Reports

Dashboards

Maps

Communications

Meter Exceptions

Meter Reads

Meter Events

Meter Event Query

Event Type Summary

Outages

Transformers

Conservation

Billing

Event Type Summary

Meter 10 (full or partial)

Event Type Leak v

Start Date (VVYVMMdd) 20120301 3

End Date (VVYVMMdd) 20120430 3

Commodity Type v

Meter Group

Submit



Exc!! PDF EY Schedule Save

Meter Name	Commodity Type	First Occurrence	Last Occurrence	Total Occurrences
\118000028 571 N Alpine Dr-WATER (\118000028 • 1000028)	leak	2012/03/04	2012/03/07	
118000061 501 N Elm Dr-WATER (118000061 - 1000061)	leak	2012/03/26	2012/03/31	6
118000090 9390 CIVIC Center Or-WATER (118000090-1000090) 1/	leak	2012/03/17	2012/03/30	
118000100 9391 CIVIC Center Or-WATER (118000100 • 1000100) 1/	leak	2012/03/21	2012/03/22	2

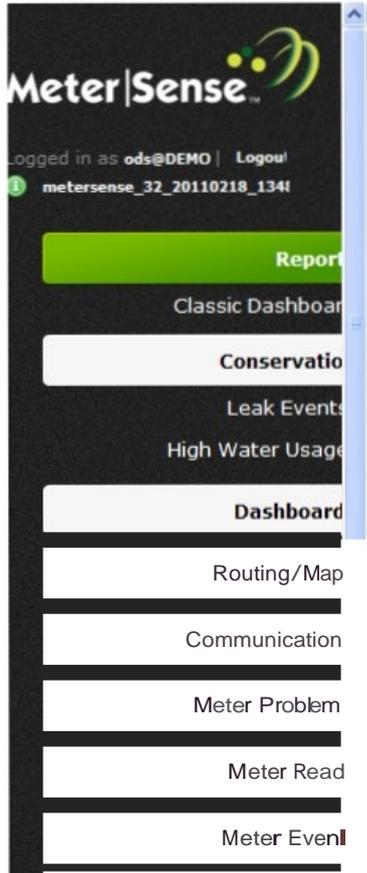
4 rows found

Exc!! PDF EY Schedule Save

Meter Name	Commodity Type	First Occurrence	Last Occurrence	Total Occurrences
118000028 571 N Alpine Or-WATER (\118000028 • 1000028)	leak	2012/03/04 17:56:00	2011/02/16 10:19:54	
118000028 571 N Alpine Or-WATER (\118000028 • 1000028)	leak	2012/03/05 00:00:00	2011/02/16 10:20:14	
118000028 571 N Alpine Or-WATER (\118000028 • 1000028)	leak	2012/03/06 00:00:00	2011/02/16 10:20:39	
118000028 571 N Alpine Or-WATER (\118000028 • 1000028)	leak	2012/03/07 00:00:00	2011/02/16 10:20:43	

4 rows found

MeterSense-J)



High Water Usage Report

This report lists meters with a high level of water consumption. The 'high consumption' threshold can be specified, and the report can be filtered to show high consumption only during restricted times, i.e. to identify lawn watering restriction violations.

Hourly Consumption Threshold: Gal

Location Classes

CJ

To select multiple location classes, hold down the CTRL key and click on each class.

Date Range (yyyyMMdd)

From:

To:

Meter Group

Times and Dates for Water Restrictions

Watering not permitted between the hours of and

On odd days for even houses and vice versa

On the following days of the week

To select multiple days of the week, hold down the CTRL key and click on each day.

Data Mining

SENSUS

Logged in as **ads@LOCAL** | Logout
1 metersense_HEAD_20110531_1054

- Reports
- Dashboards
- Routing/Maps
 - Map: BaseStations Only
 - Map: 30 days since last comm.
 - Map: 14 days since last comm.
 - Meter Communications Route
 - Meters With Most Dependents
- Communications
- Meter Problems
- Meter Reads
- Meter Events
- Conservation
- Actions
- Setups
- System Configuration
- Meter Data
- Task Manager

Done

High Water Usage Report

This report lists meters with a high level of water consumption. The "high consumption" can be filtered to show high consumption only during restricted times, i.e. to identify

Hourly Consumption Threshold M) ■

Location Classes T=1 UWT CTIII

Date Range (yyyyMMdd) From: 20120322

Meter Group

Times and Dates for Water Restrictions

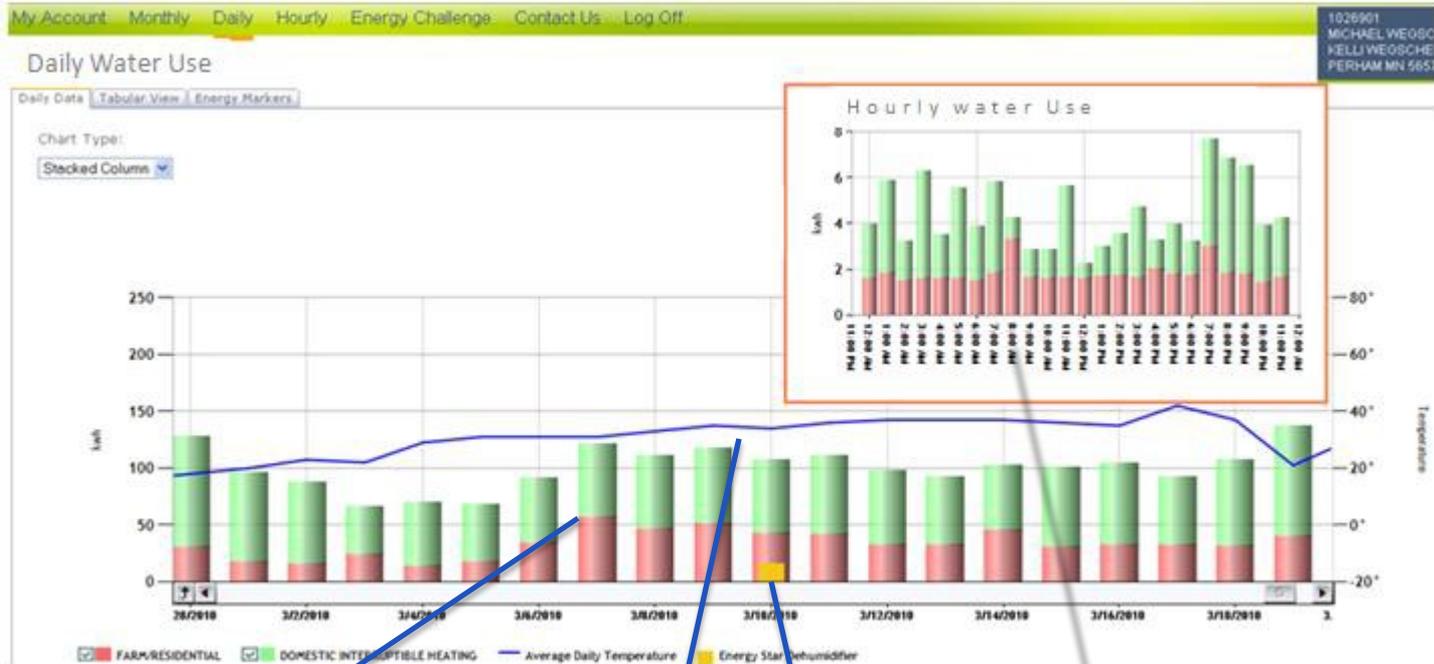
Watering not permitted between the hours

of

of

•11000001 101 N ... Or • TVATtl(11111000001 • 1000001)	XI U1'01/0e Cn...	1 1N7
W11000001 S.01 N ... Or • TVAfLA (W11000001 • 1000001)	1000001	1 UJ'9
W11000001 S.01 N ... Or • WATr(1000M • 1000004)	M17'01 (n...)	1 1It'9
W11000001 S.01 N ... Or • TVATtl(1000&e • 1000004)	MU'Ol/H (W -)	1 otOC
W11000001 S.01 N ... Or • WATcH (W11000001 • 1000001)	:OU'01/0e(n...)	1 7
W11000100 ... Or • _ATta (W11000100 • 1000100) MUJOH1		1 00U'7
W11000100 ... Or • _ATtl(W11000100 • 1000100) MUJO		1-04'416

Web Portal Customer Connect



Daily Water Consumption
Aggregate meters if required

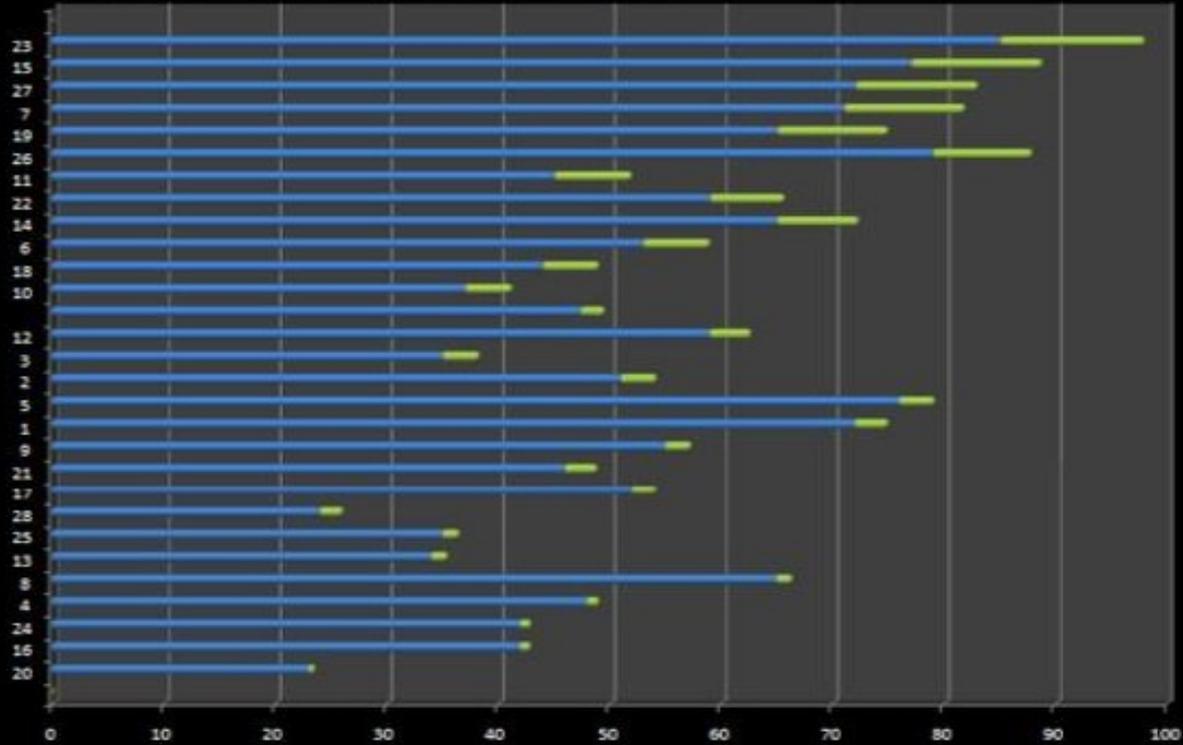
**Correlate with
weather**

Mark conservation program starts

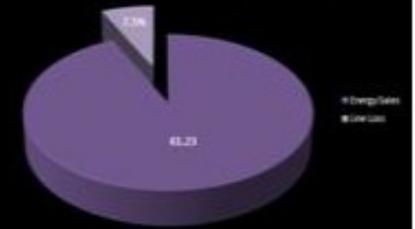
Hourly Water Consumption

Line loss analyzer

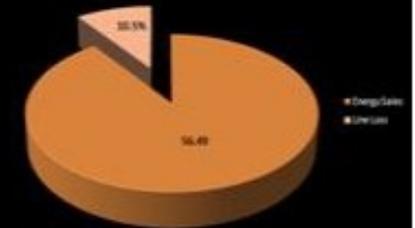
Top Water main loss by percentage



Total Losses for this period



Same Period Last year



Select Utility System

Electric
Gas
Water
Steam

Enter From Date

Enter to Date

May, 2010

Su	M	Tu	We	Th	Fr	Sa
25	26	27	28	29	30	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

TQd.ay: M.ty Z3,2010



How Does Your MDMS System Communicate to the Customer and What Can't it Do?



Library

Got a Leak? We'll Tell You. September 10, 2012

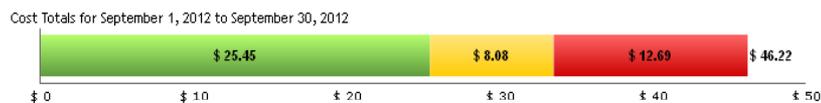
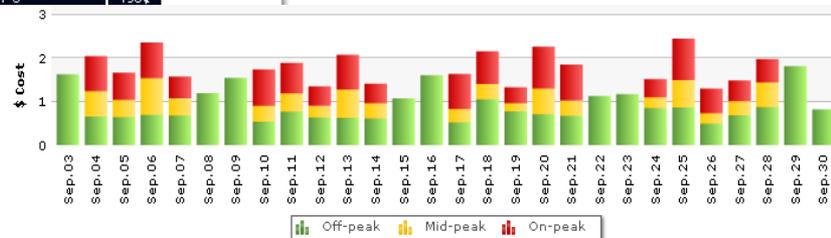


Our smart water metering systems can detect leaks on your property. We can send you an automated message to let you know when there is water leaking. In some cases we can even apply a credit to your bill to cover the cost of water lost through leaks.

[Read More...](#)

Water Rates

Tier-1	60¢
Tier-2	100¢
Tier-3	150¢



- What do I owe, when do I owe it, how do I pay?
- Why has my bill changed? What else should I know?
- How has my bill changed from last year?
- What did my appliances cost to run?
- How can I control costs?
- How does my home compare to similar homes?

If you replace your Washing Machine ... September 10, 2012

Most front-loading machines are energy- and water-efficient, using just over 20 gallons a load, while most top-loading machines, unless they are energy-efficient, use 40 gallons per load.

[Read More...](#)

Category: Conservation



Got a Leak? We'll Tell You. September 10, 2012

Our smart water metering systems can detect leaks on your property. We can send you an automated message to let you know when there is water leaking. In some cases we can even apply a credit to your bill to cover the cost of water lost through leaks.

Category: Conservation

Community Events September 10, 2012

View a list of community events in your area. You can interact with your neighbors and get the chance to walk away with valuable incentives.

[Read More...](#)



Exporting My Data June 14, 2012

The Consumption Report contains information that can be useful for personal analysis on a program like Microsoft Excel. The ability to export the data in various formats can facilitate this analysis.

[Read More...](#)

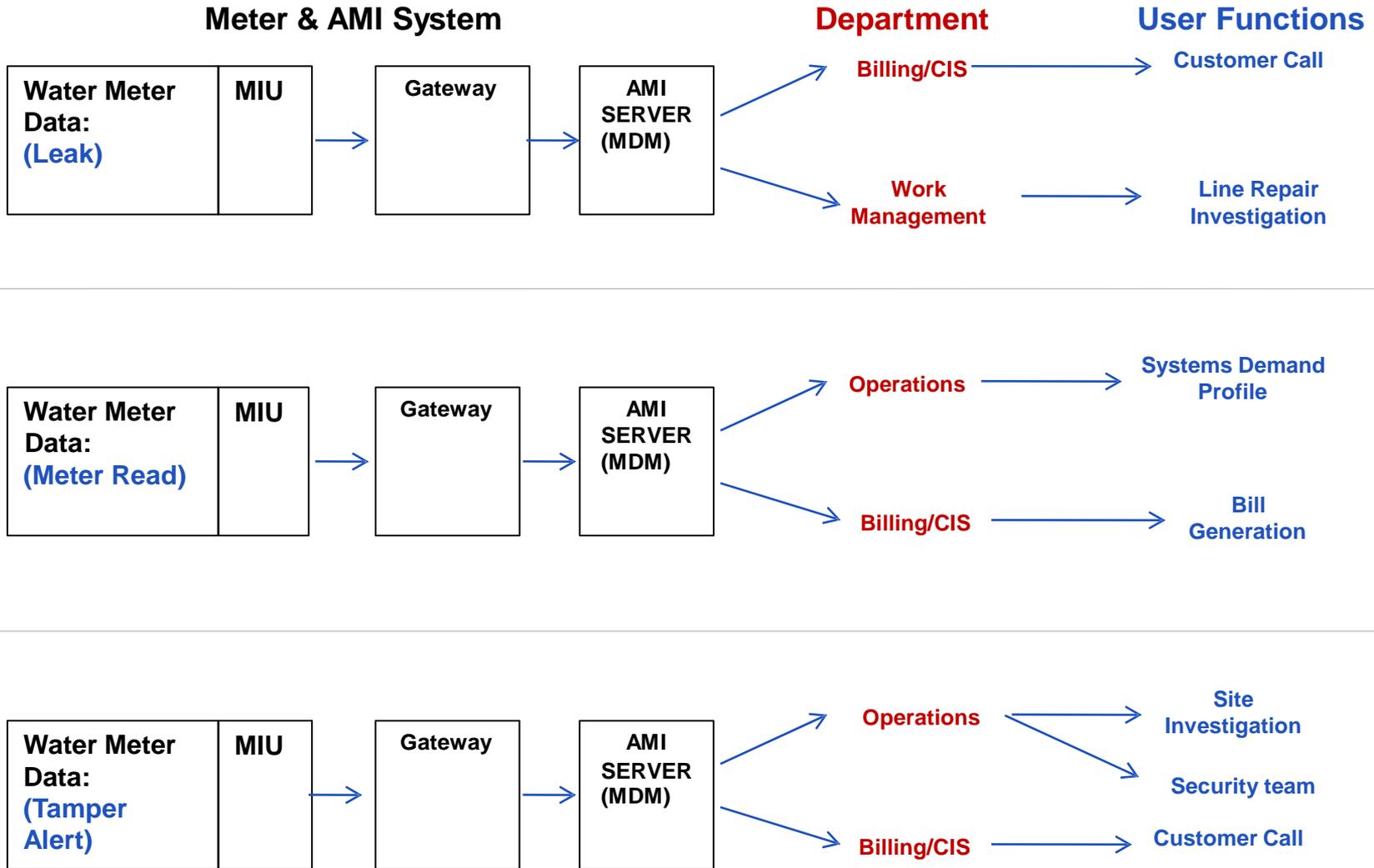


Data Mining

Customer Benefits

- **Daily water consumption**
- **Correlate with weather**
- **Hourly water consumption**

Decide Where the Data Should Go



Cost vs. Benefits

Cost vs. Benefits

Executive Summary

Project Description
Needs Assessment
Capital Cost
Schedule

Cost vs. Benefits

Project Description (example)

Deploy a “smart metering” or Advanced Meter Infrastructure (AMI) system for all water and electric meters serviced by the CUSTOMER Public Utility Board. The system will provide daily (or hourly) accurate measurement of all water and electricity that will provide financial benefit to residential and commercial customers and modern tools for city personnel to improve services, lower costs and improve the efficiency of our water and electric infrastructure assess owner by the CUSTOMER Public Utility Board.

Cost vs. Benefits

Needs Assessment (example)

In our analysis and in comparisons to similar-sized cities, CUSTOMER ranks favorably in its utilization of its current systems and personnel to manage the utility operations. At the same time, there are substantial improvement opportunities associated with this AMI project that greatly impact the consumer and the utility. Our study uncovered significant and specific value propositions that support the new tools provided in an AMI project. Without the tools provided by AMI, most of these improvement measures are not achievable.

Cost vs. Benefits

Needs Assessment – Estimated Benefits (example)

- Monitor daily and accurately report product sales
- Reduce unaccounted for product
- Recover 2.5% of electricity losses (lower customer cost \$3,500,000 per year after three years)
- Accurately meter and bill for water consumed (increase \$448K per year by 2nd year), plus revenue increase of \$538K for associated sewer charges
- Recover \$2.8M in lost water production
- Improve customer service and billing productivity by 30%

Cost vs. Benefits

Needs Assessment – Estimated Benefits (example)

- Estimated potential annual savings in excess of 10 Million per year after year three
- Empower customers to monitor and lower their utility bills
- Use 'time of use' data to negotiate lower electricity purchases

Additionally, a well designed AMI system will directly and indirectly facilitate attainment of many of the customer's goals and objectives.

Cost vs. Benefits

Capital Cost (example)

While there are several acceptable options for technology selection and deployment methodologies with a range of costs, the recommended base case scenario assumes upon a complete meter change-out for water and electric meters using a design procedure, pilot and deploy approach to maximize the project benefits. It also assumes outside resources for installation labor. In this scenario, the budgetary project cost estimate for the entire project is between a 17-22 Million with a 10% contingency.

Cost vs. Benefits

Schedule

A 24 month schedule is proposed in the base case. The recommended schedule includes a three month design process to effectively review all project variables and develop procurement strategy and documentation, a four month procurement process to solicit, review, evaluate and award component and installation contracts, a four month pilot and deployment preparation program with a small group of meters, a 10 month full-scale deployment of new meters and AMI devices, and three months of post installation support, training, business process re-design and system turnover.

Cost vs. Benefits

Summary Matrix of Estimated Potential Savings

Department No.	Department	ROI Number	2009 Costs or Baseline Dollars	2009 Costs Burdened 20%	Problem or Description	Proposed Solution	Year-1 Savings	Year-2 Savings	Year-3 Savings, leveling out	Notes
2310	Electric Meter Shop	R1	\$617,119	\$740,543	Electric Meter Investigations	AMI system, tamper detection	\$74,054	\$222,163	\$296,217	Budget doc 3500/per yr @ 17%/yr
2410	Electrical Engineering	R2	\$928,423	\$1,134,108	Electrical Engineering Dept		\$0	\$0	\$0	
2410	Electrical Engineering Systems Losses	R3	\$141,098,045	NA	Electrical Engineering Dept - Electric losses 7.02% (2% reduction of loss with AMI, 1/2% reduction with Lower Voltage control = 4.52%)	AMI system, tweak voltage, find problems; drop losses to 5%	\$1	\$2,823,961	\$1,527,451	calculate loss based on what they sold (lost kilowatts x ave sale price per kilowatt) 2% x total power purchase cost= potential
3110	W/WW Engineering & Operations	R4	\$5,208,927	NA	Water loss Production cost of non revenue (24.8% - 25% reduction to 14.9%, 15%, then 12% yr 3) Cost of Loss for 2009: 9,334,993 gal x \$2.25/1000gal = \$208,927.23	AMI system	\$1,239,221	\$2,058,366	\$2,688,479	\$2.25/1000 gal comes from Desalination (most study \$1.75/1000gal plus \$0.5/1000gal (Debt Service)
3110	W/WW Engineering & Operations	RAA	\$	\$	Add in sewer benefits				\$538,360	water at 1.9%, sewer at 3.13=1.2 multiplier
3110	W/WW Engineering & Operations	R5	\$14,954,463	NA	Lost Revenue from aging water meters, slow meter losses 664628 Kgal sold*2.25/Kgal = \$1,494,463 sale value: Assume 3% Slow on Average + replace over two years	New AMI Capable Water meters	\$224,317	\$448,634	\$448,634	
3110	W/WW Engineering & Operations	R6	\$666,742	NA	Covert 10% of Non revenue water to Offsystem sales 9,334,993Kgal * 24.8% *10% =231,507.gals *\$2.88/1000gal = \$666.74	New AMI Capable Water meters	\$133,348	\$333,373	\$666,742	use outside city commercial rate of \$2.88/1000 gal @ 2%, 5%, 10% (yr1-3)of nonrevenue water sales
3140	Revenue Recovery	R7	\$83,894	NA	260 Tamper Report X \$322.67 per report: reduce to \$64.53 (eliminate 80% by early tamper detection mitigation)	AMI System	\$67,113	\$67,113	\$67,113	
4105	Customer & Information Systems	R8	\$269,072	\$322,886	Customer and Information Services - reduce cost of services over 10% per year over 3 yrs	AMI System	\$32,289	\$32,289	\$32,289	
4110	Customer Service	R9	\$445,725	\$534,870	Large volume of payment arrangements, reconnects/disconnects, reduce yearly 0, 20, an 50% in total by third year. Need to rapidly adopt new business practices to facilitate	Pre-pay metering and payment system	\$0	\$106,974	\$267,435	
4115	Collections Bad Debt	R10	\$1,400,000	NA	Bad dept reduction, 5, 20, 50% by yr 3	AMI System/Prepay	\$70,000	\$280,000	\$700,000	
4115	Collections	R11	\$766,264	\$919,511	Collections Department, reduce workload by 5, 10, 25% total by 3yr and 50% reduction of Bad debt by year 3.		\$45,976	\$91,952	\$229,879	
4120	Billing	R12	\$833,921	\$1,000,700	Billing Department - H/LO billing 1/4 have issues - 0%, 10%, 25% of reduction of workload thru year 3.		\$0	\$100,071	\$250,176	
4125	Call Center	R13	\$343,637	\$412,364	Call center reduce over 3 yrs 0%, 20%, 50% total: Call Center (22 min wait time, \$2.28/per/call ave) look at IVR and AMI data would do to reduce these costs pg 140 budget doc		\$0	\$82,473	\$206,182	
4130	Meter Services	R14	\$537,965	\$645,554	Meter Services	Discount and Prepay	\$0	\$64,554	\$225,945	
4135	CIS Support	R15	\$326,643	NA	CIS - increase by 25% starting the first year		-\$408,304	-\$408,304	-\$408,304	
4150	Meter Reading	R16	\$768,410	\$922,092	Meter reading - reduce 0%, 30%, 80% cost reduction after 3 yrs		\$0	\$276,628	\$737,474	
4160	Cashier	R17	\$394,643	\$473,572	Cashiers - reduced cost/payment thru automatic scheduling & Prepay and ACH deduction on selected bill date (pay day) 35% reduction by third yr		\$0	\$47,357	\$165,750	What is "automatic payments"?
Total Savings							\$1,478,017	\$6,625,605	\$10,640,025	\$18,743,647

- Potential savings calculated over three years from current state
- Organized by AMI-impacted Department
- Year 1 Savings = **\$1,478,017**
- Year 2 Savings = **\$6,625,605**
- Year 3 Savings = **\$10,640,025** (Level out and reoccurring Year 3 and beyond)
- Total after Year 3 = **\$18,743,647**

March 4, 2010

AMI Drivers

While the city of Monroe's \$6.8 million automated water meter project is roughly 91 percent complete, city officials say they've already seen a better reading of water consumption leading to increase revenue.

Director of Administration David Barnes said water consumption is up in the city of Monroe over last year, according to readings from the new meters.

Consumption is up around 10 percent to 15 percent just on the residential meters. Consumption is about 150,000 gallons more a month, according to the new meter readings.

"That means our revenue is up 10 percent to 15 percent. Over the whole process, we anticipated it would be up around 10 percent, but it's a lot better than what we thought it would be," Barnes said.

The additional revenue is around \$1 million over last year because of the more accurate readings of water consumption.

"Before we put these new meters in, I'd say 70 percent of our meters were under-reading, and a lot of residents were getting a minimum bill," Barnes said. "We knew we were losing water and we knew we had problems, but we didn't know it was this big of a problem."

Thank You!

Any Questions?