



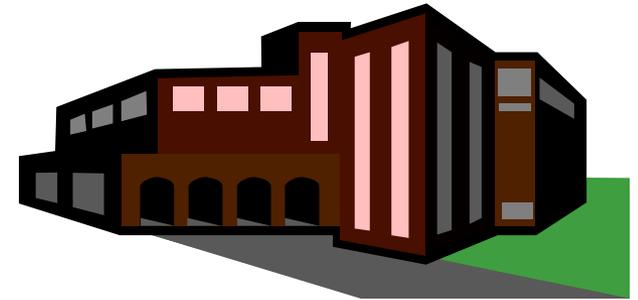
Best Practices for Implementing EEM Featuring a University of Arizona Case Study

June 2014

Presenter: Justin Thomas

Did you know?

\$14 billion annually is spent on energy by the nation's education institutions.



Energy efficiency improvements have the potential to save education institutions **\$4 billion each year**

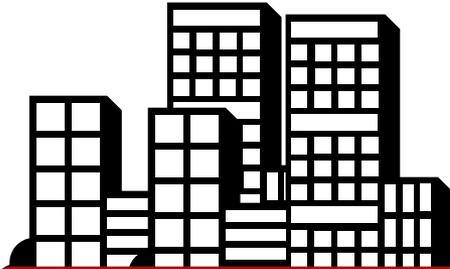
Challenges Faced by Universities

- ▶ Cost of metering the campus
- ▶ Interfacing to disparate energy systems
- ▶ Creating awareness
- ▶ Managing energy costs
- ▶ Striving for Carbon Neutral / Cap in Trade / Carbon Tax
- ▶ Reporting energy cost and consumption
- ▶ Tenant billing
- ▶ Rising energy costs
- ▶ Fuel variability
- ▶ Carbon footprint
- ▶ Generate versus Procure energy
- ▶ Managing budgets
- ▶ Climate Action Plan
- ▶ Energy Sustainability

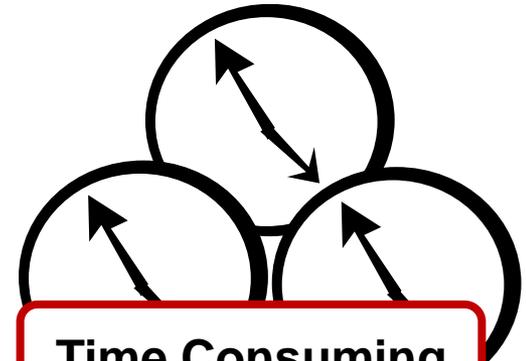
Increasing Need for EEM



Amount of Meter and Sensor Data



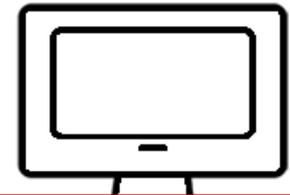
Various Buildings



Time Consuming



Green Initiatives



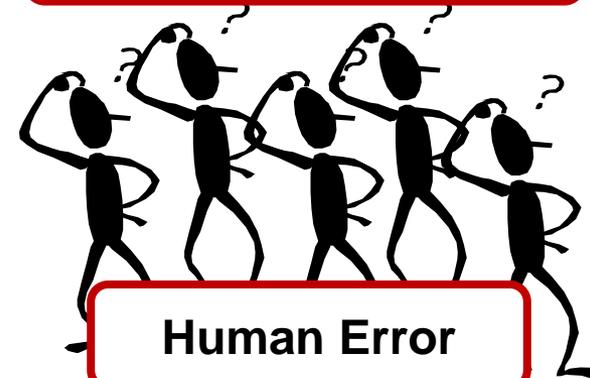
Generate Awareness



Multiple Utility Rates



Regulations



Human Error

What to look for in an EEM

- ▶ Solution developed specifically for Campus Environments (single or multi-campus)
- ▶ Hardware unbiased (integrates with existing systems)
- ▶ Centralized, real-time data management foundation
 - Organization-wide system and meter monitoring
 - View, trend, report and send notifications
- ▶ Utility accounting and cost allocation
- ▶ Energy project (RCx) tracking
- ▶ Predictive asset analytics
 - Early warning, identification and analysis of asset health and performance problems
- ▶ Energy Dashboard
 - Real-time energy awareness
- ▶ All of the above fully integrated!

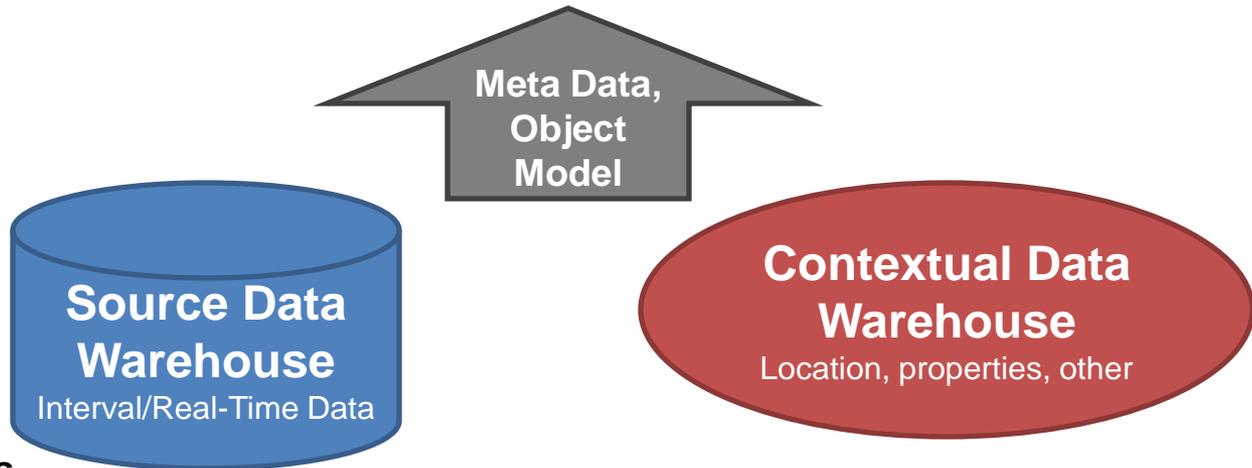
Data Management Foundation

Information Seekers:

Corporate, Operations, Maintenance, Analysts, Students/Faculty, Public/Government

Utility Billing, Analytics, Sustainability and Energy Management Solutions

Enterprise Information



Data Sources

District Energy

Electricity
Water
Heating/Cooling
Gas, etc.

Building

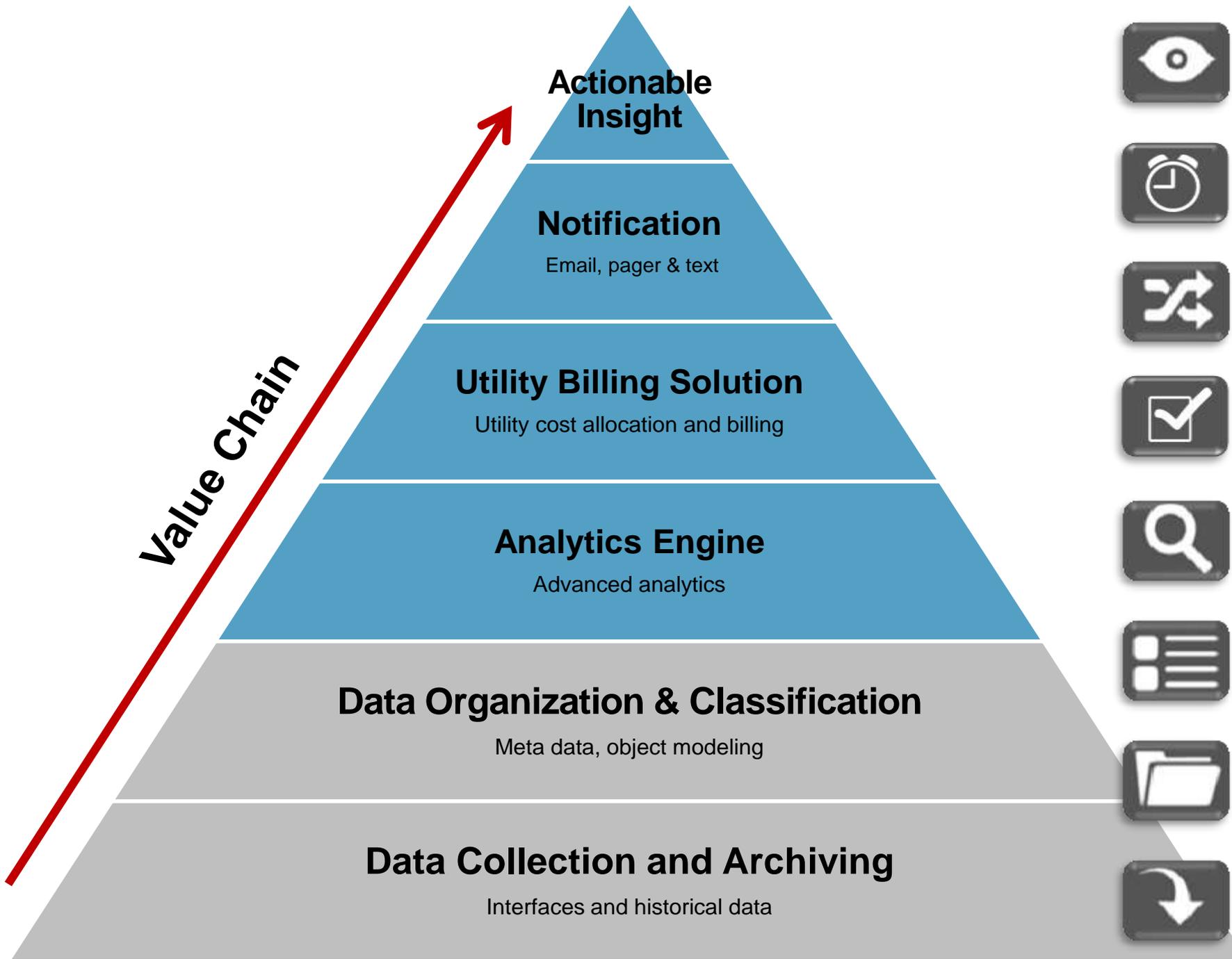
HVAC

Campus

Meters

Substations

Electric
Water Pumping
Gas Compressor



University of Arizona



- ▶ UA is a leader in sustainability
- ▶ Earned a gold star rating from the Association for the Advancement of Sustainability in Higher Education
- ▶ UA utilizes eDNA data historian for centralized data management for utility meters throughout campus
- ▶ The UA Energy Dashboard tracks utility consumption and Carbon Dioxide emissions at the University of Arizona and makes the data available to students
- ▶ EBS is used by UA to streamline the process of utility metering, billing and reporting
- ▶ Predictive analytics software used to monitor health and performance of equipment

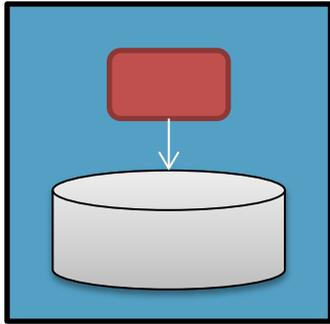


University of Arizona's Journey

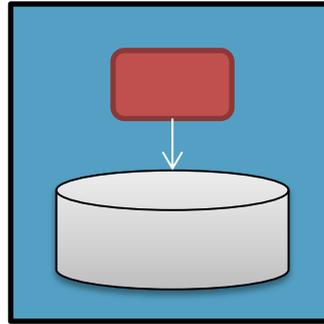


- ▶ First metering was installed in 2000
 - Over 700 (including chilled water, condensate, domestic water and electric)
 - All of the data was stored in Microsoft Access
- ▶ Realized the need for a centralized, real-time data management warehouse
- ▶ Major improvement in 2008, installed data historian
 - Modbus to BACNET IP Gateway
- ▶ Three years later added on an energy dashboard, followed by utility billing solution and predictive asset analytics software
- ▶ 2013 built custom application using historian API
- ▶ Future holds further integration and ... ?

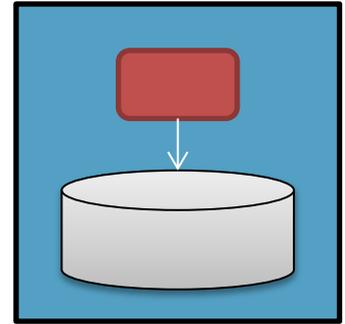
Before Data Warehouse



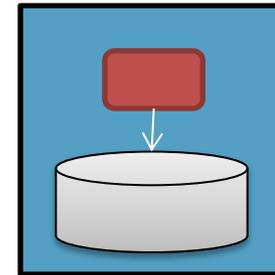
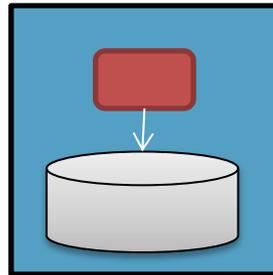
Central
Plant



Boiler Controls

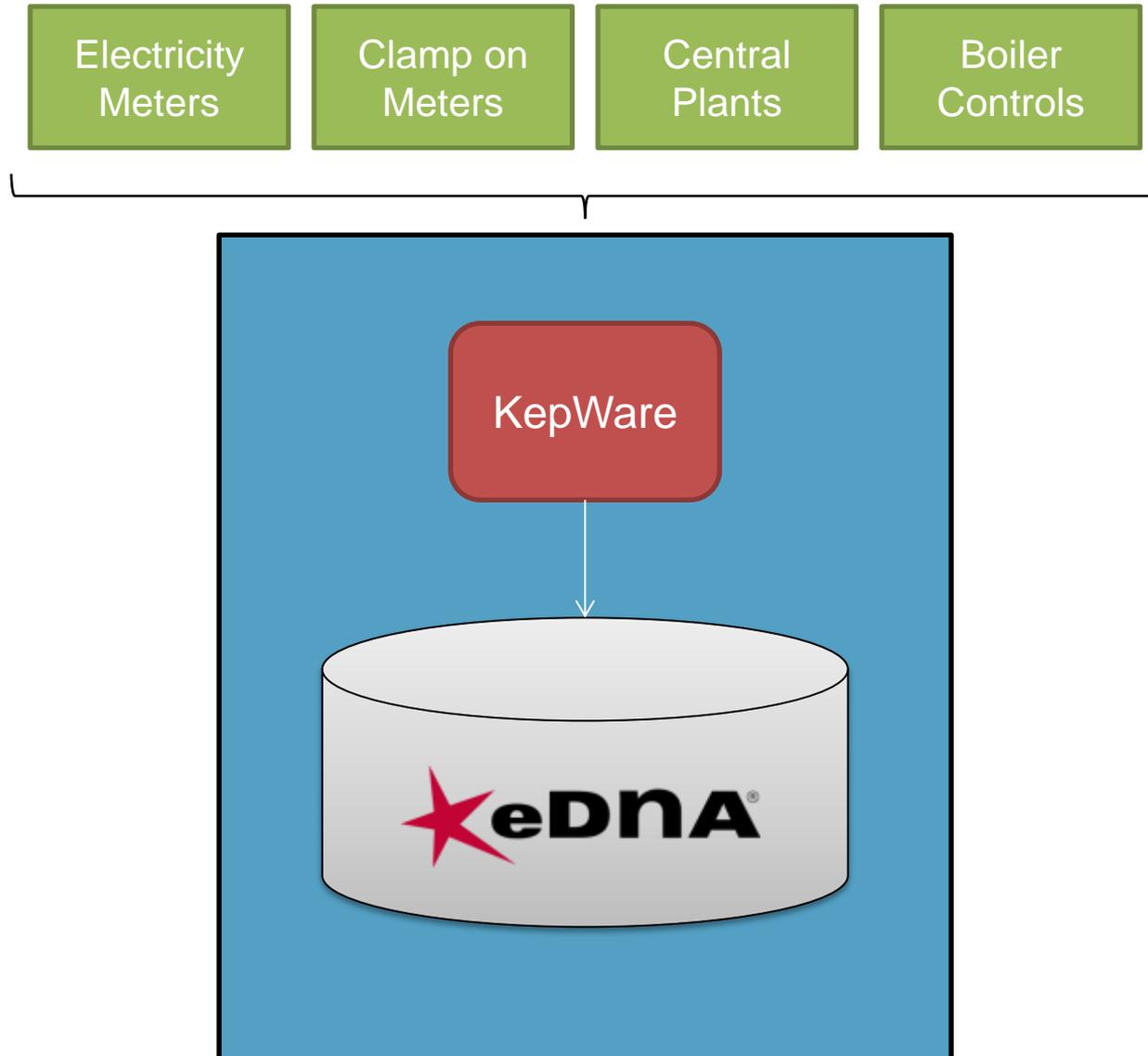


Existing Electrical
Meters and Various
Clamp on Meters



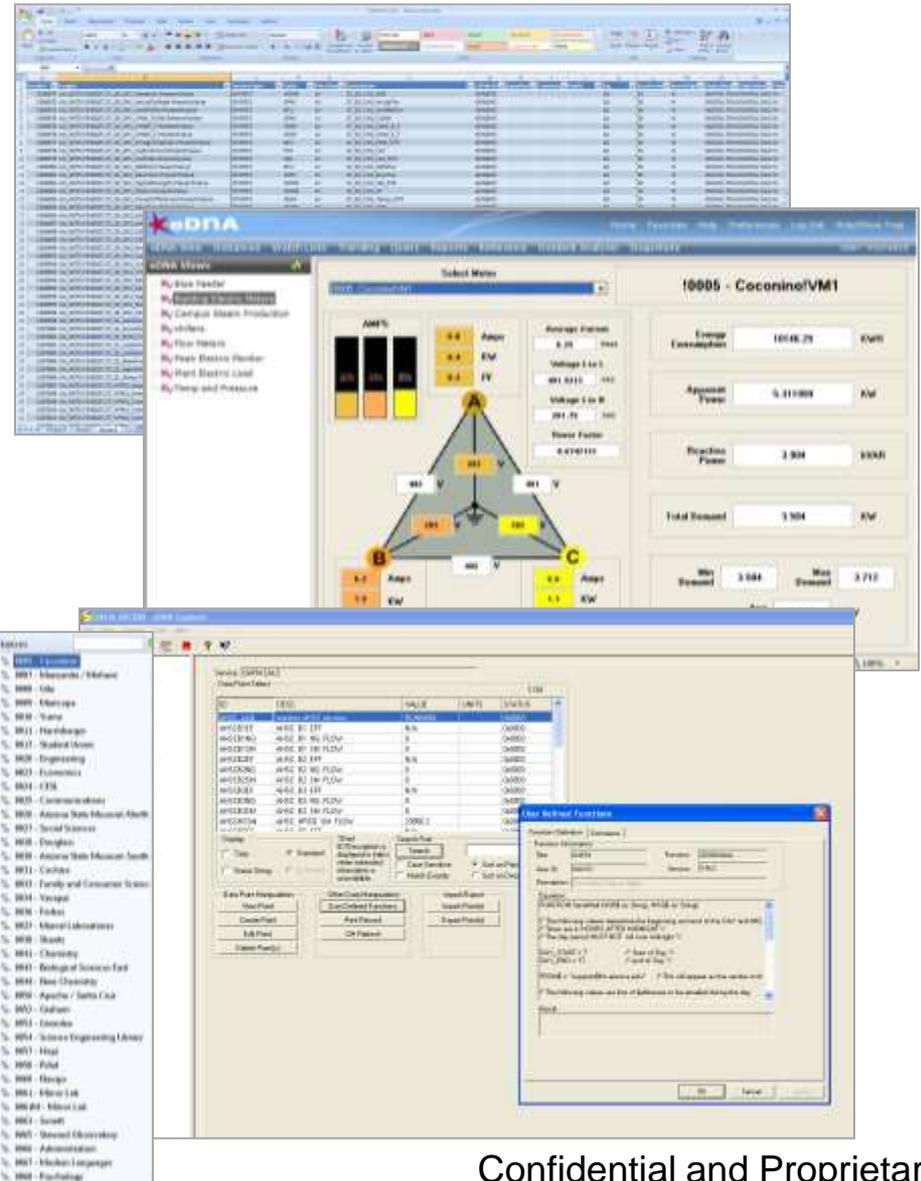
Information managed in silos. No centralized or unified data management

Data Warehouse Implementation



Process Improvements

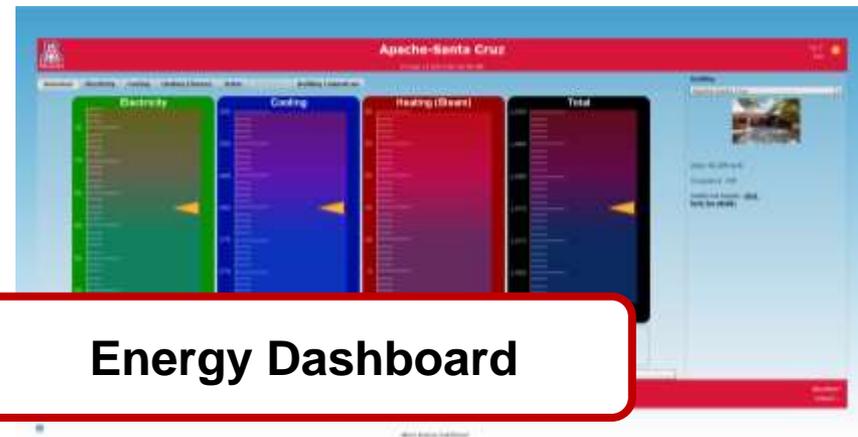
- ▶ Using templates and macros to speed data entry
- ▶ Development of View display screens
- ▶ Alarming and notification
- ▶ Complete review of all points in historian
- ▶ Developed a future metering vision
- ▶ Inclusion of meter diagnostics
- ▶ Increased plant equipment metering
- ▶ CHaD - Hierarchy



Further EEM Expansion

Building ID	Name	Address	City	Zip	Current Usage	Bill	Level	Alarm	Flow	Rate	Unit
0000	WILLOWDALE MEDICAL	1780 E 1ST	Tucson	85719	719		00	00	00	00	00
0000	WILLOWDALE MEDICAL	1780 E 1ST	Tucson	85719	86		00	00	00	00	00
0000	WILLOWDALE MEDICAL	1780 E 1ST	Tucson	85719	430		00	00	00	00	00
0000	VALLEYVIEW MOB. SER.	3700 S UNIV.	Tucson	85724	0		00	00	00	00	00
0000	WELLS Bldg	1000 S UNIV.	Tucson	85724	12710	0000	00	00	00	00	00
0000	WELLS Bldg	1000 S UNIV.	Tucson	85724	0		00	00	00	00	00
0000	West Optical Center	500 S UNIV.	Tucson	85724	0		00	00	00	00	00
0000	WILSON COMMUN.	500 S UNIV.	Tucson	85724	0004		00	00	00	00	00
0000	CAMPUS HEALTH	500 S UNIV.	Tucson	85724	0		00	00	00	00	00
0000	SPC DISABILITY REGION	500 S UNIV.	Tucson	85724	0		00	00	00	00	00
0000	MOBILE CENTER	100 S UNIV.	Tucson	85724	0001	0000	00	00	00	00	00
0000	WELLS Bldg	1000 S UNIV.	Tucson	85724	0000		00	00	00	00	00

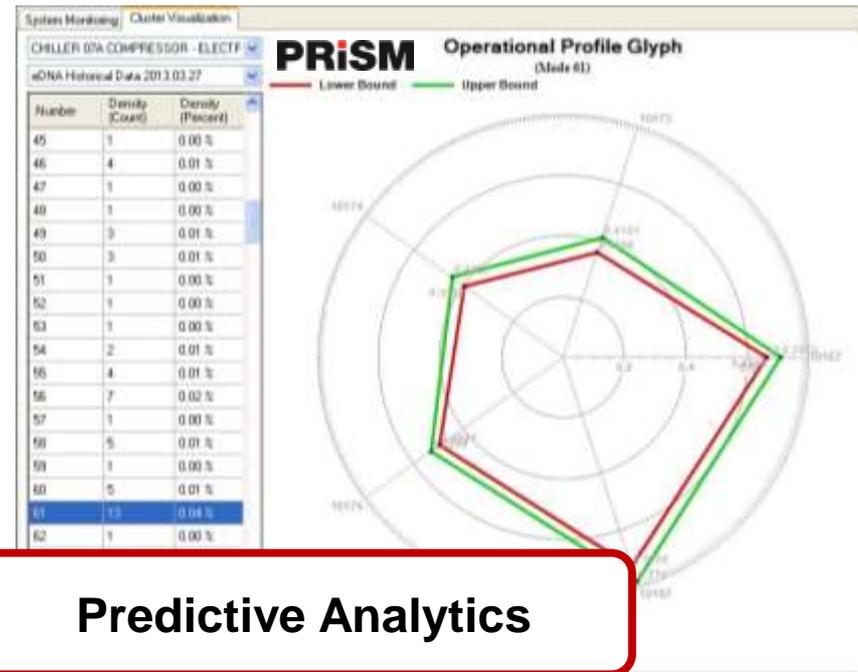
Utility Metering, Billing and Reporting



Energy Dashboard

Year	Month	Electric (MMWh)	Heating (MMBTU)	Cooling (MMBTU)
2013	Year to Date	94,717.35	381,263.83	825,287.41
	Month Usage (August)	5,338.58	17,808.55	101,843.54
2012	Year to Date	90,875.08	401,365.08	901,875.01
	Month Usage (August)	14,177.80	33,432.00	166,708.00

Custom Built Applications



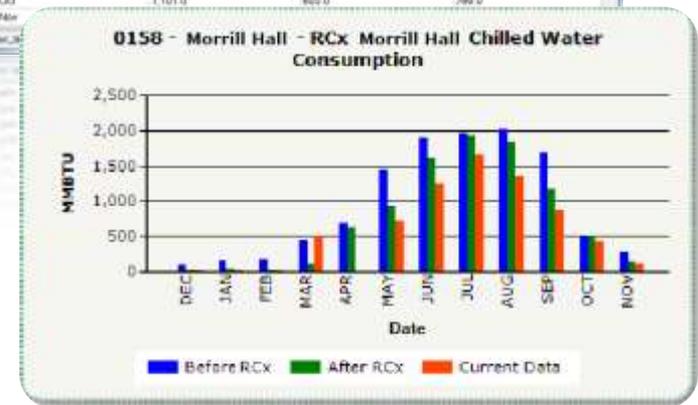
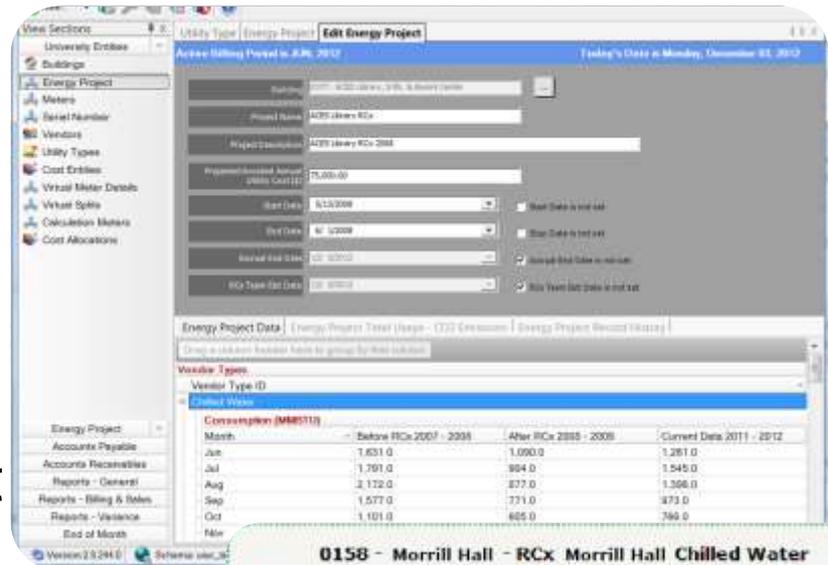
Predictive Analytics

UA Lessons Learned

- ▶ Get buy in from all parties
- ▶ Take it step-by-step
 - Start with the data management foundation
 - Once complete, evaluate logical next step
- ▶ Centralized data management is key
- ▶ Choose a scalable solution that integrates with existing equipment
- ▶ Select a vendor that will help manage the process from end-to-end
 - Including implementation, training, support and the option of future consulting services

Plus...Energy Project Tracking

- ▶ Track energy consumption and cost savings achieved in energy efficiency upgrades or Retro-Commissioning (RCx)
- ▶ Allow users to track efforts and determine if the project was a valuable investment
- ▶ Provide web-based access to increase project awareness



Enterprise Energy Mgmt. Benefits



Strategic

(energy conservation and better maintenance planning)



Financial

(utility billing management; reduce energy, operational and maintenance costs)



Operational

(reduce downtime, increase asset utilization, improve efficiency)



Awareness

(generate awareness of campus sustainability and energy initiatives)



Facility Management

(decision support, less-time analyzing and more time acting, mobile solutions)



IT

(centralized data management, real-time and predictive insights)

4 Best Practices in EEM

- ▶ 1. Establish a Baseline
 - Use historical data to understand how you are currently performing (gas, elec., water and carbon emissions by building, dorm, campus, etc.)
- ▶ 2. Set Achievable Goals
 - Based on past performance, what is a reasonable goal? Build models and monitor performance against previously achieved norms
- ▶ 3. Take Care of “Low Hanging Fruit”
 - To gain traction and maximize internal support around sustainability initiatives, start with projects that enable quick improvements
- ▶ 4. Target Equipment with Compelling ROI
 - After tackling the low hanging fruit, use EEM data to identify the biggest energy offending equipment and tackle upgrades, replacements and/or repairs where necessary



Questions or Comments?

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