GREENER U

Metering– Output Management

Technical Roundtable on Metering

November 17th, 2015

Presentation Overview:

Data is the driver
Justifying Metering
Goals for Energy Metering
Output Management
Managing and Viewing Data
Analytics
Issues Faced
Meter Health Monitoring and Recommissioning

About GreenerU

- GreenerU is an energy efficiency and sustainability solutions company focused exclusively on higher education. We collaborate with our customers to design, build and optimize energy and engagement challenges

company that collaborates

Simple

Heating

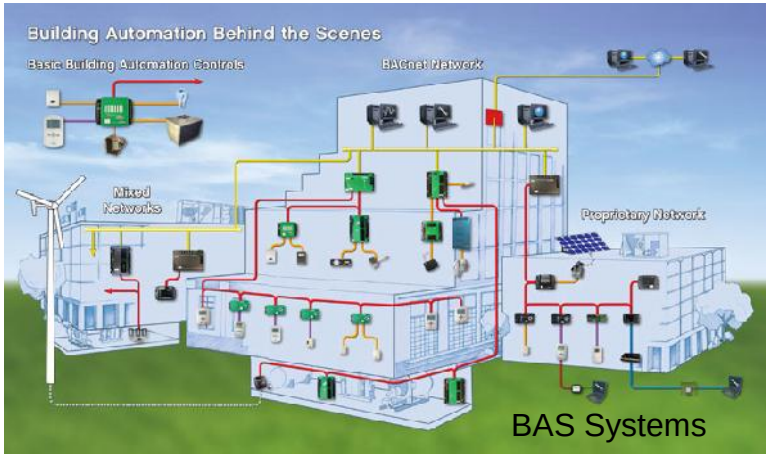
Ventilation

Temperature Control

More complicated… and more comfortable

Chilling

Air Conditioning



BAS Systems

Data is the Driver

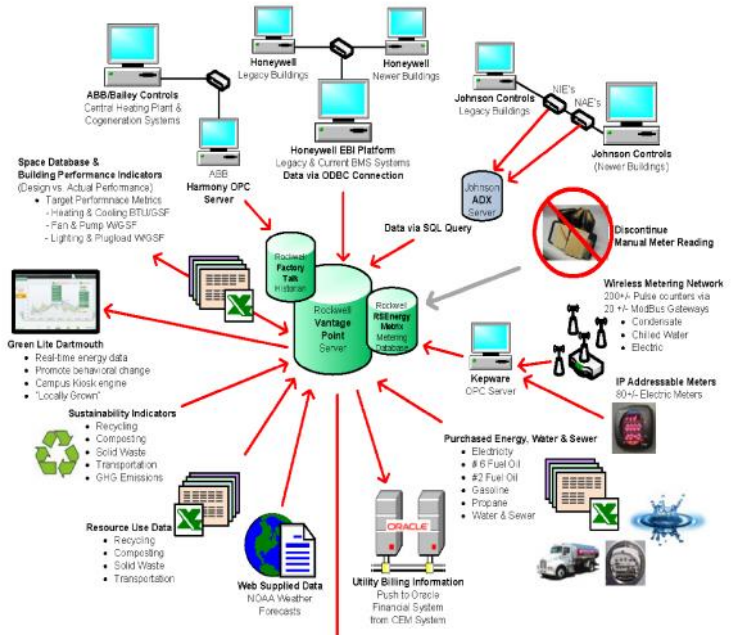
- We now have access to data… *lots of it!*
  - Building automation system data
  - Utility data
  - Metering data
  - Equipment/asset data
  - IP/web connected automation systems and smart devices
  - Standard protocols
  - Standard data formats

Hidden in this data are the keys to better building performance

- How can we turn the data into useful information?

Integration is getting more complicated

- Utility Data
- BMS
- Dashboards
- Analytics



Network map Courtesy Dartmouth College

Justifying Metering

Justifying the Cost of a Metering System

Not every facility warrants a metering system, and a simple way to cost-justify a utility meter was developed by the U.S. Department of Energy:

$$\frac{\left[\left(\frac{\text{Installed Cost}}{\text{Desired Simple Payback}}\right) + \text{Annual Cost}\right]}{\text{\% Annual Savings}} = \text{Minimum Annual Electric Bill}$$

where

Installed Cost is the total cost to purchase, install and commission the meter.

Desired Simple Payback represents the number of years it will take the metering system to produce the cost savings equal to the installed cost. In the federal sector, the simple payback period should be 10 years or less.

Annual Cost is the total annual cost of the fees and expenses to cover communications, data collection and storage, data analysis, as well as meter operations and maintenance.

Percent Annual Savings is the estimated cost savings benefits to be realized from the productive use of the metered data (typically a minimum of 2%).

Action	Observed Savings
Installation of Meters	**0% to 2%** The Hawthorne Effect
Bill Allocation Only	**2.5% to 5%** Improved Occupant Awareness
Building Tune-Up And Load Management	**5% to 15%** Improved Awareness, Identification of Simple Operations and Maintenance Improvements and Managing Demand Loads Per Electric Rate Schedules
Ongoing Commissioning	**15% to 45%** Improved Awareness, Ongoing Identification of Simple Operations and Maintenance Improvements and Continuing Management Attention

Table 1: Expected energy savings from utility metering.

Estimates of savings have ranged from 1% to 20%. The low-end savings of 0% to 2% is generally attributes to “The Hawthorne Effect” a phenomenon whereby individual behaviors may be altered as a result of individuals knowing that there are being studied. These savings quickly erode if occupants realize that the meter data is not being used. To maximize energy savings, the meter data must be used to drive action.

Courtesy of AHSRAE Article Published April 2011 by Jim Plourde

Data Acquisition And Monitoring Plan

- Think strategically
- Have a data acquisition and monitoring plan

Goals for Energy Metering

- Controlling energy consumption / costs
- Improve equipment use / reliability
- Occupant awareness

What are you going to do with this data?

- Why do you need metering?
  - Tennant Billing
  - Student Engagement
  - Measuring Impact
  - I don't know…
- What do you do with all this information?
  - Manage client billing
  - Dashboards
  - Student competition
- Who manages this data?
  - BAS Shop
  - HVAC Techs
  - Energy manager
  - Sustainability Office
  - Students
  - No one
- How do you currently collect and view this data?
  - Dashboard
  - Spreadsheet
  - Other software
  - My meters are not working

Having standards is important

SECTION 26 09 01 – CAMPUS CENTRAL METERING SYSTEM DESIGN CRITERIA

PART 1 - GENERAL

1.1 SUMMARY:

A. This section details the general requirements for metering of building electrical, standby power, Chilled water, Hot water (Medium temperature and High Temperature) and natural gas services, and related metering system accessories.

1.2 RELATED SECTIONS

A. Section 01301- Design Guidelines for Energy and Environment

B. Section 01771 - Contract Record Documents

C. Section 260010 – Electrical Design Criteria

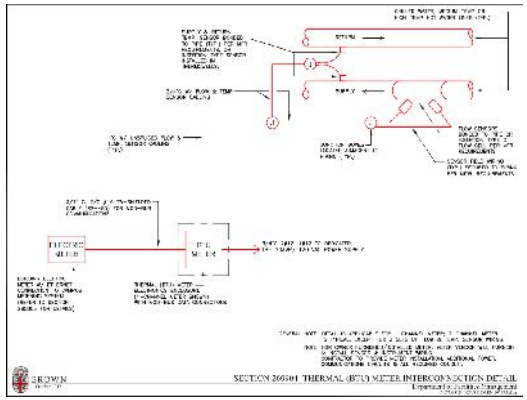
1.3 GENERAL:

A. Electrical consumption and usage data for buildings connected to the Brown campus electrical distribution systems, as well as other selected buildings, is monitored by a Siemens-brand, web-based campus metering system. This system is generally comprised of individual building meters and submeters, which are interconnected via the campus Ethernet to a central computer server and software. The metering system is presently configured to operate on Siemens "WinPM" supervisory software.

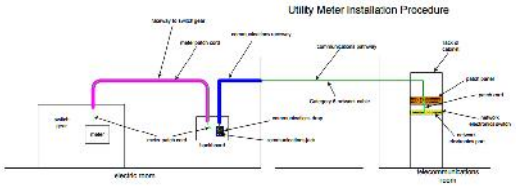
B. High Temperature Hot Water, Medium Temperature Hot Water and district cooling system Chilled Water consumption and usage data for select buildings connected to the campus central heating systems and district chiller systems is also monitored by the campus metering system. This information is provided by thermal (BTU) meters, which includes interval and totalized flow rates and BTU consumption, and instantaneous supply and return water temperature information. This system is separate and distinct from the Johnson Controls and Andover (TAC) building automation and control systems.

C. Natural gas consumption for select buildings is also monitored by the campus metering system.

D. Emergency generators are monitored and supervised by the campus metering system for energy usage and alarm monitoring.

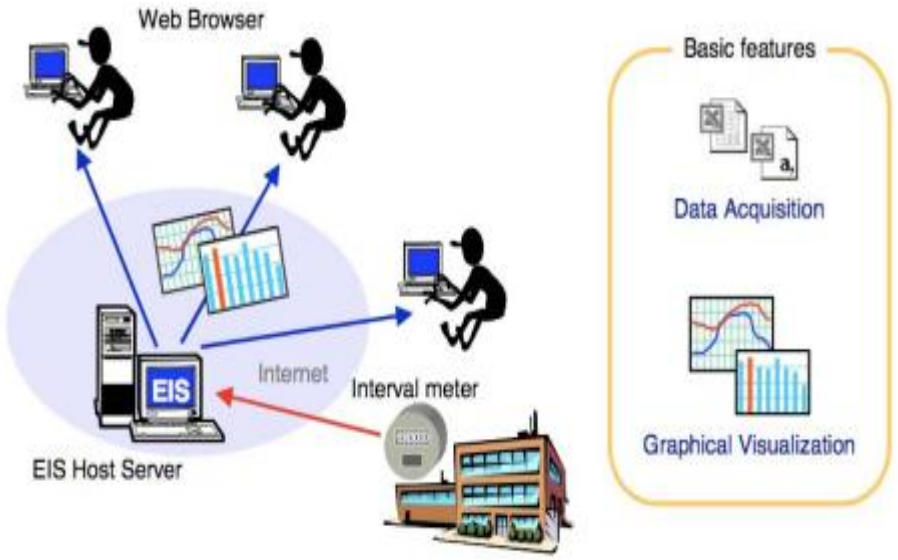


SECTION 26 09 02 – CAMPUS METERING NETWORK CONNECTION CRITERIA



Courtesy : Brown University

Output Management



Types of Outputs

- 4-20 mA, 0-10V or 0-5V
- Pulse Output
- BACnet IP or MS/TP
- Metasys N2
- LON works
- Ethernet / IP
- Modbus TCP/IP

…… And a lot more

- You need to understand before buying your meter – what kind of output is best for you.

Different ways of managing and viewing the data

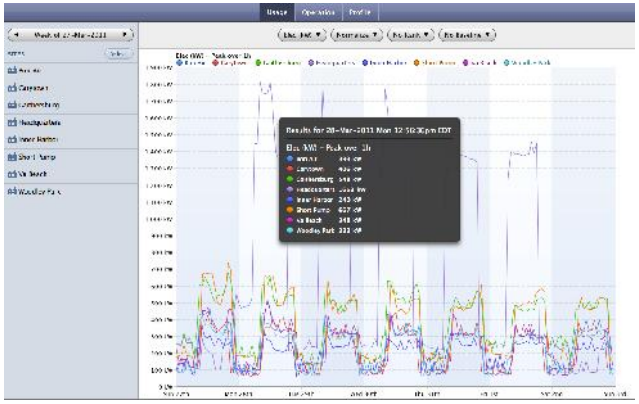
- Robust Enterprise level Energy Management System
- Dashboards
- Building Automation System*
- Analytics

Analytics with Utility Data

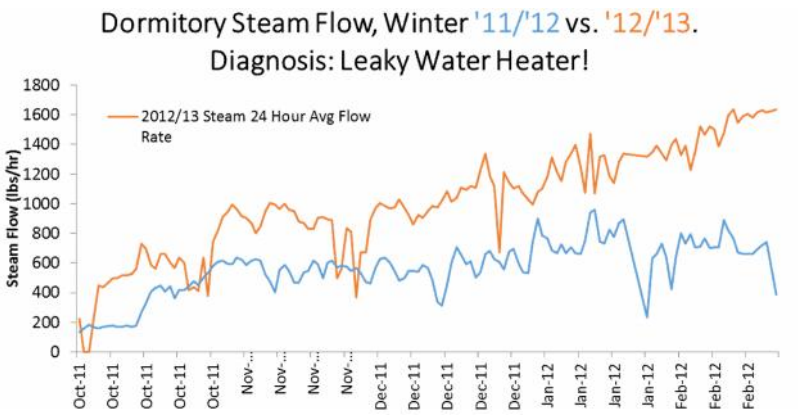
- Weather adjusted comparison
- Set your baseline year
- Key Performance Metrics (KPI)
- Look at Utility data along with Equipment Operations
- Write rules to detect anomalies
- Demand Reduction
- Easy Reporting

Analytics

The Essential Energy Reports in One Simple Tool



Consumption, demand, runtime, rank and exception reports. Normalize by area, degree days and user defined parameters



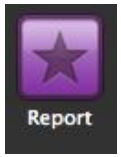
Analytics

KPI Presentation of Key Performance Metrics

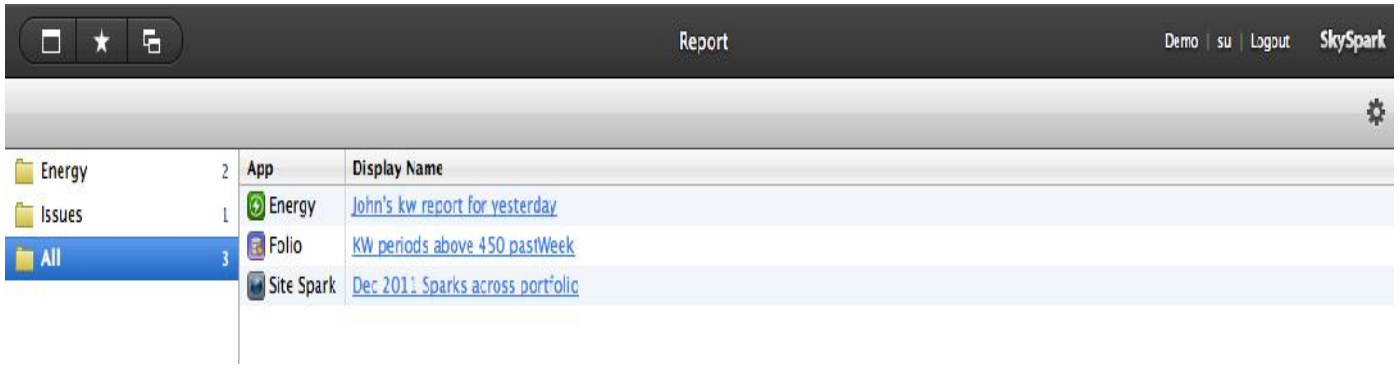
Site	kW	kW Norm	kWh	kWh Norm	Spark Cost	Sparks Count	watts/sq ft
Carytown	75 346	0.001 0.005	3k	0.041	$0	1	23.8 110
Gaithersburg	88 493	0.001 0.003	4k	0.024	$0	4	11 61.5
Headquarters	196 659	0 0	7k	0.002	$0	0	1.392 4.68
Short Pump	139 543	0 0.002	5k	0.014	$24	1	8.118 31.7
Woodley Park	49 285	0 0.002	2k	0.015	$0	0	6.906 40.2

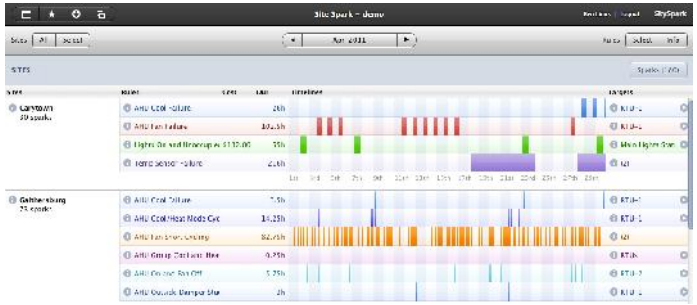
You can define virtually any KPI you want to display

Analytics



Reports– should be a one click operation

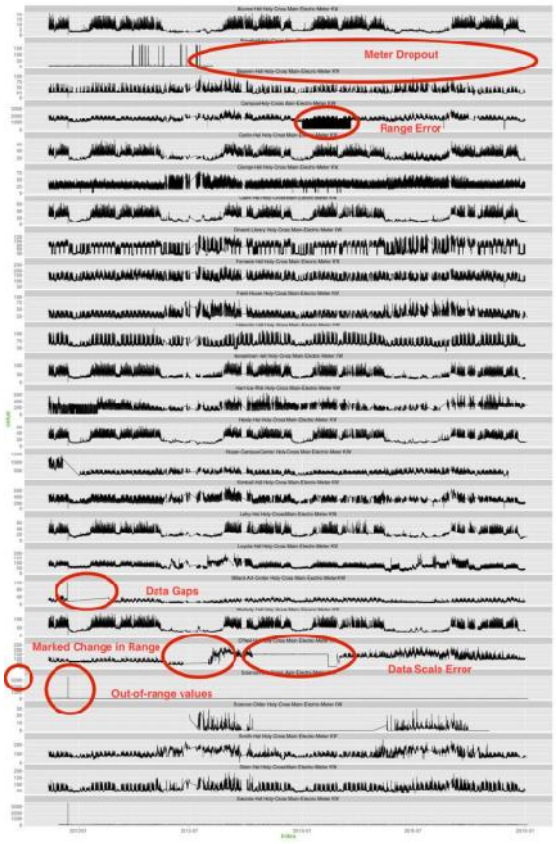




Issues faced

- Communication
- Verification of data
- Units of measure
- Scaling
- Commissioning
- Proper Documentation
- Accountability

Energy Management Tools: Meter Health Monitoring & Recommissioning



Meter Inspector Tool

- Monthly Utility Billing
- Ongoing System Changes and Additions
- Assess meter health and data integrity
- Preventive Maintenance

Summary - Value Proposition

- You can't manage what you don't measure
- Driving energy efficiency and cost reduction through data is proven
- Analytics enables you to know how your buildings and systems are actually operating
- Validate against industry benchmarks and internal goals
- Savings can be in the range of 2 – 20%
- You most likely have already made the investment to get the data
- *Its time to generate value from it!*

Q&A

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Thank You

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