You can’t manage what you can’t measure...

Michael Rochman, SPURR
Valerie Houchin, CEM, CDSM, Schneider Electric
Doug Cope, Schneider Electric

• How do you view your campuses’ energy?

<table>
<thead>
<tr>
<th>Delivery charges</th>
<th>706 kV x $12.00/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>On peak</td>
<td>$8,703.36</td>
</tr>
<tr>
<td>Off peak</td>
<td>$7,366.23</td>
</tr>
</tbody>
</table>

• Details of your new charges (continued)

<table>
<thead>
<tr>
<th>Other charges per meter Generator Engineer Supplies</th>
<th>$31.61</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct and responsibility surcharge (C) D0 C0 C11 C02 C03 C04</td>
<td>$115,823.22</td>
</tr>
<tr>
<td>C12</td>
<td>$198,978.70</td>
</tr>
<tr>
<td>C13</td>
<td>$158,378.15</td>
</tr>
</tbody>
</table>

Your overall charges include:
- $115,823.22 delivery charges
- $198,978.70 demand charges
- $158,378.15 fixed charges

Additional information:
- Percentage of energy savings by meter: D0 C0 C11 C02 C03 C04 C12 C13
- Summer peak: 18.0 kW
- Winter peak: 11.5 kW
- Summer off peak: 10.5 kW
- Winter off peak: 10.0 kW
- Summer C02 C03 C04 C12 C13
- Winter C02 C03 C04 C12 C13
- Summer C13
- Winter C13

Your overall charges:
- $317,140.07
- $314,882.75
- $298,678.15
- $289,978.60
- $278,978.60
- $258,978.60
- $248,978.60
- $238,978.60

(Continued on next page)
• OR…

<table>
<thead>
<tr>
<th>Experient's Planning</th>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Agenda

• Smart meters
• Sub meters
• Case Studies- what campuses are doing with the data
  - 7 campuses + 1 K-12
• Funding Options
• Lessons learned and advice
• How to get started
Smart Meters Defined

- Installed Only at Existing Utility Meter Sites
- May be Complete Meter Sets or Add-On Module
- Data Delivered Next Day, Not “Real-Time”

Typical Data Intervals
- 15 Minutes for Power
- Daily for Natural Gas

Basic Online Data Access Provided by Utilities

Full Deployment Targets
- PG&E, SCE, SDG&E, SMUD by 2012
- SCG by 2017
- LADWP by ?

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Sub Metering Overview

A meter on the ‘Main’ can point out a savings opportunity:

Range of meters available

Features

Power Reliability

Energy Analysis

Power Quality

Range of meters available

Features

Power Reliability

Energy Analysis

Power Quality

Sub Metering Overview

A meter on the ‘Main’ can point out a savings opportunity:
Sub Metering Overview

A meter on the ‘Main’ can point out a savings opportunity:

But sub meters are needed to identify & fix the problem.
Sub Metering Overview

The more sub meters, the better the resolution….

Sub metering spots the culprit
Agenda

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Stockton USD Pilot Project

- Started with High Performing Facilities
  - Average 88 Energy Star Rating at 10 Sites
  - Better than 88% of Similar Buildings Nationwide
- Once Project Got Rolling, Usage Reductions of
  - 7.6% for Power, and
  - 17.0% for Gas
- Improved to Average 91 Energy Star Rating
- Key Was Buy-In at All Staff Levels
Data for “Technical” Users
Data for “Non-Technical” Users
Palomar College

What was the need?
- Benchmarking building usage
- What is measurable is manageable
- To "fix" w/ minimal disruption
- Sees the value in CX to get systems to work
- Education and training of facility engineers

Overview of Metering Strategy
- 6 new sub meters and 12 sub meters already in place
- Real time meters with access to demand data
- BAS to allow for preventative maintenance, not reactive

Software
- Trending, reporting & monitoring
- Metering software operated by technicians who understand HVAC and control systems– can make changes

How was it funded?
- Public utility funding
- Local funds
- Capital outlay funding
- Rebates and incentive funding
- Training and education through local utility energy centers

How does having this system help them?
- Tool for analyzing ROI for resource allocation
- Using capital dollars to reduce energy costs and consumption
- Allows benchmarking to justify future projects

Lessons Learned and Advice
- Get stakeholders involved (top down and those affected by your projects)
- Bring in IT people early in discussion
- Create an energy awareness on your campus
- Funding is there- you just need to be proactive and get it
Mount SAC Community College

What was the need?
- Wanted to collect data for baseline
- Wants to do retro CX and prove it on paper

Overview of Metering Strategy
- 16 new electric sub meters installed (out of 50+ buildings)
- Would like to expand to include add’l buildings

Software
- Meters not yet set up on network
- Will be “owned” and operated by energy manager

Mount SAC Community College

How was it funded?
- Utility incentives
- College energy savings

How will having this system help them?
- View energy data monthly for anomalies
- Help justifying new projects and proving existing projects
- Wants to set up an ongoing “energy fund” to fund:
  - Deferred maintenance
  - Energy projects

Lessons Learned and Advice
- Bring in IT people early in the discussion
Any questions so far?

College of the Desert

What was the need?
- Knew with increasing sq. ftg., needed to reduce costs
- With ~ 500,000 sq. ft– electric could make an immediate impact

Overview of Metering Strategy
- Started metering when new buildings came on line
- Did others as retrofits
- BTU, Gas, water and electric
- Will tie in future solar project

Software
- Electric data loggers picked up by BAS system
- Viewed in a dashboard software system
- A few users with different needs/ uses
College of the Desert

How was it funded?
- Local bond funds
- Redevelopment funds

How does having this system help them?
- MBCx- on 5 Buildings and Central plant
- Prove energy conservation measures with lighting & HVAC
- Provide information to the COD Green Council

Lessons Learned and Advice
- Just do it.
- Talk to everyone you can.
- Figure out what it is you are trying to do
- Figure out how you need to measure it
- Start small, assess buildings and then figure out how to scale

College of the Canyons

What was the need?
- Meter usage from Cogen plant
- See generation vs. Edison bills

Overview of Metering Strategy
- 3 electric meters at Cogen plants (North and South)
- Real time electric data
- Gas usage- metered at Cogen plant as well

Software
- Cogen software allows users to drill down into specific data
- Cogen software rolls up into campus BAS system for easy viewing
- 1 primary user – viewing software daily
College of the Canyons

How was it funded?
• Bond funded

How does having this system help them?
• Can view real time data
• Allows them to have a well functioning Cogen system for 5 years
• Data feeds into monthly and annual reporting

Lessons Learned and Advice
• A lot of hands-on learning for running Cogen
• Requires dedication, but is worth lowering campus’ costs
• Sees opportunities for additional savings on campus

San Diego State University

What was the need?
• Started in 1991 - electrical infrastructure upgrade
• New breakers came with new electric meters

Overview of Metering Strategy
• 135 meters in place
• Need about 25-30 to be complete
• Would like to expand to include WAGES and add’l buildings
• Meters are part of new construction specifications
• Solar and cogen production is metered as well

Software
• Using same company’s metering software – with upgrades
• Viewed daily by the energy manager on campus
• Separate from BAS system
San Diego State University

How was it funded?
- part of large capital project
- later through new construction

How does having this system help them?
- Looks at power quality issues/harmonics
- Trouble shooting- if motor burns up
- Monthly and annual energy budgeting
- Reports to the Chancellors office

Lessons Learned and Advice
- If using contractors to install, ask them for references of meter installations
- Reuse meters (renovation/construction)
- It has to be somebody’s baby

Cal State Fullerton

What was the need?
- Years ago installed with Enron program
- Started metering auxiliary buildings
- Expanding ever since

Overview of Metering Strategy
- 140 meters (every transformer and multiple feeds)
- Meters the central plant
- All new construction- built into specs

Software
- Metering software overlaid with Enterprise system for billing/modeling
- Energy manager has responsibility
Cal State Fullerton

How was it funded?

• Initially through Enron
• Later through capital projects (new construction)

How does having this system help them?

• Various users: facilities, energy, physics students, engineering program
• Enterprise system for billing to auxiliary services on campus
• Building by building comparison
• Justification of ECMs
• MBCX– used existing metering and BAS system in place

Lessons Learned and Advice

• Get a electrical master plan– follow the plan

CSU San Marcos

What was the need?

• First meter installed in 2007
• Engineering needed better data for a central plant CX project
• Need to bill Auxiliary services

Overview of Metering Strategy

• Try to capture meter data on all buildings
• Adding more meters to complete WAGES data for each building
• Some connected to software, but some are still walk-up meters

Software

• Ties meter data into campus BAS system
• 1 person responsible for running BAS (daily), energy data- monthly
How was it funded?
- Capital funds (new construction)
- Utility funds

How does having this system help them?
- Can see monthly high level which buildings are “OK” and “Not OK”
- Projected vs. actual budget- monthly, annually
- Can see “building drift”– convert to BTU/sq. ft.- may need attention
- Does CX projects- reports of low/no cost measures per building
- Won Best Practice award for MBCx project at Kellogg Library

Lessons Learned
- Maintenance/Facilities– get involved with new construction specs
- Have the installing contractor or person install it as though they were the ones who were going to have to read the meter
- Understand the application of the meter
- Understand meter factor for electrical
- Understand how to read the meter display
- Try to standardize on a common communication protocol

Advice in Getting Started
- Go to the mains– read monthly against the utility bill- catch possible errors
- Choose your perceived highest energy users as your first set of buildings
- Start with metering electric first
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Funding Options

• Consider an MBCX project on a large energy-use building – resulting kWh savings eligible for CCC-IOU incentives

• Capital dollars designated each year

• Bond dollars
  • Build into new construction design & specs.
  • Plan to tie in existing buildings- as many as possible

• As part of a larger energy conservation project using 4217.
Program Incentives for 2010-12
2013-14 Pending CPUC decision…

**Metering and Sub metering can not be funded as a stand alone project**

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>INCENTIVE RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electricity</strong></td>
<td></td>
</tr>
<tr>
<td>Packaged HVAC, HVAC Controls, Motors, Drives</td>
<td>$0.24/kWh</td>
</tr>
<tr>
<td>Lighting, Lighting Controls, Daylighting</td>
<td></td>
</tr>
<tr>
<td>Central Plants, Chiller Retrofits, and other major Energy Efficiency Infrastructure Projects</td>
<td></td>
</tr>
<tr>
<td>Monitor Based Commissioning (MBCx)</td>
<td></td>
</tr>
<tr>
<td>IT Projects</td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td>$1.00/therm</td>
</tr>
<tr>
<td><strong>ALL Gas Measures</strong></td>
<td></td>
</tr>
</tbody>
</table>
Recap: Lessons learned and advice

<table>
<thead>
<tr>
<th>People</th>
<th>Technical</th>
<th>Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Need buy-in from top down</td>
<td>• electrical master plan</td>
<td>• new const. specifications</td>
</tr>
<tr>
<td>• Need IT brought in early</td>
<td>• start with electrical &amp; perceived energy hogs</td>
<td>• get IT/networking plan worked out before install</td>
</tr>
<tr>
<td>• Use as a learning tool</td>
<td>• is meter data fed into BAS or stand alone?</td>
<td>• ask for metering references</td>
</tr>
<tr>
<td>• Sustainability Groups?</td>
<td>• communication protocol</td>
<td>• install as if they were going to read meters</td>
</tr>
<tr>
<td>• User/group access?</td>
<td>• meter capabilities</td>
<td>• reuse meters</td>
</tr>
<tr>
<td>• It’s got to be someone’s baby.</td>
<td>• how to read/meter factor</td>
<td></td>
</tr>
<tr>
<td>• IOUs- get them involved</td>
<td>• software reporting application</td>
<td></td>
</tr>
</tbody>
</table>

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How to get started

• Look at Master Plan or Sustainability Plan- how does metering fit in?
• What goal am I trying to accomplish?
• What do I need to measure?
• Contact resources to get started
• Start small, but DO SOMETHING!

Questions and Comments from the Audience
Contact information:

Michael Rochman, Managing Director
School Project for Utility Rate Reduction (SPURR)
925-609-1140 [direct]
ManagingDirector@spurr.org
www.spurr.org

Valerie Houchin, CEM, CDSM
Schneider Electric
858-349-2546
valerie.houchin@schneider-electric.com
www.schneider-electric.com

Doug Cope
Schneider Electric
661-904-0938
doug.cope@schneider-electric.com
www.schneider-electric.com

Who is SPURR?

- Joint Powers Authority
- Founded: 1989
- Members: K-12 Districts, County Offices of Ed, Community Colleges
- Members: 200++ Districts
- Board of Directors: K-14 Administrators
- Program Participants: Members and Non-Member Agencies
- Goal: Buying Together, to Buy Better
Schneider Electric: making your campus smarter

- Sustainability reporting and kiosks
- Energy & water efficiency reporting
- Renewable energy solutions
- Electric Vehicle charging
- Data Center efficiency
- Critical power & cooling
- HVAC and central plant upgrades
- Lighting & lighting controls
- Building automation / CX
- Sub Metering and reporting software
- Access control
- Video surveillance