“Energy Management Solutions”

Electrical Sub-metering Strategies for Energy Efficiency and Cost Reduction

by

John Stratford - Measurlogic Inc.
Outline

- Measurlogic overview
- Sub-metering
  - Reasons to sub-meter
  - Who needs to sub-meter
  - What & Where to sub-meter
  - Installation considerations
  - Key features of a electrical sub-meter
- Visualization of the data
- Power Quality – its impact on costs
Measurlogic Overview

- Based in **Centennial, Colorado** - where the **DTS product family of AC and DC electrical sub-meters** are manufactured and supported.

- **Complies with “Buy American Requirement”** of the American Recovery & Reinvestment Act (ARRA).

- Have been in the US market for **over 12 years**

- Over 30 years of experience in electrical measurement and its associated markets
Utility Charges

- Utility Costs:
  - Continue to rise
  - Used to be an overhead expense now an operating cost

- Utility Bill:
  - kWh charge
  - Demand charge (15 minute data)
  - Time of use tariffs
  - Power factor performance / penalty
What is a Sub-meter

YOU CAN’T CONTROL / MANAGE / REDUCE UNTIL YOU CAN MEASURE !!

A “SUB-METER” is any measuring device deployed inside a facility to provide data from one or more measuring points.
Cost reduction strategies

- **Billing**
  - Revenue grade bills to tenants, common space and other utilities

- **Cost Allocation**
  - Divide energy bill per area, cost center, line or even an individual piece of plant

- **Measurement and Verification**
  - Track savings after installation of energy savings solution / initiative
  - LEED requirements
  - “Shadow” utility meter to see real-time data rather than after the fact utility bill
Cost reduction strategies - cont

- Demand side management
  - Reduce demand charges
  - Identify load peaks
  - Optimize use of electrical tariffs

- Net metering
  - Renewable resources (wind or solar)
  - Identify the utility credit for power returned to the grid

- Aggregation
  - Negotiating of lower power rates based on volume in a deregulated market
Who can benefit?

- **Owner Occupied Properties/ Facilities**
  - Integration into BMS/EMS or SCADA
    - Detailed Energy accountability
    - Process optimization
    - Load control and shedding
  - Cost allocation
    - Departmental
    - Process
    - Production line
  - Energy Conservation
    - Base lining
    - Identify “low-hanging” energy savings opportunities
    - Ongoing analysis of existing Energy Initiatives
  - LEED Points – credits
    - Measurement & Verification
Who can benefit?

- **Property Management**
  - Integration into BMS
  - Cost allocation
  - Tenant Billing
  - Common Area management
  - Equipment Monitoring
  - Preventative maintenance strategy
  - After Hours Energy usage
  - “Green” Building Initiatives
  - Measurement & Verification
  - Confirm performance of similar building types in portfolio
Who can benefit?

- **Educational Institutions**
  - Integration into BMS/EMS
    - Detailed Energy accountability
    - Load control and shedding
  - Building Monitoring
    - Departmental
    - Special Events
    - Student housing / dormitories
- **State/ Local Government**
  - State Policies can dictate compliance to “green” building standards in order to get funding
- **LEED Points - credits**
- **Education**
  - Todays kids are tomorrows’ green advocates
Who can benefit?

- **Healthcare Facilities**
  - 24/7 operation with unique requirements on power delivery and consumption
  - > $5.3 billion annual energy bill for this sector
  - Uses 2.7x more energy than typical office building

- “Green” Building Initiatives
  - Cost allocation
  - Energy conservation
  - M & V

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What to sub-meter?

- Service Entrance
  - Check meter to the single utility meter
  - Provides real-time data
- Individual Buildings
- Feeder sub-panels
- Process lines
- Departments
- Individual loads
Installation Considerations

➢ Where?
  ➢ Existing control cabinet
  ➢ Stand-alone surface mount enclosure
    ➢ Indoor
    ➢ Outdoor
Installation Considerations

- **Current Transformers - Type**
  - Solid core – new installations
  - Split Core – retro fit applications
  - Flexible RopeCTs – large bundles

- **Current Transformers - Output**
  - 5A – traditional utility style output
  - “Safe” millivolt output

- Keep distance between CT and DTS meters as short as possible
- Secondary wires should be twisted and run in separate conduit
Communication Considerations

- Pulse output for kWh
- Serial communications
  - Modbus
  - BACnet
  - LonWorks
- Ethernet Communications
  - Modbus
  - BACnet
  - SNMP
  - DNP3
AC Sub metering – key features

- **“Revenue” Grade**
  - ANSI C12.1 Class 0.5 Energy Meter

- **Flexible Measurement Interface**
  - Must be able to interface with any power system
  - Must be able to interface to 5A, millivolt and flexible RopeCTs

- **Multiple Remote Communications options**
  - Modbus, BACnet, LonWorks & SNMP

- **Various I/O configurations**
  - Allows interface of other utility meters such as water, steam, gas etc.

- **Net metering – renewable applications**
What can you Monitor?

- Utilities
  - electrical energy
  - water
  - gas

- Solar systems
  - AC & DC measurements

- Other
  - Weather data
  - steam

![Graph showing water, gas, energy, and other measurements with cost data.]

Total Facility Operating Cost Since Installation: $1715.68

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Energy - TOU

![Bar chart showing energy consumption over time for different operational hours.](chart.png)

Air Conditioner 1

- Active energy [STANDARD OPERATION Off-Peak Hours] (253.0 kWh)
- Active energy [STANDARD OPERATION Intermediate Hours] (72.1 kWh)
- Active energy [STANDARD OPERATION Peak Hours] (217.2 kWh)

*Month: Mar, 2009*
When, Where & how much?

### Electrical Energy Report

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<th>Meter Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Days in Period</th>
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#### Service Voltage
- **200V**

#### Service Amperage
- **1600A**

#### Cost Per kWh
- **$0.08**

#### Cost Per kW of Demand
- **$9.75**

#### Average Values During Period
- **Voltage:** 210.7 V
- **Current:** 174.52 A
- **Power Factor:** 0.972
- **Power:** 61 kW
- **Daily Energy Use:** 1436.41 kWh

#### Energy Use and Cost During Period
- **Energy Consumed:** 43092.261 kWh, $3447.381
- **Peak Demand:** 100.220 kW, $1065.233
- **Total Cost of Period:** $4502.61
Verify your Savings

Facility Consumption: 20390.8 kWh

Solar Power: 1245.58 kWh

Consumption w/ Solar: 19145.22 kWh

Total Energy Operating Cost Since Installation: $1550

Total Savings From Solar Since Installation: $100.84

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Energy Allocation

- Air Conditioner 1: 4655.67 kWh
- Air Conditioner 2: 4346.78 kWh
- Server Room: 2227.01 kWh
- Workshop: 7485.59 kWh
- Office: 1180.66 kWh
- Storage Facility: 495.51 kWh
- Off-Site Solar Power: 1245.58 kWh

Total Energy Usage: 19145.65 kWh
Total Energy Consumed: 20391.24 kWh
Total Energy Generated: 1245.58 kWh
Educational / Information Kiosks

Customizable Kiosks and/or informational flat screen monitors are ideal ways to inform customers and/or employees of performance targets and energy reduction goals achieved.
Power Quality - Voltage Sags

- **Natural**
  - Lightning
  - Snow storms
  - Line Faults
  - Overgrown Vegetation
  - Flash-overs
  - Animals

- **Artificial**
  - Heavy load switching
  - Internally generated s/c
  - Automatic reclosing
Power Quality

- **Power disturbances (voltage sags)**
  - From the utility side
  - 1 - 30 cycles in duration
  - Processes are now “Digital”
  - Cost the US economy billions in lost productivity annually

- **Harmonics**
  - Caused internally thru non-sinusoidal loads like VFD’s, electronic ballasts, CFLs, PCs etc.
  - Shorten transformer life or cause de-rating
  - Overheat equipment
## Contact Details

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<tr>
<th>Category</th>
<th>Details</th>
</tr>
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<tbody>
<tr>
<td>Toll-free</td>
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