METER AND BUILDING CONTROLS DATA
TO DRIVE OPIs AND KPIs

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METER DATA VERSUS BUILDING CONTROLS DATA

• A **meter** is a device that records utility consumption in intervals usually of an hour or less and communicates that information daily back to a central location for monitoring and billing.

• **Smart meters** enable two-way communication between the meter and the central system.
METER DATA VERSUS BUILDING CONTROLS DATA

• **Building automation** is the automatic centralized control of a building's heating, ventilating, air conditioning, lighting and other systems through a building management system and building automation system (BAS).

• Objectives: improved occupant comfort, efficient operation of building systems, reduction in energy consumption and operating costs, and improved life cycle of utilities.
## OPIs VERSUS KPIs

<table>
<thead>
<tr>
<th>OPI</th>
<th>KPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Performance Indicator</td>
<td>Key Performance Indicator</td>
</tr>
<tr>
<td>Inward facing</td>
<td>Outward or external facing</td>
</tr>
<tr>
<td>More detail and specific</td>
<td>High level generality</td>
</tr>
<tr>
<td>Narrow focus of information</td>
<td>Broad focus of information</td>
</tr>
<tr>
<td>Limited use of information</td>
<td>Extended use of information</td>
</tr>
<tr>
<td>Limited users of information</td>
<td>Extensive users of information</td>
</tr>
</tbody>
</table>
COLLECTING DATA – THE **WHY**

Life Cycle Cost

- **95%**

COLLECTING DATA – THE **HOW**

- **Secure Campus Network**
- **Data Acquisition from BAS and/or Meter Management Platforms (Siemens ALC)**
- **Gateway Server Device**
- **Secure On Campus Connection to Pull Data from Meter Network**
- **Secure Connection to Cloud Based Server**
- **Cloud Based Analytics (Iconics)**
- **Non-Campus Asset with Major Campus Input**
- **Glitz, Glam & Whiz-bang Dashboards and Heat Map**
- **Campus Wide Energy Management and Procurement**
- **Building Level Analysis and Demand Reduction**
- **Prioritization of Reactive Maintenance**
- **Manpower Allocation and Accountability**
COLLECTING DATA – THE \textit{WHERE}

Connecting the energy dots

- PROCUREMENT
- PRODUCTION
- DATA ACQUISITION
- DISTRIBUTION
- DEMAND
- APPORTIONMENT

“Information is not knowledge. Let’s not confuse the two.”
“There is a penalty for ignorance. We are paying through the nose.”
“When we cooperate, everybody wins.”
W. Edwards Deming
**USING DATA – THE **\textbf{WHO}\**

<table>
<thead>
<tr>
<th>Data Utilization</th>
<th>Functional Use</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Management</td>
<td>Campus level functional awareness</td>
<td>KPI</td>
</tr>
<tr>
<td>Physical Facilities Management</td>
<td>Manpower allocation and accountability</td>
<td>OPI</td>
</tr>
<tr>
<td>Energy Procurement</td>
<td>Purchased utilities analytics and budgets</td>
<td>KPI</td>
</tr>
<tr>
<td>Building Level Demand Reduction</td>
<td>Identification of focus areas</td>
<td>OPI</td>
</tr>
<tr>
<td>Staff Level Maintenance</td>
<td>Prioritization and completion of work orders</td>
<td>OPI</td>
</tr>
<tr>
<td>Deferred Maintenance Planning</td>
<td>Repair/replace decision</td>
<td>OPI</td>
</tr>
</tbody>
</table>

*Diverse utilization requires diverse reports, analytics and visualization*
OPI DEVELOPMENT – STEAM CONDENSATE TEMPERATURE

DATA REPORTING

• Key meter data or BAS operating parameters – *steam condensate volume and temperature*
• Establish performance expectations – *Condensate temperature should be less than 150°F*
• Assumption:
  • High steam condensate temperature is an indicator of poorly performing steam consuming assets within a building (traps, heat exchangers, etc.) resulting in inefficient (wasted) steam use

OPERATIONAL PERFORMANCE INDICATORS

• Percent (%) of buildings operating with condensate temperature greater than 150°F?
• Duration that buildings’ condensate temperature has been above 150°F?
• Amount of energy/money wasted or lost?

*Leverage the data available!*
## OPI DATA REPORT – STEAM CONDENSATE TEMPERATURE

<table>
<thead>
<tr>
<th>Meter</th>
<th>Bldg GSF</th>
<th>Gals</th>
<th>Lbs</th>
<th>Lbs/GSF</th>
<th>SC Avg Temp</th>
<th>Days on List</th>
<th>Cumulative $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bldg A</td>
<td>60,490</td>
<td>16,283</td>
<td>132,706</td>
<td>2.19</td>
<td>166°F</td>
<td>1</td>
<td>$21</td>
</tr>
<tr>
<td>Bldg B</td>
<td>77,766</td>
<td>64,918</td>
<td>529,082</td>
<td>6.80</td>
<td>107°F</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bldg C</td>
<td>73,114</td>
<td>351</td>
<td>2,861</td>
<td>0.04</td>
<td>60°F</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Bldg D</td>
<td>243,059</td>
<td>51,988</td>
<td>423,702</td>
<td>1.74</td>
<td>185°F</td>
<td>8</td>
<td>$148</td>
</tr>
</tbody>
</table>

- **<100°F**
- **>150°F**
DATA ANALYTICS: RETURN ON ALLOCATED RESOURCE

Bldg. D: 423,702lbs of condensate
@ 35°F of excess (wasted) heat
= 14.82957 MMBtu
@ Cost of Steam @ $10/MMBtu
= $148.30 LOST OPPORTUNITY

Corrective Cost Assumptions:
Labor Cost @ $30/hr.
Material Cost @ $15 @ 50% of labor
= $45/Hour

Steam Condensate Temperature
→ Direct correlation
→ Simplistic calculation
→ Quantifiable savings

ROAR Breakeven Analysis:
$148.30/$45 = 3.30 Hours
OPI DEVELOPMENT – CHILLED WATER DELTA T

DATA REPORTING

• Key meter data or BAS operating parameters – chilled water delta T, flow, and ton-hrs.
• Establish performance expectations – Delta T should be greater than 10°F.
• Assumption:
  • Low delta T at the building level is an indicator of poorly performing cooling or air conditioning assets within a building (cooling coils, economizers, etc.) resulting in inefficient (wasted) chilled water use.

OPERATIONAL PERFORMANCE INDICATORS

• Percent (%) of buildings operating with a chilled water Delta T of less than 10°F?
• Duration that buildings’ Delta T has been below 10°F?
• Amount of energy/money wasted or lost?

Leverage the data available!
# OPI DATA REPORT – CHILLED WATER DELTA T REPORT

<table>
<thead>
<tr>
<th>CHILLED WATER</th>
<th>Bldg GSF</th>
<th>Weeks Gals</th>
<th>Gals Seasonal Avg.</th>
<th>% Variance</th>
<th>Week's TonHrs</th>
<th>kBTU/GSF</th>
<th>GPM</th>
<th>Supply Temp</th>
<th>Return Temp</th>
<th>Delta T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bldg. B</td>
<td>77,766</td>
<td>63,892</td>
<td>110,019</td>
<td>-42%</td>
<td>494</td>
<td>0.08</td>
<td>6</td>
<td>78</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td>Bldg. D</td>
<td>243,509</td>
<td>1,083,264</td>
<td>800,856</td>
<td>35%</td>
<td>2,507</td>
<td>0.12</td>
<td>254</td>
<td>45</td>
<td>46</td>
<td>1</td>
</tr>
<tr>
<td>Bldg. E</td>
<td>74,482</td>
<td>525,696</td>
<td>548,217</td>
<td>-4%</td>
<td>3,522</td>
<td>0.57</td>
<td>50</td>
<td>45</td>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>Bldg. F</td>
<td>108,000</td>
<td>1,806,656</td>
<td>1,615,969</td>
<td>12%</td>
<td>6,982</td>
<td>0.78</td>
<td>176</td>
<td>45</td>
<td>51</td>
<td>6</td>
</tr>
</tbody>
</table>
DATA ANALYTICS: RETURN ON ALLOCATED RESOURCE

Bldg. F: 6°F Delta T
6,982 Ton-Hrs. with 176 GPM flow
Savings = $502.70 @ $0.072/ton-hr.

Factors to Consider
• Pumping lots of water with ineffective thermal transfer
• Low return temperature impacts chiller performance
• In an office type building with return air and economizer, what requires this amount of cooling… IN JANUARY?

• Actual Root Cause: The building control technician eliminated use of the economizer feature on two (2) large air handler units unless the outside air temperature was below -20 degrees.

Chilled Water Delta T
→ Indirect correlations
→ Complicated calculations
→ Challenging to quantify savings
DATA CORRELATION: RETURN ON ALLOCATED RESOURCE

Bldg. D: 1°F Delta T
2,507 Ton-Hrs. with 254 GPM flow
Savings = $180.50 @ $0.072/ton-hr.

Why Care?
• Pumping lots of water with ineffective thermal transfer
• Low return temperature impacts chiller performance
• Bldg. D condensate temp is high.
• Simultaneous heating and cooling?

Opportunities
• Elimination of simultaneous heating and cooling has combined saving potential of $328.80
• Additional efficiency gains of correcting both problems in the same maintenance trip

Simultaneous Heating and Cooling?
→ Indirect correlations
→ Complicated calculations
→ Challenging to quantify savings
REAL TIME METER MONITORING, ANALYTICS AND VISUALIZATION

PHASE 1: BUILDING LEVEL, CAMPUS-WIDE
- Step A: Implementation of two utilities (steam condensate and chilled water)
- Step B: Add three more utilities (steam, electric and domestic water)
- Step C: Graphical visualization of data for KPI transparency (campus and building EUIs)

PHASE 2: 24/7/365 REAL TIME SITUATIONAL AWARENESS
- Step A: Campus-wide visualization at central plant (steam, chilled water and domestic water)
- Step B: Auto-generated notification process (response team identification and communication)

PHASE 3: BUILDING LEVEL, DISCRETE SYSTEMS
- Step A: Identification and prioritization of critical assets (all inclusive analysis)
- Step B: System (by system) specific parameters and rule development and implementation
RETURN ON RESOURCE ALLOCATION

• Internal Staff Allocation
  • Projected ROI from auto-generated report process = 1.12-2.8 years

• Purchased Utilities Allocation
  • Projected ROI from reduction in energy costs = 0.25-0.50 years
SUMMARY

• Translation: Converting ones and zeros into meaningful investment and action
• Ownership: Functionally-aligned and assigned
• Governance: Roles and rules
• Transparency: Data sharing
THANK YOU

Questions?

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