Ask an FDD Expert

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Introductions

Hannah Kramer

David Landman
Question

What are best practices for tracking issues/flags/sparks from initial identification through resolution and verification? In many EMIS/FDD systems, it is easy to see what issues are there today, last week, year to date, etc. but it is difficult to keep track of all the open issues and if the same thing keeps popping up over time, which could be an identification of a larger issue.

Answer

- Different approaches
- Summary reports from EMIS
- Manual closing of the issue and automatically reflag if it happens again.
- Calculate the savings once
- Use different issue numbers for recurrence but keep it searchable so someone looking at reports can see how many issues or how many passing heating valve issues are for that one AHU.
### Roundtable Q&A Example 1-Summary Reporting

<table>
<thead>
<tr>
<th>Issue Name</th>
<th>Report Comments</th>
<th>Customer Comments</th>
<th>Latest Update Date</th>
<th>Priority</th>
<th>Implemented Percent</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Issue</strong></td>
<td><strong>Description</strong></td>
<td><strong>Details</strong></td>
<td><strong>Date</strong></td>
<td><strong>Rating</strong></td>
<td><strong>Percent</strong></td>
<td><strong>Status</strong></td>
</tr>
<tr>
<td>The Airduct CO2 measurements in multiple spaces are lower than expected (less than ambient CO2) or read 0.</td>
<td>Investigate the CO2 measurements and BAS points.</td>
<td>7/30/20: Michael Knecht will reach out to Airduct 9/29/20. The repair on SST 2 took place this morning, correct CO2 monitoring has been restored [Tom Holgas, Flowtech]</td>
<td>10/01/2020</td>
<td>High</td>
<td>100 %</td>
<td>Closed</td>
</tr>
<tr>
<td>Faulty outside air relative humidity sensor and enthalpy point values.</td>
<td>Inspect the outside air relative humidity sensor and calibrate/repair/replace as necessary. Revisit the BAS point configuration of the outside enthalphy point. Accurate outdoor sensor values are required for sequences of optimization such as economizer control.</td>
<td>7/30/20: Siemens techs &amp; Operators are looking into this</td>
<td>07/30/2020</td>
<td>High</td>
<td>0 %</td>
<td>Updated</td>
</tr>
<tr>
<td>Chilled water return temperature below setpoint.</td>
<td>Inspect temperature control valve and chilled water flow meter. There is a penalty for returning chilled water at temperatures below 59°.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AHU-41 high discharge static pressure setpoint.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AHU-42 low mixed air temperature setpoint and MAT is not maintained at setpoint.</td>
<td></td>
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</tr>
</tbody>
</table>

Source: NE AEE meeting (Cimetrics)
Roundtable Q&A Example 2-Fault-Level Tracking

Source: LBNL (SkyFoundry)
Roundtable Q&A Example 3-Dashboard Tracking

Onboard
- Buildings Connected: 86
- Square Feet Monitored: 9,551,105
- Equipment Monitored: 18,996

Analyze
- Total Identified Avoidable Costs: $852,719
- Average Daily Avoidable Cost by Quarter

Engage

Impact
- Completed Tasks Avoidable Costs To Date: $84,779
- Completed Tasks: 113
- Avoided Electric Use (kWh): 4,292,210
  - With Energy Impact: 34
  - With Maintenance Impact: 98
- Avoided Heating Use (kBTU): 3,379,131
  - With Comfort Impact: 81

Source: Kaiser Permanente
Question
Any case studies or best practices of flagging maintenance needs in FDD software?

Building Analytics Success Stories
- University of Iowa moved from reactive to proactive facility O&M with FDD (Link)
- Emory University reduced hot/cold calls through MBCx (Link)

Answer
- BAS programming
- Physical inspection of dampers/valves
- Some EMIS systems may filter rules based on FDD type
- Some may require manually tagging
Roundtable Q&A

**Question**

Anyone ever pulled vertical transportation systems into FDD analytics to flag issues?

**Answer**

- Monitoring downtime of elevators, escalators, and walkways at an airport
- Used alarm states and operation states to calculate number of hours in “off-state”
Question
We’re having challenges getting our O&M team to embrace FDD. What are some best practices to make this easier?

Answer
▪ Set the right context
▪ Provide more contact
▪ Decide who has ownership of the FDD
▪ Provide people and tools for them to be successful
Team and Process

- Building Facilities Group
  - Implements O&M measures, coordinates with Ownership, EMIS and Controls Vendors

- Controls Vendor
  - Implements building automation system (BAS) programming changes

- EMIS Vendor
  - EMIS Vendor implements FDD modifications and additions

- Changes needs to be coordinated, documented, and updated
Question
Is it beneficial to integrate to work order systems for tracking the fix of faults through work orders, or better to keep tracking within the FDD analytics tool? Any other ways or best practices for workflow?

Answer
▪ Site specific
▪ Who will write the WOs?
  ▪ Internal or EMIS provider?
Roundtable Q&A

Question
Are there good metrics for tracking thermal comfort in an analytics tool such as % of zones thermally satisfied, % of time outside of thermal comfort range, or others?

Answer

Source: Automated Logic
Question
Setting up a campus-wide EMIS system allowed us to finally see our meter data in a way that we could assess, first and foremost, which meters weren't even working or weren't set up right (wrong calibration, wrong gain, wrong units, faulty BAS integration, etc.). What steps must be part of a fail-proof meter connection & commissioning process and what's the right schedule / checklist for ongoing maintenance?

US DOE Metering Best Practices Guide

Answer
- The data is the data
  - Check data for COV
  - Expected range
  - Compare with temporary meters
- Check data on meter turnover. How are you correcting with meter turnovers?
- How are meters working under high and low loads?
  - More relevant to things like steam meters
- If you are expecting a COV and the values are flatlined, is it being flagged?
- Flag unexpected data to investigate
Question
What is our expert's advice on the top five faults that - once identified and addressed - produce most energy savings impact? If our team can only focus on a few things at first, what should they be?

Answer
- The answer everyone wants to know
- Site specific
- Top faults are safety and energy savings
- Campaign results
Faults from EIS data:
- Start/stop schedules
- Weekend/holiday energy use
- High baseload
- Demand spikes
- High energy use relative to portfolio or prior usage (modeled prediction)

Faults from FDD:
- Setpoints
- Simultaneous H&C
- Economizer
- Reset schedules
- Equipment staging/Control loop tuning
Question
When justifying a separate software system for energy/meter data management (e.g. Lucid BuildingOS), what can it do that a BAS (e.g. Automated Logic, Siemens, Johnson) cannot?

Answer
- Top-down approach

Source: Macalester College
### Roundtable Q&A-EIS Displays

<table>
<thead>
<tr>
<th>Sustainability Data Portal</th>
<th>Google</th>
<th>about:blank</th>
<th>about:blank</th>
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</thead>
<tbody>
<tr>
<td><strong>Usage Calendar</strong></td>
<td>Campus-Wide Electricity</td>
<td></td>
<td></td>
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</tbody>
</table>

#### Pattern Analysis
- **Campus Center**
- **Average Day Pattern**
  - Base Consumption: 66 kWh
  - Peak Consumption: 150 kWh
  - Min. Consumption Time: 1 AM – 2 AM
  - Max. Consumption Time: 11 AM – 12 PM

Source: Macalester College
Question
We purchased separate FDD and energy analytics software packages. The energy analytics seem to have taken a back seat to FDD. Any suggestions on how we can integrate the energy analytics review into our FDD review?

Answer
- Energy analytics looks top down
- FDD looks at bottom up systems
- Energy analytics allows you to perform a regression analysis and holistically look at the building.
Roundtable Q&A

Question
We are having network speed issue due to age of our BAS infrastructure. What creative solutions exist to pull data from our system without compromising the network and functionality of the BAS?

Answer
- The number of points
- Frequency of polling
- The key is to address both
Question
We need to decide on renewing with our incumbent provider longer term or again go to market through an RFP.
Do you have any advice/resources on factors we should consider in making our decision? Our plan was to at least look at where the AFDD/ASO market is at now to see if our provider/platform is still providing best in class analytics. I expect the switch cost to be fairly high from an onboarding, training, and adoption standpoint so we want to make sure the incremental improvement in analytics outweighs that cost.

Answer
- Define current EMIS needs
- Do you want to pilot with another EMIS provider?
- Does your current EMIS provider update rules? Added services?
- Are you effectively implementing corrective actions with your current EMIS provider?
- Define current and future needs and how effective your single EMIS provider is at providing that
Question
Rules of thumb for estimating costs savings on every single fault, beyond energy savings. Without the entire financial story, it’s hard to sell the benefits to leadership.

Answer
▪ Rules of thumb are difficult because its based-on size of unit, duration of fault, scale of fault
▪ Every $1 a non-profit healthcare organization saves on energy is equivalent to generating $20 in new revenues for hospitals or $10 for medical offices. (energy star)
Question
Ideal future state organization charts / roles (e.g. FDD expert, IoT Maintenance Specialists, EMIS IT Lead, Remote Operations Center etc)

Answer
- The goals is to use different skills sets to make it all work together, typically an EMIS vendor or internal person, controls programmer, facilities group. In additional IT may be needed periodically with changes to IT infrastructure or security.
Team and Process

- Building Facilities Group
  - Implements O&M measures, coordinates with Ownership, EMIS and Controls Vendors
  - IT group
- Controls Vendor
  - Implements building automation system (BAS) programming changes
- EMIS Vendor
  - EMIS Vendor implements FDD modifications and additions
- Changes needs to be coordinated, documented, and updated
Question
Tips on educating IT on EMIS/BMS to ensure an efficient cyber security process is followed & formalize Facilities/IT relationship

Answer
- Get IT on board early
- Ask security requirements and process
- Confirm with your EMIS provider what protocols they follow.
- [EMIS Specification and Procurement Support Materials](#)
Roundtable Q&A

Question
I have too many flags every day, how do I prioritize?

Answer
- Safety is always number 1
- Energy savings
- Comfort
- It depends on your industry, your business, your building use
Roundtable Q&A-Prioritization

Source: Emory University
Roundtable Q&A Example 3-Dashboard Tracking

Source: Kaiser Permanente
Question
I’m having trouble finding the root cause of [insert issue identified using your EMIS]. How should I go about troubleshooting?

Answer
- Some EMIS will be specific, like a passing heating valve creating simultaneous heating and cooling
- Some units may require physical inspection or a little more BAS work
- Some may be temporarily in override, check with internal personnel to know if a unit was worked on
Question
What else can I use the data for? Industry KPIs like sustainability and comfort?

Answer
- Comfort can be defined by a temperature and RH range in zones. How many of your zones are within this range?

Source: Automated Logic
**Question**

Best practices  
Keys to success

**Answer**

- Key is good data, root cause analysis, reporting, and communication

Building Analytics Success Stories (24 in total) are available [here](#) in the Smart Energy Analytics Toolkit.
Thank you

Questions?

- David Landman (dslandman@lbl.gov)
- Hannah Kramer (hkramer@lbl.gov)

Get involved:

- Building owners, operators, and managers: join the Better Buildings Alliance or contact bba@ee.doe.gov with questions
- To join the EMIS Tech Team list, contact Valerie Nibler (vnibler@lbl.gov)
Proving the Business Case for Building Analytics

Results from scaled implementation of Energy Management and Information Systems, as documented by the Smart Energy Analytics Campaign

BUILDING TECHNOLOGY & URBAN SYSTEMS DIVISION
Lawrence Berkeley National Laboratory

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PREPARED FOR:
Amy Shissler, Center for Building Performance

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EMIS Applications Showcase
Highlighting Applications of Energy Management and Information Systems (EMIS)

BUILDING TECHNOLOGY & URBAN SYSTEMS DIVISION
Lawrence Berkeley National Laboratory

By Eshel Crowe, Hannah Kramer, Jessica Granderson

October 2020

Proving the Business Case for BUILDING ANALYTICS

Lawrence Berkeley National Laboratory has partnered with commercial building owners across the country to gather data on the costs and benefits of Energy Management and Information Systems (EMIS). EMIS are the technologies behind automated data-driven energy management that help identify, diagnose, and implement building systems improvements. Through this partnership, Berkeley Lab has assembled the largest dataset to date on building analytic costs and benefits, proving the business case for their use at scale.
Better Buildings COVID-19 Resource Center

Existing Resources on COVID-19 Mitigation Strategies for Buildings

- ASHRAE Resources
- Market-sector specific resources (healthcare, CRE, Education)
- Technology resources (UV, air filtration, air cleaning)
- Webinars
- Whitepapers/guidance documents

https://betterbuildingssolutioncenter.energy.gov/covid19
Thank you!

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