

Seeing is Believing: Data Visualization and Alert Software Products Combine to Unlock New Value in Energy Data

Summary

Between January and May 2015, McKinstry, a construction, energy, and facility services firm based in Seattle, deployed and evaluated two business intelligence applications for Northshore School District with the goal of reducing energy use by providing enhanced energy data visualizations and creating automated fault alarms. The goal of the deployment was to unlock the value of building energy data (interval meter data) by quickly identifying trends and opportunities and automating the workflow required to capitalize on any identified energy savings opportunities. The project was successfully deployed and immediately demonstrated value to the public school system in the form of better insights into energy use and an improved feedback mechanism to ensure energy waste was identified and resolved in a timely fashion. The technology was deployed as part of the Smart Buildings Center's Accelerated Technology Deployments Program.

EEM Suite has served well as a data warehouse but does not have an easy-to-use interface or highly customizable reporting engine. As a result, many stakeholders—technicians, facility managers, financial analysts, Resource Conservation Managers (RCMs), and others—do not actively engage with relevant energy data as part of their regular routines. The quantity of data received from 34 buildings and more than 50 individual meters sending usage data every 15 minutes can quickly overwhelm custom-built Excel reports.

Past efforts included using other analytical tools that proved too complex, returned far too many false alarms that overwhelmed technicians, and ultimately did not drive the results the District wanted. In short, the District was in need of a solution that could produce verifiable energy and cost savings, reduce business risk, enhance student comfort/productivity, and help achieve the District's sustainability objectives.

Business Challenges: An Easier Way to Find the Needle in the Haystack

Northshore School District (NSD) is a leader in facility operations and energy performance. For many years, NSD has been investing in their infrastructure in an effort to reduce overall operating costs and put more of their operating dollars into the classroom. As part of that effort, they are very focused on creating ideal learning environments by managing their heating and cooling systems for both efficiency and comfort.

A constant challenge for the District has been the management of all of the meter data coming from their facilities. NSD



previously invested in a comprehensive interval meter solution to pull relevant energy data out of their facilities. Meters measure gas and electricity usage in real time at all of NSD's facilities and then reliably transmit and store the data into EEM Suite™, an energy information database hosted by McKinstry, their contracted energy services provider.

Potential Solutions: Clarity through Data Visualization and Smarter Alerts

Through the Smart Building Center's Accelerated Technology Deployments (ATD) program, NSD and McKinstry sought to find and test software solutions that could create simple-to-use, highly

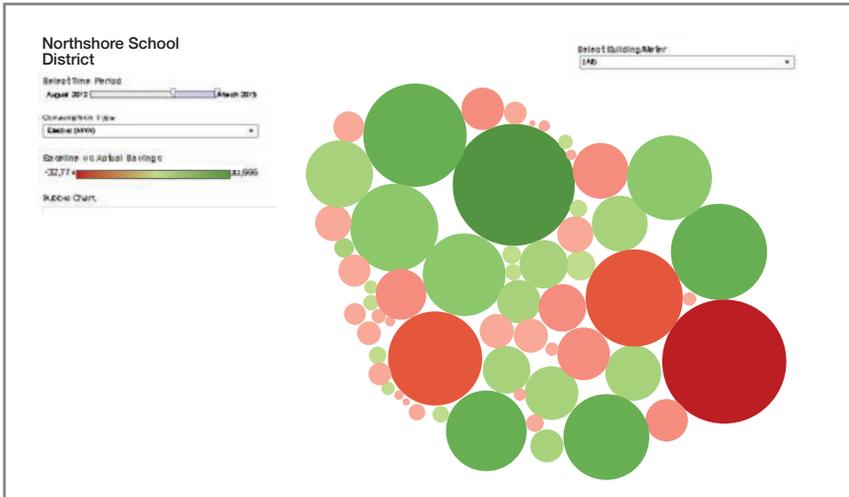
accessible reports, and relevant and timely notifications to make sense of and provide deeper value from the data stored in the EEM Suite. The goal of the test deployments was to see if the solutions could accurately manage the flow of information to the right stakeholders through simple alerts that would drive immediate corrective action.

This ATD project connected two business intelligence software platforms, Tableau

and Metric Insights, to NSD's interval energy data. Tableau is a business intelligence platform that boasts ease of use and connectivity with regard to analyzing very large volumes of data. Tableau describes their software as "helping people see and understand data." Metric Insights is a data analytics software solution that can send notifications to stakeholders based on parameters that can be programmed in an easy-to-use interface. Metric Insights was

designed specifically to work with Tableau. The two platforms are not specific to energy analytics.

The project tested the platforms' ability to improve both the analysis of energy data and workflows that enable action towards improved energy performance. The combination of these two applications was intended to allow energy analysts to quickly make customized reports and set notification rules that alert stakeholders to unexpected usage trends.



The chart on the left is viewable in Metric Insights after it has gathered data from Tableau. Data is shown and calculated for "Occupied" days only and highlights the statistical highs and lows. Users have the ability to make notes about each data point to keep track of operational changes, improvements, or events that are the cause of relevant data.

McKinstry then established a base set of rules in Metric Insights to configure an alert system that flags outlier data and notifies the appropriate contact. The alerts notified McKinstry, and ultimately NSD, of:

- High energy use during occupied and unoccupied periods
- Meter failure
- High electrical usage relative to similar past periods (with data normalized for weather conditions and occupancy)

To assess the results of the software demonstration, McKinstry developed and sent out surveys to seven primary stakeholders responsible for monitoring and managing NSD's energy use. These surveys sought to understand how the new tools impacted current operations and enabled new insights—for example, capturing resource time savings from doing the same task with and without the new software.

Results: Technology Synergy Primes School District to Connect the Dots to Energy Savings

Harness Multiple Data Sources to Discover Opportunities

While Tableau does not highlight energy savings directly, this project demonstrated that it can make navigating large amounts of data easier. At NSD, the full set of data available includes a combination of facility information collected in a third-party application, energy interval data collected and bill data collected in EEM Suite, energy baseline data collected in .csv files, and occupancy data collected in various forms depending on the building. While this project focused only on interval data stored in EEM Suite, Tableau's ease of automatically connecting to other disparate data sources could add additional value to the District over time. For example, combining equipment operational data (maintenance schedules, run-time) to energy interval data

could highlight energy saving project opportunities for the District to pursue.

Visualization and Analytics Together Help See Savings

Beyond highlighting opportunities for operational improvements, a Tableau user can create calculated values that give deeper meaning to the data. For example, an analyst can turn kilowatts of energy saved into dollars and cents by applying rate schedules to energy savings, resulting in better financial forecasting for the district.

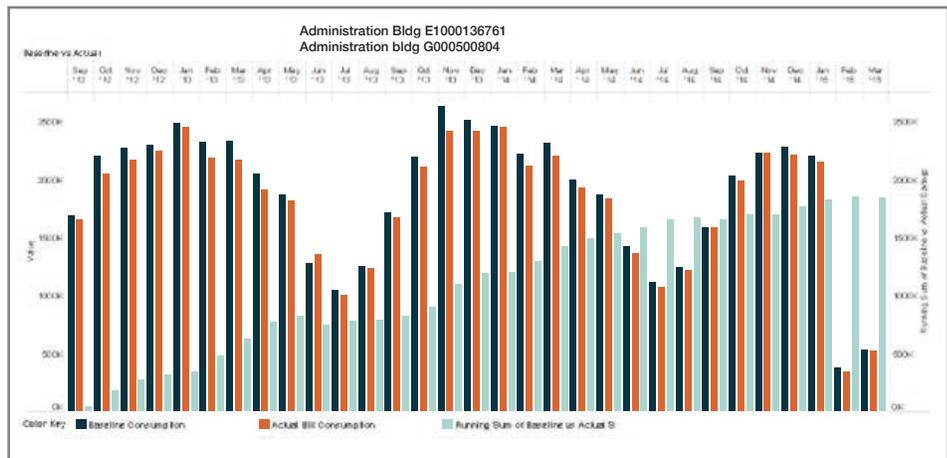
Visualizations can be constructed for long-term comparisons on one or several buildings. When looking at energy savings projects over a large, distributed campus, having simple views that highlight low-performing buildings can help target attention and project funding to the right

places. As NSD is a publicly-funded entity, creating a clear case for capital planning efforts and building public confidence in past project success helps the District bond for future projects.

Targeted Insights Saves Time and Money

In the normal job of an RCM or Energy Analyst working on any project, much of the work is in finding the energy efficiency “needle in the haystack” through a tedious discovery process of trending data over time and manually highlighting outliers. With both Tableau and Metric Insights, RCMs were either able to quickly identify savings opportunities or were alerted to issues that required attention. Deep diving into the data, RCMs were able to target specific buildings and even specific systems that may be primary drivers of performance issues. The RCM could then access targeted systems through the controls system and adjust schedules and set points. This change should lead to significant savings over the course of the year for NSD, with costs to identify and fix the issues much lower than in previous processes.

In the surveys, 100% of respondents indicated that Tableau visualizations helped them save time in analyzing energy data and that they could analyze a portfolio of building utility bill history on average 4.7 hours per faster than in their baseline method of using EEM Suite, saving up to 50 hours per year if performed monthly. The respondents indicated that when looking at energy data they could save up to 5.7 hours per week on average using Tableau versus the baseline methods of using EEM Suite. 86% of respondents also expressed that not only could they save time, they could also find new information they were not necessarily looking for such as unplanned occupancy periods.



Metric Insights connects directly to any Tableau visualization to extract all underlying data and generate alerts that building operators care about.

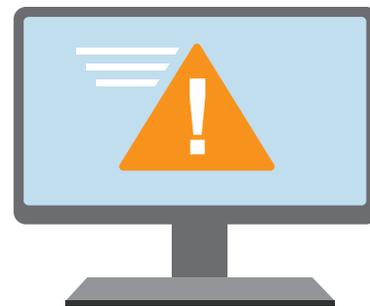
Smarter Alerts Means No More “Crying Wolf”

Metric Insights proved its value almost immediately after being configured when it triggered an alert that signaled that Maywood Hills Elementary experienced higher than expected unoccupied use on the prior day. The RCM who received the alert learned that the school had a science fair the day before—the clear culprit for the higher than expected usage. The facilities team was able to confirm that systems were set back to their normal schedule as soon as the science fair was over, quickly and easily validating that the building baseline energy use would not slip higher as is often experienced over time.

Simply put, Metric Insights allows users to “ask questions” of the data set to drill down to the answers building operators actually need, gleaning actionable insights from their data. These answers offer a simple but powerful method for monitoring energy usage that would normally take a manual effort to pull reports, compare various time periods, compare against weather, and reference school calendars to know whether the building was open for school on a particular day. Additionally, they are highly configurable and scalable—the intention of the project is to continuously improve the alerts based on feedback from those receiving them.

Industry-Neutral Solutions Offer Ease in Setup and Flexibility

The project also successfully demonstrated that sometimes, looking beyond targeted energy specific software can add value. Designed to offer solutions across many industries, flexibility and customization were part of the package with Tableau and Metric Insights. As an example, Metric Insights’ alert notification system was user-friendly to set up and did not require code-writing knowledge or expertise—unusual among most energy-specific alerting tools.



Metric Insights

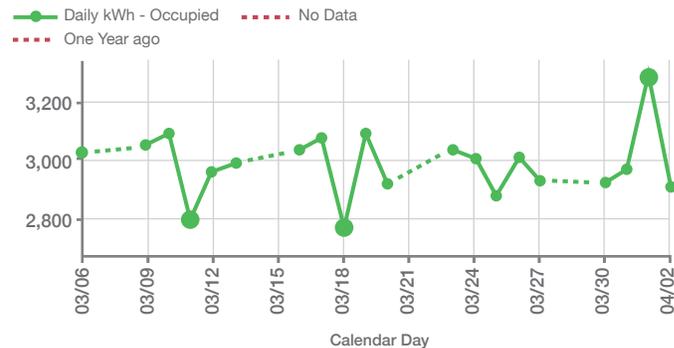
Bad news

Daily kWh - Occupied

Unusual high
3286.25 on Wednesday 04/01/2015

Daily kWh Usage for a Building Metric

Last measured on Thursday 04/02/2015 for 29.115



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An example of an email alert from Metric Insights. In this case, building operators were alerted that a specific school had unexpectedly high daily kWh during the previous weekend. Further investigation determined that this was due to a special event held at the facility.

Conclusion

Overall, the deployment of a custom platform built from Tableau and Metric Insights was a successful test. The two software packages complement one another nicely and met the needs of NSD. Many software applications dedicated to energy management exist in the marketplace; however, none offers the flexibility and customization found with Tableau. Very few pre-built solutions have alert rule and notification capability and even fewer provide a simple-to-use drag-and-drop setup, as opposed to writing complex rules in lines of code.

Leveraging two tools from outside the building energy market proved to be a cost-effective method of managing and acting upon interval meter data. For NSD, improving the accessibility of relevant facility data directly impacts energy use and comfort—ultimately allowing them to direct dollars and facility focus back to the classroom, where they can have the most impact.

About the Smart Buildings Center

The Smart Buildings Center (SBC) is a project of the Northwest Energy Efficiency Council (NEEC), which is a non-profit industry association of the energy efficiency industry. The SBC supports growth and innovation in the Pacific Northwest's energy efficiency industry, serving as a hub for industry activities and raising the visibility of energy efficiency companies and projects.



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