Issue 17 - August 2013

SkyFoundry Insider

Special Focus: Making Sense the Data-Oriented Tools Available to Facility Managers

Applying analytics to the data produced by equipment systems has been proven to be a highly effective way to reduce operating costs and improve facility operations. Analytics works by identifying patterns that represent faults, deviations and opportunities for savings. Like most new trends, however, a barrage of information and claims puts end users in a position where they are often faced with comparing "apples and oranges" as they try to evaluate the benefits of different offerings.

Comparing different technologies using a set of criteria can help facility managers better understand the roles, capabilities and benefits of these tools so that they can assess the best fit for their needs. In this issue of the Insider we will look at the range of tools available in an effort to help owners understand the differences between alarms, FD&D, analysis tools and analytics. Lets start by looking at alarms.

Alarms. Alarms are one of the fundamental functions available in BAS systems since the early 1980's, and remain an important tool. Often, when first introduced to analytics people look to make comparisons with alarms. After all, doesn't an alarm programmed in a BAS tell me something is wrong? At a very basic level there is a similarity but if we look a little bit deeper we see that there are fundamental differences between alarms and more advanced analytic tools.

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An Update

Making Sense the Data-Oriented Tools Available to Facility Managers

Characteristics of Alarms

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Perhaps the most important factor to consider when comparing alarms to analytics is that alarms require that you understood what you wanted to look for ahead of time – in other words, you were able to define the condition you want to alarm on when you programmed the BAS. While this is fine for issues like a temperatures going outside of limits, there are many inter-relationships between equipment systems that may not be known at the time a control system is installed. Having to know what we want to look for ahead of time is a limiting factor encountered with alarms.

The "Scope" of the Data Involved. Alarms typically evaluate a sensor value vs. a limit. They may also include a time delay – e.g., the condition must be true for 5 minutes before an alarm is generated. One of the most common approaches is to set alarm limits for each individual point during initial configuration – the alarm limits are effectively a property of each point. Another factor is that external, enterprise data cannot be used in controller-based alarms. This demonstrates what we mean by a limited data scope. Even in systems that allow for some level of logic-based alarms, the scope of data is typically limited to the data available in the local controller or other controllers on the network.

Time Range Evaluated. Alarms are typically evaluated "now". By this we mean the real time status of the sensor vs. the alarm limit. This is a key point - very different techniques are needed to look back over months or years to identify conditions, patterns and correlations that occurred in the past.

Expressiveness of Alarm Definition. The next factor to consider is the flexibility of expressing what we want to find. Alarms don't typically allow for sophisticated logic that interrelates multiple data items from different data sources. For example, an alarm definition might be: "Is the value of the Room Temp sensor above 76 degrees F right now?" An analytic algorithm on the other hand might be: "show me all times when any room temperature was above 76 degrees for more than 5 minutes during occupied hours in the last year, and totalize the number of hours by site."

Processing Location. Adding new alarms typically means modifying control logic or alarm parameters in controllers. This means you need to have access rights to modify or create alarms. This can be very limiting if you just want to "find things" in your data or are trying to analyze data from a system installed and managed by others.

The need to "reach into the controller" makes alarms "expensive" when trying to apply them as an analysis tool. For example, could we justify reprogramming controllers in 500 remote sites because we have an idea of a data relationship we want to look for? Most likely this would be cost prohibitive.

The important point is that there is significant "friction" involved in using basic alarm techniques for anything beyond limit-based relationships on individual points.

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Alarms, Analysis Tools, FD&D and Analytics

Fault Detection & Diagnostics

FD&D that identify equipment performance issues are fundamentally a type of analytics. FD&D offerings are typically equipment-centric, and characterized by pre-defined rules that are based on an engineering model of a piece of equipment. For example, FDD rules for a type of Packaged AHU. Because of the model-based approach, most FDD products employ pre-written rules based on known models of equipment. Programmable analytic tools like SkySpark, provide more flexibility, enabling experienced engineers to implement rules based on ***their knowledge about their own specific building systems***. They are not limited to only rules and algorithms defined by the software provider.

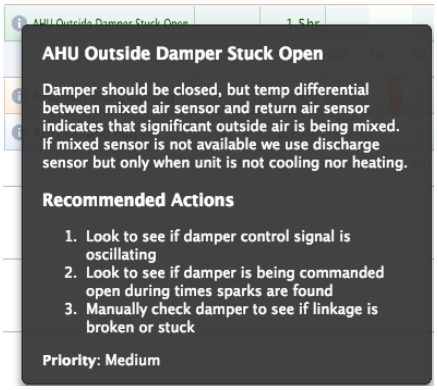
Time of implementation. Generally FDD requires that an engineering model of the equipment be developed before hand. In this respect they require significant pre-knowledge of the system. The rules are "part of the product" versus being programmable on a project specific basis. As such, FDD rules are often not flexible for use on custom, built-up central systems, and typically don't identify building level operational issues. The fact that no two buildings are alike can further limit where FDD techniques can be applied. And because of the dependence on predefined equipment models FDD is typically not a good fit for ad hoc analysis – i.e., "I have this idea about a behavior I want to look for".

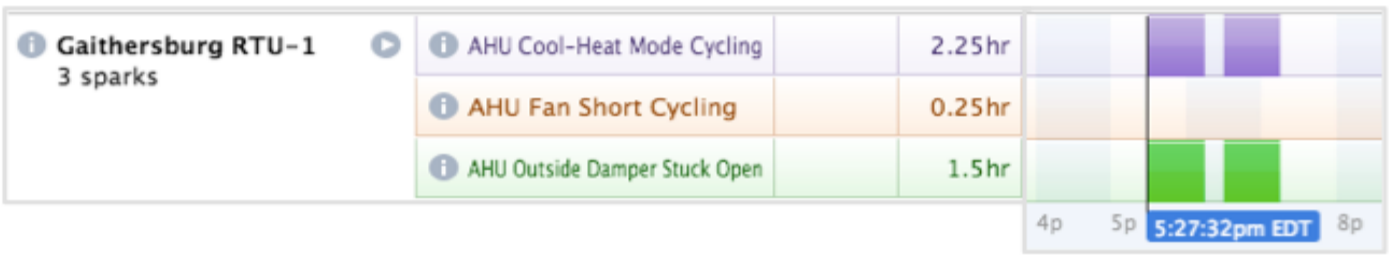
Processing Location. FDD solutions are typically applied as a separate software application that pulls data from a BAS system. The software may be installed locally or hosted in the cloud. Some FFD algorithms can be programmed into BAS controllers, but this requires "touching" the control system.

Data Scope. FDD rules are typically focused on the predefined points associated with a known piece of equipment. They may include data such as weather, but do not typically encompass external data, like age of building, historical energy consumption, type of facility, square footage, type of equipment, or provide the ability to rollup and correlate data across hundreds of pieces of equipment.

Time Range. FDD rules typically look at real time conditions or data from a sliding window of time – such as the last hour or day. Ad hoc analysis of random time periods (i.e., last August vs this June) may not be available.

Presenting Results. With SkySpark, timelines show the occurrence and duration of faults (sparks) along with their correlation to other conditions or issues, giving operators insight into the cause of the issue. And Help associated with each rule provides operators with instructions for resolution or further investigation.





Alarms, Analysis Tools, FDD and Analytics

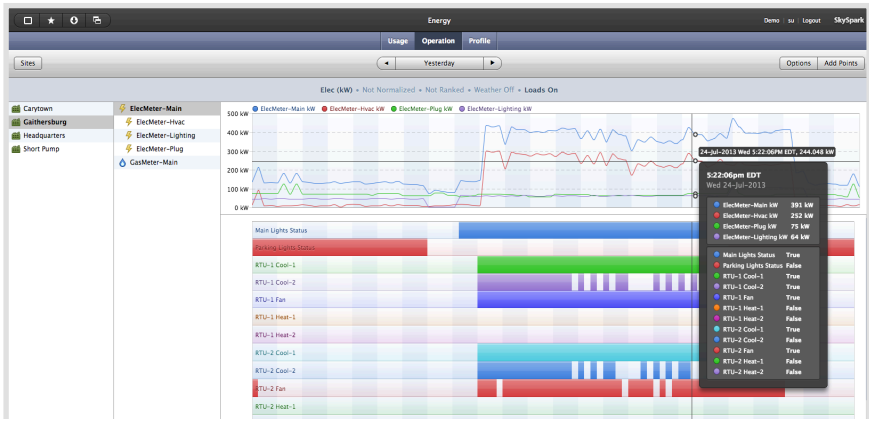
Analysis Tools

Next let's consider **Analysis Tools**, a term is most often used to describe software used to analyze energy meter data. Analysis tools provide an experienced user with the ability to look at data graphically and slice and dice it with a range of tools to identify peaks, and anomalies, and perform normalization against weather, building size, baseline data and other factors. Without question, they are an important tool. The most significant characteristic of analysis tools, however, is that they require a knowledgeable user to be sitting in front of a screen to interpret the charts and graphs to identify the important issues – in other words, the human is an essential part of the analysis.

Data Scope. Most commercially available analysis tools focus on a specific type of application, for example, energy meter data analysis. They may integrate weather, occupancy schedules and building size, but do not typically embrace the full range of equipment data such as temperatures, pressures, on/off status or other facility related data such as equipment vendor, or age of equipment.

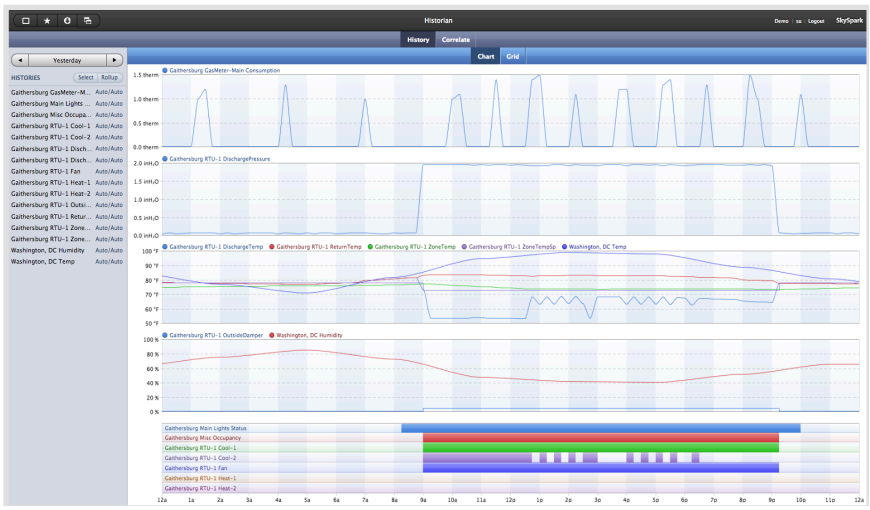
Time Range. Analysis tools provide the ability to analyze across a wide time range and support historical data analysis. As for "real time" data some products can handle data "up to the last reading" – often a 15-minute sample, in addition to supporting batch loads of historical data.

Processing Location. Analysis tools can be applied on top of existing systems as long as the data is available. They do not need to be part of the initial installation and typically do not require any changes to the BAS. Analysis software can be hosted in the cloud or installed on-premise.



SkySpark provides a range of analysis tools in addition to the automated analytics it is known for.

The **Energy App** provides users with a wide range of tools to visualize and analyze energy data including tools for normalization, baseline analysis, benchmarking, and multi-site comparison.



In addition, the **Historian App** allows users to chart and graph any data in the system and perform correlation analysis. These tools are often used to gain insights that result in analytic rules.

Alarms, Analysis Tools, FDD and Analytics

Analytics

Perhaps the most important characteristic of analytics is that they ***expose things you were not expecting.*** Users find that SkySpark's visualization tools expose relationships and correlations even before rules are implemented. For an example, showing the correlation of equipment operation vs. energy consumption see page 7.

In many ways, analytics can be thought of as a superset of the other categories – analytics can be applied to "real-time" data and offer the ability to define more sophisticated alarm conditions, and FDD rules can also be implemented with an analytics as well. When compared with analysis tools, the key difference is that an analytics engine continuously processes data to look for issues. The human doesn't need to be there beyond contributing to the selection or definition of the initial rule. *Automatic, continuously analysis is the hallmark characteristic of modern analytics solutions.*

Time of Implementation. Analytics can be implemented anytime – during initial installation or after. And with SkySpark you can add new analytic rules and algorithms at any time ***without*** reaching back into the control system to change alarm levels or logic.

Flexibility to Define Rules. While a typical alarm might evaluate a single item against a limit at a single point in time – analytic rules crunch through large volumes of data to find patterns that are difficult or impossible to see when looking only at real-time data. For example, while an alarm might tell us our building is above a specific KW limit right now, analytics tells us things like how many hours in the last 6 months did we exceed the electric demand target? And how long were each of those periods, what time of the day did they occur, and how were those events related to the operation of specific equipment, the weather or building usage patterns. For an example see page 6.

User programmability is also important because analytics is a discovery process. Initial findings highlight issues that lead to insights for new rules. Programmability is also essential to address new priorities that emerge due to changing energy costs, operating requirements or usage patterns.

SkySpark's rule language enables sophisticated data transformations that go beyond limit checks. Tools include: Rollups across time periods, calculation of max, min, average, interpolation across missing data entries, detection of peaks and troughs, linear regression, and correlations.

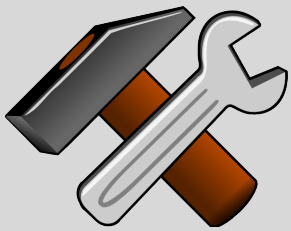
Instead of a one-time event, the successful application of analytics should be viewed as a journey with one discovery providing insight for additional analytic rules.

A Wide Data Scope. True analytics allow the use of multiple data sources, with different formats and different time sampling frequencies. This allows for analytic rules that look for correlations between age of equipment, manufacturer, service history, weather conditions, and more. This is a key point – SkySpark is not limited to working only with control systems. In many cases the analytic process starts with data available without establishing live connections, such as historical energy consumption. This minimizes the cost and complexity of achieving initial findings and financial results.

Processing Location. Analytic tools can be applied on top of existing systems as long as the data is available. They typically do not require changes to the control system. SkySpark analytic software can be hosted in the cloud or installed on-premise.

Next up *– some examples help to highlight the differences.*

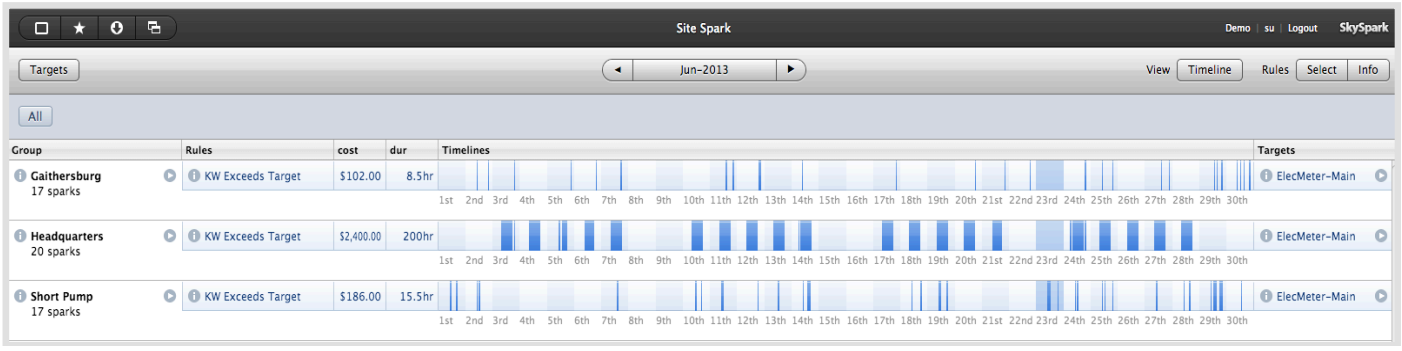
Examples Help Highlight the Differences in the Various Tools



Lets start with a look at alarms and analytics.

A Typical Alarm: Detect KW above a specified limit in real time.

Analytic rule: Identify periods of time KW demand is above a specified KW limit across any user-selected time frame. Calculate cost impact, generate reports showing duration, frequency and cost of the issue. Provide continuous real time processing of the rule as new KW data is received, which might be minutely, hourly, daily or longer. SkySpark analytics can run against batches of data – it doesn't require a live data feed. This makes it a great tool for commissioning and off line M&V studies.



The view above shows periods of time when demand exceeded 450KW, along with duration, and cost, per site for the month of June 2013

An Alarm: Detect sensor values outside of alarm limits.

An Analytic Rule: Detect dirty pitot tube sensors. In the example below, a dirty sensor caused the system to read a falsely high airflow on the supply. The return fan in turn ran at a higher speed to try and maintain the same return airflow. This resulted in excess fan energy and an unbalanced space with airflow and pressure issues. Once identified, cleaning the pitot tube sensor allowed the airflow station to read a lower accurate airflow and the fan VFDs were able to ramp down. **Result:** energy savings of $1,300/year for about 15 minutes of cleaning.

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Examples Help Highlight the Benefits of Analytics

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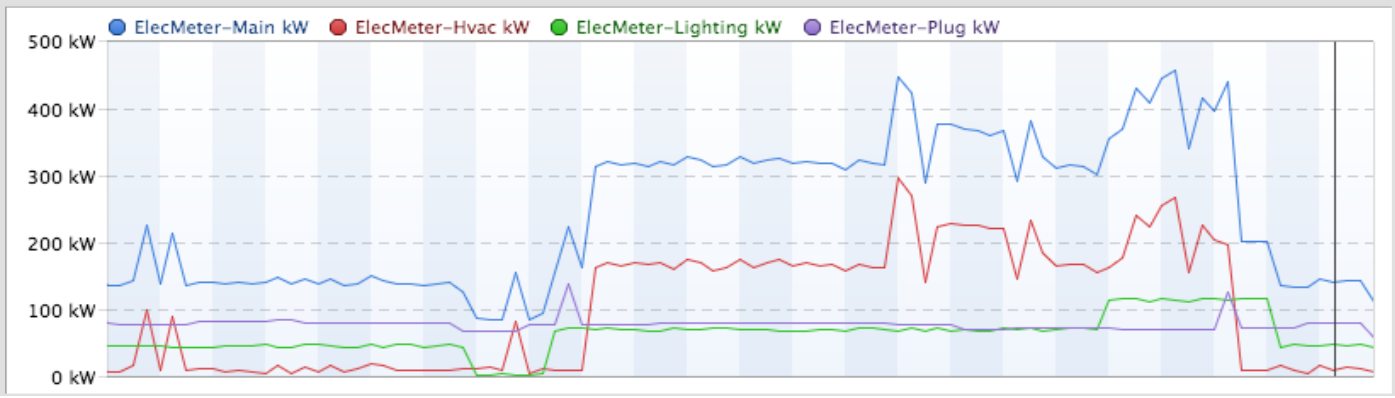
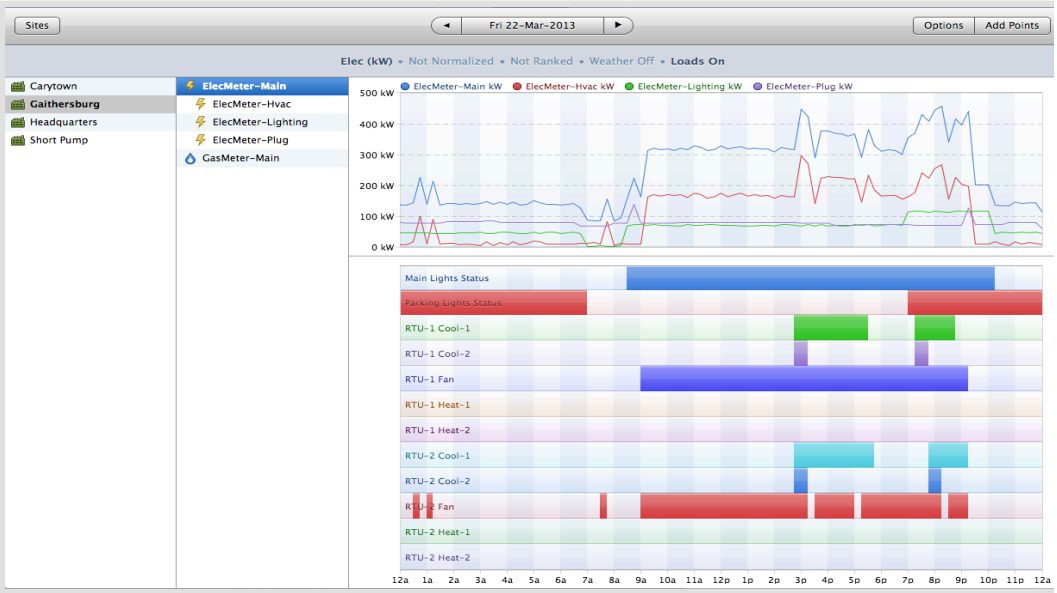
Now lets move on to some examples that show the difference between analysis tools and the results produced by automated analytics. Analysis tools enable experienced users to look at data and apply tools to identify patterns of interest. Analytics take us a step further to automatically identify correlations and patterns that are important to us.

An analysis: Generate a graph of energy consumption across a specific time. A user would then look to discern patterns.



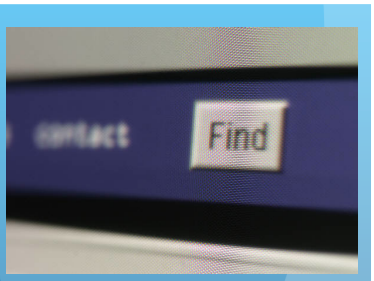
Analytics Example: Automatically correlate equipment operating status with energy consumption across a specific period of time. This enables users to see how equipment operation influences energy consumption patterns.



SkySpark's **Operations View** shows how equipment operation impacts energy consumption. Now when you have a peak you know what caused it.

From automated issue identification, to visualization tools that show operators exactly how systems behave, SkySpark® brings together the range of tools needed to improve your facility performance.

SkySpark® – Analytics for a World of Smart Devices



The past decade has seen dramatic advances in automation systems and smart devices. From IP connected systems to support for web services and xml data schemas, it is now possible to get the data produced by the wide range of systems and devices found in today's buildings and equipment systems.

Access to this data opens up new opportunities for the creation of value-added services to reduce energy consumption and cost, and to identify opportunities to enhance overall facility operations.

Access to the data is just the first step in that journey, however. The new challenge is how to manage and derive value from the exploding amount of data available from these smart and connected devices. *SkySpark directly addresses this challenge.*

The new frontier is to efficiently manage and analyze data to *find what matters*.

Project Haystack – Wins Digie™ Award, Enjoys Announcement of Broad Industry Support

Project Haystack Supporter

It's been a very active few months for the Project-Haystack initiative. Following the greater understanding generated by sessions presented at the Haystack Connect event in May, and the growing understanding of the importance of data semantics in general, the effort continues to pick up momentum. Today, there are over 350 professionals from around the globe registered on the project-haystack forum, and a growing list of companies actively supporting the standard.

Recently over 20 companies from across the BAS and energy management industry joined in a press release to announce their support for project-haystack. You can access that press release from the project-haystack website at this link: http://project-haystack.org/forum/topic/102

And, we are excited to announce that Project Haystack was awarded the Digie for Best Intelligent Building Technology Innovation at the Realcomm/IBCon conference June 12-13, 2013. Realcomm has been presenting the "Digie" Awards (short for Commercial Real Estate Digital Innovation Awards) since its first event in 1999. The award recognizes those companies, real estate projects, technologies and people that have gone above and beyond to positively impact our industry through the use of technology, automation and innovation. The award recognized project-haystack for:

- Bringing together industry leaders in an open-source community to solve the problem of standardizing data models for building system data,
- Dedicated commitment to truly open, interoperable building systems
- Creating a forum for next generation system integrators to define and share best practices.