

SkyFoundry Insider

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Highlighting real world SkySpark applications and the financial benefits of “*finding what matters*” in the operation of building systems

The Results Are In - SkySpark’s Automated Operational Analytics is a proven solution to identify energy waste and equipment faults to generate dramatic savings

In this issue of the Insider we highlight real world examples of the financial and operational benefits being achieved with SkySpark analytics. Applications include everything from retail store chains and multi-site Class A office buildings, to educational facilities. To date over **1100 facilities encompassing over 110M sq ft** are benefitting from SkySpark analytics with **documented savings in the millions of dollars.**

The results range from detection of faults in equipment systems and improper control strategies to the identification of unexpected trends and patterns in energy use. All of which enable building owners and operators to reduce costs, improve the bottom line and meet corporate goals for improved efficiency. *Isn’t it time to make money from your data!*

Special thanks to all of the SkyFoundry partners that contributed to this issue and make these projects happen.

SkyFoundry Partners in this issue





Finding Energy Waste and Inefficient Operation of HVAC Equipment

Energy Management

Establishing accurate operational targets to support optimum energy consumption is a key part of most energy efficiency projects, whether a lighting retrofit, replacement of HVAC equipment or optimization of control sequences. In one instance, analytic rules identified periods of time that deviated from desired operational targets. This insight led to the implementation of demand reduction control sequences. The result was a lower energy consumption profile and **annual savings of \$350,000 across 56 sites, totaling approximately 10 million square feet.** Continuous, automated oversight notifies operators of deviations from the desired energy baseline, enabling real time investigation and corrective action if necessary and continuous verification that the new sequences are operating as expected.



Maintenance and Operations

Non-functioning sensors and actuators result in significant waste of energy, occupant discomfort, excess equipment wear and tear, and process inefficiency. What's worse, for all their potential value, many devices aren't working and nobody even knows it. Numerous studies have shown that it is not uncommon to find over 50% of economizers in roof top applications to be non-functional or not functioning properly. These conditions can go unnoticed indefinitely if their discovery depends on looking at every trend log to identify a value, condition or pattern, an approach obviated by a targeted analytics platform.

In this way, one operator identified lighting and HVAC equipment left in manual override, resulting in operating procedure changes and control sequence modifications yielding \$650,000 in annual savings across 930 sites. Another used detection of failed sensors and economizers to prioritize work orders, **providing \$800,000 in annual operation and maintenance savings** across 128 sites totaling 23 million square feet.

Common Operational Issues - Big Dollar Savings

There is no doubt that SkySpark analytics can be used to identify sophisticated equipment performance issues. It includes many built-in functions to identify patterns in data including tools for regression analysis along with a full scientific math package.

That said, often times the issues identified are not complex yet have big payoffs when corrected. For example...

Improving Efficiency

Achieving desired comfort conditions while using the lowest amount of energy possible is subject to the complexities of program and locale. And watching the operating characteristics of all systems and their interaction with one another in real time is impossible to do manually.

By first integrating the data from various systems together into one architecture and then applying rules through the SkySpark analytics application, it is possible to achieve significant energy savings and improve comfort.

One key finding was the identification of periods of time when cooling and heating were operating simultaneously, and when outside air (above the minimum required) was being brought in during heating mode. Control sequences were changed to correct the issue and a **savings of over \$325,000 annually was realized** across 67 sites.



Finding Inefficiencies and Energy Waste

It's the **HVAC control system**, *not the HVAC equipment*, which produces the most operational issues and is the leading cause of inefficient energy use.

Lawrence Berkley National Laboratories examined 60 buildings and found the highest frequency of common problems with HVAC was in the control system.

Texas A&M research determined that of the operational and maintenance measures that could produce significant energy savings, **77% of the savings were from correcting control problems.**

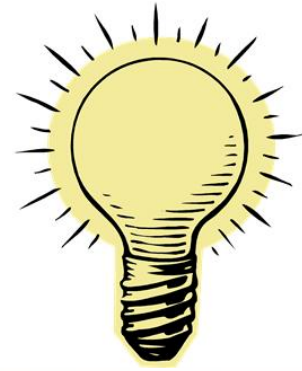
Special thanks to ESI for the real world examples on page 2 & 3



Building Solutions. Building Performance.

www.thinkesi.com

Analytics Show Us How Our Buildings Really Perform

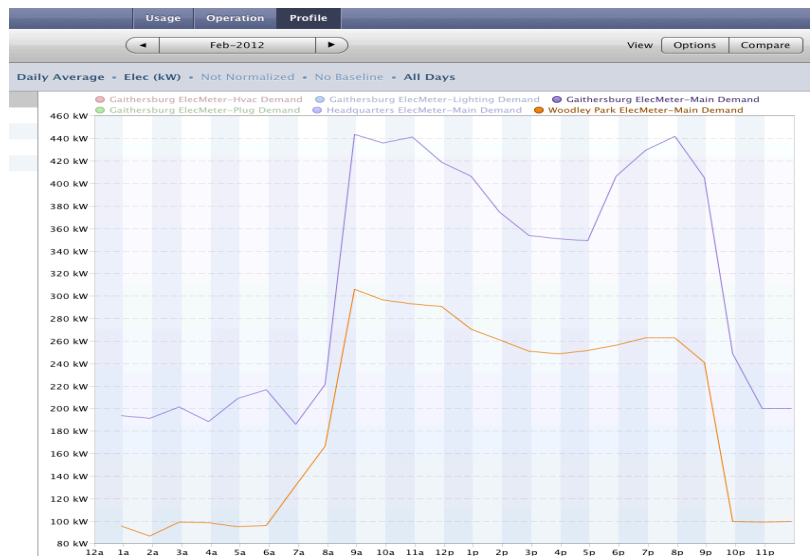


Buildings, and the systems that support indoor environments are complex. They're not like cars - every one is different. That means that the dynamics of operation can vary greatly and be very different than what was expected. To truly understand how our buildings perform we need to track actual performance and use tools to interpret those results. The following example provides an illustration and highlights the use of SkySpark in an alternative energy application and to detect a common problem of overrides.

Learning How Our Buildings Really Operate

“We use SkySpark to monitor and analyze multiple sites for one of our customers. It has provided us the ability to find and create coaching moments in our communications with our customer. In one recent example; we were able to prove to the customers' corporate facilities team that **individual locations were overriding prescribed set points** on a particular shift resulting in an increase in energy consumption.”

“In another example, we were able to **fully illustrate the impact of a 100KW PV solar system on the overall energy profile** at one location as compared to others in the same group helping to validate the financial benefit of that investment.”



Thanks to



www.engenuity.com

SkySpark as a Platform - A Cloud-Hosted Performance Verification Application for a Hybrid Geothermal Retail Store

In order to properly control, commission, and verify the performance of a Hybrid Ground Coupled Heat Pump system, an array of sensors including fluid temperature, pressure, flow rate, and electrical power, was installed throughout the system. The control

system also included sensors to monitor indoor air zone temperatures and relative humidity for the sales floor. These values are recorded once per minute and the data is automatically transmitted in real time to a remote data server “in the cloud”. The sensor data is used to automatically identify operational issues, including out-of-range indoor air conditions. The system provides alerts via email, text message, or web log.

The data server stores the incoming data in the highly efficient SkySpark time-series database and calculates energy savings and equivalent environmental impacts in real time according to industry recognized methods for evaluating energy conservation measures (i.e., ASHRAE 90.1 and IPMVP). Information from this innovative measurement and verification (M&V) system can be easily accessed from any web-enabled device and is available to owners, engineers, maintenance staff, and store visitors via a kiosk on the sales floor. As of September 27, 2011 the monitoring system is displaying a total CO₂ emissions savings/avoidance of 5.1 metric tons (see Figure below).

SkySpark was chosen as the foundation for the Indie Energy Network web monitoring system because it is low cost and purpose-built for this type of data analytics. Although the project was originally built on a standard relational database, adoption of SkySpark as a platform accelerated software development significantly.

The real time reporting and historical analytic capabilities of the system allowed the designers to be confident in innovative design strategies. Since not all operational conditions can be simulated immediately after construction, it is recognized that the only way to properly commission and optimize a geothermal-based system is through continuous and semi-automatic observation.

Con't on page 6



Web-based M&V interface displaying various energy source contributions, cost savings, and environmental benefits resulting from operating the HyGCHP system instead of the conventional HVAC design

Success story provided by: **indieenergy network™**

Finding Money in Improved Operations



Analytics Provides the Ability to Find and Quantify the Financial Impact Operational Issues

Equipment operating outside of schedule wastes a significant amount of energy and most of the time no one knows it is happening. Even if they are aware of the problem, they never fully understand how often this is happening, why it is happening and how it affects their operating budget, not to mention the increased wear and tear on their systems. For example, it was discovered in one school district, with 26 schools, that many of their boilers were left in manual mode at night, regardless of load or temperature conditions, for a significant part of the heating season **resulting in an energy cost of approximately \$200,000.**

By quantifying the cost impact of the problem, funding was apportioned to investigate and correct the problem. Analytics not only played an important role in the discovery of a significant waste of energy for the school district but also greatly reduced the amount of time and money spent monitoring and investigating building operations by quickly and efficiently analyzing the systems as a whole.

This success story provided by
DVL Automation



www.dvla.com

indie energy network™ *Geothermal Retail Store con't from page 5*

The real-time and historical data has also proven invaluable for ongoing commissioning; several energy-saving corrections were made during the first year of operation. A control valve issue was discovered automatically and diagnosed remotely. Engineers responding to emails from the system also discovered a bug in the firmware of a variable frequency motor drive that was causing underperformance in the evaporative cooling tower. Additionally, the system revealed improper operation of a heat pump economizer, which was delivering outside air during unoccupied hours and during calls for space heating.

All of these issues escaped initial commissioning and were invisible to the occupants, however the data analytic tools enabled engineers to easily diagnose and eliminate inefficiencies, and deliver on the promise of a highly efficient system.

Operating Building Systems Efficiently Makes Dollars and Sense



The common theme in all of these stories is that SkySpark's automated operational analytics are a proven means of finding issues that escape identification by purely manual means.

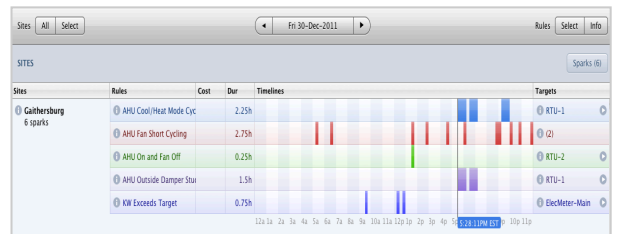
Buildings are just too complex, and operators are just too busy to be able to see how systems are operating on a minute-by-minute basis and where they can be improved. We need tools to help us find areas of energy waste and improve operations and one of the most powerful tools available is analytics software. SkySpark will even email you with full details when it finds an issue.

As can be seen from the examples presented, a single operational issue can result in hundreds of thousands of dollars in savings.

Getting Started

It's easier than you might think to get started with analytics. You don't have to "do it all" at once. SkySpark enables you to get going with a very modest amount of data and start producing financial returns quickly. SkySpark doesn't require that you have live data feeds from your systems and it doesn't require that you have access to every piece of data from your equipment systems. Many successful projects start with just historical energy data from Excel or CSV files.

So the question is what data do you have? And are you ready to start reducing your operating costs?



Sparks: 6-Mar-2012 (8)

John@skyfoundry.com
Mar 7 (5 days ago)

date 6-Mar-2012
target Carytown Main Lights Status
rule Lights On and Unoccupied
site Carytown
equip Carytown Main Lights
cost \$9.00
dur 3.75hr
times 8:15p (3hr 45min)
details [Link to http://localhost:8080/](http://localhost:8080/)
help Lights are on and site is unoccupied.

date 6-Mar-2012
target Gaithersburg RTU-1
rule AHU Cool/Heat Mode Cycling
site Gaithersburg
dur 0.75hr
times 9:15p (45min)
details [Link to http://localhost:8080/](http://localhost:8080/)
help AHU is cycling between cooling and heating and not meeting a min amount of time required between these two modes.

date 6-Mar-2012
target Gaithersburg RTU-1 Fan
rule AHU Fan Short Cycling
site Gaithersburg
equip Gaithersburg RTU-1
dur 0.25hr
times 10:00p (15min)
details [Link to http://localhost:8080/](http://localhost:8080/)
help Point is cycling on/off more often than its min on/off times.

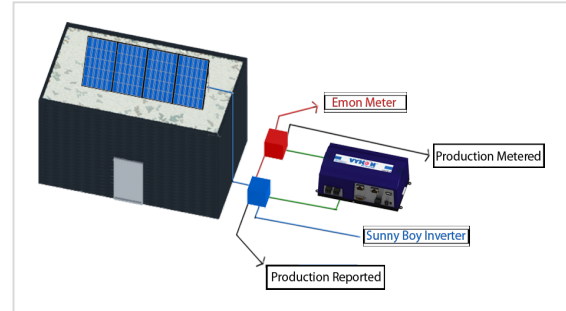


Multi-Site Solar Panel Analysis & Verification Using SkySpark

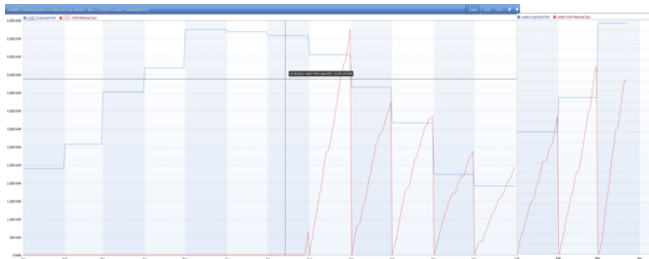


Solar installations experience significant variation of output due to a variety of factors - weather, seasonal variations, etc. With such inherent variability it is challenging to verify that the systems themselves have not experienced degradation or failure. SkySpark was the ideal solution to this challenge in a recent project.

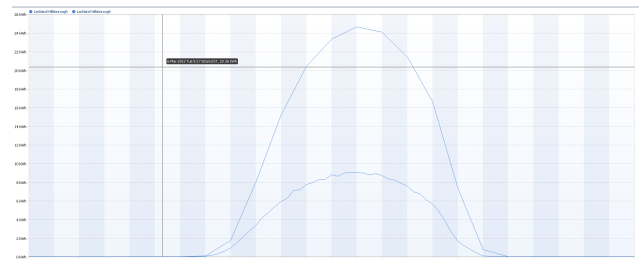
The project used Tridium Niagara Jace controllers as data aggregators at each site to integrate two communication protocols. Production meters (Emon Power Meters) were installed downstream of the Sunny Boy SMA invertors.



“Calculated histories” in SkySpark were used to project expected performance and analyze actual results. Analytic rules flagged poor performance. One calculated history sums “ProductionMetered” for each site, the other calculated history sums “ProductionReported” for each. Rules generate sparks whenever the two calculated histories are not within a defined, acceptable range. The automated analysis and detection by SkySpark has saved the customer countless hours to verify that the system is running correctly.



Sparks verified systems achieving expected goal for each month



Production metered vs Production reported

The project had significant complexity, with 28 sites and different configurations at each site. SkySpark enabled rapid generation of the database and analytic rules. The whole project was completed in 5 days including all rules.

This SkySpark success story courtesy of RGSB, Inc. and BAS Services & Graphics, LLC.



Project Facts

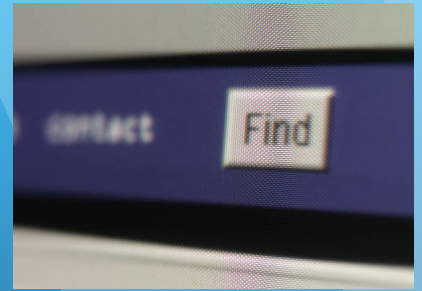
- All Internet connections are cellular connections from Jace to SkySpark (Works extremely well!)
- All sites have 38 Emon meters
- All sites have 238 panels
- SkySpark pulls data every two hours
- When Sparks occur, problems are rectified in less than 2 days
- Cloudy days create significant decrease in production as would be expected, but now those decreases are clearly understood

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 using a variety of standard protocols, 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 help businesses reduce energy consumption and cost and to identify opportunities to enhance operations through improved control, and replacement of capital equipment.

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. *SkyFoundry's*



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

What Customers are Saying...

I tried virtually every software package out there – SkySpark is the only product that provides real analytics... *Multi-site commercial property owner Midwest US*

Skyspark is a game changer for our service department... *HVAC and Automation Service Company Pacific Northwest US*

“I informed one of our facility operators today that he had a bad supply air sensor at Site-2. He gave me the evil eye; like how did you know that. He immediately pulled up the graphic and told me the temperature of the supply air, which he thought looked OK. I asked him to shutdown the fan for a few minutes and let me know if it changes. He did and the temperature didn't change proving that the sensors was bad. Then he joined me in my office and I showed him how SkySpark could help us run our buildings more efficiently. He was very impressed and said he couldn't wait to learn more about it. He asked to see the profiles for the building, which we have been unable to see until now. The profiles are terrible and he said he would figure out what's causing the building to operate the way they're operating. Thanks SkyFoundry!”

Facility Management Executive for multi-site Class A Office Building Owner/Operator in Midwest US

A solution like SkySpark is a long time coming! Good stuff...

Energy professional and active SkySpark user, Major big box retailer with over 800 stores across the US

We chose SkySpark as the foundation for the Indie Energy Network web monitoring system because it is low cost and purpose built for building data analytics. Although originally built upon a standard relational database, adoption of SkyFoundry's time series database as a back-end technology accelerated software development of the Indie Energy Network significantly... *Indie Energy, Hosted Energy Services Provider*