SkySpark

Find What Matters™

Case Study

Vermont State Office Building:

Advanced Analytics for Measurement and Verification

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SkyFoundry

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Contents

Pacific Northwest National Labs (PNNL): HVAC Energy Saving Solutions Project

Overview

Pacific Northwest National Labs (PNNL) has a building retuning program that is designed to use the building automation system (BAS) along with firsthand knowledge of building use by the occupants and facility staff to identify no-cost/low-cost energy saving solutions for the HVAC system. The majority of these solutions can be conducted through the BAS with little to no hardware or equipment changes. Typically, once all the solutions are implemented the total savings is in the range of 5%-20%. It is sometimes difficult with energy saving projects to quantify the savings since it is an absence of energy that is trying to be measured. This can become even more difficult when the energy that is being saved falls within the monthly variance in the whole facility's energy use. Measurement and verification (M&V) is the process of developing a plan to estimate energy savings by creating a baseline period (before the project) and a reporting period (after the project). The data collected is analyzed and calculated to accurately and transparently estimate the savings realized by the project.

M&V is important because it can help determine how cost effective a project is and make similar future projects more viable. There are some issues with the process though that can impede whether M&V is conducted or if it even produces accurate results. The process of deploying temporary meters and data loggers and the time involved with collecting and analyzing the data manually can become challenging and expensive, and if the data gathered is lost or gets corrupted then the accuracy of the results may not be precise enough to come to an absolute conclusion. SkySpark® can help with identifying building retuning strategies and determine how effective the strategies would be before they are implemented. SkySpark can also simplify the M&V process by collecting and analyzing the data autonomously, and can use potentially several years' worth of previous data to compare to real time data to see if the savings persist for the future. This Case Study provides an overview of such a project and the results produced by SkySpark®.

Location

Building Type – Medium size state office building (50,000ft^2), Vermont, US

Issue Description

Control Technologies was trained by PNNL to provide building retuning as a service and certified with the International Performance Measurement and Verification Protocol (IPMVP) to conduct M&V projects.

For this particular state office building, SkySpark® was used as a tool to identify a number of retuning strategies. There were several retuning strategies for the HVAC system and M&V was required for each strategy.

It was decided to use the IPMVP method of M&V as the primary way to identify the savings and then use SkySpark® as a second method to validate the first method and to also determine the effectiveness of SkySpark® as an M&V tool.

The Results

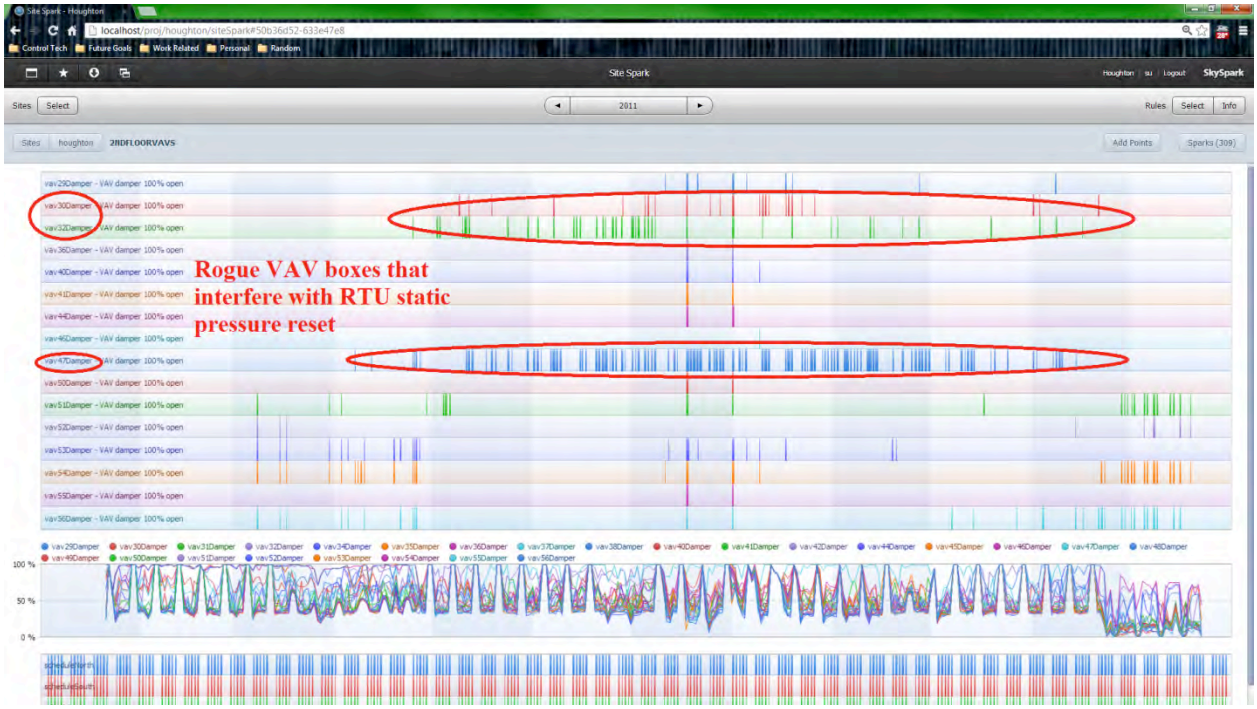
Issue 1: Rogue VAV Identification

This particular building had a typical variable air volume (VAV) system with variable frequency drives (VFD) on the supply and return fans of three roof top units (RTU). There were several retuning strategies identified with this system that needed to be implemented. Some of the strategies focused on using the static pressure reset on the RTUs to ramp down the VFD speeds. Static pressure reset is designed to increase or decrease the static pressure set point (SP) based on the VAV box with the highest cooling demand or simply the VAV with the most open damper. Decreasing the SP causes the fans to ramp down and save energy but maintains the same comfort levels required. Ideally there would be a small handful of boxes all at 95% open dampers and static pressure SP would be somewhere below maximum, but what commonly happens is there are one or two VAV boxes that are always 100% open and forcing the static pressure SP to maximum. These VAV boxes are called rogue VAVs and can be caused from being undersized, a mechanical or control issue, or even the space use changes without re-evaluating the HVAC requirements.

Implementing retuning strategies that use the static pressure reset without fixing any rogue VAV boxes would not produce the desired energy savings. Before any M&V could be done the rogue VAVs had to be identified and fixed first. The problem with finding rogue VAVs is that they usually occur in the summer during the cooling season and it has to be determined if they are truly rogue VAVs all the time or if they just have an occasional high cooling demand. With 83 VAVs under three RTUs and a year's worth of data this can become time consuming and difficult to separate a rogue VAV from a normal VAV.

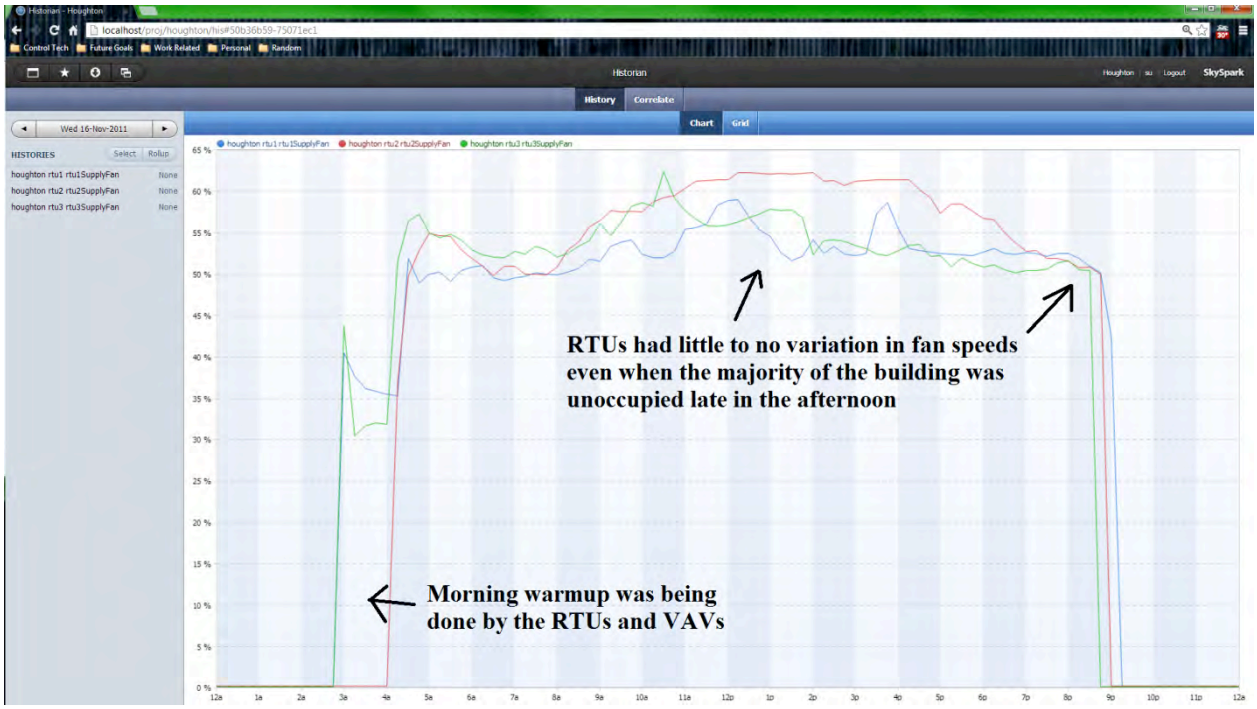
SkySpark® was used to quickly analyze a year's worth of data to identify all the rogue VAVs. Of the 83 total VAVs SkySpark found 11 that were rogue and causing the fans to run at a higher speed then they needed to.

Case Study: State Office Building

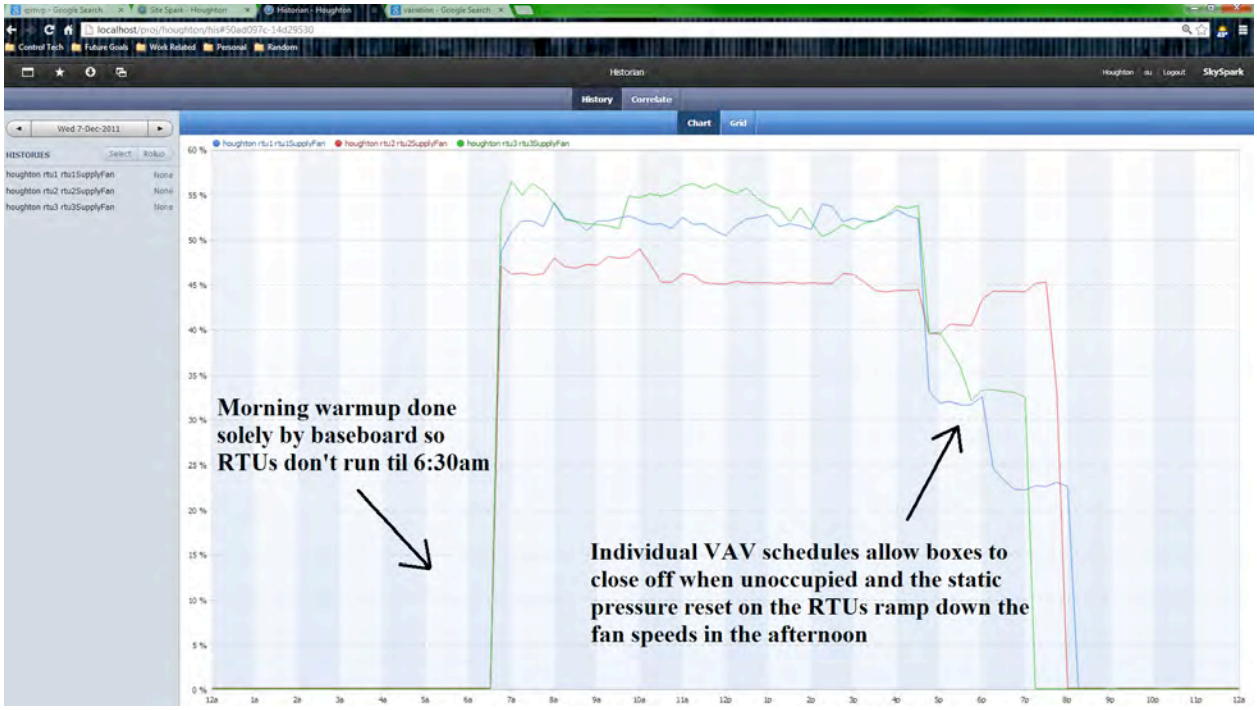


Issue 2: VAV and RTU Retuning

This state office building had several different departments, all with their own schedules and hours of operation. The RTUs and VAVs all shared the same schedules which started between 3am and 4am depending on the morning warm-up and ended at 8:30pm. The majority of departments operated from 6:30am – 4:30am with only a small handful running till 8:30pm. It was determined to schedule each VAV individually based on the department it served and when the space was unoccupied close off the VAV so the RTU fans could ramp down in the afternoon. Another strategy implemented was not allowing the RTUs to be used for morning warm-up and instead use only the baseboard radiation throughout the building thus saving fan energy in the morning.

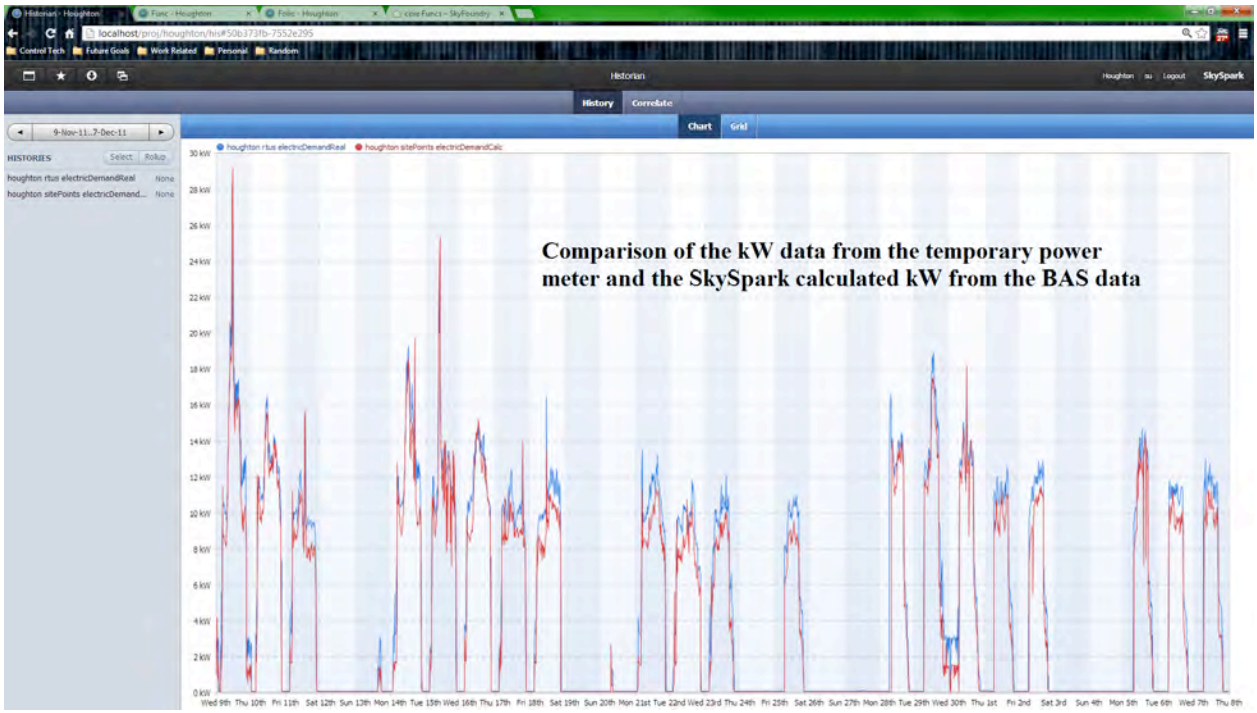


Case Study: State Office Building



Case Study: State Office Building

Once these strategies were implemented the energy savings needed to be estimated for the M&V report. A power meter on the VFDs was used to gather four weeks of kW readings (two weeks for both baseline and reporting periods). The data gathered was then used with the IPMVP method to estimate the savings. SkySpark was also used to estimate the savings, but instead of using four weeks of temporary logging data SkySpark® used the VFD speeds from the BAS to calculate the kW for the previous year along with the most recent data to calculate the savings.



Summary

Project Scope Summary

SkySpark® can help identify retuning strategies by analyzing years' worth of data quickly and finding recurring issues. When M&V needs to be done to confirm the project was a good energy savings project SkySpark® can use the data to estimate the savings without using temporary data logging.

Performance Summary

In the end there was 40% reduction in the total kWh for the three RTUs. The IPMVP method estimated the savings at 18,987 kWh or $1,593.00 a year and SkySpark® estimated 19,090 kWh or $1,601.64, a 0.5% error between the two.

Additional Information

This case study was compiled by Control Technologies Inc. with help from SkyFoundry. If you have any questions or would like additional case studies, please use the contact information below.

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SkySpark® Analytics Software - For the 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, it is now possible to get the data produced by the wide range of devices found in today's smart devices 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 operational costs and to identify opportunities to enhance operations through improved control, and replacement or repair 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 SkySpark® Analytics Software directly addresses this challenge.

The new frontier is to efficiently manage and analyze data to *Find What Matters™.*

SkySpark by SkyFoundry

About SkyFoundry

SkyFoundry's mission is to provide software solutions for the age of the "Internet of Things".

Areas of focus include:
Building automation and facility management
Energy management, utility data analytics
Remote device and equipment monitoring
Asset management

SkyFoundry products help customers derive value from their investments in smart systems.

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