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15 Ways to Run Your Facility Better with Energy Data

Energy Data is the Most Important New Tool for Successful Facilities Management

Today, the most successful facilities managers and chief engineers are using advanced power monitoring to increase equipment uptime and reduce energy consumption under tight staffing and budget constraints. While building monitoring systems offer insight into a limited subset of equipment, new ways to monitor electricity consumption directly from the circuit breaker now make it possible to:

- Strategically reduce consumption by identifying energy-intensive regions of buildings and times of day
- Receive immediate notifications of unwanted shut off or fault by keeping tabs on ALL equipment
- Ensure electrical safety by instantly detecting surges or power quality issues

In this paper, I'll share 15 ways that data on your own electricity usage can help you manage your facility more successfully. Some are best practices for increasing comfort. Others demonstrate ways to more intelligently reduce energy consumption. Many are now standard practice at cutting-edge facilities.

Read on to learn why energy data is being rapidly adopted as a facilities management tool, and feel free to share your additional ideas or questions with the author at: solutions@verdigris.co



1

Detect and Resolve Problems Before Your Annual Audit

How long has it been since you had a professional energy audit? Chances are it's been a year or longer, since energy audits are time consuming and can be costly. Energy audits may feel very productive because small issues accumulate between visits, making the potential savings from the audit appear huge. But the truth is, those energy savings should have been achieved the entire time between audits!

The business of energy auditing depends on problems accumulating between visits:

- Equipment becoming less efficient with wear and tear
- Technologies becoming obsolete and meriting upgrade
- Programmatic changes like automated lighting and temperature setpoints being altered by maintenance staff
- Behavioral changes in building usage due to staff turnover or occupancy changes

Even though energy audits are a great kick-start to an energy efficiency initiative, the best way to maintain the lowest energy usage is to monitor continuously. With continuous energy monitoring, facilities managers and chief engineers can catch many of the problems a professional energy audit would find, but nip them in the bud.

By using continuous energy monitoring, facilities managers maintain efficiency gains by:

- Identifying equipment energy consumption increases over time
- Receiving advice on technology replacements, based solely on the energy data
- Catching signs of inefficient use like spikes, short cycling, or other signatures of off-spec equipment
- Spot patterns in inefficient behavior, like lights being left on overnight

Having your own building's energy data empowers you to make changes between audits that will maintain energy efficiency gains, and can even reduce the need for audits altogether, saving money and time.

2

Measure & Verify Project Efficacy

Ever interacted with a vendor pitching an energy savings device? Then you've almost certainly received a proposal for huge energy gains that both justified the cost of the purchase and also felt unrealistic.

Three savvy ways to “audit” the vendors selling you energy-saving equipment are:

- Test a large scale project at small scale before expanding
- Conduct M&V on large capital expenditures to ensure they are realizing the expected gains
- Prove project success to get more resources for the next project

Follow this simple 4-step process to “audit” your vendors:

1. Use continuous energy data readings to measure total consumption of a representative area of your building (e.g., one floor)
2. Make the small-scale change in that area (e.g., VFD retrofit)
3. Measure ACTUAL energy saved with granular data over a representative period (e.g., 1 month)
4. Use this analysis to justify (or reject!) an energy efficiency project proposal

Equipping yourself with your own energy data helps you confidently speak about energy efficiency projects, and increases your leverage with vendors and management alike.

3

Continuously Commission your Building

Buildings used to be “set it and forget it,” with the initial programming of HVAC left untouched or tinkered with in small increments over time. Today it is common practice to have a building “re-commissioned” at regular intervals after grand opening to ensure the controls remain programmed as designed.

The goal of re-commissioning is to periodically return the building to optimal functioning:

- HVAC setpoint and staging match cooling and heating demands
- Lighting controls optimized for minimal usage with maximum occupant safety
- Large equipment operating consistent with safety requirements

Periodic commissioning—similar to energy auditing—is a lost opportunity in functionality between visits. By harnessing their own energy data (branch circuit monitors of lighting panels, components of HVAC, and other large equipment), facilities managers can do even better.

With continuous commissioning, facilities managers can:

- Identify high HVAC usage that doesn't correlate to outside or inside air temperature, indicating the need for readjustment
- Track functionality of large equipment like refrigeration and motorized manufacturing for spikes or changes in usage
- Ensure that automated lighting is operating according to spec

Energy data can help facilities managers continuously commission their equipment to maintain optimum functionality between professional commissioning visits.

4

Gain LEED Points

Installing an Advanced Energy Monitoring system is an inexpensive and minimally invasive way to get those sought-after LEED points.

With more corporations seeing the need to “go green,” LEED points have become valuable commodities. Existing buildings being retrofitted for LEED certification can be especially challenging and require major construction overhauls. Sometimes, even buildings that were once “cutting edge” become obsolete and lose their LEED status.

Did you know that Advanced Energy Monitoring counts for up to two LEED points? It’s an inexpensive way to gain points and assist with the other projects needed to get to Silver, Gold, or Platinum LEED status.



5

Game Time-of-Use Billing and Demand Management

Do you know whether your facility is in Time of Use Billing (TOU)? Smart meters collect energy consumption data at regular intervals (typically every 15 or 30 minutes) instead of getting manually checked each month. This evolution in metering led to the emergence of complex, time-based electricity billing plans. Many large facilities are charged different rates depending not only on how much energy they use, but also when they use energy.

Rate schedules vary between utility company and customer, but common TOU plans may:

- Charge the most per kWh for **peak times of day** for the entire utility territory, usually between 12pm-8pm
- Charge a middle tier rate for usage during semi-peak times
- Charge an exorbitant rate per averaged kW of power during the **single highest usage interval** during a billing cycle (peak demand)

Problems arise when organizations do not realize they are on TOU billing, and do not have access to the data points they need to control costs. Facilities can reduce their energy bill by strategizing the times of their energy use (**Demand Management**).

To game TOU billing, continuous energy monitoring services alert users in real-time to:

- Threshold crossings, such as approaching the single highest point in the month to not exceed it
- Energy spend and changes in billing on a daily and monthly basis
- Instantaneous recommendations of loads to shed or shift in anticipation of expensive times (**predictive demand management**)
- Patterns of usage over longer periods of time to identify systematic changes to reduce usage during the most expensive times (to participate in Automated Demand Response or to create a behavioral strategy)

These features allow users to make smart choices about when to use energy and when it might be more cost effective to shut off or wait to use.

6

Forecast Usage and Participate in Demand Response

Utility companies disincentivize energy usage during high demand times to avoid grid-wide brownouts and blackouts. Practically speaking, this often means facilities are charged more for energy during the hottest days of the summer months, which is when buildings are increasing their air conditioning usage, leading to heavy power draw across the grid.

Depending on your utility provider, enrolling in a demand response program saves money on your electricity bill in 3 ways:

1. Reduces spend during the most expensive times of year
2. Brings down energy costs for the rest of the year
3. Earns rebates for promised or committed kWh reductions

Here's the rub: although big savings are possible by participating in demand response programs, facilities can't effectively participate without transparency into which devices are consuming the most energy (and when). How can you make smart decisions about which loads to shed (turn off completely) and shift (turn on/off at different times) without knowing how much energy is being consumed? Lack of data can mean money left on the table.

To tackle this challenge, chief engineers and facilities managers are looking at energy data from branch circuits to understand exactly which equipment they can turn off safely. And with the right services, they're monitoring the effects of that energy reduction in real time.

Forecasting usage ahead of time helps facilities make changes before it's too late. By applying machine learning to historical usage patterns—and combining this with weather, occupancy and other datasets—services tell users when they are likely to use more, prompting pre-cooling, shutoffs, and startup changes that can save huge amounts of money on the most expensive energy days of the year.

7

Maximize Utility Company rebates

Utility companies frequently give rebates for energy savings measures like replacing incandescent bulbs with LEDs. If you haven't gone through this process before, it's a great way to get extra funding for energy projects. But did you know that there could be additional rebates for measuring and proving the great results of your projects?

Ultimately, utility companies are concerned with meeting their customers' energy demands, and rely on accurate predictions of consumption to meet customer needs. If your actual energy usage hasn't changed after an efficiency project, the utility company doesn't benefit. Additional rebates can be recouped by installing qualified meters on panels serving the equipment with the project or renovation.

Check with your utility provider to see what rebates are available to you!



8

Track Normal Equipment Operations and Anomalies

Branch-circuit monitoring separates energy usage by circuit. Many large load devices draw power exclusively from one or more dedicated circuits. This separation of power draw enables facilities managers to establish “normal” baselines for their equipment.

Unlike traditional building automation and monitoring systems, branch circuit monitoring covers ALL equipment, including kitchen devices, lighting, spa pumps, manufacturing machinery...you name it. As long as the equipment is on a dedicated circuit or clustered by end-use, it can be individually monitored.

Branch circuit monitoring allows facilities managers to both save energy and maintain normal operations by:

- Tracking “normal” baseline functionality of all circuit-dedicated devices over time (e.g., recognizing the staging of an HVAC system’s pumps and chillers as they operate)
- Tracking uptime of crucial equipment, or receive alerts when operations are down (e.g., a notification for a hot water pump that has stopped functioning and requires service)
- Detecting periods of short cycling, spiking, or other anomalies that could indicate a problem with the power quality or piece of equipment, (e.g., a rapidly cycling compressor)

Note that this level of monitoring and tracking is greatly aided by a wireless or continuous data-streaming meter, preferably connected to an analytics and alerting platform. It is much harder to accomplish as a DIY project only looking periodically at continuously collected data, and is nearly impossible without continuous data collection.

9

Detect Early Motor Faults

Fault detection data analytics is especially useful with operation-critical heavy load motors. By detecting motor faults early, facilities managers can reduce downtime and save money on last-minute repairs. For example, a motor fault might be detected on an elevator or an HVAC pump and can be addressed before leaving occupants stuck or without air conditioning.



Motor fault detection requires extremely high resolution monitoring of both amperage and voltage at the circuit level, plus algorithmic analysis of the equipment signatures.

Here's how motor fault detection works:

1. Energy consumption data is collected continuously from circuit-dedicated devices
2. Frequency analysis is used to determine a baseline “normal” operational signature, including multiple “states” of the equipment
3. Algorithms periodically parse incoming energy data and detect anomalies in the signature, indicating a motor fault (typically expressed as additional frequency bands outside of normal operations)

Depending on the service, motor faults can be translated into alerts for users to take action, such as recommending a reset, shutdown, or maintenance call, depending on the nature of the fault.

Like #8 (“*Track Normal Equipment Operations and Anomalies*”), this type of monitoring requires advanced algorithms and alerting functionalities outside of the skillset of the typical facilities team, and can be purchased as a service.

10

Save on Maintenance, Repair, and Operations

It's a fact of facilities: stuff breaks, and you have to fix it. That's why there are maintenance, repair, and operations (MRO) budgets. But what if you could find issues before the equipment was broken?

Tracking anomalous function (#8) or motor failure (#9) before they are visible by human intervention saves money in 3 ways:

1. Salvages revenue by reducing downtime for workers, guests, retail customers, and manufacturing productivity
2. Increases equipment lifespan by detecting and fixing issues before they have escalated
3. Decreases cost of repairs by scheduling them in advance (not paying rush order for parts or service)



Although you might have a building automation or monitoring system, it probably doesn't self-report on subtle errors such as three-phase motor imbalances, and certainly doesn't cover all costly equipment in your building under a single system. You might also have staff to walk around checking for problems, but even the best staff cannot continuously monitor all equipment simultaneously and remotely.

Early detection and prevention with energy data is the winning combo for reducing MRO, increasing uptime, and increasing occupant comfort!

11

Detect Power Surges and Prevent Overloads

Changes in power flowing to equipment and total use at a single panel can be both expensive and hazardous. Examples include:

- Small, unnoticed surges
- Circuit breakers that fail to trip during an overload
- Circuits that are frequently overloaded for prolonged periods, violating National Electrical Code

These kinds of problems are easy to detect and notify when branch circuit monitoring is tied into an alert system. Suppose in an event space, an unknowing guest may have plugged many extension cords into the several outlets on the same panel, which could:

1. Elevate the load on individual circuits and across the entire panel
2. Send an alert to a maintenance staff member telling them the usage is approaching or has surpassed a safety threshold
3. Lead to correction of the problem before it becomes a safety or equipment hazard

This requires a solution that has continuous data collection of branch circuits, and alerting functionality. Spot-checks or interval meters are not sufficient to detect these nuanced, time-sensitive errors.



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Reduce Hazards from Equipment Downtime

Health and life-critical equipment must remain functional to avoid safety and legal repercussions.

In healthcare, there are devices critical to a patient's next breath; in food service, refrigerators must stay within a narrow temperature range to prevent the growth of harmful bacteria; in all large buildings, insufficient air circulation can lead to loss of oxygen.

Even with redundant equipment and power systems, it is important to know when something has gone wrong to prevent further damage. And even when alerting systems are present, the alert can arrive too late. For example, an alert on a refrigerator triggered by temperature alone means that the refrigerator has already been dysfunctional for tens of minutes or hours, and critical repair time has already been lost.

Using energy data to reduce hazards works like this:

1. Branch-circuit monitors track the functionality of circuit-dedicated equipment
2. Continuous data collection means there is both a running baseline for "normal" and the ability to spot an error on the fly
3. An alert is sent to the end user when a threshold is crossed, such as when refrigerator power is lost
4. Maintenance staff can then correct the problem without any lost time

These types of issues require branch circuit level monitoring of devices that are circuit-dedicated, or monitoring with sufficient analytical power to disaggregate energy consumption from different devices on the same circuit.

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Optimize HVAC for Occupant Comfort

When you know more about your building's usage patterns, you're better able to fine-tune HVAC settings.

In an office, you might have HVAC programmed to ramp up to full cooling temperature by 8am, but notice the lighting and plugs are fully loaded by 7:30am, meaning occupants have been coming in earlier.

You can get greater insights into occupant behavior by having detailed branch-circuit energy data to track:

- Occupant time of entrance (automated hallway light triggers)
- Occupant time of exit (computer and lighting usage decreases)
- Increased occupant number (increased overall usage)

All of these data “clues” can help you fine-tune HVAC experimentally to pre-empt occupant complaints. And understanding the interdependencies between systems can enable more effective HVAC scheduling versus trying to optimize in a data void.



14

Anticipate Equipment and Room Usage

Surprising insights emerge when you track all of your equipment with branch circuit monitoring. You may find that certain rooms are never used, others are in constant use, and still others have intermittent but patterned use. Perhaps you want to track popular times of key equipment use, or schedule regular maintenance based on hours of consumption, rather than years of ownership.

This kind of detailed monitoring of rooms and equipment requires branch circuit monitoring, or at the minimum, submeters that are dedicated to a single room, piece of equipment, or area of interest.



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More Successfully Plan New Spaces

After tracking building usage with sufficient granularity (branch-circuit) over a sufficient time frame (at least a few months), the insights garnered can help to plan for and map new spaces.

With human density per square foot of office space and plug load power density increasing dramatically beyond existing building design specifications (not having enough power, HVAC limitations, lighting, safety, etc.), it's critical to know when your workforce has exceeded capacity.

Energy data makes it possible to work with your contracting firm to more fully plan for a large move by feeding your energy data into a building model. Parameters like the following can all positively influence your growth and movement into a larger space:

- How current spaces have been used
- Times lighting has been off and on
- Startup and shutdown changes
- Changes in occupant density vs. satisfaction with HVAC

With complex moves impacting more employees, better insight will help ensure a smooth transition.



Want to Learn More?

With so much new data available, it's no surprise that the number of facilities leveraging it for success is increasing rapidly. If you have questions about anything in this paper, or if you'd like to discuss the points further, email me at solutions@verdigris.co

Contact us to discuss what energy data can do for your facility:

[CONTACT US](#)



About the Author

Martin lives in the San Francisco Bay Area, works at the NASA Research Park, and has an M.S. in Civil & Environmental Engineering from Stanford University. As a Professional Services Engineer at Verdigris, Martin works with clients to make the most of their energy data every day.



About Verdigris Technologies

Verdigris helps you run your facility better and save energy. We offer an advanced energy metering and alerting solution that provides 24/7 energy monitoring from smart meters, submeters, and branch circuit CTs. Verdigris algorithms generate user alerts for energy use reduction and equipment fault detection. The Verdigris team is dedicated to meeting commercial buildings' goals with personalized reporting and free consultations.



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