THE HIGH PERFORMANCE PORTFOLIO:

MANAGING ENGINEERING PERFORMANCE

BETTERBRICKS
Bottom line thinking on energy.

SUMMARY

Not every property manager has a background in engineering, yet a building's energy performance relies on managing individuals, firms, and teams with strong technical skills. Generally, most of the energy efficiency gains that a property can achieve are available through the engineering team's operations rather than installing new systems and equipment. Given this reality, what is the best way to ensure that your building operations are optimized to improve energy performance? Asking the right questions can keep your energy management program on track, as well as highlight strengths and reveal areas for improvement.

IN DEPTH

Property managers fill many roles, and in addition to managing buildings, they are responsible for managing numerous people. Without a strong technical background in HVAC systems or controls, it can be challenging for property managers to lead engineering and maintenance staff and service contractors effectively. Yet the imperative for doing so has rarely been more urgent. A growing body of evidence demonstrates that sustainable and energy-efficient building operations are critical links to strengthening asset value and market competitiveness.

Property managers can lead these efforts by understanding the indicators of high-performance, establishing a productive relationship with the technical team, and monitoring and evaluating progress. With day-to-day building operations driving energy performance, success depends on the ability to gauge team effectiveness, diagnose issues, and critically examine how operational decisions affect all aspects of the property's performance.

First, recognize that building performance levels – and the results you are seeking – must be clearly defined. As a property manager, you will rely on your technical team to meet the building's energy efficiency or sustainability goals, and the team needs to understand those goals and how you will evaluate progress towards them.

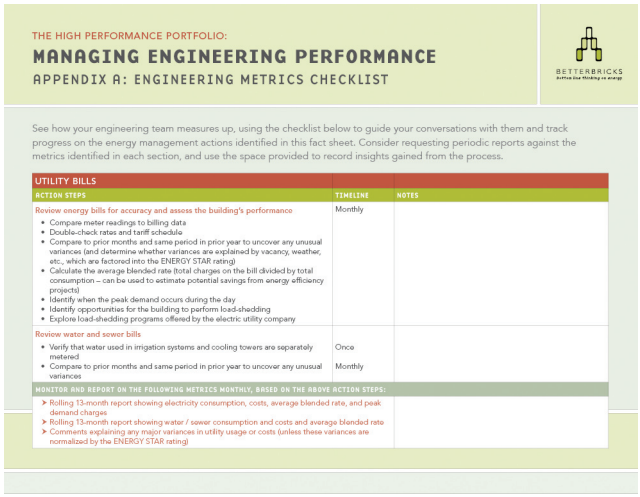
Then, with goals and measurement criteria in place, begin an examination with your team on the specifics of the building, systems, tenant demands, and opportunities to reduce energy consumption.

Use the discussion as a means to teach yourself about the operational issues of the building, but also to get a sense of your team's understanding as well. Don't be afraid to ask the simple questions, or to uncover areas that you or your team doesn't know the answers to – no team will have all the answers.

The following sections frame key areas to explore with your engineering staff or maintenance providers, and the reason each is important. Use the **Engineering Metrics Checklist** (www.betterbricks.com/office/engineeringmetrics) to review the steps for evaluating performance, and verify that you are utilizing all available information.

ENGINEERING METRICS CHECKLIST

See how your engineering team measures up, using this checklist to guide your conversations with them and track progress on the energy management actions identified in this fact sheet. Download the checklist here: www.betterbricks.com/office/engineeringmetrics.



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APPENDIX A: ENGINEERING METRICS CHECKLIST

BETTERBRICKS

See how your engineering team measures up, using the checklist below to guide your conversations with them and track progress on the energy management actions identified in this fact sheet. Consider requesting periodic reports against the metrics identified in each section, and use the space provided to record insights gained from the process.

UTILITY BILLS		
ACTION STEPS	TIMELINE	NOTES
Review energy bills for accuracy and assess the building's performance • Compare meter readings to billing data • Double-check rates and tariff schedule • Compare to prior months and same period in prior year to uncover any unusual variances (and determine whether variances are explained by vacancy, weather, etc., which are factored into the ENERGY STAR rating) • Calculate the average blended rate (total charges on the bill divided by total consumption – can be used to estimate potential savings from energy efficiency projects) • Identify when the peak demand occurs during the day • Identify opportunities for the building to perform load-shedding • Explore load-shedding programs offered by the electric utility company	Monthly	
Review water and sewer bills • Verify that water used in irrigation systems and cooling towers are separately metered • Compare to prior months and same period in prior year to uncover any unusual variances	Once Monthly	
MONITOR AND REPORT ON THE FOLLOWING METRICS MONTHLY, BASED ON THE ABOVE ACTION STEPS:		
➢ Rolling 13-month report showing electricity consumption, costs, average blended rate, and peak demand charges ➢ Rolling 13-month report showing water / sewer consumption and costs and average blended rate ➢ Comments explaining any major variances in utility usage or costs (unless these variances are normalized by the ENERGY STAR rating)		

UTILITY BILLS

Ask the questions:

- Can you walk me through a current energy bill, explaining the various charges and how each is calculated?
- Who receives, reviews, and pays our bills each month?
- What is our peak demand and how does it affect our electricity bill?
- Are load-shedding, demand-side management, or energy efficiency programs available from our utility, and do we participate in them? Why or why not?

Discuss and act:

Because engineers should be working to minimize utility costs, they need to have a detailed understanding of what charges comprise each bill, as well as what opportunities exist to reduce those charges. Even if bills are paid centrally from the corporate accounting department, on-site staff needs to review them for inaccuracies and perform a relatively simple assessment of the building's performance monthly.

Building staff should regularly compare meter readings to billing data, double-check rates and tariff schedules, and generally ensure the accuracy of the bills. When considering investing in projects to reduce energy and water consumption, engineers can use annual energy costs to estimate the savings that will come from the project.

All properties are charged for the total amount of energy that they consume, as well as for various other fixed and variable fees and service charges. At some properties, the rate will vary based on the time of year, the time of day or other factors. When this is the case, the engineer should have a clear understanding of those tiers – when the peak demand occurs during the day and how the property's costs can vary depending on when it is using energy.

There may be an opportunity for the building to perform load-shedding, shifting some of its power consumption to other time periods, or spreading it across the day to keep total demand in a lower tier. Electric utilities that implement load-shedding programs may also give customers a cost discount in exchange for allowing the utility to request the property team voluntarily reduces load when asked to do so or to install controls on some equipment in the building, such as water heaters. When the local demand begins to approach the power company's maximum generating capacity, the utility has the capability to turn off some equipment at its customers' buildings to reduce the demand.

Properties should also review their water and sewer bills to verify that they are not being charged for water that does not go down the drain. Water that is used in irrigation systems and cooling towers should be metered separately, if at all possible, and the property should not be charged (or should be credited) for water that does not enter the sewer system.

BUILDING SYSTEMS

Ask the questions:

- What systems are contributing to our energy loads?
- How large is the plug load, HVAC load, and lighting load?
- How do we identify potential problems with our various loads, and if we find a problem what is the process to determine the cause and an appropriate resolution?

Discuss and act:

At any point, the building's load can be categorized according to what systems are running and the cumulative estimated watts or horsepower of all related equipment. This can be accomplished by either taking spot measurements of major equipment or estimating the usage based on the manufacturer's specifications. Knowing the approximate load percentages of each set of building systems allows engineers to understand where the most energy is used where energy efficiency improvements could be most impactful.

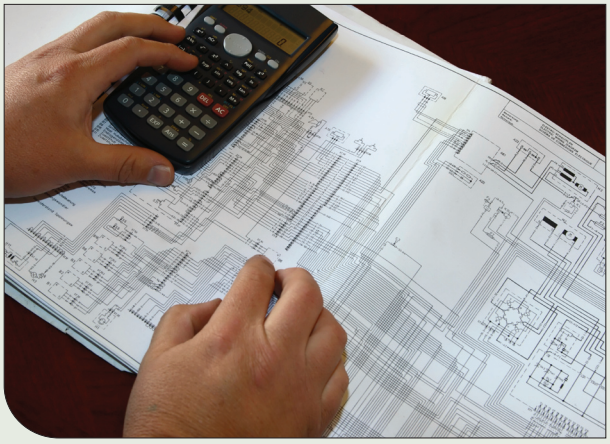
Additionally, knowing the total energy cost of operating each system can help to justify investments that will reduce those costs. It can also help you calculate the cumulative effect of low-cost changes to scheduling and operations, a valuable number when trying to convince ownership or asset management to invest in more costly improvements.

Engineers should also monitor the load profiles of each system over time to look for problems. Many Energy Management Systems support trend logging, recording data on the usage profiles of systems over time. Trend logs can be used to diagnose the cause of many symptoms of energy waste. More information on trend logging and identifying system problems is available on the BetterBricks Symptom Diagnosis Tool, http://www.betterbricks.com/DetailPage.aspx?ID=493.

OPERATIONS AND SCHEDULING

Ask the questions:

- What control equipment, if any, is used to manage building systems?
- Are timers, programs, or routines scheduled to mirror occupant requirements?
- How often are these schedules reviewed and optimized?
- Do we verify that systems are actually operating according to the schedule?
- What is interval data? Is it available through the utility?



Discuss and act:

Building schedules should match building occupancy and tenant needs as closely as possible, with any unnecessary operation eliminated. Even a small reduction in the number of hours that HVAC or lighting is provided can add up to significant savings. The building engineer should use the building's energy demand profile to optimize the schedule of operations.

Trend logging is the practice of using 15-minute or 30-minute electricity demand data (known as interval data) to create a profile of energy consumption throughout a given day. This information may be available through the utility or by installing a new or temporary meter. The data allows the engineer to see how long it takes the building to start up in the morning and when systems are turning off at night, which in turn allows for optimizing the start and stop times for the building. By scheduling the building aggressively, engineers should be able to maximize energy savings while having minimal impact on occupant comfort.

For instance, an engineer may determine that in the autumn, his office building's HVAC equipment could be started at 5:30am instead of 4:30am and still reach set-point in time for tenants' arrival, and that the system could be turned off at 7pm instead of 8pm without impacting occupant comfort. Implementing these changes could reduce the HVAC system's run-time by 13%, which would save a significant amount of energy. The engineer should continue to monitor electricity demand profiles each season in order to optimize the schedule.

Trend logging will also allow the engineer to verify that energy consumption for the building matches time schedules or the programs of other building control systems. Building systems occasionally do not operate as they were designed due to software glitches, bad sensor data, special-event schedules that have not been reset to normal parameters, or other malfunctions. Trend logging profiles allow the engineer to see whether the building's major energy-consuming systems are operated as scheduled. If trend logging data is not available, encourage the engineer to periodically visit the building after-hours to check that lights and equipment are turning off according to schedule.

The engineer should also review load profiles on weekends and holidays. In many office buildings, there is no need to operate the building on Saturdays and Sundays. Engineers and property managers can work with tenants to determine when they are actually in the building and then optimize the schedule accordingly. In multi-tenant buildings, engineers should investigate operating VAV boxes, exhaust fans, and air handling units independently so that on weekends, for instance, conditioned air is provided only to those tenants whose employees are actually in the building. More information on load profiles is available at the BetterBricks website at: http://www.betterbricks.com/DetailPage.aspx?ID=523

ENERGY MANAGEMENT SYSTEMS

Ask the questions:

- How can we better utilize our energy management system (EMS) to improve energy efficiency?
- What additional operations could we perform that would enhance or complement our EMS?

Discuss and act:

Many buildings install a new or updated EMS without enabling all the energy-saving features, either because they are deemed unnecessary or because they can be included later. The result is that the EMS is often used as a time clock, simply starting up and shutting down pieces of equipment on a pre-set schedule, when it's really capable of much more.

Review whether the EMS has the following features and confirm that they're being used effectively:

- Optimal start/stop
- Demand ventilation
- Outside air supply temperature reset
- kW/kWh monitoring
- Zone control over temperatures
- Chilled water supply temperature reset
- Hot water temperature reset
- Alarms to workstations, radios, pagers, or phones
- AHU supply air temperature reset
- AHU static pressure reset
- Remote access
- Equipment usage tracking

Further, understand which pieces of equipment the EMS controls, and consider upgrading it to enable more enhanced control if necessary. The EMS might be able to control:

- Exhaust fans
- Cooling towers
- Outside air fans
- Chillers
- Water heaters
- Boilers
- Air handling units
- Lighting
- VFDs
- VAVs or FPTUs
- Irrigation systems and fountains

Operations that are not supported by the EMS system may be approximated manually. For example, if optimal start/stop is not available, confirm that start times are adjusted seasonally by the building engineer. If not, use trend logging information to determine the optimal building start-up and shut-down times.

MAINTENANCE

Ask the questions:

- Describe our general maintenance strategy. Which elements are reactive, preventive and predictive? Why?
- What tools do we use to diagnose system problems?
- Would the property's energy management program benefit from outsourcing more HVAC support? Alternately, would it benefit from bringing some of the outsourced HVAC support in-house? Why or why not?

Discuss and act:

The management team's preventive maintenance strategy has a significant influence on the long-term cost of operating the building. Equipment should be maintained regularly to maximize lifespan and ensure optimal levels of performance. The building engineer needs to understand the relationship between regular maintenance and minimizing long term costs, know the strategy for maintaining each piece of equipment, and have a consistent and clear system for identifying and correcting problems in the building operations.

The challenge at the property level is to select the proper maintenance strategy for each piece of equipment that will extend its useful life while also minimizing service interruptions, costs, and time spent. Here are three broad strategies that can be used for maintenance scheduling: reactive, preventive, and predictive.

Reactive maintenance is straightforward: perform maintenance only after the equipment has stopped working properly. This approach maximizes the amount of time between service dates, but has several major drawbacks. Building engineers are unable to know when service will need to be performed and thus cannot plan ahead to set aside the required time or prepare tenants for the interruption in service. It should be used for equipment that has little effect on building operations, has low associated costs, and does not require much coordination to perform. It is the de facto approach used on most pieces of equipment that are not managed by a service schedule, including most lighting, some pumps and fans, and other small pieces of equipment.

Preventive maintenance seeks to maintain equipment before it reaches the point of failure, usually by tracking the amount of time between servicing. This shortens the amount of time between equipment services, which can increase the maintenance cost. However, it allows your team to schedule when the maintenance will occur, organize personnel and equipment, minimize the downtime, and coordinate with tenant schedules if necessary. Preventive maintenance is best used with equipment that is inexpensive to service, difficult to maintain, critical to building operation, and/or requires special equipment or personnel. This includes sensors, some critical or difficult-to-reach lighting, cooling towers, AHUs, and filters. Properties with an EMS system can use it to track operating hours for major pieces of equipment and alert building staff as the time for service approaches.

Predictive maintenance is similar to preventive maintenance because it seeks to intervene prior to equipment failure, but it extends the amount of time between servicing. This approach uses historical data and data from sensors to measure performance and forecast when it is time to service equipment. For this reason, it is ideal for systems that meet the preventive maintenance criteria

but are also expensive to service or require frequent maintenance. This includes major HVAC units such as chillers and boilers.

Learn more about maintenance systems and strategies on the BetterBricks website at: http://www.betterbricks.com/DetailPage.aspx?ID=489#DefineAMaintenanceStrategy

There are diagnostic tools available for each type of equipment in the typical office building. More information is available at: http://www.betterbricks.com/DetailPage.aspx?ID=494

BENCHMARKING AND TRACKING

Ask the questions:

- What does "energy performance" mean?
- How do we track energy consumption and costs?
- What are our baseline AND current ENERGY STAR ratings?
- How does our building compare to other similar properties?

Discuss and act:

Energy performance is a measure of the amount of energy that a building uses relative to its size, occupancy, function, and tenant needs. It can be represented in a variety of ways, one of which is energy intensity, or energy usage per square foot – the lower, the better. Tracking energy performance allows engineers to verify that the systems are operating as expected: spikes in usage can indicate a problem and should be explored and addressed. The industry standard for benchmarking energy performance for office buildings is Portfolio Manager, a no-cost online tool provided by the US Environmental Protection Agency's ENERGY STAR program. Porfolio Manager enables the property team to establish a baseline and measure ongoing progress, determining the building's relative energy efficiency against its peers.

Each month, someone on the property team should enter utility consumption and costs into Portfolio Manager. The tool uses the energy consumption, size of the building, number of occupants, local weather, and other data to generate metrics regarding how efficiently the building is operating, including energy intensity. Many types of buildings, including offices, are eligible to receive a rating between 1 and 100 indicating how the building's normalized energy performance compares to its peers. An overview of the Portfolio Manager tool, along with supporting information and training, is available at www.energystar.gov/benchmark.

Designate an on-site staff person to be responsible for collecting the occupancy and utility bill data that must be entered into Portfolio Manager on a monthly basis, and encourage them to take free online ENERGY STAR benchmarking training. Further, instruct the building engineer to review

energy performance data in Portfolio Manager each month to verify that it meets expectations and reflects any changes or improvements that have been made at the property. If the normalized energy performance rating or energy intensity fluctuates by five percent in either direction, the engineer should promptly investigate the underlying cause and develop a written explanation for the variance.

THE BIG QUESTION

- What are the biggest opportunities for improving the property's energy performance?

Find out what is on your engineers wish list of projects that would improve energy performance, enhance reliability and tenant comfort, and reduce costs. Most likely, your on-site team or your service providers already have some ideas on ways to improve efficiency. Check if your engineers have an understanding of what can be improved; encourage them to investigate and report the potential financial payback and other benefits of these projects.

The first point of attack is likely to be the systems that comprise the largest percentage of the building's energy loads. Identifying improvement opportunities in those areas will allow you to begin evaluating the cost and benefits of implementation, and at the same time it will help you understand your engineers' knowledge of the building systems and awareness of the associated energy costs. This question provides a framework to discuss focusing on energy performance and striving for continuous improvement.

EXAMINING YOUR PERSONNEL MANAGEMENT PRACTICES

- What training would help building operators maximize their potential?
- What feedback loops are necessary to provide insight into staff (and contractor) performance?

In addition to the discussions with your team, examine your own "human resources" practices and ensure that you are managing your in-house team and service providers effectively. Work with them directly to give them the training and feedback that they need to be successful.

Training:

Evaluate your in-house engineering team's needs for education, tools, and encouragement to achieve success in building operations and energy management. All engineers should receive periodic training on green initiatives and energy efficiency opportunities. Exposing your engineering staff to new technologies, building management approaches, and the broader concepts of sustainability can help overcome potential inertia or resistance to change.

Get a complete list of the equipment maintenance currently performed in-house and the maintenance that is contracted to third-parties. Are certain tasks outsourced unnecessarily – when building staff can do the job just as well? If so, why? A heavy reliance on service contractors can

result in diminished understanding of building operations on the part of on-site staff. On the other hand, a good working relationship between building staff and contractors (and close oversight of contractors' activities) can enhance staff skills. This will contribute to a higher level of awareness and a greater ability for building staff to identify and correct operational or equipment issues quickly without the assistance of contractors.

Building operations staff needs to have a strong enough grasp of the work being performed to be able to oversee service contractors and verify that the level of service is adequate. Periodically review the skills required to keep the building's systems functioning efficiently, and compare those to the skills possessed by the in-house team to identify any knowledge gaps. Does the team recognize any shortcomings? Consider providing additional training and education opportunities for building staff.

To determine what training would be useful, consider using an assessment of building performance to identify areas for the in-house team to improve. Alternately, review opportunities for on-going education and training toward professional licenses and certifications. Consider providing this training even to individuals that are not seeking the associated license.

Feedback:

As part of the regular performance review process, ask in-house staff members to assess their levels of service and ability to manage systems and building energy consumption. Provide feedback on individual performance, identify strengths and areas for improvement, and also share feedback on the property's energy performance indicators. Consider collecting other data to provide insight into performance, such as the number of tenant calls or complaints over time.

Also ask in-house staff to assess the performance and level of service provided by vendors on a regular basis. If service contractors are under-performing, equipment will not run at optimal efficiency, equipment lifetimes will be reduced, and more service will be required – burdening the property with additional costs for new equipment, maintenance activities, and energy usage.

Conversely, ask service providers to evaluate the property's energy management programs and existing systems. Service providers generally work with a wide variety of clients and may be able to share insights and ideas from other properties, or to identify areas for improvement at your property.

THE BOTTOM LINE:

- Clearly defined goals and metrics will help you review performance and measure your results and progress toward improved energy efficiency.
- Asking the right questions will allow you to:
  - Better understand building operations.
  - Evaluate existing routines and determine if they are still appropriate.
  - Identify opportunities to improve efficiency.
  - Uncover areas where you or your team needs additional support.
- More in-depth discussions with engineers and services providers will also allow you to understand and evaluate what opportunities for improvement the operations team would like to implement, and what areas the team may be overlooking.

USEFUL LINKS

The High Performance Portfolio Framework:
http://betterbricks.com/track.aspx?link=graphics/assets/documents/BB_RealEstate_Framework_R4.pdf

Energy Tracking and Accounting:
http://www.betterbricks.com/graphics/assets/documents/Energy_Tracking_and_Accounting.pdf

Enhanced Operations and Maintenance:
http://betterbricks.com/track.aspx?link=graphics/assets/documents/BB_WinTactics_Enhanced-OM_Final.pdf

ENERGY STAR Best Practices Checklist for Improved Energy Performance:
http://www.energystar.gov/ia/business/downloads/BP_Checklist.pdf

Motivating and Rewarding Success:
http://betterbricks.com/track.aspx?link=graphics/assets/documents/Motivating-Success_Final.pdf

Energy Transparency and Reporting:
http://betterbricks.com/track.aspx?link=graphics/assets/documents/EnergyTransparency_Final.pdf

Interpreting Electric Meter Data Training Series:
http://betterbricks.com/operations/videos

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