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Energy Monitoring and Targeting

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(Samuel was the first person to become Professional Energy Manager certified in Kenya (December 2015). In addition, he has been certified by the Kenyan government to conduct energy audits throughout the country.)

(One of the underlying principles of prudent management of energy resources involves establishing a baseline and energy benchmarks. The following article reinforces this principle and stresses the importance of continual attention to energy consumption – Thomas D. Mull, PE, PEM, CEM)

Introduction:

Facility managers should know they can improve their energy efficiency by monitoring and understanding their energy usage. Energy monitoring and targeting is a practice based on the axiom "You can only manage what you measure". It combines the principles of thermodynamics and statistics and provides feedback to determine when and why energy consumption deviates from an established target pattern. It is a continuous process as shown in the figure below.

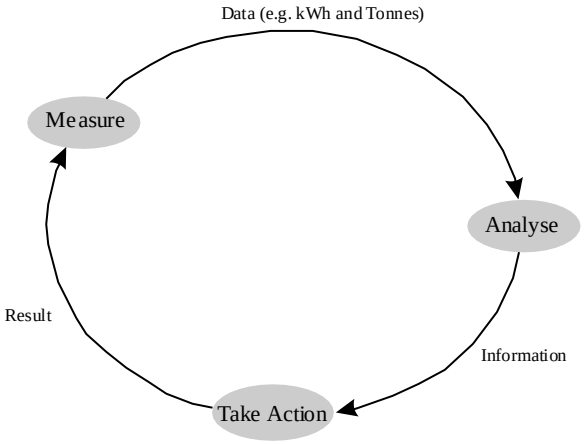

Figure - A Model of the Monitoring and Targeting Routine

The main elements of monitoring and targeting include:

1. *Measuring of energy consumption and benchmarking*:
   This is usually the initial step. It involves the collection of energy data to establish a baseline for energy management. Data can be collected through submetering of various sectors of interest. This can be done through either remotely or locally-accessed metering.

2. *Setting targets*:
   Once a benchmark is established, or an existing one confirmed, a realistic target for energy reduction can be set. It is the metering of actual consumption data that enables the setting of a realistic target. Target setting consists of two parts, 1) the level to which consumption can be reduced and 2) the timeframe to achieve it.

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3. *Frequent comparison of consumption with set targets:*
   This is the monitoring of any difference between expected consumption and actual consumption. It is best performed with use of CUSUM*, control charts and other analysis tools.

4. *Reporting variances and taking action:*
   Once negative variations are realized, the causes of the variations are identified and corrected. The cycle then goes back to the measurement phase. If the set targets are too easy or too hard to achieve, they are revised accordingly based on collected data and the process starts all over again.

Summary:
Monitoring and targeting energy consumption provides the following benefits. It helps in:

- Uncovering opportunities and generating savings,
- Validating energy efficiency program performance,
- Predicting energy consumption, which aides budgeting, and
- Making comparisons of current performance to industry standards, regulatory compliance and Corporate KPIs easier.

** In statistical quality control, the **CUSUM** (or **Cumulative Sum Control Chart**) is a sequential analysis technique developed by E. S. Page of the University of Cambridge. It is typically used for monitoring change detection.*

Where to Spend Your Energy Management Budget

By: Thomas D. "Dan" Mull PE, PEM, CEM
Executive Director/President, IEP

With limited energy management budgets, how we allocate those funds is critical to optimizing energy and environmental savings. So, how do we go about establishing priorities?

Strategic Energy Planning tells us we should identify where energy is being consumed (i.e., major energy consumers), understand our energy billing structures and where our energy funds are being spent, i.e., what equipment/processes consume the most energy expenditures. In addition, we should have benchmarks to establish a baseline and evaluate the effectiveness of programs and strategies. While all of these points are true, once we have this information how do we determine the specific programs and strategies to best allocate our funds to have the greatest impact? While factors can vary based upon specific functional needs, I would suggest the following approach to optimize funding allocation.

The initial focus should be on critical equipment/systems. A critical equipment/system is defined herein as one that is essential to the main product or service of the facility. If it is down, so is the operation.
Evaluate each *critical* energy consuming piece of equipment/system to determine its operating performance.

- Is its overall system performance meeting requirements?
- Are there significant or reoccurring maintenance issues?
- Is it being properly controlled? (on/off operation, operating pressure, minimized system leaks, etc.)
- What is the age of the equipment/system? Is it near or past its anticipated useful life?
- How efficient is it in converting energy (electricity, natural gas, etc.) into the necessary services?
- Is maintenance performed *as things break*, or is preventive maintenance conducted?

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If a system or a specific piece of equipment is providing the necessary services, and is not a significant maintenance concern, then replacing it with a more efficient option is likely not cost-effective based upon energy savings alone. Even today, many energy management decisions are based upon restrictive economic criteria. Therefore, replacement based upon energy efficiency improvements alone can be difficult. Therefore, without additional considerations (equipment age, maintenance issues, etc.) replacement based upon efficiency improvement should be relegated to a secondary consideration.

It should be mentioned there can be exceptions to this approach. For example, the benefits of LED lighting (increased efficacy, longer life, and reduced maintenance costs) along with decreasing costs have resulted in replacement widespread acceptance, primarily based upon increased efficiency.

With that noted, assuming that the existing equipment or system was properly installed and set up*, and is in good operating condition, the greatest return for energy funds can typically be found in the areas of scheduling and maintenance. Note, when properly installed and set up equipment will typically not become more efficient without a major modification. Therefore, emphasis should be placed on other controllable factors to maintain performance.

Maintenance:

The first step in optimizing system performance and minimizing energy-related costs is to assure the equipment is operating at peak performance. This necessitates a *preventive maintenance* (PM) approach, rather than a *fix it when it breaks* approach. Establishing a maintenance program that insures the fundamental services (belt-tensioning, repairing leaks, lubrication, cleaning, filter replacement, etc.) are conducted in a systematic manner will:

- Optimize performance,
- Maintain equipment/system efficiency,
- Minimizing downtime due to equipment failure, and
- Extend equipment life

Figure 1 – Group Relamping - Part of a PM Program

** Just because a system or equipment is operating does not mean it was initially set up to optimize performance and savings. This should be verified, if not explicitly known.*

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While the "*fix it when it breaks"* approach does minimize expenditures for a specific budget cycle, it invariably results in a series of negative consequences* ultimately increasing overall costs. Therefore, structured preventive maintenance plays a major role in optimizing savings.

There are a number of programs and services available that can help companies develop and implement systematic programs for equipment maintenance thereby enhancing performance and savings potential. A brief internet survey can provide multiple options. In addition, engineering universities with industrial outreach program may be able to provide assistance in developing a customized maintenance program.

Scheduling:
Appropriate scheduling of equipment and system operations is critical to minimizing energy expenditures. In evaluating current control strategies the following should be addressed:

- Is the equipment/system performing the required function when needed and off when not required?
- When "off" is the system truly off or in a secondary/idle mode still consuming energy?
- Has the equipment/system operational requirements changed since initially set up, thereby necessitating an updating of its schedule?

These are basic questions to assure the control sequence allows for the required services, but limits unproductive use of energy. Scheduling, therefore, encompasses control of the equipment or process.

An example of this might be a process that requires the use of compressed air when a production line is in motion to remove particles or moisture. But, when the line stops (for a scheduled downtime, retooling, etc.) compressed air is still discharged. Simple controls (such as a solenoid valve) can be installed to assure when the line is not in motion compressed air is not utilized.

Facility energy requirements can change for a variety of reasons. Therefore, system operations should be address periodically to assure existing schedules are consistent with required services and resource optimization.

The old adage "If it ain't broke don't fix it." may be admirable to keeping systems running, but it is not regarding optimizing operation and savings.

** Less than optimum performance/efficiency and higher potential for major failure, increased downtime and shortened life.*

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Technology offers us the capability to remotely modify schedules, control and monitor various system parameters, and provide alarm notifications so any issue can be addressed quickly, thereby minimizing downtime and maintaining operational efficiently. From a simplistic lighting control (occupancy sensor) to a sophisticated building automation system we have at our disposal the ability to control (i.e., schedule) our equipment to optimize operations. All too often, unfortunately, scheduling to optimize performance is not a priority as long as the basic facility requirements are met.

Summary:
The focus of this article has been how best to allocate limited funds to achieve the greatest energy impact, i.e. savings. To this end the following approach has been presented.

With the assumption the existing equipment is performing properly and not a significant maintenance concern*, maintaining equipment in peak operating condition and assuring appropriate scheduling is in place are the two (2) most cost-effective first steps. Next, other low and not cost opportunities for saving should be addressed. This could include such things as system leak detection and remediation, utilizing improved belt-drive systems, reducing operating pressures, LED lamps, enhanced controls, etc. Once these opportunities have been exhausted, system/equipment replacement with more efficient options is a viable next step for consideration.

** If this is not the case then a replacement with a more efficient option becomes a major consideration, with a focus on scheduling and future maintenance.*

Executive Director Announces Retirement

By: Staff Writer

Since its inception in 2009 Thomas D. “Dan” Mull has been IEP’s Executive Director/President. Under his direction, IEP has certified nearly 700 PEMs. Through IEP’s management of the North Carolina State University (NCSU) Energy Management Diploma Program, partnering with Schneider-Electric’s on-line Energy University, and providing specific PEM training programs dedicated to U.S. state governments, energy professionals have been certified in more than thirty-five (35) countries.

Dan is looking for a dedicated energy professional to take over the responsibilities of IEP by the end of 2018. He will continue to provide limited coordination, facilitation and instructional services throughout 2019 to assure a smooth transition, with his full retirement by the end of that year.

The new Executive Director/President will assume directorship of the NCSU Energy Management Diploma Program, coordination responsibilities with Schneider-Electric’s Energy University, development and issuance of the IEP quarterly newsletter, expanding PEM certifications through additional training, coordination of PEM renewals and maintaining the IEP database.

If you know an experienced energy professional looking for a highly gratifying opportunity to further the expansion of energy management training and certification, have them contact Dan at (919) 280-3480 for additional details.