Electricity-Use Monitoring in Manufacturing & Industrial Facilities

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Although it may seem straight-forward, the consumption of electricity by manufacturing machines may not always track with production activities. Sometimes power consumed may change only a disappointingly small amount whether you are in a full production mode during an "off-shift" period, or "on break" during a work shift. Worse than this, sometimes significant amounts of electrical power are being consumed by large machines which are thought to be "off-load, "idle" or in "stand-by" mode.

Identify equipment power usage patterns and correlate with plant activities

In the simplest case, monitoring power-usage can identify equipment that is using significant amount of electricity (burning money) at a time when your plant is not in a production mode.

In more advanced applications, power-use monitoring can compare alternate approaches to identify inappropriately large amounts of electricity consumption (kW-hr) by a particular piece of equipment. This can help include the cost of energy in production planning activities and validate the use of alternate approaches that do not use as many power-hungry tools.

Low-cost actions can save many dollars

For example, consider the case of two power-hungry machines may perform similar operations in a production environment, but they may have significantly different power usage profiles. This type of situation can occur with essential machines such as air-compressors, extrusion machines, required HVAC equipment, or process heaters. Often machines will consume different amounts of electricity with different work-load profiles.

Essential industrial machines will frequently have a back-up, older version, or a second machine to share the work load. Often these two machines may perform similar operations and even similar through-put, but one machine may have been designed with different technology making it more efficient than the other machine. And our experience has shown that the older machine is not always the power-hungry offender.

Many machines do not work efficiently when they are not operated at their target production rate.

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This optimum power efficiency rate is often a goal during machine design and typically cannot be adjusted during its operational lifetime. Monitoring machine's power consumption in your manufacturing environment with production loads commonly found at your facility may help you discover that one of these machines is more efficient than the other.

With knowledge about which machine is more efficient, operations may be scheduled to take advantage of this difference in order to save significant dollars during the course of a typical year. This type of change requires no expenditure of capital equipment ($'s) resources.

Power-use monitoring is necessary to understand the size of the problem.

Industrial and manufacturing facilities frequently use target time periods for recovering an investment through payback from process improvements resulting from the investment. In many manufacturing environments, this "Return on Investment (ROI) period can range from 6 months to 3 years or longer.

To assess what type of electricity-use reduction program you can consider, you first must know the number of dollars used to supply a machine with electricity during the ROI period. For example, if your company typically uses a 12-month ROI period for production improvement projects you must assess your target machine's electricity consumption during a typical 12-month period with a power-use monitoring tool.

This type of monitoring system may need to gather information during a 2 week period for 24 hours a day, seven days a week. Sometimes measurements of power-use need to be extended to fully capture changes during weekends, month-end production bumps, or seasonal activities.

Let's say that you have determined that you can use a 2 week measurement period. If your power-use monitoring system is like Sensor Synergy's Watts Aware 118, it will provide power use measurement results in both kW-hr per user selected time period and dollars per user selected time period.

Now let's say that your power-use monitoring system has determined that your target machine has consumed about $620 of electricity during this 2-week monitoring period. A simple calculation will determine that your target machine's average weekly consumption of electricity is about ($620/2) $310/week. For your company's ROI period of 12 months (52 weeks), your target machine uses:

$310/week x 52 weeks/(1-year ROI period)
= $ 16,120

You now have discovered through measurements that in your manufacturing environment with your typical production loads, your target machine consumes about $16,000 during the time period that your company's

expects a return on its manufacturing process improvement projects.

If you are considering an improvement to this machine that costs $30,000 you have a problem. No matter how efficient your machine becomes after this project, you cannot recover enough dollars during the 12-month ROI period by reducing electricity use. Even if you reduce this machine's electricity use to virtually $0, you still have only saved about $16,000 during the 12 month ROI period, and your company wants to recover all of the money from the project within 12 months. And realistically, these types of efficiency improvement projects may reduce consumption by 10% to 40% - not eliminate electricity consumption completely.

However, if you are considering a project that costs $1,500 to upgrade your machine, and you are reasonably confident your will experience a 20% to 25% reduction in electricity consumption, you may be a hero. For this case, consider the worst case of a 20% reduction in electricity consumption. To make this an extra worst case, also assume that your power-monitoring measurements were flawed for some reason and were 10% too high. You actually only spent $14,500/year on electricity for this piece of equipment. Either you had an extra heavy production session or some other problem distorted your measurements. Even in the worst case scenario, this change will save your company $2,900 the first year during the 12-month ROI period.

First year savings = $2,900 = 0.20 x $14,500

Your improvement will recover the costs of the enhancement in the first 6 months and your company will experience the benefits of your efforts for the entire 12-month ROI period --- plus as a bonus these savings will continue for many years afterwards as long as the equipment is still in service.

Knowing the size of the problem, you can consider a range of electricity-use reduction projects - some requiring no capital expenditures.

Simple, no capital expenditure power saving solutions

Consider the straightforward problem of equipment using electricity and burning dollars during off-shift time periods, so that the equipment will be "instantly" ready (warmed-up) when the main production shift arrives at your plant.

For this problem, one of the simplest solutions with the least expensive up-front costs is to arrange for a production worker to arrive at your plant earlier than normal and turn equipment "on" in preparation for the start of the main production shift. Depending on the equipment and the length of time necessary to "warm-up" your equipment prior to the production shift, your early start worker could arrive at work from 10 minutes to 1 hour before the arrival of the main shift.

The power-use monitoring system will help identify costs associated with not turning off the equipment at the end of the prior shift and that can be compared with the cost of bringing in a production worker prior to the normal start time. With this "manual" approach, it is important to arrange for another production worker to stay at the end of the shift and shut down the equipment.

More advanced solutions

A slightly more advanced solution with greater up-front costs and lower on-going costs, is to purchase automated equipment to start and stop your equipment based on a time-of-day / day-of-week clock. This automated approach may require contacting the manufacturer of your equipment to find automated "on-off" devices or the use of a small PLC unit to perform a more complex start and stop set of procedures on your equipment.

Still more advanced solutions may utilize sophisticated "smart" automation equipment that turns equipment "on" and "off" based on other factors in addition to a time-of-day clock. A power-use monitor will help you determine how many dollars are wasted on running equipment during off-shift hours so you can better decide how many dollars can be spent on automation equipment.

In some cases a $20 "occupancy sensor switch" turning lights on and off in a seldom used room might be easy to justify. In other cases a $20,000 to $30,000 "staging" air compressor controller networked to multiple pieces of air compressor equipment may not be justified by the expected savings in an acceptable ROI time period.