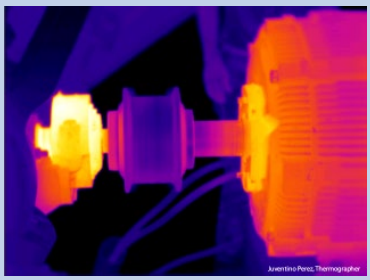
Make a low-cost electrical energy audit pay off

Application Note

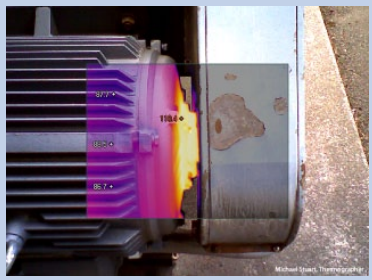
If the idea of an "energy audit" sounds expensive, think again. Managing the amount of electrical energy a building or plant consumes is just good business. The expensive part is NOT taking action.

In this common-sense approach, you:

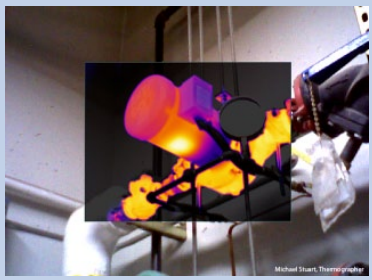
- Identify your major loads (energy hogs)
- Test to determine your energy consumption profiles
- Find and fix energy waste to minimize consumption and cost
- Optimize load usage now and into the future



Abnormal heating on sides of coupling.



Overheating motor with winding issue.



Bearing problem on a drive motor.

Infrared emissions from electric motors may reveal issues with bearings, drive components, and overall performance.

True, an audit could point toward costly remedies: major capital investments your customer may be unable to swing in this uncertain economy. Using a different approach, however, you can help your customer save many kilowatt hours (kWh)—and lots of cash—by investing time, but with little or no capital investment.

Starting with a low-cost energy audit, you can institute an energy efficiency program that puts easy money back into your customer's budget. You don't have to replace your car's drive train to make it run better. A tune-up may be all it needs. The same applies to buildings and factories.

Savings for growth

Exact savings in each facility will depend on its type, age, and size, as well as the existing approach to maintenance and operations. If your customer already has a good proactive-maintenance program, expect to save 10 to 20 percent. If the maintenance team fights a lot of

Inspection with the Fluke Ti32 Thermal Imager can reveal defective components and maintenance issues, such as energy-wasting loose connections.

fires, you may save up to 30 percent. Many facilities can reduce utility expenses by 25 percent within a one-year payback. And the benefits don't stop there.

Energy will always be an inflationary cost. Reducing utility expense increases available funds, which may open opportunities to upgrade older equipment and keep your client's operation running efficiently.

Who is it for?

There's a good chance almost any facility is operating at less than maximum efficiency. By examining the operation in detail you can find losses you can fix to save energy at little cost.

Most operations today use one of two approaches to facility energy management:

Hellhounds on my trail! Lean and mean (and maybe understaffed), these guys have a full-time job just to fix problems and keep the operation running. No time to worry about wasted energy.

Bombs away! Energy conservation programs mandated from the top down that entail major equipment upgrades can disrupt production, and incur large capital costs and long paybacks.

We like a third approach, relying on data, not dollars, to save energy. By making energy measurement and conservation part of normal maintenance/monitoring routines, you can achieve easy savings with little to no capital expense.

Selling the audit concept

Your customer may think of an energy audit the old way: costs money we don't have. Remind him that we're talking little cost to do this kind of audit—mainly an investment in time—and the potential savings in energy AND CASH are too big to ignore. Other talking points:

- Waste can happen anywhere, and we won't know until we look.
- We're in it for the long haul: Savings through making systems "run right" can continue for years.
- It's free money: Savings in energy costs may be recycled to meet other facility needs.
- You're the boss: If fixes aren't truly "low cost," postpone or forget them.

Organize for success

With a go-ahead from your customer, you'll need to decide who will do the work. If you are an outside service provider, do you have the energy management knowledge to act as a consultant in energy? Do you have the test equipment you'll need?

Your next step is to develop your plan

- Define the scope of your audit and set out your timeline.
- Establish goals that are clear, measurable, and timely.
- Complete a facility profile that identifies all of the major energy-consuming systems, lists major pieces of equipment that consume electric power (for instance, motors driving compressors, pumps, blowers and the like), and describes their operating parameters (operates 24x7, on demand, or whatever is the case).

Understanding baseline power consumption

The facility is already using plenty of electric power. Do you know how much, at what time of day, how much it's costing, and why? Such knowledge is fundamental to the audit, so you'll need to collect energy consumption data for the past 12 months.

Utility billing can be complex. The cost is based on not just how many kWh of electrical energy are used, but when and how that energy is used. Spikes in peak usage mean the utility must have capacity on hand to meet those surges in demand—and they will probably charge extra for that. Contact the power

supplier to ensure you understand billing parameters and cost drivers, and identify patterns in usage you could change to save money.

With energy consumption a national and even global issue, increased resources are available to help industrial and commercial users manage power and even help pay for energy conservation. You should understand utility company programs and government tax deduction and rebate opportunities that can improve the payback on energy conservation measures.

Tracking and reporting usage

Utility bills aren't your only data source on overall power usage. The power utility may have electric meters that provide real-time usage data so you can link power consumption directly to your customer's business cycle.

By collecting meter-level usage data and entering it into a power usage database, you can track multiple electric meters per facility; benchmark a facility relative to past performance; see in detail how performance has improved; and share the data with your client.

Distribution network measurement

Now it's time to dig down. You'll want to conduct your own measurements of power consumption and power quality. You'll use a tool like the Fluke 1735 Three-Phase Power Logger to measure and record electrical power parameters and harmonics and capture voltage events. With the Fluke 1735 you can record for up to 45 days to capture your usage patterns over the facility's entire operating cycle, or multiple cycles. You'll want to log power at main and secondary panels, recording kW, kWh, power factor, and other quality and consumption indicators.

You can then use this data during your audit to compare against utility meter readings and utility bills, and evaluate your facility's peak demand and power factor charges (if applicable).

A thermographic (thermal imaging) inspection of the distribution system can reveal problems with breakers, fuses, contacts and other components that could be wasting energy, or even present a safety hazard. By scanning utility panels and components with a thermal imager like the Fluke Ti32, you may find components that are overheated due to component breakdown, corroded contacts, or loose connections. That heat, caused by increased electrical resistance, represents wasted energy. It can also lead to further breakdowns, system outages, or fire.

Test areas: Motors and drives

In many facilities, the electric motors that drive process equipment or spin fans, compressors, pumps, and material transport systems use a lot of electric power. Your facility profile should already include a list of these large motors, with details about their specifications, operating cycles, age, and history.

The audit regime for large motors consists of three stages:

- First, use your thermal imager to check contacts, switches, bearings and driven components—such as fan and pump bearings and gearboxes—for signs of excess heat. Compare components such as bearings against similar parts on other units, when available. If you test six motors and see that 11 bearings show the same temperature but one is hotter, that hot bearing may be wasting energy—or about to fail.
- Next, use your power logger to record the energy consumption and usage profile of each major motor, through its typical operating cycle.
- Then compare the data you have logged against the motor manufacturer's specifications. If the motor is using more power than its manufacturer rating, it is either undersized for the application, it requires maintenance, or equipment attached to it is not performing correctly.

By measuring the power consumed by each major load and your total facility, you'll be positioned to manage your energy consumption—and know what gains you have achieved.

Tracking motor data

Software is available to ease the job of managing electric motors. MotorMaster+ is a free online motor selection and management tool. It supports motor and motor systems planning by identifying the most efficient action for a given repair or motor purchase decision. The tool includes a catalog of more than 20,000 low-voltage induction motors and features inventory management tools, maintenance log tracking, efficiency analysis, savings evaluation, energy accounting, and environmental reporting.

Such software can help you access performance data, perform comparative benefit analysis with possible alternatives, maintain your customer's motor inventory, keep records of motor maintenance, and calculate project life-cycle costs.

What to do next

Your action plan should flow directly from the information you have gathered. You will want to repair connections and components that your thermography inspection found hotter than comparable units.

Review motor run schedules for opportunities to adjust timing and reduce peak demands.

Another useful comparison: compare the motors in place against the performance specifications of the latest high-efficiency motors. Consider whether replacing the existing motor with a high-efficiency model, or installing an adjustable speed or variable frequency drive, could save enough energy and money to pay off. Encourage your customer to consider replacing inefficient units with high-efficiency motors before failure. The savings could quickly surpass replacement costs. And if high-usage, inefficient motors fail, always replace them with high-efficiency models.

A low-cost energy audit will give your customer detailed knowledge of where the facility is using electrical energy, and provide options to cut those energy bills. The benefits—for your customer and for you—can be long lasting. A great time to start is now.

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