

ENERGY EFFICIENCY: Take 10 Steps to Conduct an Energy Audit



As an EHS coordinator, you may be called upon to not only ensure the company complies with all environmental laws but also help improve its overall environmental performance, such as by making it more energy efficient. But to improve the energy efficiency of your company's operations, you first need to know how much energy it uses and where. That's why you should conduct an energy audit. Here's a look at the Energy Audit Manual and Tool (the Manual) developed by the Office of Energy Efficiency of Natural Resources Canada and the Canadian Industry Program for Energy Conservation. You can hire an outside consultant to conduct the audit for you but the Manual was designed to help companies of all sizes conduct such audits in-house.

TAKE THESE 10 STEPS

The Manual explains that the goal of an energy audit is to determine where, when, why and how energy is being used in your facilities. More specifically, an energy audit is a systematic assessment of current energy-use practices, from point of purchase to point of end-use, that identifies how energy is handled and consumed, that is:

- How and where energy enters the facility, department, system or piece of equipment;
- Where it goes and how it's used;
- Any variances between inputs and uses; and
- How it can be used more effectively or efficiently.

Any energy audit is a fairly involved process. The Manual spells out each step in detail and provides many useful tools. But here's an overview of the 10 basic steps involved in an energy audit:

Step #1: Conduct a Conditions Survey

The purpose of a conditions survey is to assess the general level of repair, housekeeping and operational practices that have a bearing on energy efficiency and flag situations that warrant further assessment as the audit progresses. The results of the survey will help you identify likely areas to audit as well as opportunities to improve energy efficiency without any further analysis. For example, fixing leaks in the steam system or broken shipping dock doors that won't close will pay off immediately in reduced energy consumption. And the results will help you set priorities for the audit's mandate and scope. You can conduct the conditions survey by visually inspecting areas and equipment during a walk-through of the facility.

Step #2: Establish the Audit Mandate

For the audit to be a success, you should establish the audit mandate. That is, you should get a commitment from senior management and define the expectations and outcomes of the audit. To do so, you'll need input from management and production and maintenance staff. The mandate should make the audit's goals and objectives clear and outline the key constraints in timing, resources and access to facilities or areas.

Step #3: Establish the Audit's Scope

You'll also need to establish the physical scope of the audit. For example, are you going to audit the entire facility or designated areas, equipment or processes? The results of the conditions survey will help you define the scope. You'll also need the location of all energy inputs and a list of all major energy-consuming systems. The final scope should specify the limits of the audit in terms of:

- Input energy flows;
- Energy-consuming systems; and
- Energy outflows, such as heat loss through the building envelope.

Step #4: Analyze Energy Consumption and Costs

During this step of the audit, you'll collect, organize, summarize and analyze historical energy billings and the tariffs that apply to them. You should look

at utility bills for each purchased energy source, metered data and applicable utility rate structures. You may also be able to get historical energy consumption data from the utilities themselves. The goal is to determine the relative annual cost and incremental/marginal cost of each purchased form of energy.

Step #5: Compare Energy Performance

Determine energy use indices and compare them externally to best practices available within your industry or internally from:

- One period to another;
- One facility to a similar one within your organization; and/or
- One system to a similar one.

To conduct this analysis, you'll need periodic energy consumption data as well as information about factors that impact consumption, such as production, weather and occupancy. You want to establish:

- Relationships between energy use and significant factors;
- Trends in consumption;
- Preliminary reduction targets; and
- The potential savings in reducing the variability of energy consumption.

Step #6: Profile Energy Use Patterns

Next, you'll need to determine the time relationships of energy use, such as the electricity demand profile. This analysis should identify abnormal energy use conditions not otherwise evident, such as loads that are operating when they don't need to be and systems that are inappropriately sized. To conduct the analysis, you'll need logged data over intervals from one minute to one hour to one day for:

- Electrical power;
- Gas flow;
- Temperature;
- Humidity;
- Light level;
- Air flow or pressure; and
- Other pertinent or measurable factors.

The table below shows the events you want to look for in a demand profile:

EVENTS TO LOOK FOR IN A DEMAND PROFILE	
Information	Description
Peak demand	The time, magnitude and duration of the peak demand period or periods may be determined.
Night load	The demand at night (or during unoccupied hours) is clearly identified.
Start-up	The effect of operation start-up(s) upon demand and peak demand may be determined.

Shutdown	The amount of load turned off at shutdown may be identified, which should equal the start-up increment.
Weather effects	The effect of weather conditions on demand for electricity can be identified from day to night (with changing temperatures) and from season to season by comparing demand profiles in each season.
Loads that cycle	The duty cycle of many loads can usually be seen in the demand profile, which can be compared to what's expected.
Interactions	Interactions between systems may be evident. For example, increased demand for electric heat when ventilation dampers are opened.
Occupancy effects	Often the occupancy schedule for a facility is reflected in the demand profile; if not, it could be an indication of control problems.
Production effects	As in the case of occupancy, the effect of increased load on production equipment should be evident in the demand profile; again, lack of data may be an indication of problems.
Problem areas	For example, a short-cycling compressor is usually easy to spot from the demand profile.

Step #7: Inventory Energy Use

Now you can prepare a list of all energy-consuming loads in the audit area and measure their consumption and demand characteristics. The inventory measures how much electricity is used, and how much and how fast it's used in each category. To compile the inventory, you'll need:

- Facility and equipment drawings and specs;
- Equipment inventory and nameplate data;
- Power and fuel consumption;
- Measured flow rates, temperatures, etc.; and
- Equipment condition and performance.

The inventory will provide a breakdown of energy consumption by major area of use, such as gas consumption for production vs. space heat; electricity consumption for process, ventilation, compressed air, lighting and conveyance.

Step #8: Identify Energy Management Opportunities

By looking at the energy inventories and balances, notes from the conditions survey and selected measurements, you should be able to identify opportunities to improve the management of your energy use. You should prioritize these opportunities based on those that require immediate action and those that need additional analysis.

Step #9: Assess the Benefits

It won't be feasible to take advantage of every energy management opportunity that you've identified. You'll need to determine the potential energy and cost savings, along with any co-benefits, of each opportunity. The possible benefits

of an opportunity include:

- Direct and indirect energy savings;
- Comfort/productivity increases;
- Operating and maintenance cost reductions; and
- Environmental impact reductions.

Possible costs to consider include:

- Direct implementation costs;
- Direct and indirect energy costs; and
- Operating and maintenance cost increases.

Step #10: Report Findings

Lastly, it's important to report the audit's findings in a way that facilitates action. The report should include a succinct and compelling presentation of the audit's findings, including:

- An executive summary;
- An analysis of existing energy consumption;
- A description of the identified energy management opportunities'from inexpensive housekeeping improvements to costly, capital-intensive retrofits;
- A savings assessment of these opportunities; and
- An action plan for implementing those that are feasible.

BOTTOM LINE

Conducting an energy audit may be time-consuming and complex but you can use the valuable information you get from the audit to identify opportunities to improve energy efficiency, decrease energy costs and reduce GHG emissions that contribute to climate change. You can also use the energy audit to verify the effectiveness of energy efficiency measures that you've already implemented. In addition, by going through the auditing process, workers may become more aware of how their day-to-day actions affect the operation's energy consumption.

INSIDER SOURCE

Energy Audit Manual and Tool, Office of Energy Efficiency of Natural Resources Canada and the Canadian Industry Program for Energy Conservation

Use an Audit Plan to Guide the Process

An audit plan outlines the audit's strategy and process. Although the plan should be well defined, it must also be flexible enough to accommodate adjustments based on unexpected information and/or changed conditions. An audit plan is also a vital communications tool for ensuring that the audit will be consistent, complete and effective in its use of resources. Your audit plan should cover the following:

- The audit mandate and scope;
- When and where the audit will be conducted;
- Details of the organizational and functional units or areas to be audited (including contact information);

- Elements of the audit that have a high priority;
- The timetable for major audit activities;
- Names of audit team members; and
- The format of the audit report, what it will contain and deadlines for its completion and distribution.