ENERGY AUDITING WATER AND WASTEWATER FACILITIES

Introduction

Energy is one of the largest budget items for water and wastewater facilities. An energy audit, is an examination of a facility's energy uses. Once energy use is identified the costs of the energy being used can be identified. Next, recommendations to reduce energy uses and costs, called Energy Conservation Measures (ECMs) can be identified. ECMs generally include equipment and operational changes.

We will discuss:

- What is an Energy Audit?
- How is an Energy Audit performed?
- Examples of some common energy opportunities

What is an Energy Audit?

An Energy Audit is a detailed examination of the energy use of a facility. Energy is used in many forms at most facilities. Electricity is the form of energy that immediately comes to mind but most facilities also use other forms of energy. Some examples include:

- Fuel oil
- Natural Gas
- Propane
- Methane
- Diesel Fuel
- Gasoline

A thorough audit includes all forms of energy used at a facility.

Depending on the goals of the audit and the budget for the audit, an Energy Audit can be detailed or general in nature. An Energy Audit can be performed in house (by plant staff) or it can be performed by a team of professionals. An Energy Audit can be a simple "walk-through" or a multi-step project including detailed field measurements.

By identifying your desired outcome (your goals) you can develop your audit project requirements.

How is an Energy Audit performed?

Regardless of whether the audit is a walk-through audit or a detailed audit which can even include computer simulation the audit includes the same basic steps. Energy Audits should include a preliminary identification of the goals of the audit. Some examples might be:

- To reduce energy use without the use of capital funds.
- To identify how our facility energy use compares to other similar facilities energy use.
- To minimize energy cost.
- To identify energy conservation measures that can be funded by utility or grant programs.

- To develop a long-term plan including a strategy to minimize cost and use of energy. Investment to attain these goals will be evaluated on a case by case basis.

Once the goals of the audit are identified and agreed to the audit team can be identified.

After the audit team is identified the task of data collection can begin. Data collection includes obtaining energy bills (electric bills, gas bills, fuel and fuel delivery cost, etc.). At least one year of each type of bill should be collected. One year billing data is an absolute minimum. Two to three years' data is preferred.

Other types of data that is necessary or helpful for the audit include: electrical, HVAC/mechanical and process drawings, building plans, lighting plans, and P&IDs. Other types of data that are helpful in performing an audit include: equipment lists, pump and blower curves, equipment data sheets, a list of generators and their locations, flow reports, equipment run times, maintenance records, O&M manuals, and operating procedures. Using a metric to measure improvement within a facility or to measure performance of a facility against a group of similar facilities is helpful. Wire to water ratio is useful in many water and wastewater pumping and treatment facilities. It is the ratio of the amount of electric power used in kW (wire) to the amount of water treated or pumped (in millions of gallons).

The audit can be performed by a single person. When the audit team includes multiple participants, the members often build on the ideas of other participants. The best audit teams are creative and work "outside the box." Consider including members from operations, maintenance, management, in the audit team.

It is often valuable to evaluate energy use data (energy bills) before performing any site assessment. Consider encouraging the team to discuss the energy use data before walking the site. Discussion of the process and a brief question and answer session is also helpful.

The team should walk the site from beginning of the process through each process step. Team members should be encouraged to discuss each operation as they visit it. Discuss how the process operates, hours of operation differences in day night and weekday weekend operation. Identify any sizing issues such as oversized/undersized pumps, pipe, valves, and vessels. Although the focus should be the process, leave nothing out of the discussion. Remember to review lighting, HVAC, and building envelope.

It is helpful to record each idea and concept that is developed even if it appears to have little merit. Often marking copies of drawings or preparing sketches along the way will result in identifying more questions and discussion which may help the entire team gain a better understanding of the process.

It is important to avoid getting bogged down with making measurements and trying to define exact details at this phase of the audit. The first team walk through should be a quick brainstorming session.

After the initial walkthrough, it may be desirable to return to specific areas to make more detailed observations or even take a few measurements. If dataloggers are available dispatch them where and if necessary.

It is helpful to have a few tools when performing the walkthrough. A temperature sensing gun is helpful in making quick non-contact temperature measurements. Dataloggers for air temperature, liquid temperature can be valuable. Datalogging lighting, along with building occupancy and room entry (occupancy) is very valuable. A tachometer is very valuable to determine speed of a motor.

The next step includes developing ECMs from opportunities identified during the walk through. At this point ECMs can be detailed or brief. ECMs should have enough detail to be able to be thoroughly understood and evaluated by the members of the audit team and any reviewers whose support may be necessary to approve and implement the ECM.

Once the ECMs are developed, they should be reviewed and evaluated by the team. Evaluation of the ECMs should include the cost of implementation, the time required to implement, the return on investment or the amount of savings predicted for each measure.

There are often a few no cost measures that can be implemented delivering immediate results. Examples of these measures are raising wet well levels, turning lamps off when they are not necessary, adjusting building temperatures.

In addition to these there are usually a few low-cost measures. These might include changing ballasts and fluorescent lamps from T-12 to T8, installing programmable thermostats, replacing incandescent or compact fluorescent exit lamps with LEDs.

Sometimes participation in an "energy program" can yield savings or rebates. ILR demand response programs, or Constellation's Innovative peak response (curtailment) program provides rebate money for participation.

Once the ECMs are reviewed and selected, the Energy Audit Report or Energy Conservation Plan can be developed. The report or plan should include a description of the Energy Audit process, a description of the ECMs identified, a list of the ECMs adopted for implementation along with a schedule and budget to complete the work.

Audits need to be revisited every three to five years. Often, technology changes make things that were once too costly to implement cost effective. Also, treatment plant flows, permit requirements and processes all change over time. These changes require ECMs to be reevaluated and adjusted for changing conditions.

Often times the savings from implementing one ECM can affect the cost to implement and the predicted results of a related ECM. An example of this would be the replacement of a motor with a premium efficient motor. While this may be cost effective as a stand-alone measure, if the pump driven by the motor is replaced with a more efficient pump, replacing the motor may no longer be cost effective.

Many times, it is not practical or cost effective to immediately replace lighting or motors. In such cases it is wise to identify these ECMs as upgrades to be handled when the lamps or motors fail. Rather than replacement in kind, replacement with more energy efficient units accomplishes the goal of the ECM.

Examples of some common energy opportunities

Many times, opportunities to save energy face us every day. We tend to support operating equipment and processes in a way that has been successful in the past. When we search for opportunities, we are at times astonished at the number of opportunities we could consider implementing. Some opportunities to reduce energy cost or reduce energy use are identified below. There is no guarantee that these measures will be

successful or even exist in every water and wastewater facility. However, they are common ECMs in water and wastewater facilities.

Lighting Measures

Lighting measures are low cost easy to implement and in some cases, reduce maintenance cost. Consider the following. Replacing incandescent or compact fluorescent exit lamps with LED exit lamps is easy to implement in house. The cost is low. It can be done for less than $25/fixture in many cases. The savings is the difference in energy use between the existing lamp and the LED lamp. This can be between 20 and 30 watts per fixture. Although the savings per fixture is small the cost is low and the LED replacement is usually guaranteed for five years and expected to last 20 years. That results in a cost saving in electricity and a maintenance savings. Another beauty of this measure is that it is easy to estimate the savings since the fixture remains lighted 24 hours a day seven days a week.

LED replacement lamps are becoming available in more styles and varieties almost daily. Compact fluorescent (CF) lamps are being used in outdoor applications such as wall packs in lieu of HID lamps. They offer several advantages over their metal halide and high pressure sodium counterparts including elimination of long re-strike time and lower power requirements.

Participation in demand response program

Facilities with backup generators of sufficient capacity may be able to participate in the demand response program. These programs offer payment to go off grid and use back up generation during periods when demand on the grid is excessive.

Adjust plant service water pressure

Plant service water also known as non-potable water is a cost to the facility. Pressures of seal water and non-potable water should be adjusted to meet what is necessary. Often these pressures are set to an arbitrary value \when the equipment is installed and the pressure is never revisited. Operating these in plant water systems at a lower pressure results in energy cost savings.

Variable Speed Drives

Installing variable speed drives where they are warranted is a common ECM for water and wastewater facilities. It is not prudent to install variable speed drives for every motorized device. The application must be evaluated to assure there is a benefit from implementing the drive.

Turn Devices off when they are not required

This is as simple as it sounds; yet, it is often overlooked! Asking the question “does this light need to be turned on” may result in a surprising answer.

Adjust wet well levels

Much like seal water systems, wet well levels are sometimes arbitrarily set. Moving the average wetwell level six inches or a foot can result in a large savings in a low head application.

<u>Conclusion</u>

The most successful audit teams include plant staff members. Nobody knows a facility better than the people that operate and maintain it.

When performing the audit, question everything. Ask yourself if a device or piece of equipment needs to be operated or turned on. If so can its use be regulated, reduced or replaced with something more efficient. Remember, the best way to reduce the amount of energy a device uses is to turn it off.

The most important thing you can do is to take action. The savings will not begin until you take the first step.

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