The Energy Tune-Up Process

Introduction

An Energy Tune-Up identifies and implements operational changes that reduce building energy costs in gas and electricity. The goal is to produce as much energy savings as possible through modifications that require relatively small investment and can be accomplished quickly. The Tune-Up involves an examination of equipment and controls, discussions with building operators and diagnostic testing (including spot measurements and analysis of trend logs) when necessary. Improvements may be implemented by the building owner, by vendors already under contract to the owner or by members of the Tune-Up Team.

While an Energy Tune-Up is a stand-alone service activity, it has a strong operations and maintenance element. In most cases, enhanced O&M practices will be conducted in parallel and in series with the Tune-Up. Additionally, O&M practices that are needed to maintain the viability of the improvements identified through the Tune-Up are also documented in the on-going O&M practices.

Scoping Review and Approval

Development of the Tune-Up scope of work and cost must be coordinated, reviewed and approved by the Tune-Up engineer prior to its presentation to facility ownership. This is particularly significant where the building's mechanical service contractor is not providing the tune-up services.

Prerequisite: Perform Appropriate Basic Maintenance

Basic maintenance items ensure that the operating capacity of the equipment and systems in a building are available to be optimized. In this sense, deferred maintenance and other O&M issues that affect the operating capability of a facility's systems are addressed before moving forward with the Tune-Up. Some obvious basic maintenance needs may be identified as the building is scoped. Less obvious items may be identified through the Tune-Up process.

In-house staff or an outside maintenance service contractor should also complete scheduled preventive maintenance (PM) work before the review begins. For example, if the review occurs during the cooling season, the annual PM tasks for the cooling plant and systems should be completed before commencing with the project. Typical deficiencies (dirty filters, broken or cracked belts, etc.) normally taken care of through scheduled PM should not be left for the Energy Tune-Up to identify for repair.

Pre-Visit Preparation

Substantial information is available from screening and scoping undertaken before the Energy Tune-Up. The Tune-Up Engineer should perform a detailed examination of this data, including the following:

- Review of possible problem areas identified through the scoping inspection and discussions with operations staff
- Review of owner objectives and financial constraints
- Review of the budget for diagnostic work
- Review of findings from benchmarking performed during screening

The Tune-Up Engineer should pay attention to the billing and demand-metering data, as these can provide specific clues about major energy performance problems. In particular, the following work should be conducted prior to visiting the project.

Review the findings from scoping concerning evidence of problems in the utility billing data. Complete a more detailed analysis of the short- and long-term usage trends in the gas and electric bills. Graphical analysis, as illustrated in Figure 1 can be useful. Consider the fuels used for each major end-use in determining whether the profile corresponds to efficient energy use.

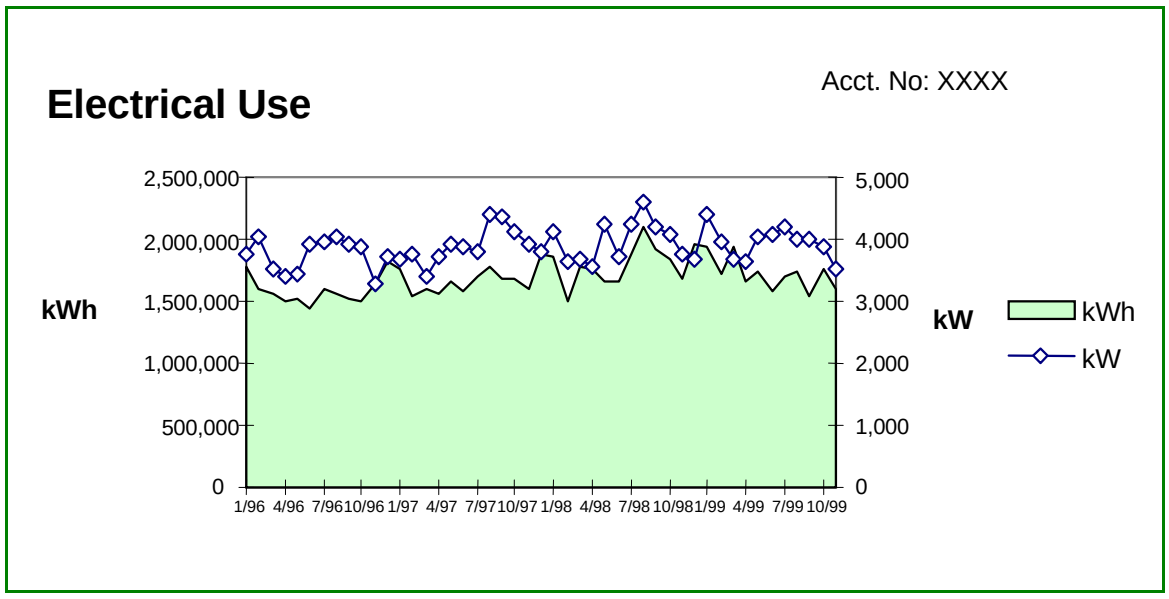

Figure 1: Graphical Analysis of Energy Usage

If available, obtain demand-metering data (5- or 15-minute interval total electric loads) for one or more meters serving the facility and prepare it for analysis. Graphical analysis, as illustrated in Figure 2 can be useful. This type of analysis can be performed using a spreadsheet (e.g., Excel) or software specifically designed for this purpose. The Tune-Up Engineer must either have the data processing and analysis skills needed to examine this type of information or have support staff in their firm who can. Consider the facility's controls, system configuration, schedule of operation and occupant requirements in determining whether the profiles represent efficient energy use.

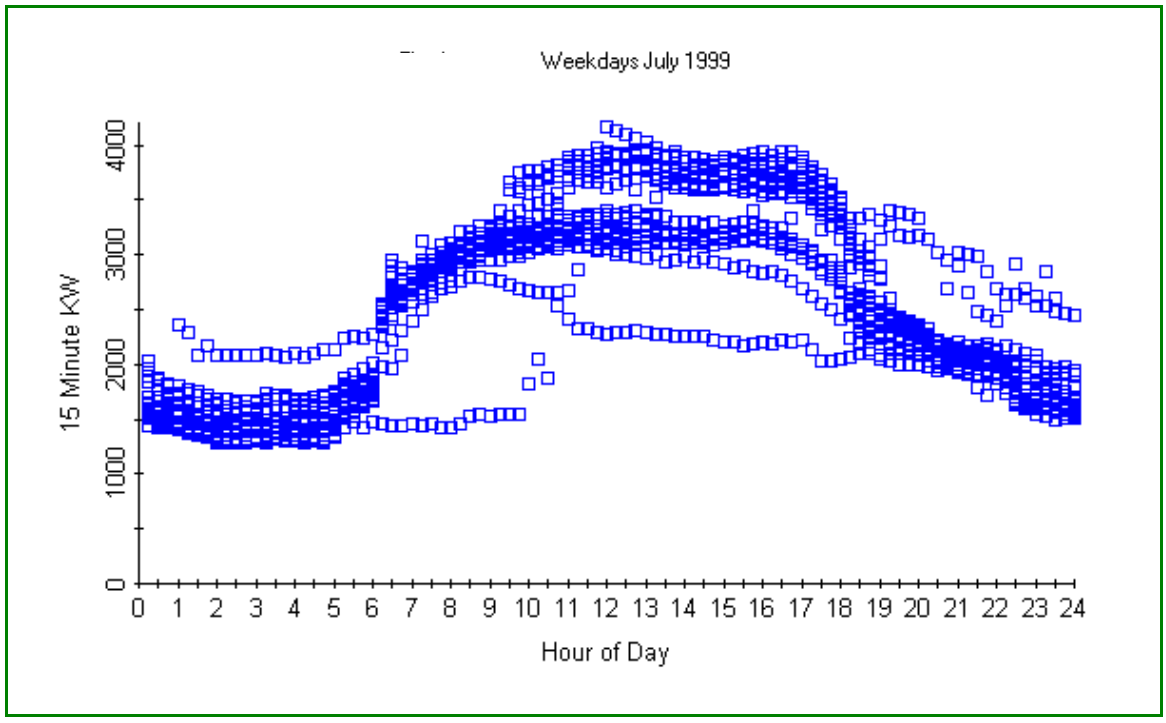

Figure 2: Pattern of 15-Minute Demand Data

The final task before visiting the site is to assemble the Tune-Up Team. The Tune-Up Engineer should determine what skills are needed to conduct the Tune-Up. Special purpose facilities like hospitals or

facilities with special purpose end-uses, such as grocery refrigeration, will require team members with specialized experience. In addition, the Tune-Up Engineer should determine what people and skills from the facility's staff and existing vendors (i.e., control contractors) will be needed and arrange for their involvement in the tune-up effort.

Initial On-Site Investigation

At the project site, the Tune-Up Engineer should gather information about the facility and its controls. This information can be obtained as follows:

- Review (if available and up-to-date) plans, maintenance records, sequence of operation, points list and other facility documentation
- Review any conclusions from scoping activities related to the above documentation prior to beginning the more detailed document review for Tune-Up
- Inspect relevant real-time readings from building automation systems (assistance from the controls contractor may be required)
- Interview operators/tenants and take one-time measurements as appropriate to complete the initial investigation and to understand the current configuration and operation of major energy systems

During the initial investigation, the Tune-Up Engineer should be aware of opportunities to make small adjustments or "quick fixes" to the building's systems. These provide the owner with immediate value from the work and will help motivate authorization for the further testing and tune-up efforts needed to achieve additional savings. Quick fixes should be performed and documented as follows:

- Identify adjustments to set points and schedules, repairs of small parts and other fixes that are obviously required and can be accomplished within the agreed upon diagnostic budget
- Implement the quick fixes with the help of operations staff, control contractors and others
- Document the quick fixes for inclusion in the Energy Tune-Up action plan; include a rough estimate of the energy savings for each and a description of preventative maintenance needed to avoid the problem in the future

Tune-Up Diagnostics

Based on the initial investigations, the Tune-Up Engineer should develop a plan for further diagnostic testing as follows:

- Identify possible problems requiring diagnostic testing
- Develop a problem list, organized by system
- Prioritize systems in terms of likely benefits from fixing problems

Use the following steps to perform the diagnostic testing:

- Determine what to measure and how to take each measurement (DDC trending, data logger, one-time measurements) in order to identify specific problems and their causes (data collection and testing must fit within the diagnostic budget set by the owner)

  DDC trending will depend on the controls software that is already in place for each building; either operated by the building staff or through a support contract with an outside vendor.

- Determine how long and when to take measurements and how to force system conditions

  Functional performance testing may be required to evaluate specific equipment, applications, or systems.

- Assemble tools needed to conduct testing
- Collect data according to the plan
- Analyze data, look for evidence of operational problems, and identify their causes

- Identify fixes

  Fixes may reduce electricity or gas consumption. Generally, look for fixes that pay for themselves in two years or less, but in all cases they must satisfy the owner's financial criteria. Fixes may involve adjusting equipment or reprogramming controls, expanding control capabilities, improving and calibrating sensors, replacing inefficient or badly specified components or repairing broken components.

- Determine the best strategy for implementing each fix and estimate implementation costs
- Quantify benefits and compute appropriate cost/benefit such as simple payback

Develop an Action Plan

Once the diagnostic testing is complete, the Tune-Up Engineer should have all of the information and analyses needed to develop a compelling action plan for the decision-maker. The major sections of the plan are shown in Figure 3 below.

Executive Summary

- Summary of quick fixes during diagnostic testing, including preventative maintenance needed to avoid these problems
- For each problem found through testing:
  - Brief Description
  - Cost to Fix
  - Simple Payback
  - Other Benefits

For Each Tune-Up Improvement

- Authorization to Proceed and Assignment of Staff
- Problem Description and How Detected
- Proposed Fix and Verification Method
- Economic Analysis
- Recommended Preventative Maintenance

Figure 3: Energy Tune-Up Action Plan

The Energy Tune-Up action plan briefly documents each problem, including test results and determination of causes. It also documents steps needed to fix each problem. The plan provides the decision-maker with:

- The cost for implementing the identified solution including their basis (e.g., fixed price, estimate of internal staff expenses, etc.) and savings associated with the solution (detailed enough to guide owners decision) for each fix
- O&M procedures and training required to avoid the same problems in the future
- A one page executive summary suitable for presentation to the decision-maker

Decision-Maker Presentation

The decision-maker presentation succinctly conveys the major features of the Energy Tune-Up and a review of O&M practices. If possible, arrange for key members of the owner's staff who would be involved

in implementing the action plan and modifying the preventive maintenance program to be present for the presentation, so that they can become personally invested in the work and can help identify any adjustments to the action plan that are needed to conduct the work in a timely and cost-effective manner.

Start the presentation with a discussion of the “quick fixes” so that the decision-maker can see what has already been accomplished. For each of these “quick fixes” present:

- Approximately how much is being saved
- Changes to preventative maintenance required to keep “quick fix” problems from happening in the future

Continue the presentation with the following information for each of the other problems identified through the diagnostic testing:

- Nature of each problem and its cause
- How it was identified
- Cost and benefits of fixing
- Steps required to fix it
- Preventative maintenance improvements required to keep the problem from recurring

Try to make the presentation format as interactive as possible, and engage all present in a discussion of how best to implement the action plan. Incorporate any changes in the action plan that are indicated by the decision-maker and get the decision-maker to authorize the Tune-Up Team to proceed with the plan.

Energy Tune-Up Implementation

Fix each of the problems as specified in the final action plan. The Tune-Up Engineer should provide technical oversight as needed. Either the owner or Tune-Up Engineer (at the owner’s request) should assemble appropriate resources (including assigning members of the owner’s staff and authorizing vendors to support the effort) in addition to mobilizing additional resources from the Tune-Up Team.

The Tune-Up Engineer should conduct appropriate inspections and testing to confirm that fixes have been made as planned. Use the action plan as a checklist in conducting this verification. If not to costly, use the diagnostic procedures again to see if each problem is fixed. Direct additional work if problems have not been fixed.

Enhanced O&M Practices

Improved O&M practices will likely be discovered through the Tune-Up process. Following implementation and verification of the fixes, work with the decision-maker and appropriate owner’s staff to ensure they understand the changes in preventive maintenance practices that are needed to keep the problems from recurring, and make sure that specifications for these changes are incorporated into an enhanced O&M practices action plan.