

## WRITING USER-FRIENDLY ENERGY AUDIT REPORTS

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### ABSTRACT

Energy audits don't save money and energy for companies unless the recommendations are implemented. Audit reports should be designed to encourage implementation but often they impede it instead. In this paper the authors discuss their experience with writing industrial energy audit reports and suggest some ways to make the reports more user-friendly. The goal in writing an audit report should not be the report itself/ rather it should be to achieve implementation of the report recommendations and thus achieve increased energy efficiency and energy cost savings for the customer.

### INTRODUCTION

In this paper we will address two questions: Why should an energy audit report be user-friendly and how do you make an audit report user-friendly? We answer these questions in the context of sharing the experience we have gained writing audit reports for industrial clients of the University of Florida Energy Analysis and Diagnostic Center (UFEADC).

At the UFEADC we have two goals when we write an audit report. Our first goal is to provide our clients with the facts necessary to make informed decisions about our report recommendations. Our second goal which we consider almost as important as the first is to interest our clients in implementing as many of our recommendations as possible. We have found that user-friendly audit reports help us achieve both goals.

### WHAT IS A USER-FRIENDLY AUDIT REPORT?

People generally think of the term user-friendly related to something like a computer program. A program that is user-friendly is one that helps you use it with a minimum of difficulty. We apply the same term to audit reports to mean a report that communicates its information to the user (reader) with a minimum amount of effort on the reader's part. We operate on the belief that a reader who is busy will not want to spend his/her valuable time struggling to understand what the report is trying to say. If the report is not clear and easy to follow the reader is likely to set it down to read later and later may never come:

### HOW DO YOU WRITE A USER-FRIENDLY AUDIT REPORT?

From our experience we have identified a number of key points for successfully writing a user-friendly audit report. These points are summarized below.

### Know your audience.

The first thing to keep in mind when you start to write anything is to know who your audience is and tailor your writing to that audience. When writing an industrial audit report your readers can range from the company president to the head of maintenance. If recommendations affect a number of groups in the company each group leader may be given a copy of the report. These you may have persons of varying backgrounds and degrees of education all looking at the report. Not all of them will necessarily have a technical background. The primary decision maker may not be an engineer/ the person who implements the recommendations may not have a college degree.

Deal with this problem by writing a report with three basic sections. Start with an executive summary which briefly describes our recommendations and tabulates our results such as the energy and dollar savings and the simple payback times. Follow that with a brief description of a recommended energy management program for our client. Then we provide a detailed section that we call our technical supplement. This section of our report includes the calculations that support our recommendations and any specific information relating to implementation. These sections are described more fully later in this paper.<sup>7</sup>

### Use a simple direct writing style

Technical writers often feel compelled to write in a third-person "passive" verbose style. Because energy audit reports are technical in nature they often reflect this writing style. Instead you should write your audit report in clear understandable language. As noted above your reader may not have a technical background. Even one who does will not be offended if the report is easy to read and understand. Some specific suggestions are:

Simplify your writing by using active voice. Writers often are reluctant to take responsibility for their recommendations/ they use passive voice to avoid responsibility" saying "It is recommended..." or "It has been shown..." rather than "We recommend..." or "We have shown..."

Consider that you are addressing the report to one or more individuals. Write it as if you were speaking directly to the reader. Use the words "you" and "your" to state the report plain and simple.

Original Installation of high-efficiency fluorescent lamps in place of the present lamps is recommended.

Better Install high-efficiency fluorescent lamps in place of your present lamps.

Result We recommend that you install high-efficiency fluorescent lamps in place of your present lamps.

Original Twelve air leaks were found in the compressor system during the audit of this facility.

Better We found twelve air leaks in the compressor system when we audited your facility.

Result We have twelve air leaks in the compressor system.

Avoid technical jargon that your reader may not understand. Don't use acronyms such as "ECS" "E8" or "E@" without explaining them. "Energy Conservation Supportivity" Energy

>anagement 8pport nity" Energy >anagement @ecommendation.7

### Present Information Visually

Often the concepts we are trying to convey in an audit report are not easy to explain in a limited number of words. Therefore we often use drawings to show what we mean. For example we have a diagram that shows how to place the lamps in fluorescent lighting fixture when you are using reflectors and eliminating two of the lamps in a four-lamp fixture. We also have a diagram showing how a heat pipe works.

We present our client's energy use data visually with graphs showing the annual energy and demand usage by month. These graphs give a picture of these patterns. Any discrepancies in these show up clearly.

### Make Calculations Self-Explanatory

The methodology and calculations used to develop specific energy management opportunity recommendations are potentially self-explanatory in an audit report. Including the methodology and calculations gives technical personnel the ability to check the accuracy of your assumptions and your work. However, not every reader wants to wade through pages describing the methodology and showing the calculations. Therefore we provide this information in a technical supplement to our audit report. Since this section is clearly labeled as the technical supplement, other readers are put on notice as to the purpose of this section.

### Use Commonly Understood Units.

In your report we refer to these units that your client will understand. Discussing energy savings in terms of Btu is not meaningful to the average reader. Kilowatt-hours for electricity or therms for natural gas are better units because most energy bills use these units.

### Make Your Recommendations Clear.

Some writers assume that their readers will understand their recommendation even if it is not explicitly stated. Although the implied recommendation may often be clear, the better practice is to clearly state your recommendation so that your reader knows exactly what to do.

Example: Install occupancy sensors in the conference room and restrooms.

Result: You should purchase occupancy sensors/ install one in the conference room and one in each of the four restrooms.

### Explain Your Assumptions.

A major problem with many reports is a failure to explain the assumptions underlying the calculations. For example, when we use operating hours in a calculation we show how we got the number. Example: "Our facility operates from 8:00 am to 5:00 pm five days a week, 26 weeks per year. Therefore we will use 2,600 hours in our calculations."

When you show your basic assumptions and calculations, the reader can make adjustments if those facts change. In our example above, if the facility decided to operate 16 hours per day, the reader would know where and how to make changes in operating hours because we had clearly labeled that calculation.

Use one section of our report to list our standard assumptions and calculations. That way we do not have to repeat the explanations for each of our recommendations. Some of the standard assumptions/calculations included in this section are operating hours, average cost of electricity, demand rate, off-peak, cost of electricity, and the calculation of the fraction of air-conditioning load attributable to lighting.

#### Be Accurate and Consistent.

The integrity of a report is grounded in its accuracy. This does not just mean correctness of calculations. Clearly, inaccurate calculations will destroy a report's credibility. But other problems can also undermine the value of your report.

Be consistent throughout the report. Use the same terminology so your reader is not confused. Always use the same values. Don't use two different load factors for the same piece of equipment in different recommendations. This could happen if you calculated the loss of energy due to leakage from a compressor in one recommendation and the energy savings due to replacing the compressor motor with a high efficiency motor in another recommendation.

Proofread your report carefully. Typographical and spelling errors devalue an otherwise good product. With computer spell checkers, there is very little excuse for misspelled words. Your non-technical readers are likely to notice this type of error, and they will wonder if your technical calculations are similarly flawed.

### **REPORT SECTIONS**

We have found that the following report format meets our clients' needs and fits our definition of a user-friendly report.

#### Executive Summary

The audit report should start with an executive summary which basically lists the recommended energy conservation measures and shows the implementation cost and dollar savings amount. This section is intended for the readers who only want to see the bottom line. Although the executive summary can be as simple as a short table, we add some brief text to explain the recommendations and sometimes include other special information needed to implement the recommendations. We also copy the executive summary on colored paper so that it stands out from the rest of the report.

#### Energy Management Plan

businesses" utility incentive programs" and the shared savings approach of the energy service companies.

>aintenance @ecommendations. We do not usually make formal maintenance recommendations in the technical supplement because the savings are not often easy to quantify. However" in this section of the report we provide energy-savings maintenance checklists for lighting" heating" ventilation" air-conditioning" and boilers.

### The Technical Supplement

The technical supplement is the part of the report which contains the specific information about the facility and the audit recommendations. Our technical supplement has two main sections: one includes our assumptions and general calculations/ the other describes the recommendations in detail including the calculations and methodology. We sometimes include a third section which describes measures that we analyzed and have determined are not cost-effective" or that have payback times beyond the client's planning horizon.

### Standard Calculations and Assumptions

This section was briefly described above when we discussed the importance of explaining assumptions. Here we provide the reader with the basis for understanding many of our calculations and assumptions. We include a short description of the facility: square footage" both air-conditioned and unconditioned areas" materials of construction" type and level of insulation" etc. If we are measuring the facility down into sub-areas" we describe those areas and assign each an area number which is then used throughout the recommendation section.

Standard values calculated in this section include operating hours" average cost of electricity" demand rate" off-peak, cost of electricity" and the calculation of the fraction of air-conditioning load attributable to lighting. When we calculate a value in this section" we label the variable with an identifier that remains consistent throughout the rest of the report.

### Audit Recommendations

This section contains a discussion of each of the energy management opportunities we have determined to be cost-effective. Each energy management recommendation (or E>@) which was capitalized in the executive summary is described in depth here.

Again" we try to make the E>@s user-friendly. To do this" we put the narrative discussion at the beginning of a recommendation and leave the technical calculations for the very end. This way" we allow the readers to decide for themselves whether they want to wade through the calculations.

Each E>@ starts with a table which summarizes the energy" demand and cost savings" implementation cost and simple payback period. Then we write a short narrative section which provides some brief background information about the recommended measure and explains how it should be implemented at this facility. If we are recommending installation of more than one item (lights" motors" air conditioning units" etc.)" we often use a table to break down the savings by unit or area.

The final section of each E>@ is the calculation section. Here we explain the methodology that we use to arrive at our savings estimates. We provide the equations and show how the calculations are performed so that our clients can see what we have done. If they want to change our assumptions they can. If some of the data we have used is incorrect they can replace it with the correct data and recalculate the results. Sooner by placing the calculations away from the rest of the discussion rather than intermingling it we don't scare off the readers who need to know the other information.

### Appendix\*

We use an appendix for lengthy data tables. For example we have a motor efficiencies table which we use in several of our E>@s. Instead of repeating it in each E>@ we put it in the appendix. We also include a table showing the facility's monthly energy use history and a table listing the major energy-consuming equipment. Similar to the calculation section of the E>@s the appendix allows us to provide background information without cluttering up the main body of the report.

### **SHORT FORM AUDIT REPORT**

Many energy auditors use a short form audit report. A short report is essential when the cost of the audit is a factor. Writing a long report can be time-consuming and it increases the cost of an audit.

The short form report is useful when an on-the-spot audit report is required because the auditor can use a lap-top computer to generate it. It is also an excellent format for preliminary audit reports when the company will have to do further analysis before implementing most of the recommendations.

Sooner some short form audit reports have drawbacks. When a report is ultra-short and only provides the basic numbers the reader will not have a memory or touch if he returns to the report sometime after the auditor has left. Since some clients do not implement the recommendations immediately) it might not until they gather the necessary capital an ultra-short form report may lose its value. Therefore some explanatory text is a critical of a user-friendly short form report. The executive summary described above could serve as a model short form audit report.

### **FEEDBACK**

Customer feedback is as appropriate in energy auditing as in any other endeavor. An easy way to get feedback is to give the customer a questionnaire to evaluate the audit service and the report. We list each section of the report as the client to rate each section on a scale of '1' with '1' being poor and '5' being excellent. We ask, for a rating based on whether the section was easy to read and we ask, for a rating of the likelihood that our recommendations will be implemented. We also ask, for any additional comments) it seldom get those.

It is important that the questionnaire be easy to fill out. If it takes much time to read and fill out the clients won't take time to return it. We used to send the questionnaire along with the report) it those were seldom returned. Now we wait for a month and then send the questionnaire as a follow up to the audit. We have a much greater return rate on those.

## CONCLUSION

Many audit reports are not user-friendly. Most often they are either lengthy documents full of explanations, justifications and calculations or they are very short with little background information. If a report is so long that it intimidates your readers by its very size they may set it aside to read when they have more time. If it is so short that needed information is lacking, the readers may not believe the results.

Writing a user-friendly audit report is an important step in promoting implementation of audit recommendations. We hope that some of our report writing suggestions and some of our experiences can help others produce their own successful user-friendly energy audit reports.