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Review of the selection Criteria for energy auditor to identify the energy efficient projects

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Abstract— this study indicated the role of energy auditor to identify the energy efficient projects. Three main types of audits are: Preliminary, Single Purpose, and Comprehensive. Selecting the appropriate type of audit for your facility saves you time and money. Each type is distinguished by the level of detail and analysis required to complete the audit. The less detailed the audit, the less accurate the estimates of project costs and energy savings. Depending on your organization's contracting requirements, the consultant who will conduct the energy audit and prepare the technical report can be selected either by sole source or competitive bid. The cost of an audit can be determined through price negotiations or competitive bidding. In either case, you must inform the bidders of the scope of the audit and its minimum reporting and analytical requirements, such as those
contained in the Energy Commission's feasibility study guide. This is to ensure that you are getting audit costs for comparable work.

Keywords— energy auditor; Weighting Factors; energy Consultants; energy audit costs; Performance Specifications

INTRODUCTION

DO YOU NEED AN ENERGY CONSULTANT?

If your staff has the time and expertise, you can save money and do the energy audit yourself. The money saved can be spent on the projects. There will be no energy savings, however, if your staff is too busy to do the audit and the project installation is delayed. If you decide to have your staff do the energy audit, we recommend that you use the Energy Commission's guide, Guide to Preparing Feasibility Studies for Energy Efficiency Projects. The Guide can provide a road map to completing a study. The Energy Commission staff uses it to evaluate consultant reports. Even if you contract with a consultant, your organization is still responsible for monitoring the contractor's activities. This ensures that the audit meets your requirements and the dollars

spent are consistent with the budget. This section discusses various areas to consider in determining whether or not to hire an energy consultant.

This document is a template. An electronic copy can be downloaded from the conference website. For questions on paper guidelines, please contact the conference publications committee as indicated on the conference website. Information about final paper submission is available from the conference website.

I. DIFFERENT TYPES OF ENERGY AUDITS

Three main types of audits are: Preliminary, Single Purpose, and Comprehensive. Selecting the appropriate type of audit for your facility saves you time and money. Each type is distinguished by the level of detail and analysis required to complete the audit. The less detailed the audit, the less accurate the estimates of project costs and energy savings. Some audits produce an energy balance which compares actual energy use from past utility bills with the estimated energy use of the existing equipment based on assumptions of current operating conditions.

The balance verifies that assumptions used in estimating the energy consumed by equipment are consistent with the total energy use identified in the utility bill. An accurate energy balance insures that the consultant will not over- or under- estimate the energy savings. The added time and cost of doing the balance, however, may not be warranted for studies which focus only on lighting retrofits. This section describes each type of audit and how to select the proper type for your facility.

A. Preliminary Audits

These are quick evaluations to determine a project's potential and to decide if a more detailed energy audit is warranted. Often these audits are used as a screening or marketing tool by ESCOs and equipment vendors. Depending on the size of facility, it usually takes less than one day to complete.

Advantages

• Provides an idea of an energy project's potential prior to spending money on a detailed study.
• Is least expensive type of audit?

Disadvantage

• Provides only minimal information; its accuracy is limited on project costs and savings.

B. Single Purpose or Targeted Energy Audit

This type of audit provides a detailed analysis on one or more types of projects. The projects analysed could result from a preliminary audit or a vendor, or could be selected by the facility staff as a needed repair or upgrade project. Often vendors that specialize in a particular type of energy efficient equipment will perform these types of audits. Examples include those that focus only on lighting, energy management systems, variable speed drives, boiler/ chillers replacements, thermal energy storage systems, energy generation, or a combination of these projects.

Advantages

• Provides a detailed analysis of specific energy technologies.
• Analyzes only the projects that you want.

Disadvantages

• Provides no energy management plan, which could result in random project development.
• Offers potentially biased analysis especially if the project is recommended by someone with a future vested interest.
• Focuses on specific technologies that may adversely impact future energy project recommendations.
• May miss non-targeted opportunities.

C. Comprehensive Audit

A comprehensive audit provides a detailed energy project implementation plan for a facility, since it evaluates all major energy using systems. The systems to be evaluated include the building envelope, lighting, domestic hot water, HVAC and controls. In some cases, the audit will evaluate the potential for thermal energy storage (TES) and energy cogeneration projects. This type of audit offers the most accurate estimate of energy savings and cost. It considers the interactive effects of all projects, accounts for the energy use of all major equipment, and includes detailed energy cost saving calculations and project cost.

Advantages

• Provides a detailed analysis of project cost and savings for all energy technologies appropriate for the facility.
• Includes the interactive effects of all projects.
•Provides a logical, non-biased plan for project implementation.

Disadvantages

• Is the most expensive audit of the three types.
• May analyse more projects than can be immediately implemented by your organization. If the audit is used later, it may contain outdated information. If this happens, the audit was a waste of time and money.

II. SELECTION CRITERIA FOR THE ENERGY CONSULTANT

Depending on your organization's contracting requirements, the consultant who will conduct the energy audit and prepare the technical report can be selected either by sole source or competitive bid. This section will describe both processes and the benefits and drawbacks of each.

A. Sole Source

In general, sole source contracts should be considered for emergencies, and special and unique projects, as they could be more

Advantages

• Reduces transaction costs for both you and the consultant.
• Puts contract into place quickly, expediting the production of the audit and implementation of the projects.
• Results in the selection of a consultant desired by your facility.

Disadvantages

• Lacking competition, your organization may not get the best price for the job.
• Allows no evaluation of other proposals which could be better for your facility.
• Could result in protests.

B. Competitive Bid

When compared to sole sourcing, competitive bidding often results in the lowest audit cost -- offering best value from both a technical and cost perspective. Formal Competitive Bidding: Request for Proposal (RFP) Some organizations use the RFP process to select engineering consultants. The RFP is sent to interested consultants who are asked to submit proposals. Each proposal is reviewed and the consultant who meets the minimum technical requirements specified in the RFP and represents the best value from a technical and cost standpoint is selected. The process usually weighs heavily the cost of doing the work.

Formal Competitive Bidding: Request for Qualifications (RFQ)
Many organizations choose to select engineering or architectural consultants by using an RFQ. In this process, bidders compete and are ranked based on qualifications. The bidder that is the most technically qualified is ranked 1, the next most qualified is ranked 2 and so forth. The cost for the work scope is negotiated with the most qualified bidder (rank 1). If an acceptable price cannot be reached with the first bidder, then negotiations are started with the next qualified bidder (e.g., rank 2). In some cases, you may get the most qualified, but not the least cost, bidder. With the RFQ, some of the lower cost benefits of the RFP process are lost. You still have the option of rejecting the most qualified, however, if you believe the price is too high.

Informal Bidding
Without resorting to a public notice, a facility manager prepares a detailed work statement which identifies the scope of the study, the buildings to be audited, the required deliverables and due dates. A select group of consultants are asked to submit a written bid for the specified work. Generally, the consultant who can do the work for the lowest cost or is determined to be the best value from both a technical and cost perspective is selected.

C. Which Is Best?

To help you determine which process may be best, here is a summary of pros and cons of competitive bidding. Compare it with the previous one on sole source selection.
Advantages of Competitive Bid
• Assures the audit is provided at "real market" cost or at the best value from a technical and cost perspective.
• RFQ - All proposals are evaluated on the same criteria, the one best meeting the technical criteria and cost requirements is selected.
• RFP - All proposals are evaluated on the same criteria; the one that meets technical requirements at lowest cost is selected.
Disadvantages of Competitive Bid
• Has a high transaction cost for both the facility staff and consultant.
• Requires substantial time to prepare all bid documents and review proposals – could delay the start of the audit.

D. FACTORS WHICH AFFECT ENERGY AUDIT COSTS?

How much should an audit cost? An energy audit may seem expensive, but it is well worth its price since it provides documentation on projects that can save you money. If you have never contracted for an energy audit, you may be shocked when you receive proposals. To guard against such surprises and to help you determine reasonableness of an estimate, this section discusses factors affecting an audit's price. They will help you accurately estimate what a study should cost. The cost may be fine-tuned in price negotiations or through competitive bidding as discussed later in this section.

E. Type of Audit

Generally, the more detailed the energy analysis and calculations, the more costly the audit. The following table summarizes typical costs:

TABLE NO- 1

Type of Audit	**Typical Cost ($/sq. ft.) 1997 dollars**
Preliminary audits	$0.013 to $0.03/sq. ft.
Single purpose audit	$0.03 to $0.07/sq. ft. (lighting) $0.05 to $0.09/sq. ft. (HVAC and controls)
Comprehensive audit	$0.18 to $0.50 sq. ft. (less than 50,000 sq. ft.) less than $0.12/sq. ft. (more than 250,000 sq. ft.)

III. AUDIT COSTS

The cost of an audit can be determined through price negotiations or competitive bidding. In either case, you must inform the bidders of the scope of the audit and its minimum reporting and analytical requirements, such as those contained in the Energy Commission's feasibility study guide. This is to ensure that you are getting audit costs for comparable work. A description of each option for determining audit costs follows.

A. Price Negotiations

Your staff can negotiate a reasonable audit cost with the selected consultant. The basis for negotiations could be past experience with the consultant or the cost information in this
document. Your facility manager can negotiate with the consultant until a mutually agreeable cost is reached. If a reasonable cost cannot be agreed upon, you may want to speak with another consultant. The key to successful price negotiations is your knowledge of the energy audit's cost. This "intuitive cost" is usually determined

arbitrarily and may not represent the lowest cost energy audit.

B. Competitive Bidding

As already discussed, competitive bidding often results in the lowest audit costs. To ensure a level playing field for all bidders, you must prepare a detailed "work statement" which discusses the scope of the audit, the expectations, the deliverables and schedule. Section IX, page 18, lists the typical information contained in the work statement. Although this method requires more up-front work by the facility manager, this is offset by the overall lower costs which result from bidding.

IV. SELECTION CRITERIA TO SELECT THE ENERGY AUDITOR?

Though cost is an important consideration in selecting a consultant, it should not be the only criteria. The success of energy efficiency projects depends on the consultant selected to prepare the audit. Energy savings calculations and project analysis using computerized building simulation models are complex and the detection of unreasonable assumptions is very difficult. Therefore, it is important to select a reputable consultant to perform the energy audit while meeting your cost requirements. This section will discuss the important factors to consider when selecting one.

A. Consultant Staff Experience

For comprehensive energy audits, the consultant should have broad experience on all types of energy efficiency projects, such as lighting, HVAC, building envelope, domestic hot water and energy equipment controls. Individuals responsible for preparing the audit should have extensive experience performing audits in facilities similar to yours. The Energy Commission's staff recommends at least three years of experience.

For single purpose audits consultants should have specialized expertise in the specified project area, such as lighting or energy management systems. Again, the Energy Commission's staff recommends at least three years of relevant experience in this specific area on related facilities. Consultants with comprehensive energy audit experience can better analyse a facility and consider the interactive effects of various energy projects than consultants specialized in only one area. Those performing the audit should have the appropriate educational and technical background, such as college degrees, professional licenses, and professional affiliations.

B. Responsiveness

The consultant selected must be accessible and responsive to questions, concerns, and problems. Even after the audit has been completed, difficulties can arise during the project bid stage or after the projects have been installed. That's why the consultant must remain available, be accountable for the audit and demonstrate a track record of past responsiveness.

C. Conflict of Interest

Your consultant should be objective and dedicated to ensuring that the recommended projects are beneficial and cost-effective. If he represents a vendor or has a vested financial interest in your projects, his objectivity may be compromised. This could result in recommending inappropriate equipment or overstating the value of the project. That's why each proposed consultant should identify any financial relationships with equipment vendors or service companies.

D. References

Preparing energy audits and installing projects are challenging tasks. It is therefore important to check a consultant's references carefully. Consider only references pertaining to projects similar to yours. Ask consultants to provide information about projects that they designed, managed and commissioned. Have them include the name of the organization, contacts, project description, project cost and savings, and consultant staff involved. References should be contacted to determine:

• A record of implementing similar projects. Discuss their projects to get ideas for your energy projects.
• The feasibility of the recommended projects.
• The accuracy of energy savings calculations and project cost estimates.
• Responsiveness to client's needs.
• Incidence of any conflicts of interest. In addition, ask consultants for sample audits.

E. Availability of Qualified consultant Staff

The availability of qualified staff is an important consideration when selecting a consulting firm. A company may have experience doing energy project work, but if they assign inexperienced staff to do the audit, the quality of the data collection and analysis may be compromised. When evaluating consultant proposals, ask for a listing of staff who will be working on your project and determine the:

• Percentage of time each will dedicate to the project.
• Nature and relevance of past work and years of experience doing work similar to that requested in your proposal.
• Status of existing works assignments.

V. METHOD FOR REVIEW THE ENERGY AUDIT

The consultant makes many assumptions when calculating energy savings and project costs. These could have an impact on the cost effectiveness and feasibility of the proposed projects. Unreasonable assumptions can make an unsound project look cost-effective. This can mean scarce public funds are spent on marginal projects. Some projects such as energy generation and thermal energy storage systems can increase operating cost and result in no savings if improperly evaluated and installed. Conversely, a poor study can result in rejecting sound projects. Someone involved in the implementation of the projects should review the audit. Your review team could include your technical and operations staff, utility representatives and financing representatives. By having input from those knowledgeable about the use of your facility, project assumptions can be verified and the feasibility of all recommended projects examined before the audit is finalized and the projects installed. Early involvement by all affected parties, particularly the decision makers, results in streamlining project installation and greater acceptance of the projects. Consultants preparing the energy audit make numerous assumptions which affect the technical and cost effectiveness of the recommended projects. It is necessary to verify all assumptions and models before proceeding with installation. This section explains the main areas in an energy audit that should be reviewed and discusses whether the review can be completed by your staff.

A. Energy Audit Review Checklist

If your organization has experienced and knowledgeable staff, no outside assistance may be needed to review the study. Conversely, if your staff only knows its facility, it may be worthwhile to get an independent review of the recommended projects. Possible independent reviewers include utility staff; public organization staff, such as those found in schools, cities and counties; Energy Commission staff; and independent consultants. Though the task of reviewing an energy audit may seem daunting, it is well worth your time to review it thoroughly. Detecting errors in the report will save you time and money when you finance and install your projects.

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TABLE NO: 2

ENERGY AUDIT REVIEW CHECKLIST

Areas to be checked in the energy audit	**Can be done with in-house staff?**	**Recommend outside review assistance?**
Facility operating hours	Yes	No
Equipment operating hours	Yes	No
Accuracy of energy and demand rates used in the energy audit	Maybe	Maybe-good idea to get independent review
Appropriateness of project recommendations for the facility	Maybe-depends on level of knowledge	Maybe-good idea to get independent review
Accuracy of existing equipment identification in the energy audit	Yes	No
Energy saving estimates	No	No
Use of appropriate simulation models and Assumptions	No	Yes
Project cost estimates	Maybe-depends on level of knowledge	Yes Maybe

TABLE NO: 3

WEIGHTING FACTORS AND CRITERIA

Criterion	**Key Elements**	**Points**
Approach to Work Statement	-Demonstrated understanding of tasks outlined in work statement - Demonstrated experience with similar tasks - Audit approach, analysis and recommendations - Ability to satisfy time lines for deliverables	40
Company Technical Experience	- Quality and relevance of experience in conducting energy audits for local governments - Depth, relevance and quality of work examples - References - Depth of relevant project implementation experience	60
Company Organization	- Organizational strengths of proposed company - Appropriate level and type of staff to complete work in a competent and timely manner.	25
Personnel Qualifications and Experience	- Qualifications of assigned personnel - Experience of assigned personnel - Availability of assigned personnel	25
Interview	- Response to questions - Quality of presentation - Explanation of approach to	50

	work statement tasks	
TOTAL		200

VI. CONCLUSIONS

Engineering design will be required for most HVAC projects, including when equipment is replaced or modified or when new controls are added to the system. Performance specifications will provide general information about the equipment and the minimum operating standards for the equipment. This information will be used by your project designer or engineer to complete the detailed drawings and technical specifications for the project.
Performance specifications should include the following, at a minimum:

A. General Project Information

1. Project Background - Describe the project's history and status
2. Summary of the Work - Explain the specific projects, buildings involved and the contractor's responsibilities.
3. Attachments - Identify the project locations and equipment to be retrofitted. Include a summary table which describes the existing and proposed energy efficiency projects by building.

B. Material Specifications

This section describes the minimum technical information for several HVAC projects.
1. Boiler - Specify size and boiler type, requirements for modulating or high and low fire, intermittent ignition, insulation, hot water reset, mixing valves, acceptable full load and part load operating efficiencies, acceptable air emissions and acceptable manufacturers.
2. Chiller - Specify size and chiller type, refrigerant type, operating strategy, minimum full load and part load efficiency requirements, requirements for UL or and other control capability, minimum operating temperatures, evaporator, warranty and acceptable manufacturers.
3. Energy Management System (EMS) - Specify EMS performance requirements, digital and analogue type and description of control points, CPU and terminal controls, power line carrier or hardwire requirements, number of cells, acceptable manufacturers, equipment and software requirements, computer requirements, remote monitoring and programming, training, service and support requirements and battery backup needs.
4. Cooling Tower - Specify minimum performance requirements, approach and range temperatures (OF), fan motor type (two speed, variable speed), operating strategy, water treatment requirements, control valve and associated controls for condenser water temperature and flow requirements and acceptable manufacturers.
5. Premium Efficiency Motor - Specify requirements for NEMA B, AC induction, horsepower, rpm rating and frequency, frame and class, ambient temperature, service factor, ball bearing type, minimum nominal efficiency according to IEEE Test Method 112B and compatibility with VFDs.
6. Variable Frequency Drives - Specify requirements for motor starter, range of response (e.g., 4-20 ma DC signal), enclosure type, ambient temperature range, adjustable minimum and maximum speeds, minimum power factor, compatibility with existing motors, equipment performance, controllers (e.g., how the VFDs will be controlled, what controllers are needed, controller size range), remote start capability, sequence of operations, minimum efficiency at various loads, noise/harmonics isolation and acceptable manufacturers.
7. Package Units - Specify heating and cooling capacity requirements, minimum energy efficiency requirements (e.g., minimum SEER for air conditioning and COP for heating) for split, gas pack or heat pump, as appropriate, and controls, such as economizer, thermostat and time clock.
8. Other Equipment - Specify equipment requirements for ancillary equipment such as heat exchangers, liquid pressure amplifiers. The equipment requirements should be at a level of detail similar to items 1 through 8.

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