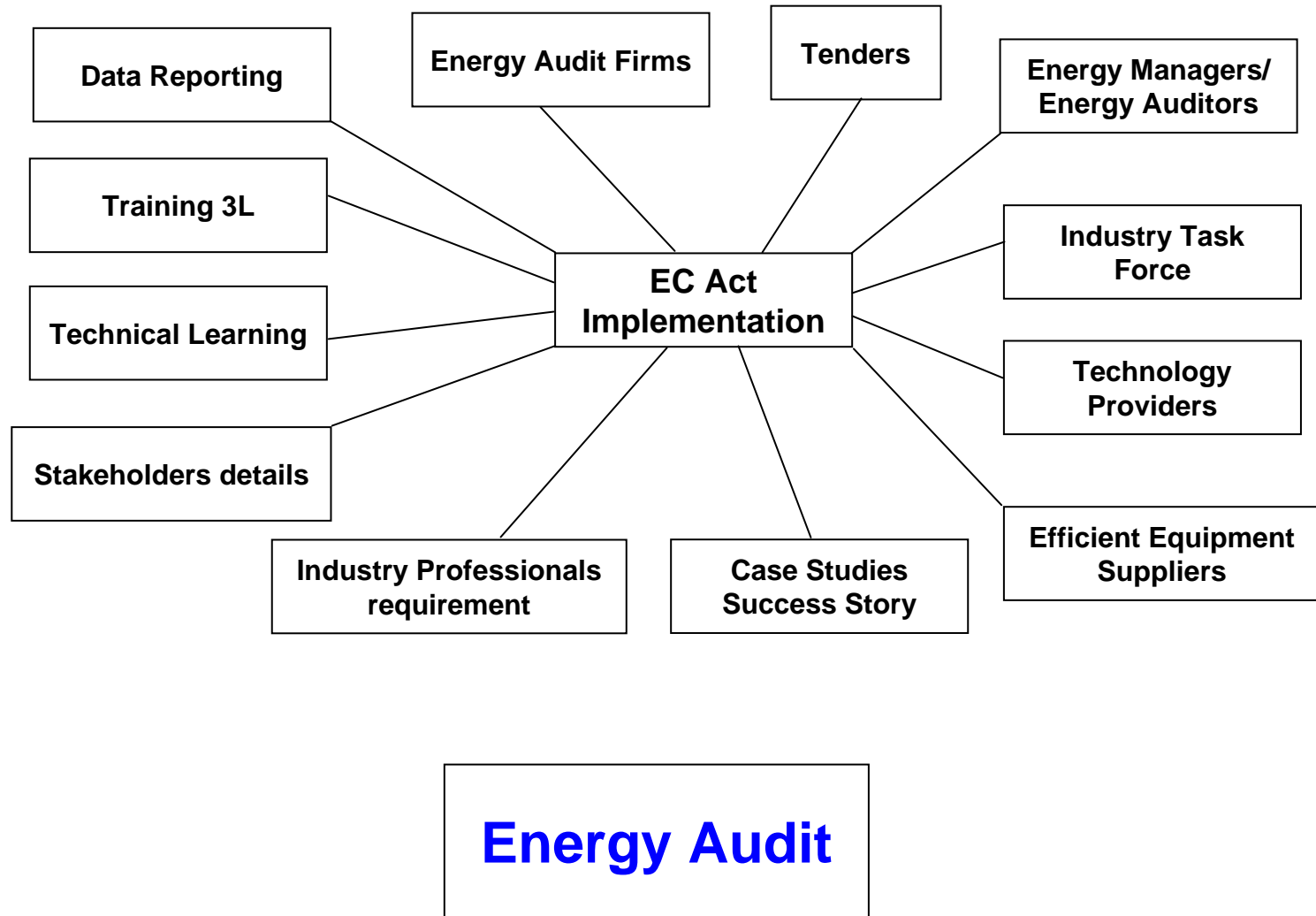


Energy Audit An overview

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Energy Management System



A. Methodology

1. Kick off the project

- A meeting between auditor and all key operating personnel.
- Agenda focuses on:
 - Audit objectives and scope of work, facility rules and regulations.
 - Roles and responsibilities of project team members,
 - Description of project activities and schedule.
 - Administrative issues, operating characteristics of the facility/ process
 - Energy system specifications, operating and maintenance procedures
 - Preliminary areas of investigation, operating constraints
 - Anticipated future plant expansions.



2. Facility Tour

- After initial meeting, a tour of facility to observe the various operations
- First hand, focusing on the major energy consuming systems identified
- Architectural, lighting and power, mechanical, and process energy systems., anticipated future plant expansions.

3. Document Review

- Documentation should include architectural and engineering plans
- Facility operation and maintenance procedures and logs,
- Utility bills for the previous three years.
- It should be noted that the available plans should represent "as-built" rather than "design" conditions.
- There may be some minor discrepancies between the systems evaluated as part of the audit and those actually installed at the facility.

4. Facility Inspection

- Thorough review of the construction and operating documentation.
- Identification of major energy consuming processes in the facility are further investigated.

5. Staff Interviews

- Audit team meets the facility staff
- To review preliminary findings and the recommendations being considered.
- Objective of the audit is to identify projects that have high value to the customer and management.
- In addition, interviews scheduled with key representatives designated by the facility as having information relevant to the energy audit.
- These representatives may include major energy consuming system service and maintenance contractors and utility representatives.
- Interview with finance managers involved in purchase of equipment and taking care of energy efficient equipment.

6. Utility Analysis

- Utility analysis is a review of energy bills for last 12 to 36 months.
- This should include all purchased energy, electricity, natural gas, fuel oil, LPG and purchased steam, as well as any energy generated on site.
- If possible, energy data is obtained and reviewed prior to visiting the facility to insure that the site visit focuses on the most critical areas.
- Billing data reviewed includes energy usage, energy demand and utility rate structure. The utility data is normalized for changes in climate and facility operation and used as a baseline to compute projected energy savings for evaluated ECM's. (energy conservation measures)
- With high cost of purchased energy it may be cost-effective to produce some of energy on-site. Options may include: power generators for emergency power solar panels, wind power and Cogeneration.

7. Identify/ Evaluate Feasible ECMs

- Typically, an energy audit will uncover both major facility modifications requiring detailed economic analysis and minor operation modifications offering simple and/or quick paybacks.
- A list of major ECMs is developed for each of the major energy consuming systems (i.e., envelope, HVAC, lighting, power, and process).
- Based upon a final review of all information and data gathered about the facility, and based on the reactions obtained from the facility personnel at the conclusion of the field survey review,
- A finalized list of ECMs (energy conservation measures) is developed and reviewed with the facility manager.

8. Economic Analysis

- Data collected during the audit is processed and analyzed.
- Build models and simulations with software (if available) to reproduce our field observations and develop a baseline against which to measure the energy savings potential of ECMs identified.
- Calculate the implementation cost, energy savings and simple payback for each of the ECMs being investigated.

9. Prepare a Report Summarizing Audit Findings

- The results of findings, recommendations are summarized in a final report.
- The report includes a description of the facilities and their operation, a discussion of all major energy consuming systems, a description of all recommended ECMs with their specific energy impact, implementation costs, benefits and payback.
- The report incorporates a summary of all the activities and effort performed throughout the project with specific conclusions and recommendations.

10. Review Recommendations with Facility Management

- A formal presentation of the final recommendations are presented to facility management to supply them with sufficient data on benefits and costs to make a decision on which ECMs to be implemented.

B. Types of Energy Audits

Interview with Key Facility Personnel

- The term energy audit is commonly used to describe a broad spectrum of energy studies ranging from a quick walk-through of a facility to identify major problem areas to a comprehensive analysis of the implications of alternative energy efficiency measures sufficient to satisfy the financial criteria of sophisticated investors.
- Three common audit programs are described in more detail below, although the actual tasks performed and level of effort may vary with the consultant providing services under these broad headings.
- The only way to ensure that a proposed audit will meet your specific needs is to spell out those requirements in a detailed scope of work.

1. Preliminary Audit

- The preliminary audit called a simple audit is the simplest and quickest type of audit.
- It involves minimal interviews with site operating personnel, a brief review of facility utility bills and other operating data
- A walk-through of the facility to become familiar with the operation and process
- Identify glaring areas of energy waste or inefficiency.
- Typically, only major problem areas will be uncovered.
- Corrective measures are briefly described
- Quick estimates of implementation cost, potential operating cost savings, and simple payback periods are provided.
- This level of detail, while not sufficient for reaching a final decision on implementing a proposed measures, is adequate to prioritize energy efficiency projects and determine the need for a more detailed audit.

2. General Audit

- The general audit alternatively called a mini-audit, expands on the preliminary audit described above by collecting more detailed information about facility operation and performing a more detailed evaluation of energy conservation measures identified.
- Utility bills are collected for a 12 to 36 month period to allow the auditor to evaluate the facility's energy/demand rate structures, and energy usage profiles. Additional metering of specific energy-consuming systems is often performed to supplement utility data.



- In-depth interviews with facility operating personnel are conducted to provide a better understanding of major energy consuming systems as well as insight into variations in daily and annual energy consumption and demand.
- This type of audit will be able to identify all energy conservation measures appropriate for the facility given its operating parameters.
- A detailed financial analysis is performed for each measure based on detailed implementation cost estimates
- Site-specific operating cost savings, and the customer's investment criteria.
- Sufficient detail is provided to justify project implementation.

3. Investment Grade Audit (ESCO)

- In most corporate settings, upgrades to a facility's energy infrastructure must compete with non-energy related investments for capital funding.
- Both energy and non-energy investments are rated on a single set of financial criteria that generally stress the expected return on investment (ROI).
- The projected operating savings from the implementation of energy projects must be developed such that they provide a high level of confidence.
- In fact, investors often demand guaranteed savings.

- The investment-grader audit alternatively called a comprehensive audit, detailed audit, maxi audit, or technical analysis audit, expands on the general audit described above by providing a dynamic model of energy use characteristics of both the existing facility and all energy conservation measures identified.
- The building model is calibrated against actual utility data to provide a realistic baseline against which to compute operating savings for proposed measures. Extensive attention is given to understanding not only the operating characteristics of all energy consuming systems, but also situations that cause load profile variations on both an annual and daily basis.
- Existing utility data is supplemented with submetering of major energy consuming systems and monitoring of system operating characteristics.