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## **Summary:**

Energy management profession has come a long way in India and abroad since its conception. Energy management, by definition is a multi-disciplinary, techno-commercial profession and involves interaction with human factors, as an integral part. For this reason, the skill set required for energy management also includes art of working with people and other related aspects. Energy conservation or energy efficiency improvement is the goal of energy management to be achieved by energy auditor and allied parties. This fact is sufficient to bring out importance of 'human factor' in energy management.

The present communication is about recommendations for overcoming barriers in energy management, identified on the basis of survey. The analysis of the situation in which a barrier has been identified shows that the barriers can be classified into few categories so that available or existing means can be employed meaningfully for overcoming the barrier. In this context, the extensive and mature experience gained through field work can provide useful insights for devising solutions to forthcoming problems. Also, with the Energy Conservation Act 2001, in place and Bureau of Energy Efficiency incorporated for offering solutions to problems, the growing community of energy auditors can be assured of all round development of the energy management profession.

## **Background:**

The identified twenty eight barriers represent interrelated, multi-disciplinary techno-commercial issues. Indeed the barriers have been known for long time. It can be expected that the solutions to problems seen as barriers can be found in the short term, medium term and longer term. In a specific situation solution may be found easily, however detailed investigation is required if general solutions are to be framed. Here, the issue is about formulating guidelines so as to either circumvent in view of various instruments available or overcome the barrier when encountered. The barriers under focus are analyzed with respect to phases of a typical energy audit in an industry and an attempt is made to identify means to be employed for either circumventing or overcoming a barrier in question.

## **Analysis of Barrier Description:**

For an energy auditor, the identified barriers are found to be directly related to following aspects of energy audit exercise, such as:

- Client selection and qualification, clients commitment to energy conservation
- Auditor qualification and technical capability required in given situation.
- Terms of payment, contract and undertaking.
- Financing mechanism for the ensuing projects.
- Safeguarding interest of stakeholders by means of standardization, calibration, and certification as a part of enforcement of law.

Over past several years, extensive experience is gathered in dealing with different aspects of energy audit exercise. With time new mechanisms have also been evolved. The most prominent among these being instruments made available under the Energy Conservation Act, 2001. Thus, Bureau of Energy Efficiency (BEE) is expected to play a lead role in facilitating creation of conducive conditions for overcoming these and other not listed barriers, in years to come.

However, the responsibility of delivering meaningful results of energy audit primarily rests with the auditors themselves. For this reason, it is imperative that auditor has the proven capability in the given situation, which is also the first element to come under scrutiny. The more qualified the auditor, lesser the chance of his making an error. This implies that in the coming years there has to be increasing emphasis on the education and training aspect of energy management in general. Through education and training it is likely that the most of the barriers will be surrounded if not eliminated. At the same time, the importance of the Energy Conservation Act and the important role of various instruments made available by the act cannot be overestimated.

In the author's opinion, following are the instruments/means which can be effectively employed for circumventing or overcoming the identified barriers in that order:

1. Enforcement of the Energy Conservation Act through empanelment and certification.
2. Education and Training for auditors, clients, equipments vendors, others
3. Auditor Qualification in terms of technical(instrument) and non-technical capability (interpersonal relation)
4. Incorporating new innovative Financing Mechanisms for implementation project.

These existing instruments/means which can be employed for overcoming identified barriers in different time frames as shown below:

Instruments/Means		Description of the Barrier to be overcome
<b>Enforcement</b>		Lack of Management support for implementation of audit findings.
		Poor Payment terms for energy audit services and no Standardization of payment terms
		Poor acceptance of findings of energy audit particularly in relation to operation, house keeping practices.
		New technology application.(Standardization, Calibration)
		Post audit reviews in energy audit services. (Periodic)
		Absence of alternative implementation strategies.
<b>Education &amp; Training</b>	<b>Auditor Level</b>	Lack of thorough knowledge in energy conservation.
		Energy inefficiency incorporation in the equipment by design itself.
		Lack of expertise and resources during the energy audit field study.

		Use of thumb rules, short cuts, assumptions and approximation in analysis and report preparation.
		Presentation too theoretical – not able to convince the plant personnel during the presentation.
		Lack of minimum instrumentation, metering and monitoring.
		Techno-economic evaluation of measures.
		Comprehensiveness of the report.
		Lack of analytical / simulation or software tools for the analysis.
	<b>Clients Level</b>	Plant sees only the first cost rather than life cycle cost while making the fresh purchase.
		Cost of energy is too small when compared to production cost.
		Techno-economic evaluation of measures.
<b>Financing mechanism</b>	Large investments are not attractive options in energy efficiency.	

A competent energy auditor is expected to have several useful traits which enable him to encounter the identified barriers successfully. With little analysis, the auditor can assess the probability of encountering a barrier and help himself corrective steps. Typically, energy audit in an industry proceeds through three phases: 1). Pre-audit assessment phase, 2). Energy audit exercise phase and 3). Post energy-audit phase. During each phase, auditors carry out specific tasks. The identified barriers which are likely to be encountered during these phases and the personality traits which are likely to be useful as remedy are summarized below:

1. **Pre-Audit Assessment Phase:** During this phase, the activities undertaken include site and data survey, discussions with client, review of audit report, if any. The goal of this phase is to formulate proposal for energy audit for the industry and a bi-partite contract document. The techniques/instruments which can be employed for overcoming barriers during this phase of audit summarized below:

<b>Barrier Description</b>	<b>Useful tip</b>
Overlapping of Energy Conservation measures	Pay attention to energy conservation measures (ECMs) implemented
Assessing the cost quality of services to fix the professional fees accordingly.	Match client's commitment to implement with auditor's capacity.
Scope of work in the detailed Energy Audit.	Certified Preliminary audit report is must.
Poor negotiation with regard to the payment terms.	Carefully plan negotiation. Minimum affordable cost must be known.
Lack of Management support for implementation of audit findings.	Obtaining commitment is a first step.
Poor Payment terms for energy audit services and no standardization of payment terms.	Keep terms of contract transparent. Enforcement agency's certification.
Poor acceptance of findings of energy audit particularly in relation to operation, house	Set up energy management team involving personnel from different levels,

keeping practices.	to share credit for energy savings realized.
Failure or Poor performance of the energy saving retrofits or equipment supplied by the vendors due to inferior quality or improper application.	Only tested equipments be recommended.
Failure of suggestions due to lack of expertise while implementing	Auditor's supervision is required Only competent agency be involved.
Non involvement or poor co-ordination among the inter-departments.	Set up energy management team involving personnel from different levels.
Post audit reviews in Energy Audit services.	Include as a contract term
Absence of alternative implementation strategies.	Only feasible measures be recommended.

2. **Energy Audit Exercise Phase:** During this phase, actual audit exercises are carried out by the auditors. The techniques/instruments which can be employed for overcoming barriers during this phase of audit summarized below:

<b>Barrier Description</b>	<b>Useful tip</b>
Plant personnel find energy conservation studies as faultfinding missions	<ul style="list-style-type: none"> <li>• Set up in-house energy management team</li> <li>• Conduct orientation sessions for awareness creation and seeking cooperation</li> </ul>
Cooperation during the field study of the Audit. Lack of Management support for implementation of Audit findings.	<ul style="list-style-type: none"> <li>• Involve in-house energy management team</li> <li>• Commitment of management is must</li> </ul>

3. **Post Audit Phase:** During this phase, audit recommendations are implemented, as per terms of contract. The likely barriers to be encountered during this phase and useful technique are summarized below:

<b>Barrier Description</b>	<b>Useful tip</b>
Overlapping of Energy Conservation measures	Client declares energy conservation measures already installed as baseline Auditors mentions these in report
Disagreement about fact acceptance. Or Disagreement about saving potential.	<ul style="list-style-type: none"> <li>• Terms of contract should be clear and transparent</li> <li>• Include in-house energy management team at appropriate level.</li> <li>• Help from enforcement agency be sought.</li> </ul>

## **Conclusion:**

Energy auditor is likely to encounter professional challenges on several accounts. With knowledge and practical experience these can be overcome or avoided. The Bureau of Energy Efficiency (BEE) is expected to assume lead role in facilitating standardizing, certifying, empanelling and safeguarding the interests of both energy auditors and energy consumers. Also, education and training programmes, in their various forms, be implemented with the objective of capacity and competence development.

## **Questions:**

1. Which agency is expected to play significant role in overcoming barriers encountered by energy auditors?
2. Which factors determine success of energy audit exercise?
3. Which aspect of energy management should be emphasized for searching solutions to problems encountered by auditors?

## **Answers:**

1. The Bureau of Energy Efficiency
2. Management's commitment, auditor's competence, involvement of in-house personnel.
3. Education and training of auditors, energy consumers, stakeholders, general public, which will provide long term solutions.