

DME Energy Auditing Course Trainer's Guidebook

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The module planning "scripts" use a model developed for the Canadian Institute for Energy Training by Stephen Dixon, TdS Dixon Inc. and Doug Tripp, CIET.

Section 1: Introduction to the Instructor's Guidebook

1.1 Purpose of the DME Building Energy Auditing Courses

In order to deliver energy efficiency recommendations for the Public and Commercial Buildings sector which are integral to the Energy Efficiency Strategy for South Africa, it has been decided to ensure that capacity exists at national, provincial and local levels to undertake comprehensive building energy audits of consistently high standard.

The capacity building program includes these two courses, one directed at prospective energy auditors, and the other at supervising engineers who would act on behalf of the building owners to implement and respond to audits.

Recognising that buildings are complex and that a complete understanding of building systems cannot be developed in a matter of a few days, these courses focus on the auditing methodology and the efficiencies that can be achieved in building systems through technological and operational measures; of necessity, the courses assume considerable prior knowledge of the underlying mechanical and electrical principles that pertain to building systems.

1.2 Purpose of the Instructor's Guide

Facilitating adult learning is an important task, no matter what the subject. This is especially true in the case of this course because of the importance of the skills being developed in the context of South Africa's Energy Efficiency Strategy.

Being effective in facilitating adult learning requires skill on the part of the instructor, knowledge of some principles of adult learning, and careful planning of the instructional sessions. This instructor's guide attempts to support the instructors for the ***DME Building Energy Auditing Course*** and ***Supervising Engineers Course*** by:

- Providing some background information on adult learning principles;
- Describing the structure of the courses and the rationale for this design;
- Providing planning "scripts" for each topic in the courses;
- Providing some initial direction on the evaluation of learning.

This Guide is intended for self-study by the course instructors; its most important use, however, is as a planning guide for trainers.

The ultimate goal of the course curriculum, and therefore of the instructors, is to ensure the success of the energy auditors and supervising engineers who participate. The author of the Guide and sponsors of the courses wish you success in your instructional endeavours.

Section 2: Facilitating Adult Learning

Objectives

After completing this section, you will be able to use instructional styles and techniques that promote effective learning by your trainees.

2.1 Some Important Principles of Adult Learning – What Works for You?

Think about a successful learning experience that you have had as an adult. It could be a workshop or seminar related to your work or a personal interest, or it could be a short course taken at the local college. Now ask yourself the question, “What made this a successful learning experience for me?” Let’s brainstorm on this for a few minutes.



By the way, “brainstorming” is a useful technique for generating ideas in a workshop, if it is done properly. Here are some rules that we can use—and that you can use if you decide to do any brainstorming in the sessions you teach:

- **Every idea is worthwhile - even weird, way-out, confusing or silly ideas**
- **Suspend judgment - critical assessment comes later**

2.1.1 How Adults Learn

Educators spend a lot of time and effort exploring how adults learn. In a one day session, we’re not going to be able to delve into this in any depth, but it is important to consider briefly what all this research tells about effective adult learning. It is important because the whole point of the course you are preparing to deliver is to change how dry cleaners behave, and/or to enable them to qualify for certification; this implies that learning needs to occur.

- ✓ **Teaching adults is not the same as teaching children.** Here are some factors that apply to adult learners. How do they correspond to your list of factors that defined your learning experience as successful?
- ✓ **Relevance . . .** Adult learners prefer training sessions that will assist them to carry out their daily tasks. They are clear about why they are taking the training, and will quickly lose interest if the session doesn’t respond to their interests. *The objectives of the training session should be stated and linked to job performance* in the introduction of the training program. The learning experiences should relate to the successful accomplishment of the program objectives.
- ✓ **Motivation . . .** Adult learners enter training with a high level of interest and motivation which is quickly lessened if the trainer fails to maintain it. In the case of this course, dry cleaners must attend in order to be certified, and there is a legal requirement to do this. Nevertheless, busy people are motivated to get the most out of a learning experience.

Motivation can be maintained by the trainer who provides clear instructional goals and learning activities that will encourage and support strong trainee interest. The competent trainer should explore ways by which the needs of each trainee can be incorporated into the training sessions. This is directly related to the different learning styles that adults have developed.

- ✓ **Participation . . .** The need for involvement in the training process is the third characteristic of adult learners. The effective instructor will keep this point in mind and design learning experiences that involve adults actively in the training process. These might include various activities—such as discussion, hands-on work, or projects—for each of the concepts that the instructor desires the participants to master.
- ✓ **Positive Feedback . . .** Adult learners like to get reinforcement for their learning successes. This might be no more than a “way to go!” from the instructor, but it is important for them to know how their efforts measure up when compared with the objectives of the training program.
- ✓ **Personal Concerns . . .** Adult learners frequently have a number of concerns about themselves and their performance during the training session. Their ability to learn, fear of embarrassment or failure, or simply not knowing what to expect can be major concerns. The instructor should open the training session with a good introductory activity that will place adults at ease. For example, an activity that will get everyone acquainted is a good suggestion for an introduction to the program. Names and faces can be linked so that participants are not just a group of strangers. This opening activity can then be followed with learning experiences that build support and encouragement.

As well, we adults may have physical limitations that affect our ability to sit comfortably for long periods of time in a workshop room; the freedom to move around, and planned activities that get us up from time to time are well received.

- ✓ **Individuality . . .** We're not all the same in terms of our personalities, education, experience, expectations, learning styles, and so on. As adult learners, we expect our differences to be respected and accommodated.

Each adult brings a unique background and set of experiences to the training session that influence his or her approach to learning. Adults through past experiences have a good foundation upon which to base new learning. As a result, they are in a better position to determine whether the ideas presented are practical in the work place. This is one of the primary reasons that the issue of relevance of the training experience was emphasized at the start of this discussion. The age factor has implications for the rates at which various individuals learn new material. Often old habits or thinking must be unlearned before new concepts or techniques are mastered.

In some cases the adult learner will have been absent from the traditional learning situation for a long period of time bringing a different set of expectations and attitudes into the new learning situation. In some instances adults may have difficulty coping with the new situation, exhibit defensive behavior or in some cases hostile behavior.

2.1.2 Background Reading: How the Trainee Learns

The following provides a little more detail on some of the issues we have explored.

2.1.2.1 The Learning Process – It's about “learning”, not “teaching”

Training is essentially a form of communication; no matter how skilled the trainer may be, learning is essentially the task of the trainee, and can be accomplished only through his/her own efforts—you know, “you can lead a horse to water, but you can't make it drink”. The trainee must be in a responsive frame of mind, must have the ability to learn, and also the desire to learn.

If the trainee does not want to learn, the trainer can use every known instructional method but nothing will be learned. A bad trainer working with a group which wants to learn will achieve far more than a good trainer with a group which does not want to learn.

The trainer's responsibility is to see that all the motivating tactics available are used. The main strategy is to create a **learning** situation rather than in a **teaching** situation. Good instruction should be trainee-centred rather than trainer-centred.

Interest is essential for attention, and attention is essential for learning and mastery. The trainee must be made aware of the importance of the learning to himself and his future. There should be a definite purpose behind every piece of instruction given.

2.1.2.2 Feedback goes Two Ways

We know that adult learners need feedback, but so does the trainer. Feedback allows the trainer to know just where the trainees' are at any given time during the instruction. The more feedback there is, the more the trainer will know about the success of the instruction.

Feedback can be obtained in many ways. Many trainers tend to depend upon watching the faces of the learners for a large amount of their feedback. If the trainees look fairly pleasant or satisfied, if they seem interested, or if they smile and nod their heads positively, the trainer reads this as feedback that says, “Things are going great”. However, looks can be deceiving; it is important to ask, and on doing so, you might be surprised to hear, “Uh, I don't know.... I haven't been able to follow you very well”.

2.1.2.3 Discovery Learning

Instead of feeding “old” information back to the trainer, the trainees may offer new conclusions or concepts and even new factual information they have found on their own. Here we have a much better situation for retention to take place, since the trainees are accountable for the learning and must know where they are going in order to see whether they have got there.

A case study is an excellent way to get a group involved in coming up with some good conclusions that they might have missed if the trainer had not told them about a management principle or described an abstract situation.

Some trainers, however, are so afraid that the point will be missed that they state the conclusions themselves instead of waiting for the trainees to make suggestions. Be patient, and allow discovery to happen.

2.1.2.4 Trainee Controlled Instruction

While not really applicable to the Building Energy Auditing Course, this is an altogether different approach to the learning process. It is concerned less with technique or methodology than with obtaining the desired performance through a "contracting" process that gets the trainer and the trainees agreeing on several things before the training begins. They are the goals or objectives in behavioural terms - and they agree on the measuring devices for seeing whether the goals are actually met. The trainee is required to do the tasks assigned; the trainer is required to see that the assignment will guarantee that the trainees achieve the objectives when the assignment is completed.

2.1.2.5 Assignments and Discussions

A training program has been likened to a marketplace, where experience and ideas are actively exchanged. By means of assignments and discussion, ideas are collected and pooled by trainer and trainees. A task or a problem is suggested by the trainer or by the trainee, which is a challenge to the trainee and calls for effort and initiative. The work to be carried out may involve experiments, handling samples, making sketches, diagrams, or observation of videos, followed by discussion. This method ensures active participation of the group and encourages initiative and finding things out for oneself.

2.1.2.6 Participatory Learning

Participation of the trainee is an essential part of any learning method, and can be achieved in many ways.

How much telling, teaching, showing, demonstrating, participation, activity, doing, freedom to learn by mistakes, freedom to discover, should be included in a particular lesson or course can only be determined by taking into account factors, such as:

- the objectives, skills, knowledge, attitudes;
- the size of the group;
- level of the work;
- the differences between the individual;
- and the personality of the trainer.

2.1.2.7 Memory

It goes without saying that, as trainers, we want the participants of our course to remember the important things they have learned. Remembering what we have been taught is a more complicated process than you might realize. Here are some factors that have an impact on what we remember from training experiences, and what, as trainers, we should do about it.

Table 1: Summary of Factors Affecting Memory.

Factor	How it affects memory	Implications
Understanding	Little memory without this	Make meaning clear, use simple words
Trainee interest and attention	Memory is proportional to interest and attention	Motivate the trainees
Depth of impression	Memory is proportional to impression	Be dramatic use surprise, excite curiosity.
Association	Memory is assisted by association of ideas	Good sequence, logical development
Repetition and reinforcement	New information must be repeated and reinforced	Applicable to disconnected facts
Time	Memory fades with time	Regular systematic revision and tests with quick feedback
Frequency of recall	Recall strengthens memory	Trainees should be given opportunity to revise.

2.1.2.8 Learning Styles

As we have discovered, different people have different learning styles. Most individuals feel comfortable with one dominant style but will often use a combination of all styles to a lesser or greater extent. Learning styles can be summarized as follows:

- Learning from ***Feeling*** and ***Doing (Kinesthetic)***
 - Learning from specific experiences
 - Relating to people
 - Influenced by action
 - Needs practical application
- Learning by ***Watching*** and ***Listening (Auditory and Visual)***
 - Careful observation of tasks to be learned
 - Viewing concepts from different perspectives
 - Looks for a logical meaning
- Learning by ***Thinking (Conceptual)***
 - Analyzes concepts
 - Needs to develop an intellectual understanding

The trainer has to take these styles into consideration when planning a learning activity so that the instructional strategies will incorporate all three ways trainees learn, and thereby accommodate the styles of all trainees.

Table 2: A Typical Example of a Learning Session which Accommodates all Types of Learning Styles

LEARNING ACTIVITY	DOMINANT LEARNING STYLE
Introduction to the Topic	Auditory and Visual
Explanation of the Topic <ul style="list-style-type: none"> • By presentation • Use of video • Visual aids 	Auditory and Visual Conceptual
Demonstration <ul style="list-style-type: none"> • Trainer demonstrates equipment • Trainer provides examples 	Auditory and Visual Conceptual
Trainees Imitate <ul style="list-style-type: none"> • Group discussion • Role play • Trainee demonstration to group 	Kinesthetic
Trainer Summarizes	Auditory and Visual Conceptual

Table 3: Emotional Characteristics of the Mature Adult Learner

CHARACTERISTICS	IMPLICATIONS FOR THE TRAINER
Self Concept Adult trainees see themselves as capable of self-direction and desire others to see them in the same way	<ul style="list-style-type: none"> • Allow trainees to: • Direct their own learning as much as possible. • Avoid talking down to the trainees. • Avoid potentially embarrassing situations by exposing individual trainee's lack of knowledge. • Evaluate trainee progress according to trainee self directed goals
Motivation Adult trainees are motivated to learn when they have a need to do so. They want to know how the training will help them. Much of an adult's willingness to learn is determined by the benefits of the learning situation balanced against the disadvantages of not learning.	<ul style="list-style-type: none"> • Make sure that trainees are given an opportunity to explore why they should complete the training. • The training must be relevant to the trainee's needs. • The advantages of completing the training must be understood. • New skills and knowledge must be immediately applicable. • Explain the benefits to be gained. • Benefits of training must be measurable.

<p>Personal Learning Environment</p> <p>Adults have established emotional frameworks consisting of values, attitudes and tendencies.</p> <p>Learning often requires changing behaviors and possibly, changing parts of this emotional framework.</p> <p>All change can be disorienting and provoke anxiety.</p> <p>An adult's ability to change (and, therefore, learn) is directly proportional to the degree of emotional safety he or she feels</p>	<ul style="list-style-type: none"> • Provide a non-threatening learning environment. • Allow time for the trainee to adapt to change. • Respond to non-verbal expressions.
<p>Reinforcement</p> <p>Adults respond to reinforcements.</p> <p>Although adults are usually self directed, they do need to receive reinforcement.</p>	<ul style="list-style-type: none"> • Provide meaningful reinforcement for the trainees. Reinforcement must be perceived as positive from the trainees' frames of reference. • Allow for peer group reinforcement.

Table 3: Intellectual Characteristics of the Mature Adult Learner

CHARACTERISTICS	IMPLICATIONS FOR THE TRAINER
<p>Previous Learning</p> <p>Adult trainees possess a great deal of previous knowledge.</p> <p>Adults learn best when they are able to link new knowledge and skills to existing knowledge and skills. This linkage decreases anxiety about new areas.</p> <p>Existing knowledge and skills can also be a hindrance to learning.</p> <p>Information contradictory to existing knowledge sometimes allows the trainee to dismiss or reject the new information and to rely on what is familiar.</p>	<ul style="list-style-type: none"> • Help trainees to build bridges between existing learning and new learning by providing specific examples and application. • Recognize and give credit for what the trainees already know or are able to do. • Allow trainees to explore what they know about an area before providing new instruction. • Provide job aids or assist trainees to develop their own job aids to help them "unlearn" previous learning that is interfering with new learning.

<p>Passive vs. Active Learning</p> <p>Involve students in the learning process. Studies show that over a period of 3 days, the retention of learning is as follows:</p> <ul style="list-style-type: none"> • 10% of what we read • 20% of what we hear • 30% of what we see • 50% of what we see and hear • 70% of what we say • 90% of what we say as we do (i.e.; orally work out a problem) <p>Adults can learn by reading, listening and watching. They will learn better if they are actively involved in the learning process.</p>	<ul style="list-style-type: none"> • Pair information presented in lectures or reading assignments with activities such as discussions, exercises and job simulations. • Minimize passive learning (lectures and reading assignments). • Maximize “learning by doing”.
<p>Learning Preferences</p> <p>Most adults have preferred methods for learning new knowledge and skills.</p> <p>Adult learners respond better when the new material is presented through a variety of instructional methods which appeal to their learning preferences.</p>	<ul style="list-style-type: none"> • Identify the trainees’ learning styles • Employ a variety of presentation techniques • Match instructional style to the trainees’ styles

2.2 Being an Effective Trainer

A common myth is that instructors, especially those found in schools, colleges and universities, have greater knowledge of their area and more experience than those whom they teach, and that, therefore, it is pointless to challenge their teaching or to criticize their behavior.

“The role of the student is quite simple: to listen and learn.”

- Do you agree or disagree with this statement?
- Is it a myth or is it a fair and factual statement?
- Is it as true of workplace-oriented training as it is of formal education?
- Will your opinion have an impact on the manner in which you perform as an educator of adults?

As a check on your attitude about teaching and learning, look at the following statements and indicate whether you agree, disagree or are uncertain about their validity.

Worksheet 1: Attitude Survey

Agree	Disagree	Uncertain	Statement
			I must maintain a dignified posture at all times to gain the trainees' respect.
			The trainer must always be in control of the teaching situation.
			I can only be friendly and approachable when away from the teaching situation.
			A trainer must always know more than the trainee.
			A trainer must not become overly friendly with trainees.
			I should never show weakness by accommodating trainees' requests for changes.
			I should never lend my personal teaching aids to the trainees.
			A trainer must be able to answer any question.
			I should never let the trainees think that I care what they think of me as a person.
			My sessions must always start and finish on time.
			A trainer should never make a mistake.
			If a trainer does make a mistake it should be covered up and not discussed with the trainees.
			I should never allow my decisions to be influenced by the trainees.
			I should never share my personal opinions on matters unrelated to the course with the trainees.
			I should never appear to be uncertain in any of my answers.
			Sharing feelings and emotions with my trainees is not acceptable.
			I should be absolutely impartial when controlling my trainees.

A Good Trainer Must:

- **Be consistent**
- **Be sensitive to the trainee's needs**
- **Motivate the trainees**
- **Develop good working relationships with trainees**
- **Develop a good teaching / learning atmosphere**
- **Know the subject matter**
- **Be positive**
- **Be committed**
- **Be enthusiastic**
- **Be a good communicator**
- **Be flexible**
- **Be well organized**

2.2.1 Facilitate or Instruct?

In the training profession, one runs into these two terms to describe what the trainer does. The difference in meanings has a lot to do with how the trainer sees his or her role.

“Facilitate” means “make easy” or “enable”. Facilitators of learning “enable” people to learn. Their expertise has more to do with the learning process than it does the subject matter—which isn’t to suggest that a good facilitator can be unfamiliar with the subject matter.

“Instruct” means “teach” or “give information to”. Instructors play an active role in transferring information that is to be learned, and in developing the skills of the trainees.

Our view is that these courses will require aspects of both. You are here partly because of your knowledge of energy auditing; but you are also here because of your interest in playing a role in facilitating learning.

So that we don’t make to fine a point of it, let’s refer to each other as “trainers”, while recognizing that there are aspects of facilitation and instruction involved in defining our roles.

2.2.2 Being an Effective Instructor

On being asked to perform as an Adult Educator, most trainers are inclined to imitate the style of the teachers they had at secondary school or some higher educational institution.

However, as we have seen, the training of adults is not the same as the educating of young people. The characteristics of adult learners have implications for the techniques used by trainers, as the following table summarizes.

Table 4: Training Adults

CHARACTERISTICS OF ADULT LEARNERS . . .	IMPLICATIONS FOR TRAINERS
Adults learn by doing and are accustomed to being very active. They need opportunities for active participation whenever possible.	avoid lengthy lectures
Adults bring a wealth of life experience to the classroom. Therefore they wish to speak and contribute to what is going on.	You should also relate your class material to their prior knowledge.
Because of their rich life experience, adult learners (and the instructor) can learn a great deal from one another .	Set up your training session to allow a high degree of interchange and sharing among the learners.
Adults are afraid of losing their self-esteem in classroom situations.	Create a non-threatening, supportive environment, and respect their views and feelings; help them to be successful.
Adults are highly self-directing .	Avoid being too directive; consult with your learners and find out their wants and expectations.
Adults want learning to help them with real-life problems in the here and now, not in the distant future.	make your training practical and relevant
Adults want to see progress and need frequent feedback on how they are doing.	Give regular and positive feedback; do it very supportively and never punitively.
Adults learn best in a friendly, informal atmosphere .	Create a learning atmosphere where they feel safe and are allowed to make mistakes.
Adults like to see the big picture .	Make sure you explain the agenda and session goals at the outset.

To be an effective trainer it is necessary to develop the following skills.

- ✓ **Consistency and Determination . . .** Know exactly what is to be done and how to do it. Be consistent and determined so that the trainees understand the importance of the objective and develop a sense of achievement as they master the course contents.
- ✓ **Sensitivity to the Trainee's Needs . . .** Be sensitive to the needs of the trainees at all times. A good trainer knows that the training program objectives must meet the needs of the trainees.
- ✓ **Encourage Trainees (Motivation) . . .** Encourage the trainees to master the new information and skills.

How to Give Constructive Feedback

- ✓ **Key Principles:**
 - Be Honest
 - Be Gentle
 - Don't attack
 - Protect the trainee's self-esteem
 - Never embarrass anyone
- ✓ **Look first for the positives . . . always start with the strengths:**
 - "I liked the way you . . ."
 - "What you did well was . . ."
 - "Your explanation of the agenda was clear and logical . . ."
- ✓ **Then be clear about the negatives . . . constructively and tactfully:**
 - "Next time you may want to try . . ."
 - "What you may want to think about is . . ."
 - "I had difficulty with . . ."
- ✓ **Avoid saying "You should . . ."**

- ✓ ***Develop Good Relationships with the Trainees (Rapport)*** . . . Establish a positive relationship with your trainees. Introduce yourself, the course and training objectives.

Discuss expectations before the training commences. Allow the trainees to introduce themselves and indicate their expectations. Demonstrate that you are concerned that each trainee will gain an advantage from the training.

Demonstrate that the training will be of value both to the trainees and their organizations.

Indicate clearly that you feel that the training provided will help the trainees perform their work in a manner that will be an advantage both to the trainee and their organizations.

Demonstrate that ultimately the training will promote the trainee's career development.

If you don't believe this—sometimes a training course may be required to suit the needs of the organization not the trainee—be honest and indicate your true opinions and discuss how to use the situation to the best advantage. In this way the trainees will trust you and not see you as someone who is just doing a job with no concern for its outcome.

How to Build Rapport with Trainees

- ✓ **Trainees want to feel:**
 - Safe
 - Comfortable
 - Reassured
 - Welcome
 - Important
 - Understood
- ✓ **Welcome everyone and introduce yourself.**
- ✓ **Provide a structure for the trainees to introduce themselves.**
- ✓ **Use a fun “icebreaker” to relax the trainees and get them talking.**
- ✓ **Create a relaxed learning environment:**
 - Reassure trainees that making mistakes is OK
 - Encourage participation and asking of questions
 - Allow trainees to disagree and debate
- ✓ **Explain the goals of the session—with their input—and stress the benefits.**
- ✓ **Use humour.**
- ✓ **Explain the logistics:**
 - Schedule
 - Duration of sessions and breaks
 - Arrangements for refreshments and lunches
 - Where are the washrooms
- ✓ **Stress your role . . . to help and facilitate learning.**

- ✓ ***Develop a Good Teaching / Learning Atmosphere . . .*** Develop and maintain a supporting and informal approach in which the trainees are not intimidated and feel they can ask questions and participate in group discussions. Use group experience to the best advantage.

- ✓ ***Know Your Subject . . .*** The Trainer must know the subject matter of the training course. Don't lose your credibility; if you are uncertain about the correct answer to a question, tell your trainees that you are not sure of the answer, and then use the situation as a group learning experience where you and the group find out together.

This is an opportunity for the trainer to adopt the role of a group leader and guide the trainees in discovering solutions. It is an acceptable training technique not to always simply supply answers, but to draw on the combined experience of the group to find solutions.

- ✓ ***Be Positive, Demonstrate Commitment and Enthusiasm . . .*** By being positive and showing enthusiasm for subject matter you indicate to the trainees that you believe in what you say, you demonstrate the importance of the subject and build up your credibility as a trainer. If you can show that you believe in what you say and do the trainees will believe in you.

- ✓ **Develop Good Communication Skills . . .** There has to be two-way communication between the trainer and the trainee. You must be seen and heard clearly but do not dominate the situation. Trainees must have the opportunity to participate in the teaching learning process.

How to Lead a Group Discussion

- ✓ **Your role is to lead, not participate in, the discussion; it's usually best not to express your own opinion.**
 - ✓ **Some techniques:**
 - Engage . . . introduce the topic and ask the first question
 - Encourage participation . . . "What do you think . . .?"
 - Probe . . . "What do you mean by . . .?"
 - Clarify . . . "So what you are saying is . . ."
 - Guide . . . "Perhaps we have strayed off topic."
 - Summarize . . . "What we have said is . . ."
 - ✓ **Use the flipchart as a group memory . . . bullets only**
 - ✓ **Use the flipchart as a "parking lot" . . . for discussion you want to defer, but not forget**
-
- ✓ **Teach, Don't Talk . . .** *Talking is not teaching; don't just talk to your trainees—be a showman, demonstrate, explain, question, listen, and direct your group. A good trainer is very similar to a good actor; however, you must always remember to keep a balance between instructing and entertaining.*
 - ✓ **Be Flexible . . .** Actors are skilled in holding the attention of the audience. Much of their skill depends on a sense of timing that reflects the mood of their audience. A good trainer is able to gauge the mood of the trainees by observing their reactions, and then react accordingly. If things are going badly, don't continue. Be flexible, stop the session, and start something new or, better still, determine what is wrong, discuss it with the trainees and adjust.
 - ✓ **Be Organized (Planning) . . .** Be well organized. Plan your presentation. Start on time and finish on time. Remember that trainees can only concentrate for a short period. A good presentation will have a beginning, with the objectives clearly defined, followed by a full explanation and, if possible, some type of activity.

A rule of thumb for planning the presentation is:

- Say what you're going to present
- Present it
- Say what you presented.

How to Ask Questions

- ✓ **Questions should be:**
 - Brief
 - Clear and very specific
 - Focused on one issue
 - Asked in simple language
 - Not too easy, not too difficult
- ✓ **Ask open-ended questions . . . avoid the “yes” or “no” answers**
- ✓ **Ask questions of the whole group, rather than one individual . . . unless you are trying to engage others.**
- ✓ **Don’t feel that you have to answer questions directed to you . . . reflect them back to the group.**
- ✓ **If you get a wrong answer, consider re-phrasing the question . . . try to find what is correct in it.**
- ✓ **Praise correct answers.**
- ✓ **If you don’t know an answer, don’t bluff . . . admit it and commit to finding an answer.**

- ✓ **Control . . .** One of the most difficult skills is to balance all of the above requirements and still maintain control. Many inexperienced trainers dislike the democratic approach because they fear losing control of the situation. Maintaining a good balance in your instructional techniques is not easy and like any other skill can only be developed with practice.

Some trainers have a natural gift, while others have to develop the required skills slowly over a period of time. The purpose of this ToT is to identify, and to provide the opportunity to develop, the required skills.

The art of teaching is not gained quickly and easily. The qualities discussed here will help you to develop the “Tricks of the Trade”.

2.2.3 Using Visual Aids



The materials for the **Building Energy Auditing Courses** include Guidebooks and sets of PowerPoint slides. The slides can be used in hard copy (that is, transparencies) or projected from your computer. In the latter case, you can add animation to them in the PowerPoint program, although this has not been done with the master sets.

Using transparencies for projection is a matter of personal preference. The advantage of transparencies is that they enable the instructor to deviate from the “script”—the sequence of topics—in the event that the needs and interests of the participants require a different approach. As well, it is easier to go back to previous slides than would be the case with projection. Of course, the technology of overhead projection is simpler, and less likely to fail as can be the case with computer projection. Many presenters who use projection carry a set of transparencies as a back-up.

On the other hand, projection, especially with animation, can give a more compelling, professional presentation, provided that the “script” is going to be followed without too much deviation.

Except for any visual aids or exhibits that you bring with you, the only visuals that are built into the course itinerary are the overheads and flip charts. Good overhead slides should present very concise “talking points”, highlighted where possible with colour, diagrams, and other graphics to capture trainees’ attention; slides that present large amounts of text are useless. Hopefully, you will find that the slides developed for this program meet these criteria.

Both slides and flip charts can be used to good effect, if used properly. Here are some tips.

Using Overheads

- ✓ **Pointing** . . . A pointer can be a pencil or pen touching the transparency as it sits on the projection surface, or a laser pointer directed at the screen.
- ✓ **“Chalkboard technique”** . . . blank slides can be used to good effect as a writing surface (using the right kind of erasable overhead markers) in place of a chalkboard or flip chart.
- ✓ **“Revelation technique”** . . . Place a sheet of blank paper over all or part of a transparency to block areas that you do not wish to be seen yet. Reveal points in the sequence you wish to coincide with discussion.

Using Flip Charts

- ✓ Good for brainstorming and impromptu problem-solving, “on the fly” explanations.
- ✓ Be selective in using flip charts
- ✓ Avoid unnecessary, distracting details
- ✓ Use arrows, circles, graphics to make connections
- ✓ Use colours to emphasize, distinguish, categorize
- ✓ Leave a couple of inches between lines to enhance visibility
- ✓ Use only the top 2/3 of the sheet of paper
- ✓ Use as few words as possible
- ✓ Highlight key points by:
 - Using different colours
 - Underlining key words
 - Drawing a box around key words
 - Drawing pictures
- ✓ Make sure the colours used are easily visible.

2.2.4 Conditions Which Promote the Learning Process

We retain:

- **10% of what we read**
- **20% of what we hear**
- **30% of what we see**
- **50% of what we see and hear**
- **70% of what we say**
- **90% of what we say as we do (i.e. orally work out a problem)**

As a trainer, you can create conditions that are conducive to learning—or not. Here are some tips:

- The trainee will perform better if he knows exactly where he is starting from and what he will be expected to do upon completion of training.
- The trainee will perform better if the required knowledge and skills are presented in a logical sequence (i.e. from the known to the unknown, from the simple to the complex, from the lower levels of learning—recall, recognition—to the higher levels—relationships and problem solving).
- The trainee will perform better if material is presented in steps small enough to be grasped and practised.
- The trainee will perform better if allowed to progress at his/her own pace in acquiring the required skills and knowledge.
- The trainee will perform better if actively involved in the process of acquiring knowledge and skills, rather than listening passively.
- The trainee will perform better if given immediate knowledge of his/her progress, praised for correct performance, and any given constructive feedback to correct errors.

Table 5: Reading Trainees' Body Language

TRAINEE BEHAVIOURS	POSSIBLE FEELINGS	WHAT TO DO ABOUT IT
<ul style="list-style-type: none"> • Smiling • Nodding affirmatively • Leaning forward • Eye contact 	<ul style="list-style-type: none"> ✓ Enthusiasm ✓ Understanding 	Continue and make a mental note that the training is being well-received.
<ul style="list-style-type: none"> • Yawning • Vacant stare • Shuffling feet • Leaning back in chair • Looking at the clock 	<ul style="list-style-type: none"> ✓ Boredom 	Try taking a break, speeding up, or checking your training method to be sure that the trainees are involved in the process.
<ul style="list-style-type: none"> • Frowning • Scratching head • Pursing lips • Vacant stare • Avoiding eye contact 	<ul style="list-style-type: none"> ✓ Confusion 	Ask trainee about areas of confusion and provide clarification. Or if time is limited, talk with the trainee at the next break.
<ul style="list-style-type: none"> • Running fingers through hair • Squirming • Restlessness 	<ul style="list-style-type: none"> ✓ Frustration 	During a break, ask trainee how he/she feels about the course so far.

Table 6: Trainer's Body Language

POSITIVE	NEGATIVE
<ul style="list-style-type: none"> ✓ Facing the trainees whenever possible ✓ Continually scanning the whole group to be aware of their reactions. ✓ A pleasing disposition, smiling at the trainees ✓ Affirmative gestures, such as nodding in agreement to trainee responses ✓ Moving around the workshop room 	<ul style="list-style-type: none"> ✓ Talking to the overhead projector, the flip chart or the chalk board, rather than the trainees ✓ Turning your back to the trainees when using teaching aids ✓ Avoiding eye contact with the trainees ✓ Negative facial expressions when an incorrect response is given ✓ Ignoring the trainees when they are completing worked examples

A Practical Checklist

- ☐ **Is the room set up appropriately?**
 - How many participants?
 - Enough tables and chairs for trainees
 - Adequate room
 - Sight lines
 - Can trainees see each other – face to face?
 - Name tags and tent cards
- ☐ **Is the instructional equipment ready?**
 - Where are the electrical outlets?
 - Does the overhead projector work; is the projection surface clean?
 - VCR or other equipment needed
 - Computer projector for PowerPoint
 - Power cables taped down to the floor
 - Projection screen
 - Flip charts and markers
- ☐ **Room conditions**
 - Where are the light switches?
 - Can the light level be adjusted sufficiently?
 - Are the fans and air conditioning noisy?
 - Is the temperature comfortable?
- ☐ **Materials**
 - Workshop manuals
 - Handouts
 - Slides (transparencies)
 - Agendas
 - Evaluation sheets
- ☐ **Schedule**
 - Catering set up, breaks and lunch scheduled
 - Start and finish times clear
- ☐ **Facilitator's Kit**
 - Flip chart markers
 - Transparency markers
 - Hi-Liters
 - Spare blank transparencies
 - Pointer – physical or laser
 - "Stick Up" or masking tape for flip chart sheets
 - Post-It Notes
 - Extension cords
 - Duct tape
 - Write-on name tags
- ☐ **Getting ready**
 - Event sign posted (if hotel or conference centre venue)
 - Write summary of agenda on flip chart
 - Cue video

Section 3: Design of the Building Energy Auditing Course and Supervising Engineers Course

Objectives

After completing this section, you will be able to:

- Describe the overall purpose of the Building Energy Auditing Course and the Supervising Engineers Course;
- Relate the curriculum design elements to the principles of adult learning and instruction discussed previously.

The Building Energy Auditing Course has been developed to respect the principles of adult learning, and to support the instructional techniques discussed in this Guidebook.

It is a course that is designed to enable prospective energy auditors

- to apply their existing knowledge of the electrical and mechanical systems that comprise buildings to the identification of opportunities for energy efficiency;
- to develop a systematic method to the data collection and analysis that is at the heart of energy auditing;
- to appreciate very specifically how the energy efficiency of buildings and their operating systems can be improved through technological and operational measures.



The Building Energy Auditing Course is actually two courses within one; it includes a separate one-day segment designed for Supervising Engineers to develop their knowledge and skills of issues that fall within their purview. While they are intended to attend the full course alongside prospective auditors—and so benefit from a full understanding of the structures, principles, and skills developed by the auditors, as well as their personal relationships with the auditors themselves—one day during which the auditors are engaged in a practical experience is given over to this separate segment.

The DME building energy auditing program requires a consistent approach to energy audits; it is also important that nothing is overlooked in the assessment of the designated buildings.

3.1 The Trainees

Trainee auditors will have completed tertiary education at, as a minimum, the technologist level in a mechanical, electrical or other building systems discipline. They will have prior knowledge of operations and maintenance of generic building systems, including building envelope, HVAC, refrigeration plant, heating and boiler plant, domestic hot water systems, lighting, motors, pumps and other driven loads, electrical plug loads, and building control systems.

Supervising engineers will be qualified professional engineers in a mechanical, electrical or other building systems discipline. They will have prior knowledge covering the same scope as the trainee auditors, plus facilities management and/or design knowledge, and project management experience.

3.2 The Course Structure

The Building Energy Auditing course is designed to maximize its flexibility so that it can be delivered in a number of formats, such as a full-time intensive course, or on a modular basis. The total time required for instruction is nominally 30 hours, although the training provider may choose to expand this significantly to allow more time for practice and hands-on exercises. It is anticipated that the theory course described below will be supplemented with extensive related practical experience provided by the trainee's employer or sponsor.

3.2.1 Auditor Guidebook Structure

The manual for this course has been described as a Guidebook for the reason that our intention is that it serve as a useful resource long after the course is over to guide energy auditors as they conduct building assessments.

The Guidebook consists of eleven modules, participant copies of the instructional slides designed for note-taking, and an Appendix. The Guidebook modules are as follows:

Module 1: A Context for Building Energy Audits

- 1.1 The Context for Building Audits
 - 1.1.1 DME's Building Audit Program
 - 1.1.2 Characteristics of Government and Institutional Buildings
- 1.2 Good Practice in Building Operations
 - 1.2.1 Energy Indicators
 - 1.2.2 International Good Practice and Case Studies

Module 2: Basic Principles of Energy

- 2.1 Energy and Its Various Forms
 - 2.1.1 Chemical Energy
 - 2.1.2 Thermal Energy
 - 2.1.3 Mechanical Energy
 - 2.1.4 Electrical Energy
- 2.2 Units of Energy
- 2.3 Electricity Basics
 - 2.3.1 Power
 - 2.3.2 Definitions and Units
 - 2.3.3 Alternating Current and Power Factor
 - 2.3.4 Electrical Energy
- 2.4 Thermal Energy Basics
 - 2.4.1 Temperature and Pressure
 - 2.4.2 Heat Capacity
 - 2.4.3 Sensible and Latent Heat - A Closer Look
 - 2.4.4 Useful Thermal Energy
- 2.5 Heat Transfer - How Heat Moves
 - 2.5.1 Conduction
 - 2.5.2 Convection
 - 2.5.3 Thermal Radiation
 - 2.5.4 The Impact of Insulation
 - 2.5.5 Insulation Systems
 - 2.5.6 Controlling Radiative Heat Transfer
- 2.6 Energy Estimation Calculations
 - 2.6.1 Conductive Heat Flow
 - 2.6.2 Convective Heat Flow - Sensible
 - 2.6.3 Convective Heat Flow - Latent
 - 2.6.4 Hot or Cold Fluid
 - 2.6.5 Pipe Heat Loss
 - 2.6.6 Refrigeration

2.6.7 Steam Leaks, Vents and Flow

Module 3: Overview of Building Energy Audits

- 3.1 A Systems Approach to Energy Auditing
 - 3.1.1 Energy management in buildings
 - 3.1.2 The structure of energy consuming systems
 - 3.1.3 A basis for the energy balance –
the Law of Conservation of Energy (First Law of Thermodynamics)
- 3.2 Defining the Energy Audit – from Walk-through to Detailed Audit
 - 3.2.1 Information required before the site visit
 - 3.2.2 The Client Meeting
 - 3.2.3 Historical data analysis before the site visit – an introduction to energy monitoring
 - 3.2.4 A practical auditing methodology – ten steps
- 3.3 Planning and Implementing the Audit
 - 3.3.1 Developing the audit plan and schedule
 - 3.3.2 Audit guidelines
 - 3.3.3 Coordination with O & M personnel and building occupants
 - 3.3.4 References
- 3.4 The Steps in the Audit
 - 3.4.1 Step 1: The Walk-through—a building condition survey
 - 3.4.2 Step 2: Defining the audit mandate
 - 3.4.3 Step 3: Defining the audit scope
 - 3.4.4 Step 4: Analyse energy consumption and costs
 - 3.4.5 Step 5: Comparative analysis
 - 3.4.6 Step 6: Profile energy consumption—energy use as a function of time
 - 3.4.7 Step 7: Inventory energy loads
 - 3.4.8 Step 8: Identify energy management opportunities
 - 3.4.9 Step 9: Assess the costs and benefits
 - 3.4.10 Step 10: Report for action

Module 4: Historical Energy Assessment

- 4.1 Measurement and Data Collection
 - 4.1.1 Data Sources
- 4.2 Instrumentation for Energy Audits
 - 4.2.1 Introduction
 - 4.2.2 Understanding Measurement for Energy Auditing
 - 4.2.3 Spot and Recording Measurements
 - 4.2.4 Useful Features of Digital Instrumentation
 - 4.2.5 The Auditor's Toolbox
 - 4.2.6 Electric Power Meter
 - 4.2.7 The Combustion Analyzer
 - 4.2.8 Light Meters
 - 4.2.9 Temperature Measurement
 - 4.2.10 Humidity Measurement
 - 4.2.11 Air Flow Measurement
 - 4.2.12 Ultrasonic Leak Detectors
 - 4.2.13 Tachometer
 - 4.2.14 Compact Data Loggers
- 4.3 Historical Data Analysis - Analysing the Energy Tariff
 - 4.3.1 Sources of Purchased Energy
 - 4.3.2 The Tariff and the Electricity Bill
 - 4.3.3 Tabulating Energy Purchase Data
 - 4.3.4 Load Factor vs. Utilization Factor; An Indicator of Potential
 - 4.3.5 Graphical Analysis of Historical Energy Use Patterns
- 4.4 Comparative Analysis
 - 4.4.1 Energy Density Calculations
 - 4.4.2 Correlating Energy Consumption to Weather

Module 5: Analysing the Demand Profile

- 5.1 Introduction
- 5.2 Obtaining a Demand Profile
 - 5.2.1 Periodic Meter Readings
- 5.3 Interpreting the Demand Profile
 - 5.3.1 Opportunities for Savings in the Demand Profile
 - 5.3.2 Power Factor Correction Savings Opportunities

Module 6: Energy Assessment - Load Inventory

- 6.1 The Electrical Load Inventory
 - 6.1.2 How to Compile a Load Inventory
 - 6.1.3 Instrumentation Used in the Load Inventory
 - 6.1.4 Load Inventory Forms
 - 6.1.5 Collecting and Assessing Lighting Information
 - 6.1.6 Collecting and Assessing Motor and Other Data
 - 6.1.7 Reconciling the Load Inventory with Utility Bills
- 6.2 Thermal Load Inventory
 - 6.2.1 A Method for Preparing an Energy Flow Diagram

Module 7: Energy Assessment - EMOs

- 7.1 A Three Step Approach to EMO Identification
 - 7.2.1 Actions at the Point of End-Use Save More
 - 7.2.2 Cost Considerations
 - 7.2.3 Summary
 - 7.2.4 Optimise the energy supply
- 7.2 Assessment of the Costs and Benefits
 - 7.2.1 Assessment of Disadvantages Associated with Savings
 - 7.2.2 Savings
 - 7.2.3 Costs

Module 8: Energy Efficiency in Electrical Building Systems

- 8.1 Applicable building performance standards
 - 8.1.1 The South Africa Energy and Demand Efficiency Standard (SAEDES®)
 - 8.1.2 SABS 0400-1990 Ventilation Requirement Standard
 - 8.1.3 ASHRAE Standards
 - 8.1.4 Good Practice in South Africa
 - 8.1.5 Appliance Labelling in South Africa - Plug loads
- 8.2 The Building as an Energy System
 - 8.2.1 Energy interactions of building systems
 - 8.2.2 The impact of measures on power quality, IAQ, and GHG emissions
- 8.3 Energy Efficient Lighting
 - 8.3.1 Meeting the Need
 - 8.3.2 Alternative Light Sources
 - 8.3.3 Energy Management Opportunities – Lighting
 - 8.3.5 Worksheets
- 8.4 Plug Loads
- 8.5 Motors, drives and driven equipment
 - 8.5.1 Electric Motors
 - 8.5.2 Fans and Pumps
- 8.6 Compressed Air Systems
 - 8.6.1 Efficiency Strategy

Module 9: Energy Efficiency in Building Thermal Systems

- 9.1 Energy Efficiency in the Building Envelope
 - 9.1.1 Heating and Cooling Loads and the Building Envelope
 - 9.1.2 Heat Transmission
 - 9.1.3 Infiltration Load
 - 9.1.4 Radiative (Solar) Heat Load
 - 9.1.5 People Load
 - 9.1.5 Energy Management Opportunities - Summary
- 9.2 Heating, ventilating and air conditioning systems
 - 9.2.1 Overview of HVAC
 - 9.2.2 Heating Plant - Boiler Efficiency
 - 9.2.3 Steam and Hot Water Distribution
 - 9.2.4 Cooling plant – Refrigeration Systems
 - 9.2.5 Cooling Plant – Chillers
 - 9.2.6 Efficiency in Air Distribution Systems
 - 9.2.7 Waste Heat Recovery
- 9.3 Building Control Systems
 - 9.3.1 Basic Principles of Building Control Systems
 - 9.3.2 Efficiency from Control
 - 9.3.3 Control Applications

Module 10: Interpreting the Business Case

- 10.1 Investment Appraisal
- 10.2 Investment Criteria
 - 10.2.1 Simple Payback
 - 10.2.2 Cash Flow and Net Project Value
 - 10.2.3 Return on Investment (ROI)
- 10.3 Life Cycle Costing
 - 10.3.1 Net Present Value (NPV)
 - 10.3.2 Internal Rate of Return (IRR)
 - 10.3.3 Spreadsheet Applications for NPV and IRR
- 10.4 Risk and Sensitivity Analysis

Module 11: Reporting for Implementation

- 11.1 Introduction
- 11.2 Some General Principles for Good Audit Report Writing
 - 11.2.1 Know your reader
 - 11.2.2 Use simple, direct language
 - 11.2.3 Present information graphically
 - 11.2.4 Make your recommendations clear
 - 11.2.5 Explain your assumptions
 - 11.2.6 Be accurate and consistent
 - 11.2.7 Present your calculations clearly
- 11.3 A Template for the Audit Report
 - 11.3.1 Executive Summary
 - 11.3.2 Technical Section

3.2.2 The Supervising Engineers Guidebook Structure

As noted above, there are separate issues that fall within the purview of the Supervising Engineers; these, together with the broad understanding of the audit process developed in the foregoing modules, comprise the Supervising Engineers Course. This Course is designed for delivery as an intensive one-day Workshop; however, it is also flexible in design and can be broken out into its three separate modules for delivery as a series of shorter sessions.

The Supervising Engineers Guidebook consists of the following topics:

Module 12: Audit Quality Assurance

- 12.1 DME Audit Guidelines
 - 12.1.1 Guideline Structure
 - 12.1.2 The Preliminary Audit
 - 12.1.3 The Preliminary Audit Findings
 - 12.1.4 The Detailed Audit
- 12.2 Quality Assurance
 - 12.2.1 Selection of the ESCO
 - 12.2.2 Selection of the Quality Assurer

Module 13: Project Development Cycle

- 13.1 Step 1: Project Definition and Scope
- 13.2 Step 2: Technical Design
- 13.3 Step 3: Financing
 - 13.3.1 Project Financing
 - 13.3.2 Financing options for in-house implementation
 - 13.3.3 Energy performance contracts and ESCOs
 - 13.3.4 Benefits of Third-Party Financing
 - 13.3.5 Managing the Risks
- 13.4 Step 4: Contracting
- 13.5 Step 5: Implementation and Performance Monitoring

Module 14: Savings Verification

- 14.1 An Overview of Measurement and Verification (M&V)
 - 14.1.1 Working Definitions
 - 14.1.2 Why Measure & Verify?
 - 14.1.3 General Approach to M&V – The IPMVP
- 14.2 A Statistical Basis for M&V
 - 14.2.1 Relating energy use to weather
 - 14.2.2 Heating Requirements and Weather – A Rigorous Development of the Relationship
 - 14.2.3 Variants of the Regression Pattern for Buildings and Processes
 - 14.2.4 Baseline Definition
- 14.3 A Framework for Verification
 - 14.3.1 M&V Process Flow Chart
 - 14.3.2 M&V Option Selection Decision Model
- 14.4 Verification Applied
 - 14.4.1 Determining Base Year Data and Conditions
 - 14.4.2 Hierarchy of Available Energy Use Data
 - 14.4.3 Computing Savings Using the Performance Model
 - 14.4.4 Non-Routine Adjustments
 - 14.4.5 Uncertainty in Verification
 - 14.4.6 Cost Saving and Emission Reduction
- 14.5 Case Study: IPMVP Option C – Whole Building Multiple ECM Project
- 14.6 M & V Checklists

3.2.3 Design for adult learning

As we have seen, adult learners want their training experiences to:

- Be practical and relevant to their day-to-day activities;
- Help them achieve their own objectives;
- Provide opportunities for participation;
- Give them feedback on how well they are doing;
- Respond to their different learning styles.

The course and the guidebooks are focused primarily on the transfer of knowledge required to do building energy audits. It is the instructor's responsibility to "bring this knowledge to life", to make it real and relevant to the trainees. Engaging trainees in discussion, analysis and problem-solving is part of the instructional strategy that we are promoting.

The Guidebooks have been designed with some features that are intended to meet some of those adult learning needs:

- ✓ **Slides** . . . PowerPoint slides that provide a structure for instruction and highlight key learning points, while being a visual mode of information transfer to complement the auditory, are included in the course; to assist trainees in taking notes, they are included in the Guidebook in a note-taking format of 3 per page.
- ✓ **Graphics** . . . Photos, line diagrams, tables and charts are used wherever they are likely to be helpful in the Guidebook. Other graphics—cartoons, and so on—to add colour and interest are used in the slides, again to help with the multi-mode transfer of information.
- ✓ **Calculations** . . . Various calculations are carried out during the course, assisted by the use of worksheets.
- ✓ **Checklists** . . . In order to provide information that is directly and immediately applicable, we have included various checklists of steps to be taken and savings opportunities to be considered.
- ✓ **Case Study** . . . A case study to engage trainees in the planning of an energy audit is included in Module 2.
- ✓ **Practical Experience** As noted earlier, since auditing is a very practical activity, guided practical experience is an essential component of the learning itinerary. It is possible to provide an "artificial" experience as an element of the course; this might be a pre-arranged "mini-audit" of a portion of a building. However, because of the complexity of the range of topics addressed, it is more likely that the course will be delivered over a period of weeks or months, with ongoing practical experiential learning helping to promote learning of the theoretical principles and the associated skills.

Section 4: Module-by-Module Scripts

Objectives

After completing this section, you will have lesson plans for each of the modules in the Auditor and Supervising Engineers Courses.

4.1 Purpose and Format of the Scripts

The Module-by-Module “Scripts” are planning tools for your use in preparing for delivery of the Course. As every instructor is different in terms of experience, knowledge, and style, it is important to develop your own plan for instruction. However, it is equally important that the core knowledge required for certification be effectively instructed.

The “Scripts” or module plans consist of the following elements:

- **Objectives**, from the point of view of the instructor; i.e. this is what you are attempting to achieve; this is a different point of view on the same outcomes that are expressed in the Guidebook in terms of learning objectives from the point of view of the trainee;
- **Context**, that is, how this module relates to the “big picture” and the other modules in the Course;
- **Slides** and any other resources that are used in this module;
- **Activities** that are used in conjunction with key learning points;
- **Delivery sequence**, a brief overview of how the module can be taught;
- **Time-line**;
- Notes, the specific points, strategies, resources, and so on that you want to utilize in your instruction.

This part of the Instructor’s Guide is intended to be used on an ongoing basis, as your experience with delivery of the course continues to grow, and as you prepare for delivery to the various groups of trainees.

4.2 The Building Energy Auditing Course

Module 1: A Context for Building Energy Audits

<p>Objectives: As facilitator, your objectives in this Module are to develop a context for building audits, and in particular:</p> <ul style="list-style-type: none">• to acquaint participants with DME's building audit program• to introduce energy indices that are used to indicate building energy performance• to provide some representative building performance benchmarks• to provide examples of good practices in building operation.	
<p>Context: This course advocates an holistic approach to energy auditing; building performance assessment needs to be undertaken in light of the circumstances and regional differences (climate, utility structures, etc.) that have a bearing on building performance.</p>	
<p>Resources: Slides:</p> <ol style="list-style-type: none">1. Building Energy Auditing2. Module 1: A Context for Building Energy Audits	<p>Activities:</p> <ul style="list-style-type: none">• Introductions and “hip pocket” needs assessment; trainers need to introduce themselves, and provide an opportunity for trainees to do self-introductions and express their expectations—“what I want to get out of this course”;• Overview of the Course: provide an outline of the full course and the schedule for the four days; acquaint trainees with the contents of their Guidebook. <ol style="list-style-type: none">1. Introduce yourself briefly, with information about your experience in the industry, interests in training, etc.2. Setting the tone: ask trainees to introduce themselves in terms of who they are, where they are from, what they do, and what they want to get out of this course; record expectations on the flip chart as a “hip pocket” needs assessment.3. Mini-lecture regarding DME's building audit program and Q & A to ensure understanding.4. Mini-lecture on building performance; engage participants in discussion about the key characteristics of high-performing buildings.

Timing:

Plan on about 30 minutes for the introductions and about 30 minutes for the remaining content.

Notes and Custom Script:

Module 2: Basic Principles of Energy

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none"> • To develop an understanding of the underlying principles of energy required to effectively identify what data needs to be collected, to estimate energy flows, and to analyse energy use data. • To respond to the existing level of knowledge of the trainees by spending more or less time in the development of these principles as needed. 	
<p>Context:</p> <p>It is presumed that auditor trainees have prior knowledge related to electrical and thermal energy; however, many may need the key principles refreshed as important background to the data collection and analysis techniques developed later in the course.</p>	
<p>Resources:</p> <p>Slides:</p> <ol style="list-style-type: none"> 3. Module 2: Basic Principles of Energy 4. Learning objectives 5. Energy in its various forms 6. Basic electricity 7. Electrical power 8. AC/DC 9. Calculating power 10. Power Factor - lagging current 11. Why should I care about power factor? 12. Power factor correction 13. Power and energy 14. What is efficiency? 15. Thermal energy units 16. Other useful units 17. Sensible and latent heat 18. Humid air - psychrometry 19. "Quality" of heat - a question of usefulness 20. Heat transfer mechanisms 21. Thermal resistance of insulation 22. Controlling heat loss - insulation 23. Protective coverings 24. Radiation heat loss 25. Heat flow calculations 	<p>Activities:</p> <ol style="list-style-type: none"> 1. This module involves some lecture on the basic principles of electrical and thermal energy; however, a question and answer technique to engage the participants will help in their understanding. As well, the trainer may want to offer example calculations depending on the trainees' needs. 2. Depending on trainee needs, more or less time may be spent explaining the steam tables (in Appendix) and the psychrometric chart (in Appendix). 3. Slide 19 invites some discussion to allow the trainees to answer the basic question posed about "quality" of heat. 4. Figure 2.7—for the determination of surface resistance by an iterative process—requires some demonstration; the trainer should provide an example to demonstrate the use of the chart. 5. Section 2.6 provides detail on the estimation of heat flows in various situations; example calculations will be required to enable trainees to fully understand these principles and estimation methods. Worksheets 2-1 and 2-2 provide models of the sample calculations, and these two examples at least should be completed; further similar examples can be provided by the trainer.

Timing:

The time required for this module depends very much on the prior knowledge of trainees. At a minimum, allow about 4 hours, but considerably more time if additional sample calculations are to be completed during class time.

Notes and Custom Script:

Module 3: Overview of Building Energy Audits

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none"> • To outline a systematic structure for conducting a building energy audit • To provide working language pertaining to audits. 	
<p>Context:</p> <p>The context for this module—in addition to the national and regional issues raised in Module 1—is the need for a systematic structure for conducting the energy audit, and the theoretical foundation upon which audit methodology is built. In particular, there is a need to provide some working language—i.e. preliminary and detailed audits—that is consistent with DME’s methodology, and to develop a step-by-step strategy to conducting the audit.</p>	
<p>Resources:</p> <p>Slides:</p> <p>26. Module 3: Overview of Building Energy Audits</p> <p>27. Learning objectives</p> <p>28. What is energy auditing?</p> <p>29. How is energy management done?</p> <p>30. Managing Technology</p> <p>31. Energy consuming systems in buildings</p> <p>32. A basis for the energy audit . . . what comes in, goes out</p> <p>33. Two levels of audit</p> <p>34. DME’s Audit Process</p> <p>35. Pre-site inspection data requirements</p> <p>36. Preliminary data analysis</p> <p>37. Preliminary Audit</p> <p>38. Preliminary audit findings</p> <p>39. Detailed audit</p> <p>40. Auditing – the “big picture”</p> <p>41. Ten Steps</p> <p>42. Planning for the audit</p> <p>43. Coordination with O&M personnel and building occupants</p> <p>44. Step 1: the walk-through</p> <p>45. Step 2: Analyse energy consumption and costs</p> <p>46. Step 3: Comparative analysis</p> <p>47. Data analysis</p> <p>48. Performance indices</p> <p>49. Energy use drivers</p> <p>50. Types of comparisons</p> <p>51. Benchmarking is...</p> <p>52. Selected benchmarks</p> <p>53. Best practices</p> <p>54. “This facility is different from those benchmarks!”</p> <p>55. Step 4: Define the audit mandate</p> <p>56. Step 5: Define the audit scope</p> <p>57. Step 6: Profile energy consumption</p> <p>58. Step 7: Inventory energy loads</p> <p>59. Step 8: Identify EMOs</p> <p>60. Step 9: Assess the costs and benefits</p> <p>61. Costs and benefits</p> <p>62. Step 10: Report for implementation</p>	<p>Activities:</p> <ol style="list-style-type: none"> 1. This module consists mostly of a mini-lecture in which the theoretical foundation for auditing—i.e. the law of conservation of energy—is put in the context of a building, and in which the audit methodology is laid out in terms of pre-site visit functions and ten steps. 2. The DME audit process flow chart needs to be presented and discussed; note that this information came very late in the process of developing the curriculum, and therefore strong linkages between the ten-step process developed in this module and the DME process have not been made. Nevertheless, some discussion about the correlation between the two models can be made in view of the fact that they are consistent with each other. 3. The “big picture” of the entire ten step process is presented first, followed by a very concise elaboration on each of the steps; remind trainees that the remainder of the course goes into considerably more detail on these steps. 4. The first “tool” offered to the trainees is the condition survey or walk-through template. Explain the template and note that others are given in the Appendix. 5. The next tools offered are checklists for the audit mandate and scope; again, explain the use of these to the trainees and explore their “fit”—i.e. entertain ideas to modify them to suit particular circumstances. 6. In reference to EMO identification, some thorough discussion together with the example are needed to make the point about actions at the point of end-use. 7. It would be a useful exercise to provide the trainees with a sample building description in the form of a case study and require them to develop an audit plan; the trainer needs to develop a situation description, perhaps utilising the facility in which training takes place.

Timing:

This module in total should take about 2 to 4 hours for this Module.

Notes and Custom Script:

Module 4: Historical Energy Assessment

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none"> • To develop a working knowledge of the key data analysis methods employed by the auditor to assess building performance; • To acquaint trainees with the instrumentation typically used in a building audit; • To develop the data analysis skills required before the site visit. 	
<p>Context:</p> <p>This module is the first in a series of four that address in detail the analysis methods that are used with the data and information collected in the audit. It focuses primarily on the pre-site visit analysis in regard to tariffs and the relationship between consumption patterns and independent variables such as weather.</p>	
<p>Resources:</p> <p>Slides:</p> <ul style="list-style-type: none"> 63. Module 4: Historical Energy Assessment 64. Learning objectives 65. Analyzing performance requires energy data 66. Data requirements 67. Instrumentation for auditing 68. Hand-held wattmeter 69. Single-phase connections 70. 3-phase digital power meter 71. Combustion analysis 72. Light level measurement 73. Temperature measurement 74. Humidity measurement 75. Static pressure 76. Leak detection - ventilation and compressed air 77. Check your speed - digital tachometer 78. An electricity tariff 79. Analysing the electricity billings 80. Load factor 81. Graphical analysis of historical energy use 82. Calculating degree-days 83. Correlation of energy consumption to degree-days 	<p>Activities</p> <ol style="list-style-type: none"> 1. Engage the trainees in the process of thinking about kinds of data that are needed to assess building performance; generate their list using the flip chart to record. 2. Then compare/complete the list with that in the Guidebook. 3. Instruments of the type listed and described in Section 4.2 should be provided as exhibits; efforts should be made to demonstrate their operation by taking measurements on energy devices in the classroom or laboratory—for example, the energy consumed, and the light emitted by light fixtures in the room. 4. Tariff analysis can be expanded by providing copies of other utility tariffs, especially those that are pertinent to the region in which the course is being given. The important points to discuss are the components of the tariff, and what constitutes the incremental cost of electricity (as opposed to the average cost). 5. A key point in the analysis of energy tariffs is the calculation of incremental cost of energy—and how it differs from the average cost. Emphasise the point that incremental cost must be used in the estimation of potential savings from proposed measures. 6. Provide sample historical energy billings data and enable trainees to develop summary reports using tools such as Excel, as in the examples in the Guidebook. The graphical analysis of energy consumption data is easily done using Excel or other spreadsheet applications; if time permits, the trainer can work up an example in Excel using real or simulated data from a building audit, and projecting the Excel spreadsheets as they are developed. 7. Use Worksheets 4-1 and 4-2 to do sample calculations for load factor and utilisation factor. 8. Mini-lecture and sample calculations on degree-day analysis. Regression analysis is easily done using spreadsheet programs such as Excel; trainees should be instructed on the use of these tools to determine the energy performance model.

Timing:

Module 4 needs at least 4 hours, with more time provided for calculation exercises and hands-on demonstration of audit instruments.

Notes and Custom Script:

Module 5: Energy Assessment – Demand Analysis

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none"> • To develop a working knowledge of electrical demand analysis, using the demand profile; • To enable trainees to identify EMOs arising from the demand analysis; • To acquaint trainees with power factor correction. 	
<p>Context:</p> <p>This module is the second in a series of four that address in detail the analysis methods that are used with the data and information collected in the audit. It focuses specifically on demand analysis, which is Step 6 in the audit process.</p>	
<p>Resources:</p> <p>Slides:</p> <p>84. Module 5: Energy Assessment - Demand Analysis</p> <p>85. Learning objectives</p> <p>86. Hourly Demand Profile</p> <p>87. An Electrical Fingerprint</p> <p>88. Patterns Revealed</p> <p>89. Analyzing the Profile</p> <p>90. Obtaining a Demand Profile</p> <p>91. Obtaining a demand profile</p> <p>92. 3 phase measurement</p> <p>93. Daily or monthly</p> <p>94. Meter response</p> <p>95. What the demand meter sees</p> <p>96. Savings opportunities</p> <p>97. Peak demand control</p> <p>98. Power factor correction</p> <p>99. Analyse this!</p>	<p>Activities</p> <p>1. Explain how a demand profile can be generated using single-phase and three-phase measurements. If the trainer has a power meter to show trainees, it can be used in conjunction with the discussion of demand profile.</p> <p>2. Explain how the power factor of resistive and inductive loads can be used to interpret the demand profile. The understanding of demand profiles is best developed with as many examples as can be provided for different types of buildings.</p> <p>3. There is a sample demand profile in Worksheet 5-1 which should be examined with the trainees to answer the questions given.</p>

Timing:

Module 5 needs at least 4 hours, with more time provided for exercises in the interpretation of demand profiles. If possible, hands-on demonstration of load measuring instruments and the development of the demand profile would require additional time.

Notes and Custom Script:

Module 6: Energy Assessment – Load Inventory

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none"> To develop a working methodology for creating load inventories of electrical loads and thermal loads. 	
<p>Context:</p> <p>This module is the third in a series of four that address in detail the analysis methods that are used with the data and information collected in the audit. It focuses primarily on the load inventory, which is step 7 in our audit methodology; it provides a step-by-step approach and related forms for the collection of load inventory data for electrical systems, and the development of the thermal energy flow diagram for thermal loads. Thermal load analysis uses the energy estimation calculations developed in Module 2.</p>	
<p>Resources:</p> <p>Slides:</p> <ul style="list-style-type: none"> 100. Module 6: Energy Assessment - Load Inventory 101. Learning objectives 102. Analyse the load inventory 103. Why inventory? 104. Inventory calculations 105. Demand breakdown 106. Peak demand breakdown 107. Energy breakdown 108. Sample inventory 109. Energy flow diagram 110. Thermal energy inventory 	<p>Activities</p> <ol style="list-style-type: none"> 1. Mini-lecture on the load inventory method and the forms provided that relate to the data collection process. A useful exercise is the development of the load inventory for the room in which the class is being given, or some other suitable site, using Worksheet 6-1. 2. Load inventory forms are provided in the Guidebook as templates for the collection of load information; trainees should be well acquainted with them even though they may choose to modify them to suit the particular circumstances of their audits. Note that sample and blank copies are provided in this module. 3. Sample calculations where they occur in the Module should be carried out. 4. Worksheet 6-2 provides a case study of an elementary school and links together the information derived from the demand profile and the load inventory. 5. Worksheet 6-3 provides a similar exercise for an extended health care facility.

Timing:

Module 6 needs at least 4 hour, with more time provided for hands-on exercises in the development and interpretation of the load inventory.

Notes and Custom Script:

Module 7: Energy Assessment - EMOs

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none"> • To develop a systematic approach to the identification of energy management opportunities; • To clarify the factors that need to be considered in assessing costs and benefits of EMOs. 	
<p>Context:</p> <p>This module is the last in a series of four that address in detail the analysis methods that are used with the data and information collected in the audit. It focuses on Steps 8 and 9 in our audit process, a systematic three-step process for the identification of EMOs, and the costs and benefits that need to be considered in the full business case assessment that is addressed in Module 10.</p>	
<p>Resources:</p> <p>Slides:</p> <ul style="list-style-type: none"> 111. Module 7: Energy Assessment - EMOs 112. Learning objectives 113. Finding opportunities: Start at the end-use 114. Start at point of end-use 115. Component efficiencies 116. System efficiency 117. Component and system efficiencies 118. Three simple steps 119. Why this order? 120. Match the requirement 121. Maximise efficiencies 122. Assessing the costs and benefits 123. More about savings 124. More about costs 	<p>Activities</p> <ol style="list-style-type: none"> 1. Do a mini-lecture/discussion on the three-steps used to identify EMOs. The sample calculation of the cost of energy at point of end-use is a good way to explain the rationale for the order of steps. 2. Use a question and answer discussion approach to the section on costs and benefits: i.e. “what are some of the benefits that you can think of obtained from energy efficiency measures?” “What costs do you think need to be taken into account?” “How might we evaluate the merits of a given measure from a business point of view?” Make the link to Module 10 for a more detailed discussion of investment analysis.

Timing:

Module 7 needs about 3 hours, with more time provided for calculation exercises.

Notes and Custom Script:

Module 8: Energy Efficiency in Building Electrical Systems

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none"> • Develop a working knowledge of applicable building performance standards; • Develop a strong working knowledge of the source of efficiencies in the building electrical systems that auditors will ordinarily encounter. 	
<p>Context:</p> <p>Module 8 is the first of two modules that focus on the efficiencies that can be achieved in building systems as a basis for the identification of EMOs by the auditor. This module deals with the generic electrical systems found in most buildings, and reviews the principles of efficient operation and maintenance and the efficiencies inherent in newer technologies.</p>	
<p>Resources:</p> <p>Slides:</p> <p>125. Module 8: Energy Efficiency in Building Electrical Systems</p> <p>126. Learning objectives</p> <p>127. Building performance standards - SAEDES®</p> <p>128. SAEDES performance standards</p> <p>129. . . . And climate data</p> <p>130. SABS 0400-1990 – ventilation rates</p> <p>131. The building as an energy system</p> <p>132. Other impacts of energy reduction</p> <p>133. Lighting system</p> <p>134. Lighting considerations</p> <p>135. Lighting quality</p> <p>136. Colour rendering index (CRI)</p> <p>137. Light source efficacy</p> <p>138. Some questions</p> <p>139. Summary of lighting opportunities</p> <p>140. EMOs for lighting</p> <p>141. Plug loads</p> <p>142. Electric motors</p> <p>143. Imbalance = Inefficiency!</p> <p>144. Match the motor to the load</p> <p>145. Operating conditions</p> <p>146. Motor rewinding</p> <p>147. Energy efficient motors</p> <p>148. Watch your speed!</p> <p>149. Fans & pumps</p> <p>150. Assessing fans & pumps</p> <p>151. Powerful laws</p> <p>152. Efficiency optimisation</p> <p>153. Fan/Pump savings strategy</p> <p>154. Assessment questions</p> <p>155. More fan/pump questions</p> <p>156. Fan/pump EMOs</p> <p>157. The advantage of variable speed</p>	<p>Activities:</p> <p>1. One of the key issues in assessing building performance is compliance with applicable standards; two standards that relate to buildings in South Africa are presented in this module – SAEDES and SAB 0400-1990. In addition to developing an understanding of these standards through presentation and discussion, the trainer may want to incorporate brief discussion of other standards that in his/her view are applicable.</p> <p>2. The building as an energy system: the principle is presented that auditors need to take into account the interactions among building systems when assessing energy performance; two or three examples of such interactions are given, and the trainer may want to explore other interactions that trainees are aware of—keeping a record on the flip chart. This discussion should include not only a listing of interactions, but an exploration of their implications for efficiency measures that might be recommended.</p> <p>3. More detail than is required for discussion regarding lighting technologies is given in the Guidebook; assign this as “home work” reading. If available, the trainer could demonstrate the relative efficiency of lighting systems by using a power meter and light meter with different fixtures.</p> <p>4. Note the worksheets that are provided as a template for sample calculations; these should be used with examples developed by the trainer.</p>

Timing:

This module needs about 6 hours in total to consider the electrical system efficiencies. Demonstrations using sample equipment would be a very useful addition to this module, for example to demonstrate the efficiency in motor speed control.

Notes and Custom Script:

Module 9: Energy Efficiency in Building Thermal Systems

Objectives: As facilitator, your objectives in this Module are: <ul style="list-style-type: none"> Develop a strong working knowledge of the source of efficiencies in the building systems that auditors will ordinarily encounter. 	
Context: Module 9 is the second of two modules that focus on the efficiencies that can be achieved in building systems as a basis for the identification of EMOs by the auditor. This module deals with the thermal loads found in most buildings, and reviews the principles of efficient operation and maintenance and the efficiencies inherent in newer technologies, specifically in building envelope, HVAC and building control systems.	
Resources: Slides: 158. Module 9: Energy Efficiency in Building Thermal Systems 159. Learning objectives 160. Heating/cooling loads and the "comfort zone" 161. Heat loss and gain – basic relationship 162. Insulation EMOs – reduce heat loss/gain 163. Insulation EMOs 164. Infiltration/Exfiltration EMOs 165. Solar gain – radiation heat load 166. Reduce solar gain . . . 167. Summary of heat load EMOs 168. Reduce heating energy 169. Reduce cooling energy 170. Energy efficient HVAC 171. Causes of inefficiency 172. Finding HVAC EMOs - some questions 173. . . . more questions 174. EMOs checklist - ventilation 175. EMOs checklist - space conditioning 176. Boiler plant systems 177. Hot water boiler plant 178. Fuel combustion 179. Losses from boiler systems 180. Combustion efficiency measurement 181. Measuring combustion efficiency 182. Boiler plant EMOs 183. More boiler plant EMOs 184. . . . And more EMOs 185. Heat recovery opportunities 186. Savings example 187. Assessment of boiler plant 188. Steam distribution 189. Assessment of steam distribution	190. Losses in distribution systems 191. Losses in domestic hot water 192. Insulation opportunities 193. Cooling plant 194. Refrigeration EMOs - some questions 195. Refrigeration EMOs - more questions for the experts 196. Minimize temperature lift 197. Reduce the cooling load 198. Maintenance & monitoring 199. Higher cost opportunities 200. Match the requirement 201. Maximize efficiency 202. Chiller efficiency 203. Efficiency in air distribution systems 204. Waste heat recovery 205. Match the source to use 206. Simple heat exchange 207. Heat recovery methods 208. Direct heat recovery 209. Gas to gas 210. Liquid to liquid 211. Gas to liquid 212. Indirect heat recovery 213. Heat pump 214. Flash tank 215. Compressed air systems 216. Compressed air EMOs - some questions 217. Compressed air EMOs 218. Building control systems 219. HVAC control loop 220. Efficiency through control - 4 principles 221. Control applications

Activities:

1. Review the principles of heat transfer and the energy estimation methods developed in Module 2.
2. Use the examples in sections 9.1 and 9.2 as calculation exercises
3. Spend some time discussing the decision trees given in figures 9.9 and 9.10 for the assessment of boiler opportunities, and do the sample calculation that follows.
4. Do a sample calculation on boiler efficiency and flue gas analysis as laid out in Worksheet 9-1.
5. Spend some time discussing the decision tree given in figure 9.12 for the assessment of steam distribution system opportunities, and do the sample calculation that follows.
6. Section 9.2.7 has more detail on waste heat recovery than is needed for a discussion of EMOs; assign the detailed information for extra reading.
7. Mini-lecture on building control systems.

Timing:

This module needs about 6 hours to consider the thermal system efficiencies, with extra time as required for sample calculations.

Notes and Custom Script:

Module 10: Assessing the Business Case

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none"> To develop an understanding of the basic investment analysis techniques and criteria that should be applied to proposed EMOs. 	
<p>Context: Energy auditors need to report their findings in a way that will meet the expectations of financial managers; while a thorough investment analysis is not intended here, the topics developed in this Module are sufficient to enable a sound business analysis of proposed measures.</p>	
<p>Resources: Slides: 222. Module 10: Assessing the Business Case 223. Learning objectives 224. Objectives of investment appraisal 225. Investment Criteria 226. Simple payback period 227. Cash flow analysis 228. Cash flow table 229. Time value of money - discount factors 230. Net present value 231. Internal Rate of Return 232. Payback and IRR 233. Risk and sensitivity analysis scenarios</p>	<p>Activities:</p> <ol style="list-style-type: none"> Module 10 is designed to enable the trainees to do the kinds of financial calculations that are needed in the audit report; use the worksheets to develop these skills from the simple payback through life cycle costing and IRR. Worksheets 10-1 and 10-2 should be used to do the cash flow and NPV calculations for the example given in the Module, or other examples provided by the trainer. Once the manual calculations are understood, automation of the NPV and IRR calculations with Excel should be demonstrated.

Timing:

Financial analysis is not usually familiar to potential auditors; this Module should be given at least 5 hours.

Notes and Custom Script:

Module 11: Reporting for Implementation

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none">• To emphasise the importance of the audit report in facilitating implementation of energy efficiency measures;• To provide a report structure, and advice on good practice, that will enable the trainees to produce effective reports.	
<p>Context:</p> <p>Many audit reports end up on office shelves, never having been acted upon. It is crucial that the audit reports that these auditors produce be fully considered and, where realistic to do so, have their recommendations acted upon. Otherwise, the effort in doing the audit is wasted.</p>	
<p>Resources:</p> <p>Slides:</p> <p>234. Module 11: Reporting for Implementation</p> <p>235. Learning objectives</p> <p>236. Writing good audit reports</p> <p>237. A report template</p>	<p>Activities:</p> <p>1. This is primarily a mini-lecture on report writing. Sample audit reports can be provided for critiques by the trainees.</p>

Timing:

This module is pretty straight forward; allow about 2 hours.

Notes and Custom Script:

4.3 The Supervising Engineers Course

Module 12: Audit Quality Assurance

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none">• To engage the supervising engineer in an exploration of what constitutes a high quality audit, and what they can do to ensure that the audit meets expectations;• To relate the audit to DME's process.	
<p>Context:</p> <p>The role of the supervising engineer includes acting on behalf of the building owner to ensure that the audit is complete, accurate, comprehensive and consistent with DME's expectations. Having participated in the Auditing Course, the supervising engineers have a context to consider this aspect of their role. This module is the first of three that comprise a one day, or approximately 8 hour, course specifically for the Supervising Engineers.</p>	
<p>Resources:</p> <p>Slides:</p> <ol style="list-style-type: none">1. Module 12: Quality Assurance2. Learning Objectives3. Audit Process4. Audit Process5. Parties to the Process6. Preliminary Audit7. Preliminary Audit Findings8. Detailed Audit9. EMO Checklist10. Quality Assurance Issues	<p>Activities:</p> <ol style="list-style-type: none">1. Revisit the DME audit process flow chart, now with particular attention to the column that highlights the involvement of the Supervising Engineer in providing quality assurance.2. Discuss the direction provided in DME's draft audit guidelines with regard to the outcomes from the preliminary and detailed audits, and the standards against which building performance is assessed.3. Discuss the parts played by the ESCO and Quality Assurer in the DME model, and develop some criteria for the selection of these service providers.

Timing:

This Module should not take more than 2 hours to complete, depending on the extent of discussion and experiences of the trainees.

Notes and Custom Script:

Module 13: Project Development Cycle

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none"> • To develop a framework for project development from the point of view of the project manager; • To explore the issues that are critical to the success of projects related to the implementation of audit findings. 	
<p>Context:</p> <p>While this course is primarily about energy auditing, it is useful to consider what happens after the audit report is filed. As noted earlier, the emphasis needs to be on the implementation of audit findings, and that often involves a “project” of some kind—building retrofit, maintenance program, etc. This Module provides the Supervising Engineer with a step-by-step management process—a checklist of sorts—for project development and implementation.</p>	
<p>Resources:</p> <p>Slides:</p> <ul style="list-style-type: none"> 11. Module 13: Project Development Cycle 12. Learning Objectives 13. The steps in the PDC 14. Step 1: Project Definition and Scope 15. Criteria for Prioritisation 16. Step 2: Technical Design 17. Step 3: Financial Proposal 18. Loan Agreements 19. ESCO Services 20. Benefits of 3rd Party Financing 21. Step 4: Contracting Options 22. ESCO Contract Types 23. Step 5: Implementation Guidelines 	<p>Activities:</p> <ul style="list-style-type: none"> 1. The project experience of trainees is the “fuel” for this module; in addition to delivering a mini-lecture on the project development cycle, the trainer needs to engage participants in discussion about their experiences in doing projects, particularly from a problem-solving perspective..

Timing:

This Module should be given about 2 hours to complete, depending on the extent of discussion and experiences of the trainees.

Notes and Custom Script:

Module 14: Measurement and Verification

<p>Objectives: As facilitator, your objectives in this Module are:</p> <ul style="list-style-type: none"> To develop a working knowledge of measurement and verification, both in terms of the underlying statistical principles and the provisions of the International Performance Measurement and Verification Protocol (IPMVP). 	
<p>Context:</p> <p>An important aspect of project planning and implementation is the verification of savings arising from it. On the presumption that this falls within the role of the Supervising Engineer, these principles are developed in the context of a rationale for M&V, the statistical methods applied, and the guidance provided by the IPMVP especially in the context of energy performance contracts.</p>	
<p>Resources:</p> <p>Slides:</p> <ol style="list-style-type: none"> 24. Module 14: M&V 25. Learning Objectives 26. Working Definitions 27. Why Measure & Verify? 28. Spend more to reduce costs? 29. Determining Savings 30. The IPMVP - M&V Options 31. Four IPMVP Options 32. Statistical Basis for M&V 33. Regression Analysis 34. Variants of Regression Pattern 35. Define base year performance 36. Adjustments 37. Adjustments and IPMVP Option 38. Option Selection 39. M&V Cost and Uncertainty 40. A Structured Approach 41. Define Post-EMO Period 42. Develop Energy Performance Model 43. Test/Revise Performance Model 44. Define and specify metering equipment 45. Define Ongoing M&V Activities 46. Implement the EMOs 47. Implement the M&V Plan 48. Risk Factors 49. Financial Risk Factor 50. Operational Risk Factors 51. Performance Risk Factor 52. Applying Price & GHG Factors to Energy Savings 53. Applying Energy Prices 	<p>Activities:</p> <ol style="list-style-type: none"> 1. Discuss the importance of doing M&V in terms of the rationale presented in the Guidebook. 2. Describe the IPMVP; the Trainer should acquire a copy of the IPMVP document (Volume I) which can be downloaded from the internet. Trainees should be referred to the same source should they wish to obtain their own copy. 3. The statistical analysis involved in developing a “performance model” for the building—i.e. a relationship between energy consumption and weather in most cases—is best done with a sample data set; the Trainer should develop such a data set based on real or simulated building energy consumption data. 4. Use the worksheets provided to do the case study exercise for the selection of an IPMVP option.

Timing:

This Module should be given at least 4 hours to complete.

Notes and Custom Script:

4.4 Course Slides