

On the Road Again: Delivering Energy Efficiency Education to the Construction Community—Successes and Failures

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Virtually all new construction programs involved with energy efficiency are trying to improve the standards of practice by providing technical information and professional training. Many different approaches have been tried. This paper examines two sets of related training programs: 1.) training in changes to the California Energy Standards; and 2.) various attempts to provide up-to-date education in new efficient lighting technologies. The examination of these case studies raises a number of issues that can effect the success or failure of a training effort.

Multiple organizations often collaborated to initiate a training program and fund the development of materials. This collaboration was sometimes cumbersome and often bore no direct fruit to the funding organizations. And yet, training programs with strong support from a number of organizations were more likely to have a long life and thus, improve over time. While public agencies professed interest in supporting private initiative, they were often just as likely to smother entrepreneurial efforts.

Successful execution of a training program requires that details about the delivery mechanism be established before development of materials is begun. Ideally, not only should the target audience be precisely defined, but the mode of marketing to that audience and funding their participation should be clearly worked out. The window of opportunity for training should be clearly identified.

Production of concurrent materials, such as a training manual or reference book, greatly enhances the value of the training. Presentation media and length of presentation should be selected based on the type and size of the audience and its familiarity with the information to be conveyed. Speakers should ideally be involved in the authorship of the training materials, or be gradually apprenticed into the program. Building an evaluation process and periodic revisions into the training program will greatly increase the effectiveness of the training over time.

Introduction

Virtually all new construction programs involved with energy efficiency are trying to improve the standards of practice by providing technical information and professional training. This includes both building code implementation and utility DSM programs. Some have done it well. Some have not.

It's a fairly common problem to want to train a large portion of the building community quickly in the use of new codes, programs, or technologies. Because of the urgency of information, the typical time frame to produce and deliver a training program is 6 to 12 months. Depending on the size of the target audience, this speed of delivery may require a coordinated training program involving multiple presenters and/or multiple presentation

technologies. The old model of the traveling expert doing a simple "chalk talk" can't always meet these timing demands.

Some programs have delivered high quality technical information to their target audiences just as they were needed. Others have missed the mark on quality, or just as deadly, missed the narrow window of opportunity when the information is fresh and in demand. The challenge is to find the most cost-effective means to quickly develop and deliver a training program that will influence the prevailing standard of practice.

This paper attempts to draw some lessons from the authors' fifteen years of combined experience in creating

and producing technical training programs for the building community. These training efforts have been sponsored by state and federal agencies, utilities, professional associations, and private initiatives. Most of these training programs have not been publicly documented or analyzed.

We will describe two sets of related training programs. All were initiated in California, but some have spread significantly beyond the state's borders. The first set looks at training to support compliance with California's Non-residential Building Energy Efficiency Standards (Title 24). The second set looks at efforts to enhance the standards of practice in applying highly efficient lighting technologies. Both of these histories involve a complex web of public and private initiatives. In both cases there was a very conscious attempt to marry public interest and market incentives in delivering these training programs. Finding the most successful mix of public support and private initiative has been a continuing challenge.

After presenting a brief history of the various programs, we discuss a number of key issues that we have identified as influencing the success of a program:

- Initial conception
- Funding mechanism
- Presentation medium(s)
- Delivery logistics
- Provisions for evaluation and revision

Brief Histories of Two Related Training Efforts

An Abbreviated History of Recent Training on California's Energy Code. The California Title 24 Building Energy Standards have been on a repeated revision cycle since their inception in 1978. These revisions have generated a recurring need for training to keep the new construction community apprised of the changes in the code. Over the years, training has been sponsored by the State, private organizations, professional associations, and utilities in support of their DSM programs. The State also set up an institute expressly for the purpose of training code officials.

When a major revision to the nonresidential code occurred in 1988, a private energy consulting firm initiated a series of training classes directed at the professional community. This firm also had a contract from the California Energy Commission (CEC) to write the official manual to explain the nonresidential code, and so it had a unique expertise in communicating the code changes. A loose co-sponsorship of the training by the AIA, ASHRAE, and IES was negotiated: in return for endorsements by the professional associations, and use of the associations' mailing lists, the firm conducted the seminars at its own cost, and shared

profits with the associations. The firm, using two senior staff, conducted about 20 workshops to professional audiences varying in size from 20 to 80, over the course of a year.

This private firm was later retained by the California Energy Commission to train the CEC staff, to develop materials that could be used by a larger pool of trainers, and to produce a 2-hour video that would introduce each section of the code in discrete 10-minute sections. 100 copies of this video were available to be loaned out by the CEC to any interested party. No records were kept of video use, but trying to get the 100 videos returned into circulation was enough of a chore that the CEC decided not to repeat the lending library approach.¹

A subsequent revision to the nonresidential code scheduled for 1992 brought out a flurry of training proposals. A trade association of energy consultants sought seed money from a handful of utilities and later, the California Energy Commission, to prepare training materials and deliver seminars. They put together a small pool of about 6 qualified trainers, and over a year and a half period delivered about 16 seminars to audiences ranging from 30 to 100. Trainers were paid for their time, and profits from the effort were returned to benefit the association.²

In addition, the state legislature required that there be effective training of code officials in the new code provisions. To achieve these ends, a non-profit institute was established with a substantial contract from the State of California to provide energy standards training to all local code officials. While the contract funds fully supported the development of materials and delivery of presentations, a moderate fee was charged to attendees in order to establish a value for the program and to help fund future training efforts. A faculty of 6 to 8 subcontractors was maintained to deliver the courses. Over the course of four years, 2450 building officials and a couple of hundred of private consultants attended the institute's training courses. Variations of the program were delivered 114 times with an average attendance of 21. In addition, two 30-minute videos were produced, and 500 copies of the videos were distributed free of charge to each building department in California. The institute also created and administered an energy plans examiner certification program.³

At the same time, a group of California utilities decided that they had an interest in developing their own training programs, especially to provide Title 24 training in conjunction with introduction of their Title 24-linked DSM programs. The utilities formed a consortium to sponsor the development of training curriculum. Each utility was then free to use the materials through its own preferred delivery mechanism. Individual utilities used the materials both to train their own staff, and as an educational service

to their “trade allies” in new construction, (architects, engineers, energy consultants, etc.). A two day train-the-trainers workshop was held to introduce the materials to a group of about 50 pre-qualified potential trainers, both private consultants and utility staff, however just a few consultants eventually delivered the majority of the one- and two-day presentations. In one year, at least 24 days of training were given, reaching approximately 2000 design professionals and utility staff.

Meanwhile, the firm that had provided the 1988 training concluded that its privately funded training efforts could not compete against state and utility subsidized training, and so decided not to continue its training program.

A Short History of Tier 1 Lighting Efficiency Training. In the late 1980’s, the California Energy Commission asked its *Advanced Lighting Professional Advisory Committee* (ALPAC) to identify barriers to the use of energy efficient lighting products. The ALPAC identified a need for a technical guide to assist the lighting community in evaluating and using advanced, energy efficient lighting products. From this need, a publication called the *Advanced Lighting Design Guidelines* was developed. These Guidelines, first published by the CEC in 1990, were later revised and expanded for a 1993 edition. The 1993 edition was sponsored by the CEC, the U.S. Department of Energy, and the Electric Power Research Institute, who have each subsequently published and distributed their own editions of the *Guidelines*.

In addition, upon the recommendations of the ALPAC, CEC initiated a strategy to develop a “Three Tier”

Lighting Education Program. The Tier 1 was to consist of an overview of lighting issues for nonlighting-expert audience who was responsible for making lighting decisions, such as building owners and managers, architects and designers, utility representatives, and commercial real estate agents. Tier 2 was to provide technical instruction at the community college level for electrical contractors, technicians, and sales representatives; Tier 3 was to provide professional education at the university level for future lighting designers. The *Advanced Lighting Design Guidelines* were to be used as a prime resource and text for the various training courses.

A group of six major sponsors, as shown in Figure 1, was assembled to fund and guide the development of the Tier 1 training effort. In addition, an independent steering committee reviewed the curriculum for balance, objectivity and technical accuracy. Photographic slides were combined with additional computer generated text slides, and assembled into presentations of three lengths; a full-day curriculum including speaker’s notes and attendee handouts, a 45-minute presentation, and a 15-minute presentation. The curriculum was designed to allow adaptation to local needs and individual presentation styles.

Each sponsor was provided with a master copy of the training materials. A few of the sponsors have made extensive use of the materials, while others have made no use of them. The issue of ownership, distribution rights, and steering committee involvement have played a significant role in determining the extent of distribution of the Tier 1 training program. Figure 1 illustrates a simplified family tree of the Tier 1 training efforts.

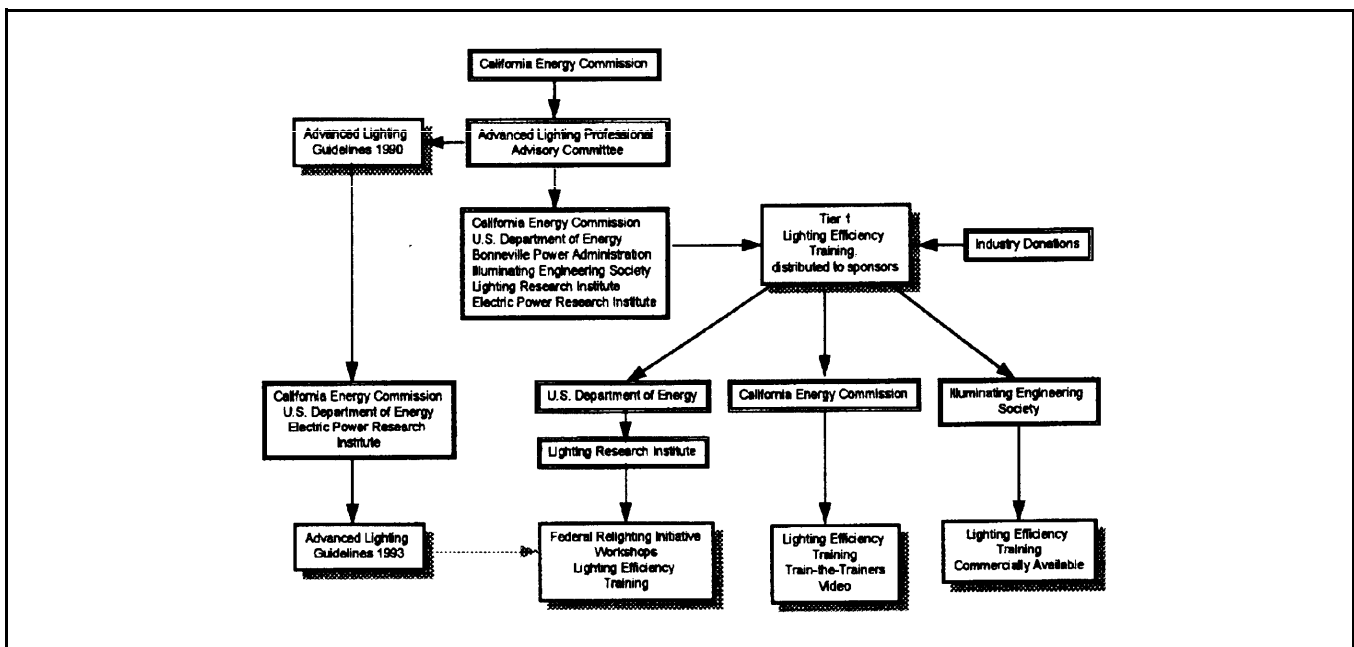


Figure 1. A Lighting Training Family Tree

In addition to use by the sponsors, the delivery mechanism for the program was assumed to be local IES chapters who would market the program to educate their clientele while generating revenues for the chapters. The IES, as the professional organization representing the lighting community, was granted the copyright on the materials and the right to promote their use and sell them commercially. The national office of the IES has since distributed about 200 sets of slides. The majority of these were donated to local IES chapters to promote their local training efforts. It is not known how, or even if, the slide sets are used at the local level. The national IES has since independently updated the full-day slide set, making it commercially available through their catalogue, and is considering sponsoring a future training effort directed at building owners.⁴

The Federal government has made the most extensive direct use of the Tier 1 materials. Federal agencies have apparently been the prime purchaser of the IES training materials. ⁴In addition, the DOE Office of Federal Energy Management Programs has used the Tier 1 curriculum as the first half of its Federal Relighting Initiative Workshops. Over a three-year period, 14 two- and three-day workshops have been delivered, providing lighting training to approximately 600 Federal agency personnel and facility level managers.

The California Energy Commission has sponsored a few train-the-trainers programs, to expand the number of trainers who are familiar with the curriculum. The CEC also produced a video for the full-day program, to help trainers learn the material and improve their delivery. This video has been used in at least one university extension course. Results of these train-the-trainer efforts were not available at the time of writing this report.

Another sponsor, the Bonneville Power Administration (BPA) reports it has made no use of the materials. Lighting trainers already working with BPA were critical of the quality of the materials and were more comfortable with training materials that they had produced themselves. BPA lost further interest in the curriculum when they realized that the IES was granted the copyright and authority to commercially market the materials.⁵

EPRI, which acquired the copyright to the 45-minute program, planned a revision tailoring it to its customers' specific needs, but has since put the project on the back burner.

A few of the original steering committee members and consultants involved with the development of the program have reportedly used the slide set for training programs. Of the people interviewed, this group seemed to be the most comfortable with the use of the basic curriculum and

with adapting it to their own needs. However, they also expressed discomfort with the issue of ownership: i.e., "Is this a public-domain or privately owned program?"⁶ This uncertainty makes them hesitant about presenting the program, especially for a profit or with a highly public profile.

Thus, an effort directed at providing widespread lighting education for the nonexpert seems to be hindered by lack of a clear delivery mechanism and clear ownership.

Training Issues

Initial conception

Both of these training efforts, for the Title 24 Standards and the Lighting Efficiency Training, were guided somewhat by a master plan. The strengths and weaknesses of the initial master plan can be seen in the successes and failures of the various training paths. Most of the issues discussed below are common management concerns, but they deserve revisiting in this context.

Project Organization. A single project manager with well-honed instincts may provide the most efficient path from conception to completion for a training project. However, since training programs typically are intended to reach a large and diverse population, some up-front effort to include a number of potentially interested organizations in the planning, and perhaps funding, of a training program seems to be good politics and to contribute to its success. Almost every large training project discussed above included multiple sponsoring organizations. These organizations typically saw their collaborative seed funding as leveraging the impact of their training dollars. In some cases, however, members of collaborative efforts saw no direct benefit from their contribution.

A case can be made that the projects were more successful because of the initial collaborative approach. First of all, there is each organization's valued perspective on the needs and preferences of the audience. These contributions can help to balance and focus a presentation. Secondly, multiple organization involvement lends a respectability and level of significance to a training package. Thirdly, involvement of multiple organizations can provide important free advertising, as word spreads that the training program is being prepared. Fourth, initial involvement is likely to increase acceptance of the final package, as the groups recognize their contributions and feel a sense of authorship.

The price for such a committee approach, however, may be delay, confusion, and a possible diffusing of the focus of the program. Committees tend to always say, "Yes, let's include that, too. We'll include everything!" Again,

the best antidote to this diffusing tendency of a committee is often a strong project leader with well-defined goals.

Defining Goals. Clearly stated goals for a training project serve as guideposts along the various paths of conception, development, delivery, and assessment. Basic questions, like: “Who will be trained?” and “What will they learn to do?” set the foundation for the rest of the effort.

The more specific the target audience and the clearer the path to reach that audience, the easier it is to reach. For example, “municipal building officials in California” or “members of local IES chapters” constitute a well-organized, specific audience. More diffuse target audiences, such as the “lighting decision makers” identified for the Tier 1 Lighting Efficiency Training, are difficult to identify and difficult to reach. It is also difficult to evaluate the impact of their training.

Timing. Timing is everything. There must be a demand for the information, and the training must be provided when the target audience most feels a need for the information. Old information has no market value. Alternatively, people generally are not interested in information that is more than three months away from an immediate need. Similarly, the audience expects all supporting information to be available with the course: a training program for code officials was rated very poorly by attendees when the supporting manuals were not available until after the training (Connerly 1993).

Premature delivery is as much of a problem as tardy delivery. In an attempt to make sure people were ready for code changes, both the trade association and the non-profit institute scheduled “pre-implementation” training sessions in advance of the July, 1992 start date of the code. However, when the implementation of the California Energy Standards was unexpectedly delayed for 6 months, the people who had attended those sessions were very dissatisfied that they had been trained in materials that they couldn’t use for another half of a year. ²

Lengthy technical reviews for accuracy may improve the training materials while delaying the delivery, and thus “missing the boat” on timeliness. With rapidly changing technologies, new programs, or energy codes, the timeliness of delivery is perhaps the single most important element of the training effort.

Funding Mechanisms

There are two ends of the public-private funding spectrum. At one end, training can proceed on a private-market model with an entrepreneur risking an up-front

investment on the expectation of profit from fees collected. At the other end, a large organization or government agency can fully sponsor all materials development and delivery costs, at no charge to attendees. In between these two there is a full range of combinations, such as partial sponsorship of private efforts or fees charged for fully sponsored programs in order to offset costs or fund future efforts.

The private entrepreneur approach involves no cost to the public. If more than one entrepreneur pursues the market, there will be competition for cost, quality, and speed of delivery, and there is likely to be more variety of offerings. Market survival is the acid test for any program. A large organization, however, such as a utility or a government agency with an immediate need to get the message out, may find a fully funded effort more reliable than depending upon private initiatives. A conflict inevitably develops here in that any fully funded effort will quickly smother any private initiatives that serves the same market segment.

A hybrid approach has evolved combining subsidized finding of material development costs with private delivery of the materials. The idea of this approach is to speed up creation of materials, and yet provide opportunity to competitive private-sector presenters. However, this has not always achieved the intended result. First, subsidized development gives an advantage to the developers of the delivery mechanism. Secondly, as we will discuss below, just developing materials, without also providing a clear mechanism to fund delivery, has tended to stall the training effort once the materials are completed. Diffuse ownership seems to confuse rather than facilitate presentation. While we have been involved with a number of efforts funded by a large committee of clients, we have yet to see all of the original finding organizations make full use of the materials.

Presentation Media

The choice of a presentation medium directly impacts the delivery and acceptance of the training program. Careful consideration should be given to the goals and needs of the audience in selecting media. Figure 2 presents a graphical summary of some attributes of the presentation media discussed below.

Overheads. Overheads are the lowest investment material to use in training presentations. They are quickly made and thus easily modified to accommodate changes in the presentation. They lend themselves to an informal speaking style, and with the use of markers, allow an interactive teaching approach. They are best in more intimate settings, with about 20 people attending.

Presentation Media					
Qualities	Overheads	Slides	Video	Prepared Curriculum	Multi-media
Ease of revision	■	■	I	■	■
Cost to produce	I	■	■	■	■
Time to produce	I	■	■	■	■
Ability to customize	■	■	I	■	■
Cost of delivery	■	■	■	■	■
Formality	I	■	I	*	*
Interactive level	■	■	I	*	*
Size of appropriate audience	■	■	■	*	■
Potential technical content	■	■	■	*	■
KEY:					
very low or very small					
low or small					
medium					
high or large					
very high or very large					
varies or not applicable					

Figure 2. Presentation Media

Overheads, however, tend to be greatly abused in presentations. They are often made with too many words and too small type faces so that audiences have difficulty reading the material. They also present an on-stage management problem for the presenter, who must speak while shuffling through a stack of transparencies and attempting to keep them in order. They quickly reach their limitations with larger audiences, where the projection equipment required for a large room often distorts the image, and the intimacy of the speaker-audience relationship is lost.

Slides. 35 mm slides offer a much higher-quality image that can be readily projected onto a large screen for a larger audience. Color, computer graphics, and photographic images are easily incorporated into a slide presentation. Comparable color quality can be achieved for overheads, but at considerably higher cost than multiple sets of slides.

Slides constrain the flexibility of the speaker compared to overheads by imposing the preset order of the slide tray. While it is easy to flip between adjacent images, it is not possible to rearrange images on the fly during a presentation or a discussion. Slides, however, allow easy and inexpensive revisions to a presentation by rearranging and updating individual images.

Videos. Videos have become increasingly popular components of a training program. At their simplest, videos can be just a canned slide show. Production values can continue up from there, with quickly spiraling budgets. However, because of our cultural experience with television, audiences are used to Hollywood-level production values (i.e. shows produced for about \$20,000 /rein), and tend to be impatient with comparably low-budget

training videos (produced for about \$1000/min). In our examples discussed above, videos were used to enhance speaker presentations, to train speakers, and to make audio/visual training directly available for self study. Individuals can view the training videos during off-hours or at home. Training with video reportedly has been especially popular with hands-on practitioners, such as building department field inspectors, whose schedules keep them out of the office.

Videos are also expensive and difficult to show to a large audience because big screen projection equipment is expensive and still rare at most conference facilities. This limitation argues that videos are best used as an individual, or very small group, training device.

Video production does guarantee a consistent quality of presentation. While a good live instructor might be more entertaining, a bad instructor can be avoided. When videos are used as self-study tools, an individual or small group can be exposed to high-quality training without the expense of paying a qualified trainer to present. However, the informality of viewing a video can undermine the imperative for training. People just don't seem to take a canned video as seriously as listening to a live instructor. A good speaker, upon seeing someone in the audience start to fall asleep, can crack a joke or change the pace to bring people back to alertness. But once a home viewer falls asleep on a couch, they are generally lost to the video and the training.

The most popular training videos seem to be short, in the range of 10 to 20 minutes. The limited time means that limited material can be covered, and the technical level of training is, of necessity, greatly reduced. Such a video can

only introduce a subject and, perhaps, touch on a few of the most frequently encountered issues. Indeed, it can be argued that video is best used as a motivational tool, rather than to impart detailed technical information. (Hollywood certainly follows this approach!)

Mixed Media. Some of the most successful training efforts that the authors have been involved in used many media to present the material. This approach tailors the material to the type of medium where it is conveyed most effectively, and also varies the pace and intensity to keep the audience's interest.

Foremost to consider, an excellent manual or workbook which the audience is motivated to master greatly enhances the impact and depth of the training. The quality of the *Advanced Lighting Design Guidelines* used with the Tier 1 Lighting Efficiency Training and the CEC *Non-residential Manual* used with all of the California Title 24 training elevated those training efforts from "talk about" to "learn-to-use" sessions.

Slides and overheads can also be combined in a presentation. Slides increase the visual impact of the information, while a break to overheads allows for a period of more informal and spontaneous discussion. Filling in forms or worksheets is easily demonstrated with overheads, while information is most easily summarized on text slides. Short breaks to view a video segment can provide an additional level of information, such as a real-time site visit (assuming adequate equipment is available for the audience to view the video). The Federal Relighting Initiative combines slide and overhead presentations, with real-time demonstrations of software, and also whenever possible, hands-on computer sessions. In addition, an extensive "Tool Kit" is used as a workbook of materials that the attendees will take home and use.

The materials that an audience takes home from a training session seem to greatly influence assessments of the value of the presentation. The Federal Relighting Initiative Workshop attendees consistently rank the quality of the materials provided in the "Tool Kit" as one of the most important aspects of the workshops.

Delivery

Most technical or policy organizations are likely to focus on the technical quality of the materials produced, while forgetting the importance of timing and delivery logistics.

Size Of Audience. The size of the audience seems to be as much a function of the funding mechanism as an issue of educational impact. Private market training efforts tend to have large audiences, in order to insure a profit. Audiences from 60 to 100+ are reported, with presenta-

tions to less than 40 people often canceled to prevent financial losses. The publicly funded efforts may target large audiences, but are often presented regardless of actual attendance. The average audience size for the non-profit institute training of building code officials was 21 people, with many presentations being run for 5 people or less.³ The simultaneous trade association effort to reach energy consultants was presented to audiences averaging about 70 people.²

As discussed above, the audience size strongly influences the choice of presentation medium. It also clearly determines the speed with which the information can be disseminated to a large population.

Length of Presentation. Training efforts in our examples range from 10-minute videos to 3-day workshops. Certainly, the longer the presentation, the more information can be communicated, but also the greater the expense for everyone involved. Even when there are no fees to attend a training, organizations will still find it very costly to spare key personnel for a full day, let alone three days, of training. The longer the training presentation, the more effort needs to be put into marketing the presentation in order to guarantee the necessary audience attendance.

The length of presentation also influences the degree of interaction between speaker and audience. Short presentations, those up to one full day, tend to retain a formal distance between instructor and audience that keeps the training in a one-way mode. There is always a notable relaxation in formality on the second day of multiple day presentations, with individuals feeling much more comfortable approaching the instructor to discuss individual issues. By the third day, members of the audience are likely to have formed small mutual aid alliances to discuss issues and work together. This interactive process is greatly accelerated if members of the audience already know at least one other person attending. One instructor of Federal energy workshops insists upon project teams attending her workshops in order to increase the level of interaction and thereby improve retention of the material.⁷

The more familiar an audience is with material, the more quickly they assimilate it and become interactive with the instructor. When an instructor is presenting technical material to an expert audience, he or she will be immediately challenged with questions and comments. When material is new to an audience, however, it is usually not until the second, or often even the third day, before members of the audience feel comfortable raising questions and interacting with the instructor. Thus, the degree of familiarity of the target audience with the material should influence the choice of the length of the presentation.

Multiple Speakers. Individual speakers presenting their own material is probably the most efficient way to quickly deliver information to a limited audience. Speakers are invariably most comfortable with materials that they have personally produced and tailored to their individual presentation styles. They efficiently use the time preparing the materials as a mental rehearsal for their delivery. A single presenter, however, has limits in how large of an audience can be reached. It is unusual for a busy professional, of the caliber required for a high level of technical expertise, to be able to devote a majority of their time to a concentrated training effort. Thus, short-fuse delivery efforts often look to a larger group of presenters to deliver the program. This raises the issue of how to insure a consistent curriculum and quality of presentation with many presenters. Two basic solutions which are used frequently are discussed first, with possible variations or improvements discussed afterwards.

The first approach breaks the curriculum into subareas delivered in repertory fashion by individual experts, each responsible for their own presentations. This approach saves time by requiring a minimum of coordination between instructors. But it can also suffer from that very lack of coordination, leaving audiences confused with conflicting points of view or bored with repeated subjects. The Federal effort to provide energy manager training has broken the subject areas down into six courses, and does involve some overlap in subject areas. The audience invariably questions why there is not more coordination between speakers. Specialized training was also proposed for the utility-sponsored delivery of California Title 24 training. It turned out, however, that there was far less demand for specialized training than for the general overview. As a result, a few generalists did most of the presentations.

The second approach to multiple speakers is to create a uniform curriculum and then train a larger group of presenters to deliver it in a consistent fashion. The cost of adequately training multiple speakers is often a considerable burden to a training budget. Practice sessions, the preparation of “Speaker’s Notes,” or the production of a demonstration video are all attempts to accelerate the speakers’ learning curve in mastering the material.

The authors have been involved in many projects which attempted to train multiple speakers to deliver materials and have seen them fail over and over again. Programs expecting the private sector to assume delivery of prepared curriculums, such as the Tier 1 Lighting Efficiency Program and the utilities’ energy standards package, have seen few, if any, takers for the challenge. Some organizations, such as the energy consultants’ trade association and the code institute, have assembled and trained a “stable” 6 to 8 faculty, only to have to constantly monitor their

performance and see a high turnover in presenters, requiring more costly training of replacements.^{2,3}

A solution to this problem is to recognize the barriers to adoption of materials prepared by others and the length of time it actually takes for a newcomer to master the presentation of a technical curriculum. Ideally, a small team of only 2 or 3 core presenters would author, or supervise, the development of the curriculum, thus gaining a sense of ownership of the materials. This core team should then put on the first one or two presentations, refining it as needed. After watching the initial presentations, a second group of assistant presenters is then teamed up one-on-one with the core speakers and assists with presenting a proportion of the curriculum while they master the materials. When the assistants are judged ready, they then join the core speaker’s group and start training assistants of their own.

This apprentice speaker approach minimizes the training time, while insuring quality and consistency of presentation. The availability of “understudy” speakers stabilizes the programs and adds flexibility in scheduling.

Provisions for Evaluation and Revision

The first step in revision and improvement is evaluation and feedback. Evaluation is a notorious weak link in most training programs. It is difficult and expensive to complete conclusively.

Cost Benefit Analysis. While the costs of putting on a training program can be fairly easily established, the benefits are notoriously difficult to assess because they are diffuse and difficult to measure. It is difficult to isolate the specific impact of training, as opposed to good management, good program structure, etc. This difficulty has contributed to the determination by the California Public Utilities Commission that utilities may not consider public education as a direct DSM cost.

The simplest metric of training success is the number of people attending sessions or the number of training materials distributed, but there are pitfalls in this simple assessment. The number of materials distributed is only a very rough indicator of number of materials used. Assessing how many people actually use individual study materials, like a disk, manual, or video is almost impossible to determine.

Another question is, “Are the people who are trained the appropriate target audience?” Generally it is the more junior members of any organization that receive the majority of training. They are less expensive to send to a training program and are most likely to benefit from the new information. Unfortunately, it is the junior staff who

are also most likely to be laid off or move to another job. This problem was especially noted in training California building officials in the building energy standards. With the recession, many of the code officials who received the training were laid off from their jobs. For example, Riverside county, the fastest growing county in the nation as of 1990, subsequently laid off all the building department personnel with fewer than seven years of seniority. Thus, nearly all of the 120+ Riverside personnel who were trained in the energy code no longer work for the county (Connerly 1993).

A deeper question is “Does exposure to the training materials effect attendees’ subsequent decisions and actions in regards to the subject matter?” Such a question is very difficult to assess, requiring some form of sophisticated survey and analysis techniques. Few training programs have the resources to conduct such studies, and so content themselves with self-reported information from surveys of the audience as they leave the presentation, before they have actually tried to make use of it. A follow up survey, mostly likely by phone, with a sample of the audience 6 to 12 months after the training is more likely to assess real impact.

Revision Cycles. Organizations that have planned revision cycles into their training products have seen them steadily improve and achieve greater effectiveness. However, repeated cycles of revision and improvements require a stability and long range vision that is often rare in our world. Unfortunately, revisions of a curriculum tend to cost almost as much as the initial development of the program. Thus, short revision cycles can dramatically raise the cost of training. Somewhere, there is an ideal balance between improving materials and keeping them up-to-date vs the repeated cost-effective delivery of those materials.

Overly fast revision cycles can also build resentment within the community being trained. There is a reluctance to learn new material if it is known that it is about to change, producing a 6- to 12-month period of resistance to training before a change. After new material is introduced, it takes at least 12 months to reach training saturation of the professional community. Once trained, people want to grasp changes and feel confident with application of material before they are asked to learn new material, adding at least another 6 months to the cycle. This implies that presenting new information on faster than a three-year cycle will be met with substantial resistance.

Short revision cycles of 1 to 2 years to improve a program are appropriate when material is to be delivered to an ever-changing audience, with no repetition to any particular individual. Later attendees benefit from

revisions, without having to accommodate changes to their understanding of the material. Longer revision cycles of 3 to 5 years are appropriate when the same group of individuals is to be retrained in changes to a set program or code.

Conclusions

Delivering high-quality and timely technical information to the building and construction community requires a concerted cooperative effort by many public agencies and private organizations. Multiple organizations participating in the conception of the training slows the process, but enhances its chances for success. The entire construction community benefits from high-quality education, but has difficulty funding the development of the necessary materials. Bridging the divide between private enterprise and public funding has the potential to serve the public interest in timely delivery of new information, while also supporting private entrepreneurial efforts. However, there are many pitfalls along the way that should be carefully avoided.

Successful execution of a training program requires that details about the delivery mechanism be established before development of materials is begun. Ideally, not only should the target audience be precisely defined, but the mode of marketing to that audience and funding their participation should be clearly established.

Production of concurrent materials, such as a training manual or reference book, greatly enhances the value of the training. Presentation media and length of presentation should be selected based on the type and size of the audience and its familiarity with the information to be conveyed. Speakers should ideally be involved in the authorship of the training materials, or be gradually apprenticed into the program. Building an evaluation process and periodic revisions into the training program will greatly increase the effectiveness of the training over time.

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Lighting Research Institute, Utility New Construction Advisory Professionals, and the U.S. DOE, Office of Federal Energy Management Programs.

The opinions and recommendations expressed herein are solely those of the authors and do not necessarily reflect those of any of the other organizations involved in these programs.

Endnotes

1. Personal communication, Laurie TenHope, California Energy Commission, March 1994.
2. Personal communication, Cathy Chappelle, organizer of California Association of Building Energy Consultants training, March 1994.
3. Personal communication, Eric Makela, author of California Building Code Institute Training Program, March 1994.
4. Personal communication, Beth Bey, Marketing Director of the Illuminating Engineering Society of North America, March 1994.
5. Personal communication, Andy Eckman, Market Transformations Communications Director for Bonneville Power Administration, March 1994.
6. Personal communication from various Tier 1 Steering Committee members (who wish to remain anonymous).

7. Personal communication, Ted Collins, U.S. DOE Federal Office of Energy Management Programs, June 1994.

References

ADM Associates, 1992 *Energy Efficiency Standards, Trainer's Manual*, Utility New Construction Advisory Professionals c/o Dennis Fitzpatrick, PG&E, San Francisco, CA.

Charles Eley Associates, 1993. *Advanced Lighting Guidelines*, published by the Electric Power Research Institute, California Energy Commission, and the United States Department of Energy.

Connerly and Associates, 1993. *Final Report, Training Contract #400-89-002 by California Building Officials*, for the California Energy Commission, Sacramento, CA.

Lighting Research Institute, and ADM Associates, 1992. *Lighting Efficiency Training Course*, Bonneville Power Administration, California Energy Commission, Electric Power Research Institute, Illuminating Engineering society of North America, Lighting Research institute, U.S. DOE, Office of Federal Energy Management Programs. Published by IESNA, NYC, 1993.

Lighting Research Institute, and Heschong Mahone Group, 1994. *Federal Relighting Initiative Speaker's Notes*, U.S. DOE, Office of Federal Energy Management Programs, Washington, D.C.