Innovation in Industrial Training: A Regional Approach

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ABSTRACT

Industrial training programs are often viewed by participants as a mandatory requirement that acts as a "get out of jail free card," allowing them a break from their regular work. Training usually takes place only in a classroom setting and produces few meaningful results; research shows that participants retain, on average, only 10 percent of the material covered. This situation presents a challenge, for research also suggests that proper training is imperative in getting industrial businesses to embrace energy management as part of their organizational culture.

Over the past two years, the Industrial Efficiency Alliance (IEA), an initiative of the Northwest Energy Efficiency Alliance (NEEA), has altered its traditional approach to training. Rather than focus on a single company and target participants with specific job assignments (e.g., shop floor employees), the IEA collaborates with a utility provider to identify and train a group of companies from the same region whose energy use is largely dedicated to a particular technology (e.g., compressed air). The participants, chosen in collaboration with the plant manager, may come from management, engineering, operations, and/or maintenance. Called Industrial Mentored Training (IMT), the program also prescribes three months of "super training" for a "champion" (or champions) who will follow up with implementation and develop good energy management throughout the entire organization. Grant County Public Utility District in Washington and Idaho Power Company both conducted IMT programs in 2006.

The purpose of this paper is to discuss the framework of the IMT training, to present findings from the implementation of the two training programs in Idaho and Washington, and to present results to date, including the method used for quantifying energy savings.

Introduction to Industrial Mentored Training

This paper puts forth a creative approach to training plant-level personnel to improve savings retention, solutions, applied methods, ownership energy savings, and the institutionalization of Continuous Energy Improvement Practices (CEIP).

The Industrial Efficiency Alliance promotes CEIP. Built on the methodologies of other improvement programs (lean, TQM, Safety, ISO 9000 etc.), the CEIP model focuses on enabling industrial companies to build energy efficiency awareness by making a commitment to develop an energy plan, and constantly reviewing and assessing progress in order to make improvements. With this purpose in mind, the IEA took a comprehensive look at current Best in Class U.S. Department of Energy (DOE) courses and discovered that the material presented to students was not effectively applied when they returned to the plant. Clearly, the classic didactic method of lecturing was ineffective, and a fresh approach was needed to generate better results.

Accordingly, the IEA adopted a methodology based on student-centered learning and dealing with practical applications integrated with the Best in Class DOE, Compressed Air Challenge (CAC), and other industrial training courses. To avoid violating the integrity of the DOE CAC 1 class, the IEA engaged one of the best DOE trainers in the nation to assist in the integration process; none of the CAC 1 class content was altered in the adaptation, and the CAC ethics were upheld by the trainer, complementary "Energy Mentors," and all support personnel. The IEA training methodology can be applied to any industry and technology.

The IEA works to create efficiencies in two ways: by helping companies incorporate energy efficiency into their normal business operations, and by advising companies to take a "whole systems" approach to energy efficiency, as opposed to merely dealing with individual components or technologies. Naturally, training plays a key role in supporting the initiative's focus. The IEA targets two industry sectors for its training: Food Processing, and Pulp and Paper. The IEA is using student-centered learning – experiential learning – to support and improve the likelihood that new EE skills and knowledge are directly applied in the workplace.

Definition of Players

Stakeholders are defined below:

- **Participants:** Learners hand-picked by management sponsors to be trained to manage and oversee both the supply and demand sides of compressed air systems. They are owners and take personal responsibility of their respective systems.
- **Management Sponsor:** Decision-maker with the authority and determination to promote activities and individuals who will enhance energy efficiency practices for improved performance while still supporting the operational goals of the plant or system.
- **Technical Trainer:** CAC I certified trainer motivated and flexible enough to change the format to extend a standard CAC I class to two days to include hands-on learning. Progressive instructor who can incorporate student-centered learning into the training process.
- **Energy Mentor:** A technical specialist with 10-15 years' experience in technical audits, project management, change management, and evaluation of both supply and demand systems.
- **Energy Champion:** Plant employee who takes on the role of leading energy efficiency initiatives in his/her facility. In some cases, he/she may manage a small energy team who regularly meet and report on progress, metrics, results and challenges.
- **Market Specialist:** An industry specialist well-connected to the target industry who has good working relationships with utility partners, understands change management, and can clearly communicate with plant management the value of investing time in a rigorous training process.
- **Utility Partner:** Utility representative who has good working knowledge of what is going on in each facility within a specific geographic region. Clearly understands the challenges facing the food processing industry and is open-minded to training that requires a high degree of participation and support.
- **Training Logistics Center:** Training center that engages technical specialist to be a catalyst for change through a dynamic training program. Must be able to manage multiple schedules and provide program management services, at multiple levels, to utilities and food processing facilities.
- **Best in Class**

Profile of Training Events

In 2006 the IEA conducted two IMT training programs with the Food Processing industry in the Pacific Northwest: one in Moses Lake, Washington (with co-sponsoring utility Grant County PUD), and one in Twin Falls, Idaho (with co-sponsoring utility Idaho Power Company). Both utilities had IEA target companies that expressed interest in improving their energy utilization. Working closely with the utilities, the IEA identified and approached an additional six plants in both Moses Lake and Twin Falls, all of which agreed to participate in training.

Goals

Goals for the IMP training programs included:

- **Improved learning retention levels:** Industrial Mentored Training (IMT) strives to improve retention levels in participants by utilizing student-centered learning methods, involving practical experience, group discussions, presentations, plan development and accountability.
- **Utilization of systems solutions:** The training is centered on a systems approach (versus a component approach) to compressed air, thoroughly exploring both supply and demand aspects. Compressed air is not discussed in isolation but integrated with other utilities (gas, electricity and water) in a holistic approach.
- **Development of internal champions:** Champions are made, not born. One of the keys to success is turning training into action at the facility level. Each participant and team is supported by "energy mentors" who develop an action plan and start implementing solutions as soon as they return to their respective facilities. "Energy mentors" assist participants in moving through challenges in their first 90 days, so that a new approach is embedded into their work life. Champions require regular support for a period of 30-90 days. As part of the extended learning process, "energy mentors" work with champions to develop the skills needed to become proficient at properly managing Compressed Air systems.
- **Development of a corporate culture that supports champions:** It is imperative that the company's management be supportive of the new approach and methods of returning participants. Business practices must accept champions, key performance indicators (metrics and data), and a systems-oriented focus. In other words, management must be involved and supportive, if this training is to succeed in bringing more energy efficient practices to their facility.

Training Methodology and Process

Step 1: Pre-Work and Identification of Appropriate Candidates

Step 1.A. In preparing for the IMT, the IEA worked with utility partners to identify and invite five to seven manufacturing facilities to participate in the training process. Those selected had in practice elements that indicated they were open to learning (i.e. Lean, ISO 9000, ISO 14000, Continuous Improvement organization, quality circles etc.). The invitation came with the requirement that participants needed the support of management to fully participate in training and follow-up activities.

The IEA and the utility partner took extra time to cultivate management's interest in the concept and the process. For the two trainings in Washington and Idaho, plant management was supportive, allowing the IEA technical specialist to come into each facility for a one- to two-hour walk-through to gain a basic understanding of the compressed air systems. Once all the plants were inventoried, the team chose the "Best in Class" plant to showcase for the second day of training. Detailed notes were taken to document the elements to elaborate on during the training process.

Step 1.B. The IEA market specialist and the utility partner worked with the plant manager to determine the best-suited personnel to receive training. This selection process focused on who would become the system "champion" after training. The IEA recommended that each plant send at least two and preferably three people from each facility (one an engineering type, another with more operations and maintenance focus, and ideally a representative from management, such as a plant manager or production manager). The IEA technical specialist contacted the compressed air vendor (a.k.a. trade ally) who worked with the facility, encouraging them to participate either as part of the plant team or as a technical mentor for follow-up services.

Each plant team was given the assignment of coming to class with a current block diagram of their compressed air system, together with any future plans to expand, and a list of challenges they faced.

Additionally, the utility was asked to provide additional information about the plant as it pertained to the compressed air system, such as previous energy efficiency programs, audits, consumption, or known challenges.

Step 1.C. The training coordination team met three weeks in advance to work out details, including roles and responsibilities, logistics on the plant tour, materials, energy efficiency opportunities (identified in initial walk-throughs), timeline of assignments, plan development and scheduling for a recognition dinner. This team included the following: the technical trainer, utility partner, energy mentors, and the IEA market specialist and training director.

Five days beforehand, the training logistics center phoned each participant to confirm attendance with a friendly reminder to bring the system schematic (Piping and Instrumentation block diagram) and a list of challenges. This process set the tone for a training experience with a personal touch requiring a high degree of accountability.

Step 2: First Day of In-class Training

Step 2.A. The first day began with introductions of participants, mentors, trainers and the utility partner, followed by clarification of the syllabus, and timeline for the two day course, the formation of teams, and the outline for the 90-day post-training follow up. The IEA market specialist explained the elements of Continuous Energy Improvement Practices (CEIP) and how it pertains to a compressed air system; he also defined the role of the "champion." The utility partner presented a brief overview of incentive programs and support services that were available.

Step 2.B. The technical trainer conducted a Compressed Air Challenge, Level 1 training with a student-centered approach, encouraging each participant to surface challenges from which the whole class could learn. The instructor also engaged participants in discussions of the pre-work they brought completed, sharing their facility's challenges and system maps.

Step 2.C. At the close of the first day, the IEA market specialist gave a brief overview of activities and expectations for the next day and each team gathered to review questions and answers from the pre-work assignment.

Step 3: Second Day of Training

Step 3.A. Champions. The IEA market specialist opened the second day of training with a discussion of the role and responsibilities of system champions and explanation of key performance indicators (KPIs). Participants were invited to discuss challenges and barriers to implementing these new approaches.

Step 3.B: Shop Floor Air Training. The IEA energy mentor then presented an IEA original course, Shop Floor Compressed Air, and shared how this course can be customized for training to their particular facility (complete with familiar pictures and equipment). "Shop Floor Air" is a course that educates the shop floor users on key energy efficiency considerations and issues, particularly the appropriate and inappropriate uses of compressed air.

Step 3.C: Preview of Plant Tour. The energy mentors and participants from the host facility gave an overview of the plant chosen as "best in class," explaining the general operation and specifically how compressed air is used in the facility. The IEA team asked the class to keep a critical eye out to identify proper installations and uses of compressed air and pointed out specific recommendations and challenges. Participants were urged to take notes and write down questions to make sure they understood as much as possible about the facility.

Step 3.D: Plant Tour. The energy mentors assisted the host team in pointing out unique and "best in class" solutions. Again, participants were urged to take notes and ask detailed questions. During the pre-work phase, specific points of interests were identified by the IEA team to focus the participants on "best in class" solutions and opportunities for improvements. Free form discussion was encouraged, but each stop was required to include 3-6 specific learning opportunities.

Step 3.E: Debriefing. After the plant tour, all participants reviewed what the tour had revealed and provided an assessment of the showcase plant. This was a highly interactive discussion with the host team fielding questions along with energy mentors. Working together, all members of the group identified challenges and opportunities, and generated a general 90-day action plan.

Step 3.F: Development of the Action Plan. Following the group assessment and dialogue, each team was asked to develop a 90-day action plan for their own facility with support from their energy mentor. The action plan defines the expected outcomes and gives the manufacturing organizations a definition of success (or failure). Without such a definition, it is impossible to measure the benefits of this training.

Each team considered similar concerns, such as: leak detection and repair, identification of appropriate and inappropriate uses of compressed air, key performance indicators, and operation and maintenance programs. Most teams explored the idea of reducing pressure, servicing neglected equipment, conducting “shop floor” training classes, removing open blowing applications, and establishing a leak repair program. Some of the more proactive plans addressed issues such as substituting an electric motor or blower in the place of compressed air. Finally, the company teams discussed the next steps with their energy mentor, including communication loops with energy mentors and the IEA Training Center, as well as potential demonstration projects and case studies with their utility partners

Step 3.G: Internal Event Evaluation. In order to better understand the dynamics at the training event and between participants and technical trainer, the IEA conducted the following data collection activities at the training site:

- Pre-training questionnaire of participant knowledge and attitudes about energy use
- Post-training questionnaire of participant knowledge and attitudes about energy use
- Post-training assessment of site, trainer and amenities

The IEA used this data to determine a change in knowledge and attitudes about energy use as well as to provide immediate feedback to trainers and organizers for IEA’s own continuous improvement process. Findings generally indicated that participant’s knowledge and attitudes about energy use changed dramatically over the learning process (total systems approach, demand and supply awareness, life cycle costing and change management).

Step 4: Follow-Up

Step 4.A: Mentoring. Every two to three weeks following the training, the energy mentors contacted the team leader from their assigned plants to check on progress, update action plans, and help identify additional resources and/or technical information needed. Energy mentors kept in touch by making phone calls, using e-mail, and making plant visits, involving the utility partner and sometimes a Trade Ally vendor. These follow-up meetings helped participants with challenges identified since the previous visit. The mentor reviewed the action plan and monitored progress to make sure the team was on track. If a team leader required assistance from plant management, the energy mentor or the IEA market specialist held confidential conversations with the management sponsor.

Step 4.B: Monthly Consultations. Energy mentors and the IEA market specialist held a monthly conference call with the utility partner to discuss progress, resolve challenges, and bring additional resources to bear as needed. This was a great opportunity to update the utility partner and encourage their involvement throughout the follow up stage.

Step 4.C: Presentations. Sixty days into the follow up stage, IEA instructed the plant teams on how to present results of their 90-day action plans. The teams received a presentation template which established a standard organization of material that could be modified, depending upon the direction of the individual team’s action plans and results. The template included the following:

- Documentation and inventory of existing system (history, equipment, challenges)
- Explanation of action plans
- Progress of action plan to date
- Savings in energy obtained
- Non-energy benefits (i.e. improvements in operations and maintenance), documented and quantified
- Next steps and potential capital projects

Step 4.D. Preparation of Presentations. The training logistics center collected all the presentations, and worked with the energy mentors to format and "polish" them. It should be noted that most of the company teams had not made formal presentations to a large group, and some had rarely used the PowerPoint program.

Step 5: Recognition of Achievements

Step 5.A: Recognition Dinner. After the 90-day post-training period, a dinner celebrating the achievements of the company teams was organized; those invited included management sponsors and the utility partner, who with the IEA presented awards to all participants. Each team was given ample time to make presentations to the whole group with follow-up question-and-answer periods. Teams presented energy and non-energy savings, challenges and solutions, and the current status of action plans. In some cases, the management sponsors were unaware of the extent of the work that had been accomplished and were very proud of their teams. The energy mentors and IEA market specialist added their input on additional successes that the teams had achieved. What was especially interesting was the involvement of utility partners in the accomplishments and plans for future projects. A clear indication that IEA had instilled the idea of continuous energy improvement was revealed by the additional plans that several teams had already started developing, which looked 90-360 days into the future.

Step 5.B. Internal Process Evaluation. The IEA team again solicited feedback at the event through a survey after dinner, as well as in casual post-dinner conversation and formal meetings. We provided summaries to company sponsors, utility partners, energy mentors and technical trainers.

Without exception the feedback was favorable. Participants are making a difference in their facilities; corporate sponsors are encouraging more activities on the plant floor; utility partners are more connected and are providing additional services to the plant while taking on capital projects identified in the training; and the industry as a whole is strengthening because industry is controlling costs and operating their equipment more efficiently – in sum – increasing productivity.

Step 5.C. Projects Turned Over to the Utility. At this point the formal training/mentoring process is over, leaving the Energy Champions engaged in the work on their own with a more connected workforce and management. Relationships with utility partners have been strengthened, and projects flow directly from the plant to the utility partner.

Keys to Success of Industrial Mentored Training (IMT)

"I have been a compressed air trainer for the past 20 years, and I've never been involved with a training that was as successful as this one (Grant County) has turned out to be. That's because we tracked the commitments made at the training, coached them through challenges and saw the attendees take ownership of their systems…I can tell behavior changes are underway and are sticking." (Yarnell 2007)

IMT differs from traditional training methods in several unique ways. Listed below are some of the key elements.

Student-Centered Learning

- Training through experiential and project-based learning
- Work assignments to participants prior to class
- Technical walk-through of facility to enhance on-site learning
- Development of action plan following a learning experience
- Mentors working hand in hand with each team to implement learning and track progress on action plans over a specified time period
- Presentation of results to peer group and celebration of achievements with peers and management

Objectives

- Identify and train system-based Energy Champions
- Provide methods to build institutional knowledge for participating facilities
- Identify and implement Key Performance Indicators (KPIs) for all systems
- Develop and implement action plans – 30/60/90 day period and beyond
- Promote closer working relationships with serving utilities, trade allies, and sponsors
- Development of corporate commitment to Continuous Energy Improvement Practices (CEIP)

Results

- Champions trained and given responsibility for both supply and demand
- Champions empowered to be "owners" of their system and become good stewards
- Comprehension and application of the concept of life cycle cost analysis
- Identification of no- or low-cost solutions that lead to substantial savings
- Increased productivity in a properly managed system

This training methodology provides solutions to traditional training barriers, which are outlined in Table 1 below. Nevertheless, IMT faces its own set of challenges, which are outlined in Table 2.

Table 1. IMT Solutions to Traditional Training Barriers

Barrier	Solution
Learners have low retention: estimated at about 10%.	Student-centered learning methods, utilizing several learning techniques: small group discussions, writing/developing plans, question-and-answer sessions, presentations, problem-solving and physical interaction with the material.
Industrial training events rarely lead to implemented solutions. Traditional industrial training events have no action plan moving forward after training event.	Action plans developed on second day of class, energy mentor continues to engage participants to implement their plan.
Returning attendees from industrial class have little opportunity to work through real life problems in their own facilities.	Day-to-day challenges often preclude applying new learning. Energy mentor acts as a resource to keep the learning process alive 90 days after training.
Attendees rarely see other solutions to challenges that they experience in their own facilities.	Field trips to nearby "best in class" plant exposes participants to possible solutions in their own facilities.
Management doesn't see the value of sending people to a learning experience if there are no results.	Involvement of management in the learning process is essential. Definition of roles, accountability, action plans, regular check and actual results get management behind the learning process.
Servicing utilities are not aware of the capital project opportunities inside facilities unless formal proposals are brought forward. Most facility personnel are not given the ownership or authority to engage servicing utilities to provide added value services other than power quality and service issues.	Involving utility partners is key to the success of industrial trainings. Great resources are available from utility technical staff. Funding of projects that come out of trainings play a key role in continued support. Management likes to see that the company is able to tap into available resources and funds to improve plant systems.
Attendees are not trained to be champions and take ownership of a technical system. Tools are not provided, mentors are not available and deliverables are monitored.	Providing definition around roles, responsibilities and tools on what is required to be a champion empowers technical staff to become system owners. Educating them on what a systems professional do empowers them to be the source of information on a specific system. Energy mentors coach them through real life challenges and help them to be self realized.
Peer to peer discussions are not encouraged during training events due to structure, focus is on skills, tools and materials.	Break down the traditional model and encourage the peer to peer learning that will make the learning process personal. Help establish relationships that will continue on after the training is finished.
Traditional training doesn't allow for flexibilities in teaching methods and learning styles.	Focus on a learning experience that support student centered learning'. Assume that learners have something to offer. Trainers need to tailor the content in response to the learners not to the trainer.
Attendees return from training events excited and charged to implement learnings but day-to-day challenges keep them from ingraining newly acquired skills and applying tools. Day to day management doesn't support change.	Provide systems and methods to stay connected to the learner after the formal training event has passed. Establish a regular check in with participants to keep them focus on new skills and action plans.
Management doesn't set expectation of trainee upon returning from training event. Trainees view it as a get out jail card for the day.	Encourage management to be involved in the learning process and set expectation of quantifiable results.

Table 2. Potential IMT Training Barriers and Improvements Made to Solve Them

Barriers	Solutions
Difficult to identify organizations that have the right people attending training event (Champion and management sponsor).	Work closely with Utility partners, trade allies and industry associations to identify great candidates.
Facilities have difficulties in freeing up resources to leave for multiple day trainings.	Management buy-in is a must, once that is achieved they will see the values. Recommending management to discuss this process with other organizations that have experienced the training event should be sufficient.
Requires more resources and coordination to implement training event. Expensive to implement training and all associated events.	Implementation team will need to acquire resources or plan on charging more to participants- results warrant added resources being invested.

Results

Listed below are the results documented by the individual teams as they reported at the 90-day recognition dinners. Most facilities are experiencing a number of financial benefits, including:

- Notable energy savings by reducing line pressure
- Energy savings by reduction of leak load
- Improved quality of product from stable air supply
- Improved safety operations from system being properly tuned
- Reduction in operation and maintenance cost by eliminating moisture in the compressed air system
- Improved reliability and performance of system by monitoring KPIs
- Greater incentives flowing to facility from enhanced relationship with utility
- Cost-effective, state-of-the-art solutions through enhanced relationship with vendors and energy mentors
- One of the most notable improvements came from the Best in Class facility, where leak detection was applied to a shield gas on a welding operation, reducing not only the amount of shield gas but the amount of rework because the quality of the welds improved from lack of contamination. (Genie lift)

Cost Effectiveness

The cost effectiveness of this type of training has yet to be quantified, but early results look quite promising (see Table 3). Of the two trainings completed, it appears that all the companies involved have saved roughly 5.111 mWh (Interim Evaluation report on Savings from Training by the Northwest Energy Efficiency Alliance April 2007) with low or virtually no-cost investment other than the training effort by the Technical Trainer, Energy Mentor, and Utility Partner. This translates to $255,000 of savings per year at $.05 kWh. Consequently, $250,000 in energy savings can then be equated to over $5 million in sales (for a company with a profit margin of 5%). Said differently, these companies would have to generate an additional $5 million in sales to pay for the energy they saved. Each training costs roughly $20,000-$25,000 to implement.

"I think what was interesting about the Mentored Training concept was the way the information was presented. I'm certain I learned much of the information that was presented through the program many years ago but forgot it over the years. It was presented in context through the Mentored Training and that made it more interesting. It showed you how to convert wasting energy to dollars so that you understand why those dollars are important. And more importantly, it showed me how easy it is to save money without having to stretch too far." (Miller 2006)

Table 3. Results by Company[1]

Company	Energy Savings Identified (First 90 Days)	Non-Energy Benefits (First 90 Days)
Company A	201,480 kWh savings = $3,022 annual savings Plan to Install VFD	Installed small receiver in packaging, improved production and reduced down. Plan to hold shop floor training. Improved employee morale.
Company B	Audible leaks repaired. Resulting in increased downtime for 2nd compressor. Identified opportunity to install another receiver. Reduced pressure from 130-120 Estimated 50,000 kWh Savings $9,000 per year total.	Performed air audit with engineer to determine potential savings and possible opportunities. Operations are running much smoother
Company C	Estimated savings on Air compressor $26,500 per year Estimated savings on welding shield gas $10,000 Estimated improved quality on welds Estimated savings $50,000 in rework of product Reduced compressor by fixing leaks 250,000 kWh Launched a study to investigate they remove compressed air blowing to low pressure blowing (Potential savings of 1,500,000 kWh)	Implemented leak detection system that includes the following; Use more efficient power sources More effective parts to reduce leaks Replace octopuses with manifolds improved safety They have switched some of their tools from air to electrical power.
Company D	5.0 cfm/kW = 11% improvement system performance on leak repair. 70,000 kWh savings. Saving roughly $3,500 per year.	AirmasterPlus study estimated that additional savings of 90,000 kWh in piping upgrades, increasing receiver capacity and controls.
Company E	Reduced leak load 30,000 kWh by leak program. Potential savings by Air master Plus study estimated that additional savings of 80,000 kWh in piping upgrades, increasing receiver capacity and controls	Reduced air velocity and pressure drop Improved production efficiencies Management more interested in getting involved in plant wide Continuous Energy Improvement Program
Company F	Estimated potential savings of 1,500,000 kWh by all efforts, leak reduction, piping, lowering pressure, enhanced controls, reducing pressure drop $30,000 yearly savings	Improved air delivery to whey plant, improving productivity Successfully got air leak PM back on track. Started air line labeling and maintenance program Reduced electrical spikes due to compressor staging Improved productivity within plant do to re-piping Reduced fluctuation in plant to achieve better air pressure reliability.

[1] As quoted from team presentations; savings are self reported not validated by a third party evaluation team.

Company	Energy Savings Identified (First 90 Days)	Non-Energy Benefits (First 90 Days)
		New dryer installed end of Feb '07- Improved air quality Enhanced documentation of compressed System (Piping &Instrumentation) drawing
Company G	Reduced leak load by 20,000 kWh on system with estimated savings $1,000 per year. After action plan could be 100,000 kWh savings	They are in the process of implementing formal leak detection program. Proposed action plan should improve pressure drops throughout the plant that cause valve fluctuations and ultimately, quality issues.
Company H	Over 50 leak points identified and many corrected Shut down one 75HP compressor- 95% of time. Savings 820,000 kWh with a $16,337 per year Aggressive future plan potential of 900,000 kWh.	Improved productivity, reduced pressure drop better reliability of source air. Plan to lower is system pressure from 120 down to 90 psig.
Company I	One month savings of 2.4% improvement in productivity plant wide through proper management of compressed air. Equal to roughly $60,000. savings in utility costs.	They have completed a shop floor training course for all of the production, improving the use of CA, maintenance, and lab personnel, and plan to update it annually. Reduced reactionary repairs and maintenance. Plan to lower is system pressure from 110 down to 90 psig.
Company J	Running (110-90) 20 psi lower pressure calculates to a yearly savings of $1,500 minimum on main system Turned off warehouse compressor between shifts = a savings of $1,000/year Completed repairs of detected warehouse leaks = savings of $2,500/year Air pressure in the Freezer reduced savings yet to be determined Low hanging fruit found from class was $5,000/yr savings	Leak detection process identified failing equipment on packaging machine. Once fixed machine now works flawlessly no added labor required. Improved safety due to less waste on the floor. This has reduced downtime. Have established programmed maintenance for compressed Air systems

Third Party Evaluation

The Northwest Energy Efficiency Alliance contracted with a third-party evaluation firm to contact the participants, via web survey, 3-6 months after the initial training event. The web survey focused on the participant's conversion of planning to action and actions to energy savings. The third party evaluator scheduled site visits with those participants that indicated in their web survey that they had achieved improved energy efficiency as a result of IEA training. A qualified engineer from the evaluation firm traveled to the manufacturing sites to inspect the compressed air systems and review any O&M changes.

Based on the individual firm's action plans and evidence of change, the evaluation engineer calculated energy savings for each site. At three of the Moses Lake sites, the evaluation engineer was able to validate savings per the firm's action plans. At two sites, the engineer determined that the firms had an action plan but had not fully implemented them.

The Northwest Energy Efficiency Alliance conducted an evaluation of the training effort for 2006 and noted: "….one Industrial mentored training event (during the period surveyed) constituted 23.5% of all the plant-systems that eventually converted training into action and action into energy savings. The annualized energy savings for 2006 from this event amounted to 730,500 kWh/year or 36.3% of the energy savings for changes in O&M behavior observed by this survey. The impact of this event on energy savings, compared to the total of all other IEA training events, was substantial." (NEEA, Interim Evaluation Report) The training event referred to was one of the earliest; numerous improvements have since been made.

Improvements

The IEA is closely monitoring the training process and continuously seeking to improve the content, methodology, and implementation. It has been noted from extensive interviews, class evaluations, and third-party discussions that the following improvements could make the course offering even better:

- More one-on-one exercises during training, especially during the first day
- Reduce costs to include more organizations in the region
- Engagement of management in a more meaningful way to gain further support
- Engage Trade Allies more often as early as possible
- Enhance cross-pollination of participants to keep communicating after formal training has been completed
- Develop methods that allow energy mentors to be more involved on a more regular basis, as part of plant-wide energy teams, Web conferences, online chats, etc.

Conclusions

The overall response from participating facilities exceeded everyone's expectations. Participants returning to their facilities took direct action and made a real difference in the operation of their compressed air systems. Plant managers have seen significant savings in operations, reliability and performance. Shop floor personnel have a new understanding of the appropriate and inappropriate use of compressed air. Utilities have seen a sharp increase in energy efficiency projects coming out of each facility that have support from management and are put in place quickly.

The savings results are significant in light of the fact that most plants had little or no investment in the projects that were implemented as part of the first 30/60/90 action plans. The return on investment (ROI) to the plants was significant as participants were not only trained on the fundamentals of compressed air but also on their role as system champions, on the significance of compressed air key performance indicator, and on how to lead and collaborate with their co-workers and their utility partner to leverage energy efficiency funds to implement future projects.

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