Expanding the Industrial Assessment Center Program: Building an Industrial Efficiency Workforce

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ABSTRACT

Energy efficiency provides an unequaled opportunity for manufacturing companies to reduce operating costs. Energy efficiency improvements not only lead to reduced energy costs, they can lead to even greater improved productivity and decreased waste. However, many cost-effective projects are not being implemented. Manufacturing companies have indicated that this is often due not to a lack of funds but rather to a lack of access to technical information and trained workforce.

One of the most successful programs for achieving energy efficiency savings in the manufacturing sector is the US Department of Energy's Industrial Assessment Center (DOE IAC) program. In addition to significant energy savings, the IAC program helps train a steady stream of energy engineers who are in high demand as plant energy managers, energy efficiency consultants, and energy efficiency design engineers.

This paper proposes a strategy for expanding the IAC program in both size and scope to better meet the workforce and energy assessment needs of U.S. manufacturers. The expansion would be accomplished by establishing Centers of Excellence at current IAC locations, and then partnering with other universities, community colleges, and trade schools to create satellite centers to educate students at all technical levels. This would provide additional assistance to industrial customers over larger regions than is currently possible. Further partnerships with other organizations that already service manufacturing facilities would take advantage of existing infrastructure to enable the most efficient distribution of energy efficiency services.

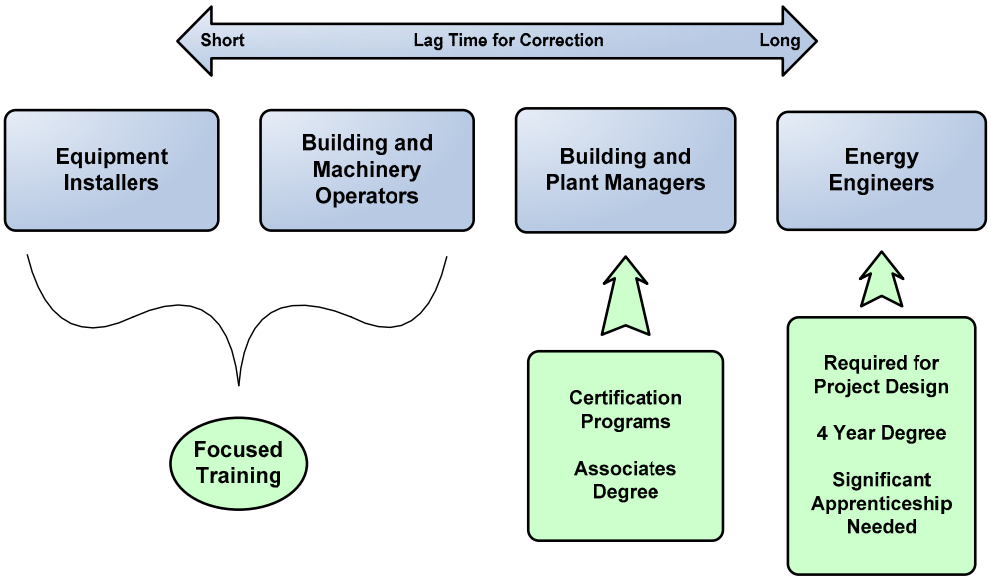
Introduction – Needs of the Industrial Sector

Energy efficiency provides an unequaled opportunity for manufacturing companies to reduce operating costs. Energy efficiency improvements not only lead to reduced energy costs, they can lead to even greater improved productivity and decreased waste. However, many cost-effective projects are not being implemented. Based on the authors' interactions with companies over the past few years, manufacturing companies have indicated that it is frequently not a lack of funds that prevents more energy efficiency—though in the current economic climate access to capital represents a major hurdle. Instead, they have identified four barriers to greater investments in energy efficiency: 1) Lack of targeted energy assessments to locate opportunities; 2) Lack of access to industry-specific expertise for implementation; 3) Lack of availability of a trained workforce; and 4) Lack of access to new technology from research, development and deployment (RD&D) efforts. In other words, the greatest obstacles to energy efficiency for manufacturers are access to information and trained workforce.

While many larger manufacturers can often afford to hire consultants and both large and small manufacturers can take advantage of various energy assessment services offered by the DOE, the issue of workforce is harder to confront. Figure 1 shows the wide range of energy

efficiency workforce needs, from installation to operation and maintenance to plant management to energy engineers; and those are just within a manufacturing facility. Industrial energy efficiency relies in a broader sense on the larger energy efficiency community, which requires energy efficiency experts for energy modeling, audit services, research and development, education, and policy.

Figure 1. Relationship Between Workforce Expertise Level and Lag Time for Educational Programs



Source: Muller (2008)

Figure 1 also suggests the timeframe needed to train the different parts of the workforce. While installers can be trained in weeks or months, energy engineers can take four or more years to train. Few programs exist that meet the long-term needs of the energy efficiency workforce, and none of the programs target the whole range of the workforce. The program that comes closest to meeting these needs on a national level is the U.S. Department of Energy's Industrial Assessment Center program.

History and Results of the IAC Program

For over 30 years, the Industrial Assessment Center program has provided small and medium-sized manufacturing firms (with total annual utility bills between $100,000 and $2 million) with the technical assistance necessary to make important energy efficiency improvements in their facilities. There are currently 26 centers located at engineering universities across the country, each performing about 15 assessments per year. Staffed by faculty energy efficiency experts, the centers train undergraduate and graduate engineers to identify potential energy, waste, and productivity savings in manufacturing facilities.

To date, the IACs have performed over 14,000 energy assessments in all 50 states (IAC Database 2009). For each assessment, a group of students analyzes the company's utility bills before visiting the facility. The assessment includes a plant tour and meetings with key company representatives, from maintenance workers to plant managers to presidents and CEOs. The students regularly identify 10-20% energy savings in a single day at a facility by working with

plant personnel to find the most cost-effective projects with the greatest chance of being implemented. The students collect the data on the same day, and then write a technical report detailing the energy savings recommendations, which is provided to the company at no charge. The IACs have issued more than 100,000 individual recommendations, and almost half of them have been implemented by industry. Every year, manufacturing firms implement IAC recommendations that save a total of nearly $40 million per year, or over $70,000 per assessment (IAC Database 2009).

While the program has typically targeted smaller manufacturing firms, the expertise developed by the program was a crucial resource for the Save Energy Now initiative for energy-intensive manufacturers, launched by DOE in response to the hurricanes of 2005. Both of these initiatives demonstrate the effectiveness of manufacturing assessment programs in achieving energy savings and productivity enhancements, and both are highly respected and sought after by industry.

The IAC program has relied on the ingenuity and dedication of its academic partners to provide manufacturing firms with cutting-edge energy guidance. This ingenuity and dedication is one of the key reasons the program has been so successful. Even though there are certain rules and guidelines they must follow and targets the centers must meet, the IAC directors are allowed substantial liberty in how they run their centers. This flexibility allows each center to grow organically and develop a methodology and expertise that reflects their individual characteristics regarding geography, industry mix, and university setting. The centers can thus focus on the areas of expertise of the director and the needs of local industry. However, this freedom also can allow some good ideas and practices to fall between the cracks. One area of concern is coordination. There is not a great deal of shared knowledge among the centers, and partnerships with external organizations are sporadic. For example, while some centers may have a good relationship with their local CHP Regional Application Center (RAC) or their local Manufacturing Extension Partnership (MEP), many centers do not effectively use these available resources. Even fewer centers coordinate with local utilities, state energy offices, or manufacturing associations. While not every center may benefit from relationships with all these groups, there is no doubt room for improvement in this area.

Even though each IAC operates differently, their performance is continually monitored. The Center for Advanced Energy Systems (CAES) at Rutgers University oversees the entire IAC program and releases a quarterly report to the centers rating the IACs against each other using 20 different metrics such as implemented savings, number of recommendations, and involvement of teaching faculty (CAES 2009). These ranking metrics and subsequent feedback are another key to the success of the program, giving the centers incentive to continually improve their operations and adapt to the needs of industry.

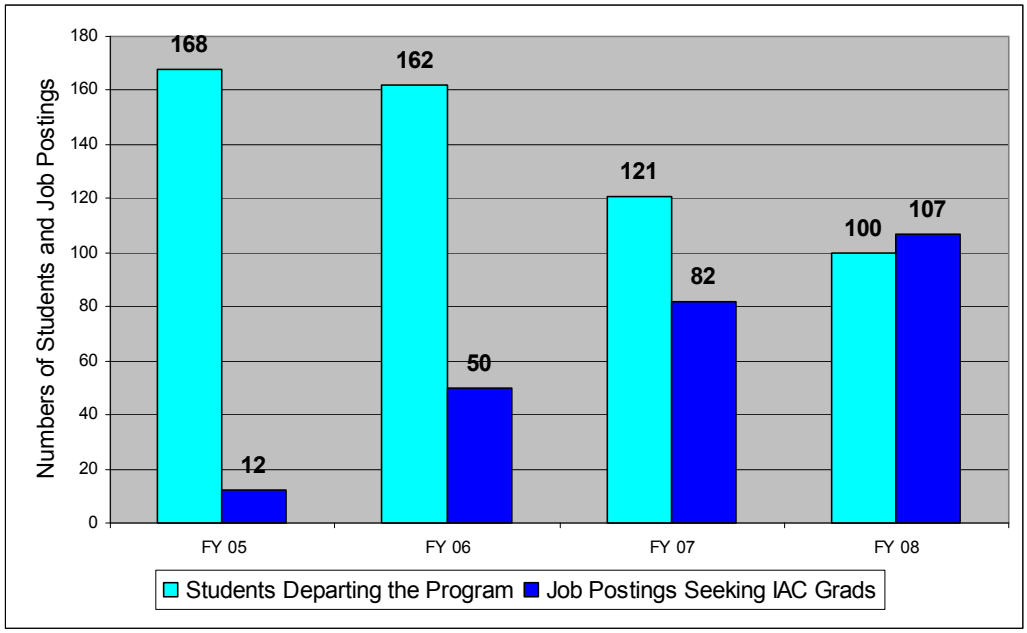
Workforce Development and Other Benefits

While the Industrial Assessment Center program could be justified based on direct savings alone, it has numerous other benefits. By situating the IACs at universities, engineering professors are funded to study energy efficiency. As a result, many of the IAC directors offer courses in energy systems and energy efficiency. The IAC program administration has estimated that for every student that goes through the IAC program, three additional students attend these classes and are exposed to energy issues (Muller 2009). Furthermore, many universities encourage or require research, leading IAC directors and students to contribute to the field of

energy efficiency science and research by publishing studies in peer-reviewed papers and journals. Another major benefit of the IAC program is the IAC Database. Maintained by Rutgers University, the database contains assessment and recommendation data going back to 1981. This is the largest and longest running database of industrial energy efficiency recommendation and implementation data. It is an invaluable tool for researchers, energy modelers, and industry alike.

Perhaps the IAC's biggest asset is its alumni. The program's university connections provide a much needed direct pipeline through which engineering students are prepared for careers focused on energy management and efficiency. It is this role that is so critical to the continued growth and strengthening of energy efficiency investments in the industrial sector. Over 2,500 students have been part of the IAC program, and over half of them take jobs directly dealing with energy issues (IAC Forum 2009). The demand for these well-educated, highly skilled, and adept energy engineers far outstrips the supply. Figure 2 below shows that while the number of graduating students has been declining due to budget cuts, the number of job requests on the IAC Forum have been steadily increasing. The part-year numbers for 2009 indicate that job posting will far exceed the number of students departing the program.

Figure 2: Total Student Departures versus Job Postings by Fiscal Year



IAC graduates are highly sought as plant energy managers, energy efficiency consultants, and energy-efficient design engineers, and for good reason. They are well-versed in the most up-to-date and cutting edge technologies and have a keen sense for improving energy efficiency in a wide range of applications including product design, project engineering, and organizational/facility energy management. On average, IAC students complete 18 assessments during their tenure, but many students complete as many as 30 or 40, and a few complete over 100 (IAC Forum 2009). This hands-on experience in various industrial settings—chemical, paper products, food, primary metals, assembly, and so on—gives them an edge over other graduates. IAC students are required to write detailed reports and present recommendations to plant personnel ranging from maintenance workers to CEOs. This helps the students develop

excellent verbal and written communication skills, further setting them apart. One recruiter lists the following reasons why hiring an IAC graduate straight out of the program is worth another engineer with several years of experience:

- *Technical proficiency*
  - *Engineering*
  - *Energy*
- *Real world experience*
  - *Audits*
  - *Manufacturing processes*
  - *Calculations*
  - *Presentations*
  - *Confident*
  - *Recognize opportunities*
  - *Leadership* (Licht 2008)

All things considered, the program has been among the most cost-effective and impactful of the federal energy efficiency programs. Despite the outstanding energy and cost savings by industry, unparalleled workforce development, and other auxiliary benefits, in recent years the IAC program has seen its budget cut in half from $8 million per year to $4 million per year. This reduced funding means fewer audits for industry and less experience for the students, but it also leaves the program struggling to stay afloat.

Proposal for an Expanded IAC

In addition to restoring funding to the IACs, the program needs to be expanded to meet the demand for IAC graduates. However, in order to train the next generation of energy engineers and technicians, the IAC program should be expanded in both size and scope. First, the network of IAC centers must be increased to meet the needs for assessment services, which currently are not being fully met. A number of universities exist that until recently had an IAC or still have a similar program. These schools could become centers within the next year, and other schools could develop programs in the following year as needed. In addition, the current centers could increase both the number of staff and students to perform more audits. Second, new program elements must be added to explicitly enhance the workforce development aspect. This proposal argues for increasing services and training to students as well as developing new types of centers and partnerships to train different levels of workforce.

Instead of a one-size-fits-all approach, we suggest there should be three different tiers of Industrial Assessment Centers. Five to ten of the best-performing centers should become *Centers of Excellence* (CoE). These centers would set local goals and help produce regionally-focused educational materials for their own staff as well as that of surrounding satellite centers (discussed below). These *Centers of Excellence* would be spread geographically to cover the needs of industry across the nation, and each CoE would develop internal expertise most relevant to the primary industries in their region. In addition to guiding the satellite centers, the CoEs would typically host the top talent among both staff and students. This expertise would allow them to expand into larger facilities or perform a more detailed assessment than the standard one-day audit. CoE students and staff could also develop methods to more effectively

incorporate other energy efficiency-related topics such as demand response into IAC audits to further reduce manufacturers' energy bills. While IAC audits already calculate savings from reducing peak load, a more strategic focus on demand response could not only provide further savings but also give students more energy experience.

Currently the IACs serve small and medium-sized facilities, which are ideal for students to learn about industry while providing useful recommendations to clients. It is important that the program continue to focus on small and medium-sized facilities, but expanding the scope to allow the CoE staff to visit larger facilities as well would increase the savings potential for the program and offer bigger challenges for the top centers.

The rest of the current IACs, and any new centers, would be satellite centers loosely affiliated with the local CoE. Satellite centers would serve similar purposes as the CoEs, but rely on each institution's internal expertise and require less administrative overhead. These satellite centers could serve as auditors for the local CoE in areas that may be underserved (or hard to serve geographically) by the CoE. The CoE would coordinate with other satellite centers to ensure regional needs are met. Satellite centers would be housed in universities and colleges with four year ABET[1]-accredited engineering programs.

The third tier would call for the creation of Technical Training Centers (TTC) at local community colleges, trade schools, and apprenticeship programs and bring them into the larger network centered upon the local CoE. The TTCs would not focus solely on assessments like the other IACs, but would instead concentrate on training and best practices to facilitate a workforce of installers, operators, and maintenance technicians who are fluent in current state-of-the-art energy efficiency technologies. A significant barrier to continued energy efficiency is having an on-the-ground workforce that is knowledgeable about energy efficiency. Students at this level would be encouraged to join audits at satellite centers or CoEs to get more in-plant experience. The students at the TTCs would also have the opportunity to continue their education at a satellite center or CoE.

Implementation of this proposal must be done carefully to preserve the unique aspects of the program that have made it such a success. The key aspect will be to enable the infrastructure for the IACs to grow organically into a form that best meets the needs of each center and/or region. It may make sense for the three tiers of IACs to operate differently in different areas. Working with community colleges, trade schools, and apprenticeship programs will be the biggest change from the current IAC model, so it will be important to take local concerns into consideration and not overly regulate the creation of these centers. Partial state funding, discussed below in the budget section, could play an important role here by creating local buy-in to the center network. A base number of satellite and community college/trade school IACs should be opened in every state or region, and additional centers could be opened if states offer to cost-share. States that want to invest in the program can secure additional benefits for its manufacturing sector. If no states offer matching funds there will still be a sustainable base of IAC centers and funding.

However, some operational aspects of the current IAC program, such as intercenter communications, need to be improved. Centers of Excellence must coordinate activities with their satellite centers and TTCs. Furthermore, Centers of Excellence should establish contact with their local RAC, MEP, state energy office, utilities, and manufacturing groups. Whether to

[1] The Accreditation Board for Engineering and Technology (ABET) assures "that a college or university program meets the quality standards established by the profession for which it prepares its students." (www.abet.org)

maintain these relationships should be left to the Center's discretion, but some contact should be made in order to find any possible mutually beneficial partnerships.

One key way to boost coordination with industry is to develop an internship program. After assessments are conducted, firms may have the option of bringing on an experienced student to work with the firm long term (all or part of a quarter or semester), assisting in the implementation of the recommendations that the original IAC assessments produce. Working with industry in this way would help improve the IAC's implementation rate, provide in-depth experience for the student, and give the company the extra engineering expertise it needs to see a project through to completion. The local Center of Excellence or partner organization would provide training and the introduction to the work. Firms that wished to participate in the internship program would provide the student with an orientation to the firm, and would fund 50% of the entire cost of training and placing the intern. The internship would provide the firm an ideal opportunity to recruit a trained and talented engineer—one who could become a new internal champion for energy efficiency within the firm. This concept has been well received by industry.

Finally, activities to enhance the student training experience should be expanded. This expansion could include program funding for students to attend conferences, do independent research, and take part in a number of training opportunities, such as DOE specialist, Certified Energy Manager, or training offered by manufacturing associations. Some of these were more common when funding was higher, but it is still critically important for IAC students to take part in professional development activities.

Budget and Impacts

The Industrial Assessment Centers are currently funded at $4 million annually. To fully expand the program into the better-serving Centers of Excellence network model, the program funding should be expanded over several years to the level of $40 million annually. Conservative estimates suggest full funding would produce annual implemented savings in the manufacturing sector of $150 million and train 1,300 students each year. We suggest a portion of the federal funding could be conditioned on state-level matching funds with this funding coming from state or utility industrial programs. A suggested breakdown of funding might be as follows: Each Center of Excellence would be funded at $750,000 to $1 million per year. Funding would depend on size of program and size of region served. There are currently about 10 centers that are positioned to become Centers of Excellence, which would cost a total of about $8 to $10 million. Funding approximately 30 satellite centers at $500,000 per year would cost about $15 million. It should be noted that currently each IAC only receives about $100,000. This is about half of what each center received before the budget cuts. The Technical Training Centers would be funded at $100,000 to $300,000 per year. About 50 of these TTCs would cost $10 million. The internship program would cost about $5 million and require a 50% employer match, providing the whole program with a $10 million annual internship budget.

Conclusion

The IAC program is a long-running and well-performing program that continues to achieve significant results despite budget cutbacks. It has three primary missions:

1. performing industrial assessments to help manufacturers save energy and cut costs to stay competitive,
2. contributing to the science of energy efficiency through research, and
3. training the next generation of energy engineers.

However, in order to break the barriers to energy efficiency in industry, which are primarily a lack of engineering expertise and an energy efficiency-trained workforce, the IAC program should be greatly expanded. Increasing the size of the program to train more energy engineers to meet long-term workforce needs, while also including community and colleges and trade schools to train equipment installers and operation and maintenance workers in energy efficiency best practices, will ensure that the workforce needs are adequately met.

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