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WASHINGTON STATE UNIVERSITY
EXTENSION ENERGY PROGRAM

Energy Efficiency Management Skills for Manufacturing:

Implications for Workforce Development in Washington State

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Washington State University Energy Program

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About the WSU Energy Program

The Washington State University (WSU) Energy Program is a recognized leader in energy research, development and technology transfer. The WSU Energy Program works with government agencies, power marketers, utility consortiums, educational institutions, private businesses and industries on projects that promote energy conservation, research, development of renewable energy sources, and economic and workforce development.

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Acronyms and Abbreviations

ACEEE	American Council for an Energy-Efficient Economy
AMO	U.S. DOE Advanced Manufacturing Office
AWS	American Welding Society
BCG	Boston Consulting Group
BLS	U.S. Bureau of Labor Statistics
BPA	Bonneville Power Administration
CEWD	Center for Energy Workforce Development
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ETO	Energy Trust of Oregon
HVAC	heating, ventilation and air conditioning
IAC	Industrial Assessment Center
ICT	information and communication technology
IT	information technology
ITTF	Information Technology and Innovation Foundation
JSP	Job Skills Program
MSSC	Manufacturing Skill Standards Council
NEEA	Northwest Energy Efficiency Alliance
NIMS	National Institute for Metalworking Skills
NORPAC	North Pacific Paper Corporation
NWFPA	Northwest Food Processors Association
NWPCC	Northwest Power and Conservation Council
PNCECE	Pacific Northwest Center of Excellence for Clean Energy
PPT	PowerPoint presentation software
PSM	Professional Science Master's degree
SCANS	Secretary's Commission on Achieving Necessary Skills, U.S. Department of Labor
SEP	Superior Energy Performance
SME	subject matter expert
STEM	science, technology, engineering and mathematics
U.S. CEEM	U.S. Council for Energy-Efficient Manufacturing
WBL	Work-based learning
WISER	World Institute of Strategic Economic Research

Executive Summary

The primary purpose of this study was to better understand the growing role that energy efficiency professionals perform in manufacturing operations, and to define the work functions, activities and required knowledge and skills of individuals in energy efficiency management. The study also sought to describe the industry context and implications that the growing emphasis on energy efficiency by manufacturers has on workforce education and training policies, priorities and programs.

Methods

The research team conducted a literature review, performed interviews with manufacturing industry leaders, and convened a focus group of individuals with energy management experience in manufacturing industries. A structured process and survey instruments were used to collect and analyze the qualitative and quantitative data that identify the critical work functions, key activities and ranking the occupational skills required of proficient energy efficiency managers. A review of the draft report by focus group participants and stakeholders, and an employer survey was implemented to verify the skills profile generated by the study.

Conclusions and Implications

A primary deliverable of the project was the systematic definition of critical work functions, key activities, and skills identified by energy efficiency experts from the manufacturing industry. Interviews with focus group participants and other industry experts and reviews of relevant research provided supplemental information from which the following conclusions and implications were derived.

Energy Efficiency Managers Drive Success

One message heard consistently during stakeholder interviews is that the position of manufacturing energy efficiency manager constitutes a critically important role. Without a champion to lead the cause of energy efficiency, it becomes much more difficult to accomplish conservation measures. The existing research and data collected for this study suggest that companies will continue to pursue energy efficiency goals, and more manufacturers are looking to energy efficiency initiatives to reduce operating costs and environmental impacts, and to be responsive to consumers who increasingly expect sustainable business practices from manufacturers. The development and availability of qualified energy efficiency managers will enable manufacturers to pursue those goals and help ensure that Washington manufacturers are competitive.

An Emerging Occupation

There is no clearly defined career or career pathway in place for a manufacturing energy efficiency manager in Washington, and this finding appears to hold true at the state and

national levels as well. The interviews and other data collected for this study suggest that the lack of a standard position description or career pathway for energy efficiency professionals in manufacturing is due in part to the evolving nature of the occupation. Across manufacturers, the occupation requires many similar attributes and skill sets, but currently there is not a high degree of uniformity among the companies included in the study about how the position can be ideally structured, or the precise range of roles and responsibilities the occupation should encompass. In short, the manufacturing energy efficiency manager represents a relatively new occupation in manufacturing organizations, especially as a dedicated position, and thus its structure and roles are still emerging and evolving.

One Size Does Not Fit All

The position of manufacturing energy efficiency manager is unique, even within similar types of industries, such as food processing and pulp and paper mills. There is no "one size fits all" definition of the position, even within the same manufacturing sector. As might be expected, the variation in position responsibilities and requirements among companies is also a function of the unique organizational structures, production systems, and operational features of each company. Similarly, the roles and expectations of energy efficiency managers can vary, depending on the importance attached to energy efficiency by corporate leadership, including whether energy efficiency is viewed as a primary or secondary goal. This study indicates that manufacturing energy efficiency managers need technical skills and experience along with the leadership and communication skills essential to draw together a team of people with varying skills and lead them in activities focused on the common goal of improving energy efficiency at the facility. The skills profile information developed by this project provides a foundation for identifying common functions, activities, and skills that cut across different types of manufacturing organizations.

Need for Greater Coherence

There is strong interest among the stakeholders interviewed for this report in creating a higher level of coherence for the manufacturing energy efficiency manager occupation, and in establishing a pathway structure that can be used to align workforce education and training in industry and among postsecondary education institutions. The critical work functions, key activities, competencies, and skills identified by this study provide a practical foundation for establishing a coherent structure for the occupation, which can also be used as the basis for structuring more cohesive position descriptions, career pathways, and industry training for incumbent workers. The results of this study should also help drive development of public education and training programs, educational pathways, and career guidance services that can prepare students for successful careers in this growing field.

Implications

As a national leader in the development of clean energy and energy efficiency, Washington has established a solid foundation for energy efficiency going forward, backed by aggressive goals for further efficiency gains as a strategy to meet projected future electricity load growth in the decades to come. This foundation of energy efficiency success has not been lost among Washington's manufacturers, many of whom have invested heavily in achieving energy conservation through the strategies and actions they have undertaken.

Aside from the many technology tools and enhancements that can be applied to enable improved efficiency in manufacturing, the results of this study show that a key success factor is the availability of a skilled energy efficiency manager to coordinate, lead, and facilitate the work inside manufacturing plants. Indeed, the input from leading Washington manufacturers suggests that while a number of employees have some role in helping to achieve energy efficiency results, more firms are looking to a dedicated manufacturing energy efficiency manager to serve in this pivotal role.

State Workforce Policy and Practices

Because the success of energy efficiency activities in manufacturing depends heavily on competent staffing to establish and manage project activities, state workforce development policies should support the development and use of education and training that reflects what manufacturing says it requires of competent energy efficiency managers. To that end, the findings and skills profile completed by this project can be used by workforce development system stakeholders as a tool to emphasize the importance of a skilled workforce.

The state should require that the skill profile created under this project be used as a foundation for the development of postsecondary education and training for future energy efficiency managers. Similar policies and practices already exist among the state's community and technical colleges, and among registered apprenticeship programs, which are required to incorporate industry-defined skill standards in proposing, developing, or improving workforce programs. In the future, project funding for workforce programs that target industrial energy efficiency should be required to incorporate the industry data generated by this study to guide new program designs, curriculum content, delivery options, and career development services.

Many of the functions and skills identified by this study are likely to be transferrable to other industrial environments, so the state should also encourage the use of the energy efficiency manager skill profile in other industrial settings where energy efficiency skills are required.

Long-term, state policy makers and workforce development partners should consider ways to incorporate skill profile information as part of the state's ongoing effort to align workforce and economic development strategies.

Industry Applications

Industry should be encouraged to adapt and apply the findings from this research. The study findings and skills profile information provides valuable context and a consistent approach to define the primary roles, functions, and activities of effective efficiency managers. Manufacturers should be encouraged to adapt and apply this research to define long-term goals, staffing requirements, and potential projects that a dedicated energy efficiency manager might be expected to lead.

For firms that are already engaged in efficiency projects, the data from this study provides a benchmark of functions, activities, and skills from which performance measurement, staffing requirements, and professional development options could be determined or updated. The skill profile could also be used by industry as a platform to engage regional education and training providers in discussions about industry's expectations and the structure and content of related preparatory programs.

Pathways and Programs

Colleges with energy efficiency training and education programs should use the results of this project to ensure that their current programs are aligned with the stated needs of manufacturing employers, and to strategize about ways that their program content, teaching tools, and delivery options can be most effectively combined to position program completers for success. For those institutions that anticipate starting new programs or incorporating some elements of energy efficiency into existing programs, the profile results can provide a useful reference for program enhancements and curriculum content.

The results of this study suggest that the pathway into the manufacturing energy efficiency manager position is not linear. Therefore, primary focus for employers should be on how to create pathways into the position for *current* employees who are gaining these experiences already and who, by virtue of their interests and qualifications, are best positioned to do this work.

A long-term issue to explore is how new and current energy efficiency management programs available through universities, community and technical colleges, and other training providers can most effectively structure their program content and learning experiences to support development of new energy efficiency professionals. The application of structured Work-Based Learning experiences should be encouraged so students can see how their training could lead to a career in energy efficiency, and to more fully engage manufacturing employers in developing a pipeline of future energy efficiency talent for their own organizations.

Workforce Stakeholders and Dissemination

The results of this skills profile project should be widely disseminated to workforce education and training partners, including industry, professional associations, and others who could benefit from the study findings.

Introduction

This study sought to understand the prevalence and importance of energy efficiency in manufacturing, with a primary focus on key energy efficiency work functions, activities, workplace competencies and skills needed in manufacturing operations. The study was designed to identify and define the workforce attributes of effective energy efficiency managers using a systematic process that relied on data and information received directly from industry experts.

The intent of this work was to accurately describe the roles and workforce requirements of energy efficiency professionals in manufacturing in order to provide timely information and tools that can be used to a) inform workforce development policy and practices, and b) the development or improvement of education and training programs for energy efficiency managers.

This study presents the following information:

- The study begins with an overview of energy trends and efficiency initiatives in industry and manufacturing, including a review of existing literature and resources related to energy efficiency in the manufacturing sector.
- A review of relevant research and a summary of interview data from manufacturing employers are then provided, followed by a description of the study methods.
- The study findings are derived from employer interviews, and the full-day focus group discussion with industry energy efficiency experts. These experts described and defined the core work functions, activities, knowledge and skills required of early-career energy efficiency managers in the manufacturing workplace.
- The conclusion summarizes the key findings and implications for energy efficiency workforce development policies and practices. These findings fill gaps in current knowledge about the work and requirements of manufacturing energy efficiency managers in manufacturing, and identify potential policy and programmatic changes that could improve the quality and responsiveness of the state's workforce education and training system to better support the energy efficiency goals and employment needs of manufacturers.

The Context for Energy Efficiency in Manufacturing

Manufacturing supports an estimated 17.2 million jobs in the United States—about one out of every six private-sector jobs. Nearly 12 million Americans (or 9 percent of the workforce) are employed directly in manufacturing.[1] Similarly, manufacturing in Washington provides employment for over 250,000 in the state, or more than 9 percent of all covered employment in the state.[2]

Manufacturing represents the economic backbone for many communities, providing good-paying jobs and career opportunities at all levels for individuals who possess the necessary qualifications and skills. Manufacturing in the U.S. and in Washington State is enjoying a resurgence as the economic recovery picks up speed and some manufacturers are bringing more of their off-shore operations and jobs back to the U.S.[3]

A key element of manufacturing's competitive advantage has been its ability to embrace and apply "Lean" manufacturing methods, which enable companies to boost quality and cut costs by improving manufacturing processes and reducing many forms of waste.[4] Although Lean manufacturing often includes reducing waste tied to energy use, Lean does not always explicitly include energy efficiency as an objective. In part, this is because Lean is typically aimed at improving production processes and operations. But many of the major industrial production systems currently used by manufacturers – whether to generate heat, steam, refrigeration, lighting, or to drive motors to power the production line itself – use enormous amounts of fuel and electrical energy.

Improvements aimed at complex industrial production systems are typically beyond the scope and expertise of most Lean initiatives because they are often large and technically-complex, requiring specialized knowledge and experience to diagnose problems, and to develop and implement effective solutions.[5] Although new technologies and process improvements have helped reduce the amount of energy wasted by manufacturers, there remains considerable energy savings potential in most companies. To remain competitive, especially as energy use and related costs continue to rise, companies are prioritizing energy conservation and efficiency to reduce energy-related costs.

Aside from cost considerations, another important reason for increasing efficiency is that the manufacturing sector accounts for a large proportion of total energy use in our nation, and in Washington State. The generation of electrical power, and the consumption of fossil-fuels used to generate power for industrial processes by manufacturers, contributes significantly to annual greenhouse gas emissions. While the exact figure varies among sources, manufacturing accounts for at least one quarter of the nation's total energy use.[6]

The news is not all bad: Industrial energy consumption actually decreased by 17 percent between 2002 and 2010, according to the U.S. Energy Information Administration (EIA), which regularly surveys the manufacturing sector regarding energy use.[7] Energy intensity in manufacturing, defined as energy consumption per unit of production, also experienced a relatively significant decrease during the same period. While a number of factors likely contribute to this decrease, many experts link energy efficiency efforts in the manufacturing sector to at least a portion of this improvement. An April 2013 brief by the Manufacturers Alliance for Productivity and Innovation noted about the EIA's survey that, "The sharp fall in manufacturing's intensity of energy use over an eight-year period suggests that increased energy efficiency was an important factor."[8]

Finally, public perception about environmental issues and manufacturing has begun to shift consumer demand for more 'green' products, but consumers are also more attuned to how those products are manufactured, especially concerning safety and environmental impacts.[9] Research suggests that there is a compelling business case for manufacturers to operate in a greener and more sustainable fashion, and more manufacturers are seeing how a greater commitment to sustainable manufacturing practices – which includes energy efficient manufacturing systems and processes – is having a positive impact on business success.[10]

The Pacific Northwest and Washington State

The Pacific Northwest region—and Washington State in particular—is a recognized leader in industrial energy efficiency programs, initiatives, and results. The regional impetus for this activity stems, in part, from a policy and regulatory environment that puts energy efficiency and renewable energy at the forefront of regional energy plans. Every five years the Northwest Power and Conservation Council (NWPCC) conducts an assessment of the region's long term electricity needs, and develops a power plan aimed at meeting those needs through a portfolio of traditional, clean energy and energy efficiency resources and activities.

The Sixth Northwest Conservation and Electric Power Plan (the Plan) address the risks and uncertainties affecting the region's electricity future. [11] The Plan accomplishes this, in large part, through an aggressive pursuit of conservation. Through energy efficiency and renewable energy sources, the plan proposes to meet 85 percent of the new load growth for electrical power in the region over the next 20 years. According to NWPCC, "If developed aggressively, this conservation, combined with the region's past successful development of energy efficiency could constitute a resource comparable in size to the Northwest federal hydroelectric system. This efficiency resource will complement and protect the Northwest's heritage of clean and affordable power" (p. 1).

The Plan is used to guide regional energy-related organizations such as the Bonneville Power Administration (BPA), the Northwest Energy Efficiency Alliance (NEEA), and the Energy Trust of Oregon (ETO) in their planning efforts for industrial energy conservation programs. These three agencies have been instrumental in developing successful programs in the residential, commercial, agricultural and industrial sectors throughout the Pacific Northwest that have helped to meet the conservation goals set out by the NWPCC.

The Value of Onsite Energy Efficiency Managers

These regional organizations have also sponsored successful initiatives that support onsite energy managers at manufacturing facilities in the Northwest, including in Washington State. Each agency's initiatives have been tailored to fit the needs of their individual constituents, but strong communication among the funders facilitates:

- Learning from each other's successes,
- Capturing and promoting best practices, and
- Helping manufacturers adapt their energy efficiency programs so they are successful.

Staff from BPA, NEEA and ETO interviewed for this study emphasized the importance of a skilled energy manager, which they defined as critical in helping ensure successful industrial energy management programs. Without someone to champion energy efficiency efforts for a company, it is often too difficult for staff to stay focused on implementing energy efficiency measures, let alone create an energy plan, and set and meet energy goals.

Each of these agencies has supported the development and codification of the onsite energy manager role, whether through pilot programs or specifically-funded positions. These agencies have demonstrated that the manufacturing energy efficiency manager is a position considered critical in helping to successfully meet energy efficiency goals set by industry, and regional stakeholders.

Workforce Solutions for Energy Efficiency in Manufacturing

The increased emphasis by consumers, companies and government agencies to bolster industrial energy efficiency has implications for how manufacturers organize to achieve their energy efficiency goals. More new technologies, process improvement methods, technical assistance and related programs, policies and resources are available than ever before to enable manufacturers to make efficiency gains. The U.S. Department of Energy (DOE) offers a variety of technical assistance resources, tools, and training to help manufacturers achieve greater energy efficiency. Other federal agencies such as the U.S. Environmental Protection Agency (EPA), and a number of state and local agencies and professional and trade organizations, also provide resources and training to support industrial energy efficiency.[12]

Regardless of how advanced and useful these external resources may be, achieving greater energy efficiency in manufacturing ultimately depends on the actions of individual companies and their leaders. Moreover, while top management and investors must support energy efficiency in principle – and by allocating resources to support efficiency work – the responsibility for diagnosing, assessing, and designing options to enhance energy efficiency in a manufacturing company ultimately rests on the expertise and initiative of a few key employees.

The background research and interview data collected for this project suggests that energy efficiency work, expertise and responsibility have historically been spread among a variety of employees who work as a loose-knit team on an as-needed basis. These teams may include managers, engineers, technicians, and maintenance and production staff, depending on the project. More recently, companies that place a high priority on energy efficiency have found it more effective to designate or hire a manufacturing energy efficiency manager to lead and coordinate the energy efficiency work at a manufacturing site or across multiple sites.

A New and Evolving Role

Research and industry input about energy efficiency management roles is fairly extensive, however the descriptions of responsibilities and expectations are often generic. Even where the energy efficiency manager exists as a dedicated position, the responsibilities and expectations can vary widely depending on the leadership, efficiency goals, challenges and type of manufacturing environment.[13] This finding is consistent with the data collected from industry experts for this report, who described the role of energy efficiency manager as "new and evolving."

A recent study by the American Council for an Energy-Efficient Economy (ACEEE) focused on energy efficiency in manufacturing, and specifically on the role of the energy manager.[14] The study conducted a review of five of the nation's more successful programs for onsite industrial energy efficiency managers. While the survey does not provide information on career pathways for this position, it does offer some important insights for the current study:

- Energy management, and the role of the onsite energy manager, is still fairly new to the industrial sector.
- The most effective energy managers require strong communication, motivation, and persuasion skills, and have financial acumen.
- Strategic energy management practices are very individualized – each company approaches the topic differently, and each energy manager is contracted differently.
- More research is needed to determine the best approach, and one that is more comprehensive, for establishing a full time, onsite energy manager.

Taken together, these findings suggest that the energy efficiency position – including the common functions, responsibilities, skills, and abilities – are not clearly understood. The expectations of manufacturing energy efficiency managers can vary widely depending on the circumstances. Based on our review of the literature and input from leading manufacturing employers, many of whom have invested heavily in industrial energy efficiency activities, no current research exists that has systematically defined the specific critical work functions, key activities, or knowledge and skills associated with the manufacturing energy efficiency manager position in the manufacturing industry.

The lack of systematic data on the functions, activities, and skill requirements of manufacturing energy efficiency managers limits the ability of companies to view the energy efficiency manager as an established position in industry, which may constrain the development of a regional labor supply for this position. Without a common understanding of the roles, responsibilities, and qualifications required by industry, it is also difficult for education and training providers to know how best to provide a cohesive, effective response to industry or workforce development needs for energy efficiency managers. Lack of clear, systematic information about industry's expectations, knowledge, and skill requirements also makes it difficult to attract students who might be interested in a related career in manufacturing. Students lack the information needed to identify career opportunities available in this growing professional field, or determine what kinds of education and training will best support their own career goals and employment options.

Finally, the manufacturing employers interviewed for this study each expressed that there is a need to better-define the foundational work functions, activities, and qualifications required of energy efficiency managers to help codify the occupation for manufacturing, build education and career pathways into the field, and help attract and prepare new professionals for energy efficiency careers.

Study Methodology

The WSU Energy Program team used best practices and rigorous academic standards for this study, based on prior experience with related research. Study methods included a combination of qualitative and quantitative data collection strategies and analyses, organized into three steps:

1. **Research and Industry Trends**: An extensive background review of existing reports, industry research, and other technical documents was conducted to identify manufacturing energy efficiency trends, resources, and related workforce development activities in industry and the manufacturing sector. These data provided the background and context for the study, and helped guide the overall project design, data collection instruments and report content.
2. **Stakeholder Interviews**: The authors interviewed 14 individuals over the course of this project, including experienced manufacturing energy efficiency managers, energy engineers, technical experts, company managers, corporate executives, and other knowledgeable individuals. Individuals representing professional and trade organizations such as The Northwest Food Processors Association, which was an early proponent for employing onsite energy managers, were also interviewed. Several Association member companies leveraged regional incentive programs that supported the employment of onsite energy efficiency experts. It was necessary to interview some individuals several times for clarification, to collect additional data, or to ask for referrals to other energy efficiency experts in the region. Interviews were conducted by phone or in person.
3. **Energy Efficiency Experts Focus Group and Data Collection**: On March 19, 2013, a day-long focus group comprising industry representatives from seven manufacturing companies was convened to collect data about industry trends in manufacturing energy efficiency and to better understand the role of a manufacturing energy efficiency manager. The companies selected to participate in the focus group were invited because of their recognized leadership in energy efficiency in the manufacturing industry. The diversity of company types selected helped to ensure that a range of manufacturing sectors and product types were represented. Three of the companies had received a Washington Industrial Energy Leaders award, presented by Governor Christine Gregoire in 2012, for their achievements in industry energy efficiency. Two of the other companies were nominated for the award that year.

   The focus group representatives came from:

   - **Boeing –** Boeing is the world's leading aerospace company and largest manufacturer of commercial jetliners and military aircraft combined. Boeing also designs and

manufactures rotorcraft, electronic and defense systems, missiles, satellites, launch vehicles, and advanced information and communication systems. Boeing has a strong focus on conservation, including energy management.

- **Campbell's Stockpot –** Stockpot, part of the Campbell Soup Company, manufactures soups, chili, entrees, and sauces. The $80 million, 220,000 square foot state-of-the-art facility in Everett, Washington opened in 2007, and has been very active in energy conservation programs and initiatives with their utility and other regional stakeholders.
- **Darigold –** Darigold is a farmer-owned milk products manufacturing company representing over 500 family farms throughout the Northwest. Darigold's processing plants produce milk, butter, sour cream, cottage cheese, and other dairy products. The company has been very actively involved in energy efficiency and other sustainability efforts at local, regional, and federal levels.
- **North Pacific Paper Corporation (NORPAC) –** NORPAC is the world's largest newsprint and specialty paper mill in North America. The facility operates around the clock to produce more than 720,000 tons of products annually on three of the world's largest and fastest paper machines. NORPAC is very active in sustainability and energy efficiency efforts, and in 2012 was awarded a Governor's Award for Leadership in Innovation through the first annual Washington Industrial Energy Leaders program.
- **Nucor Steel Seattle, Inc. –** Nucor Steel Seattle is a steel recycling facility that turns scrap steel into new steel products. The facility is the only steel mill in the state, and it makes 100 percent of its steel from recycled feedstock. The mill's energy footprint as a local producer is significantly lower than any product imported, especially imported internationally. Nucor received a Governor's Award for Leadership by Example through the first annual Washington State Industrial Energy Leaders program.
- **SEH America –** SEH America is part of the largest producer of semiconductor silicon in the world. The Vancouver, Washington, facility manufactures single-crystal silicon ingots, and polished and epitaxial wafers, and also provides service and engineering support for customers. SEH has been actively involved in energy efficiency efforts with their electric utility and other regional stakeholders for many years.
- **Shields Bag & Printing Co. –** Shields Bag & Printing Co. is a custom blown film extruder that extrudes, prints, and converts film for use in a wide range of industries. The facility manufactures more than 100 lines of flexible packaging products using the latest technological advances. Their energy conservation efforts

yielded Shields a Sponsor's Award for Leadership in Innovation through the first annual Washington State Industrial Energy Leaders Awards program.

Focus Group Process

Each focus group participant was regarded as a subject matter expert (SME) in their field by virtue of their extensive experience in energy efficiency management; each individual had at least seven years of energy efficiency experience in a professional capacity. All of the SMEs were directly responsible for some aspect of energy conservation activities at their companies, whether as a dedicated energy efficiency/conservation professional or as a technical or managerial expert where energy efficiency comprised a significant portion of their overall work responsibilities.

The focus group was facilitated by the authors, who provided a general introduction to the project goals and focus group data collection process (described in detail in the next section). The focus group meeting lasted eight hours. The data collection approach was a modified version of the systematic data collection process used for many previous energy-related skill standards projects directed by WSU researchers.[15]

Discussion topics introduced during the focus group event included:

- The emergence of the manufacturing energy efficiency manager position in manufacturing and other industries.
- The career pathways each SME pursued to become an energy manager.
- How the increasing focus on manufacturing energy efficiency impacts business priorities for industry, and the various approaches that individual companies choose to accomplish their goals.
- The roles that an energy manager plays within a manufacturing company.
- The specific work functions, activities, occupational skills and basic workplace competencies required of experienced energy efficiency managers in manufacturing.

Data Collection Process

Critical Work Functions and Key Activities

The first step in the focus group process was to identify the primary functions and key activities that constitute the work of a competent energy efficiency manager. The targeted level of experience was set at between three and five years of experience, which focus group participants and other industry experts identified as the minimum level for professionals in this occupation.

To leverage existing research and avoid duplication, the authors generated a draft of sample critical work functions and key activities for the focus group meeting. The draft was derived

from an analysis of background research, existing skill standards from related industry and occupational sectors, and input from industry experts. The focus group used this draft document as the basis for its initial review of the work functions and activities of energy efficiency managers. Throughout the course of the meeting, participants jointly revised and adapted the draft functions and activities to reflect the requirements of a competent manufacturing energy efficiency manager. Participants freely made changes and recommendations, and agreed as a group on the content of the document.

Occupational Skills

The next step was to identify the key occupational skills associated with each of the critical work functions defined by the group. These skills were deemed important to the job performance of a competent energy efficiency manager. Once identified and confirmed, participants were asked to rank-order each skill by the level of importance needed to perform the associated critical work function. Individuals reported their scores, which were recorded, analyzed and summarized for the report (see Table 1 and Appendix B).

Workplace Competencies

A survey of workplace competencies was administered to focus group members to measure the basic competencies required of workers in any workplace setting. This survey was developed by the authors[16] and has been used regularly to establish basic competencies for other industry-defined skill profiles and occupational skill standards. A sample of experienced energy efficiency managers and other SMEs with specific knowledge of the manufacturing energy efficiency manager role also received the survey to help verify the competencies. Twenty-two surveys were returned. Survey results are provided in the next section of this report.

Review and Verification

A draft of the critical work function and key activity data charts and tables generated by the focus group was circulated for review by all focus group participants. Modifications were made to correct factual errors or omissions identified by participants, and new information suggested or provided by reviewers was added to the report where appropriate.

A verification survey of critical work functions and key activities was sent to a sample of experienced energy efficiency managers and other SMEs with specific knowledge of the manufacturing energy efficiency manager role. All critical work functions and key activities were verified, and each key activity was rated for its level of importance. Response data were compiled and averaged to find the level of importance of each critical function. Surveys were returned from 24 participants representing 18 employers. The results from the focus groups, surveys and feedback were compiled and analyzed, and a draft of the final document was reviewed by the focus group participants and other project stakeholders.

Results

Stakeholder Interview Summary

Portions of the qualitative data derived from industry interviews and the focus group discussion are summarized here and in other sections of this report.

Energy Efficiency Managers: Common Types

A common theme emerging from the focus group discussion, and among the companies interviewed for this study, is that there are typically two types of energy managers found in many manufacturing organizations who are actively-pursuing energy efficiency goals:

- An on-site energy manager – often referred to as an energy "champion," and
- A corporate-level energy manager.

Below is a brief summary of each type of energy efficiency professional, as described by focus group participants and interviewees. It should be noted that many variations of each type were identified by respondents. However, there respondents generally agreed that these two descriptions accurately depict the general structure and roles of positions most common to the manufacturing industry.

Plant Energy Efficiency Champion

The energy champion is typically positioned at a single manufacturing facility. Their energy efficiency management roles and tasks are often add-on responsibilities to an established job, such as manufacturing engineer or technician, operations manager, or maintenance supervisor. Because this role requires extensive coordination with other plant-level and external technical experts (consultants, equipment vendors, or other technically-specific specialists), the energy champion role is best served by someone who has a passion for efficiency, and has strong motivational and leadership skills.

Technical experience is less important for these individuals; what matters most is the ability to draw together a team of people with varying skills, and lead them in activities focused on the common goal of improving energy efficiency at the facility. One of the managers interviewed for this study reported that in his early role as corporate energy manager, he used to think the best candidate for an energy champion would be someone who possessed strong technical skills. In the six-plus years he has been managing the company's corporate energy program, he has come to understand that the most important trait for a successful energy champion is that they possess outstanding people and communication skills and strong leadership abilities. From his perspective – which is consistent with reports from other respondents – technical skills are important, but secondary to the overall job performance and effectiveness of a competent energy champion.

Respondents asserted that, to be effective, energy champions need to be well-respected by their team and their peers, a condition that is earned through job experience, recognized expertise in their occupation, and a network of solid interpersonal relationships with work colleagues across the facility. Champions must:

- Demonstrate a passion for energy efficiency work,
- Schedule time to help create an energy plan for the team, and
- Lead the team towards successfully meeting goals created in the energy plan.

Finding time to engage in energy efficiency activities is probably the most difficult part of this position, but providing opportunities to recognize the energy champion's achievements – especially at the corporate level – has succeeded in encouraging and maintaining their commitment.

Corporate Energy Efficiency Manager

The second type of energy manager works more closely at the corporate level. These energy managers are often assigned to one or more industrial facilities in a service territory, and often their duties are exclusively focused on establishing, managing and achieving energy efficiency goals. These individuals often possess a higher-level of technical skills and awareness than plant-level energy champions/managers. Most have desirable technical qualifications, and four-year or advanced degrees, and extensive experience in manufacturing or engineering positions or technical management.

As with plant energy efficiency champions, respondents identified that corporate energy efficiency managers must have strong leadership skills and the ability to bring people together to work toward a common goal.

An Undefined Pathway

When asked about the typical career and educational pathways of professionals in either type of position, the consensus among interviewees – and the descriptions of career trajectories by focus group participants – suggests that a clearly-defined pathway for these professionals does not yet exist or, at the very least, it is not well-defined. Interviewees generally agreed that many energy efficiency professionals simply "end up" in their jobs out of personal interest and a foundation of accumulated work experience, rather than through a deliberate effort to pursue employment in this field or through a specific educational program that prepared them for a career in energy efficiency. Additional discussion about career pathways for manufacturing energy efficiency managers is presented later in the report.

The broad range of backgrounds, experience and qualifications of each of the seven focus group participants helps to underscore the wide diversity of career pathways among established

energy efficiency managers in manufacturing. Prior to his current position, one participant started as a lobbyist and human resources representative. Another participant had worked as an urban planner. A third had a four-year liberal arts degree, arriving in his position through a production job. Four of the focus group participants were trained as engineers but none began their careers in energy efficiency.

Focus Group Results

Career Pathways, Evolution of Position

Focus group participants and interviews with other industry experts revealed that the manufacturing energy efficiency manager position is usually filled by someone working onsite in a mid-level position with three to five years of experience in manufacturing energy efficiency. Most often, the position would be promoted or filled from within the company.

It became clear during the focus group session that, while the manufacturing energy efficiency manager is an important role, it is not well understood and a uniformly accepted definition of the position does not yet exist. Even among companies that currently support an energy manager or champion, priorities of the position varies greatly from company to company, as does the pathway it takes for employees to fill these positions. The concept of energy management and the role of a manufacturing energy efficiency manager are growing in importance and popularity, but there is no standard pathway to educate this type of employee. While there is some similarity in foundational knowledge for energy managers across the industry, their educational background and specific roles vary tremendously within the manufacturing sector, and even within similar types of industrial companies, such as food processing and pulp and paper manufacturing.

As an example, in the food processing sector, the facility's thermal load (i.e., processing equipment such as boilers and ovens that are powered by gas rather than electricity) may comprise upwards of 90 percent of the company's annual energy costs (depending on the type of food being processed). Other types of industries that rely more on motors, compressed air, and refrigeration to process their products have a much higher electric load. As a result, the priorities of a facility that relies heavily on thermal-powered processing equipment will be very different from those of facilities that use primarily electric-powered processing equipment.

In summary, there is no existing career pathway for this position. Because the manufacturing energy efficiency manager position is growing in popularity and demand, there is potential – and some would argue a need – for creating defined career and educational pathways for this position. Many of those interviewed for this study expressed an interest in further study on ways to create a career pathway. Further research is warranted to accomplish this goal.

Sample Job Description: Manufacturing Energy Efficiency Manager

Because every company has different priorities based on type of manufacturer and the kinds of goods they produce, the following description is included simply as an example of tasks and requirements that may be needed to fill this position.

Summary

The manufacturing energy efficiency manager is a mid-level position working in an industrial manufacturing plant, responsible for identifying, implementing, and tracking energy conservation at the plant. Responsibilities include: managing energy team and stakeholder interactions; setting and tracking energy goals; identifying and implementing energy efficiency improvements; managing conservation project resources; tracking and reporting energy consumption and savings; and coordinating education, training, and awareness – internally and externally.

Primary Duties

A manufacturing energy efficiency manager may perform any combination of the following tasks:

- Promote team building and leadership activities
- Write/edit plans, proposals, outreach materials, and other documents
- Develop and deliver presentations
- Utilize software tools – Excel, Word, PowerPoint, charts, graphs, and other electronic media
- Provide and promote clear communication – verbal and written
- Facilitate meetings
- Perform and apply energy calculations and policy analysis, forecasting and modeling of energy use, and basic business accounting tasks
- Resolve conflicts among plant staff, vendors, and other stakeholders
- Manage education and training opportunities for staff

Minimum Qualifications

Typically requires three- to five-years of experience in a manufacturing environment. Basic understanding of energy concepts, Strong communication (oral and written), and negotiation skills required. Strong leadership skills and ability to work in team environment important. Relevant postsecondary education/training or degree is preferred.

Skill Profile

This section presents the results of the focus group data collection and analyses. A sample job description is provided based on input from SMEs and stakeholders. Data summaries depicting critical work functions and key activities are provided in Table 1. A list of occupational skills identified for each critical work function and prioritized by SMEs is provided in Table 2.

The following tables represent a consensus viewpoint of SMEs who participated in the initial focus group meeting. This information was subsequently modified, and then verified by a sample of industry stakeholders. It is important to note that neither the critical work functions (CWF) nor the key activities (KA) are organized in a specific sequence. This is because each company may organize the work of energy efficiency managers differently.

Each chart in the following skill standards template contains the components defined here:

Critical Work Functions

Critical work functions represent the general tasks that a fully competent manufacturing energy efficiency manager with approximately three to five years of experience would perform.

Key Activities

Key activities are the tasks related to the critical work functions, composed of work activities that are measurable and observable and that result in a decision, product, or service.

Occupational Skills

Occupational skills include technical and non-technical skills required for competent job performance by an experienced employee.

Employability Skills

Employability skills are basic academic and personal skills that are needed to build more advanced competencies. They are required by all workers to obtain meaningful work and to participate in the modern workplace.

Level of Importance

Professionals who are actively working in this occupation rated the level of importance for each critical work function and key activity through a verification survey. Values ranged from not important to critical. Survey responses showed that all critical work functions were rated as important, very important, or critical.

Table 1. Skill Profile for Manufacturing Energy Efficiency Manager

Note: Critical Work Functions and Key Activities are not listed in order of priority or work flow sequence

Critical Work Functions	***Key Activities***								
A. ***Manage energy team/stakeholders***	*A1* *Ensure tasks/ activities are completed on time and within budget*	*A2* *Facilitate team and stakeholder meetings*	*A3* *Resolve conflicts*	*A4* *Ensure effective time management*	*A5* *Organize team/stakeholder work*	*A6* *Provide leadership and support*	*A7* *Engage in strategic planning and set priorities*	*A8* *Conduct and promote team building*	
B. ***Develop and track energy goals, plans and proposals***	*B1* *Perform fundamental electrical, mechanical and process calculations and analyses*	*B2* *Write and edit proposals and planning documents*	*B3* *Ensure that fundamental energy concepts are embedded in plans and proposals*	*B4* *Organize necessary plan/proposal information, resources and documents*	*B5* *Conduct and interpret energy and policy analyses; incorporate trends in energy markets*	*B6* *Generate graphs, charts and other energy trend information*	*B7* *Engage in strategic planning, and forecasting, and modeling of energy usage*	*B8* *Apply and integrate business fundamentals in plans and proposals*	
C. ***Develop and manage project resources and opportunities***	*C1* *Conduct project costing, financial and data analyses*	*C2* *Communicate project resources and information verbally and in writing*	*C3* *Facilitate and support plant economic analyses*	*C4* *Perform and apply project research*	*C5* *Perform and apply project technical analyses*	*C6* *Conduct and oversee project management activities (budgets, schedules, scope)*	*C7* *Identify and define technical requirements and staff expertise*	*C8* *Coordinate/ lead project management*	*C9* *Find and eliminate energy wastes through continuous efficiency improvements*

Critical Work Functions	*Key Activities*								
D. ***Manage identification and implementation of conservation measures***	*D1* *Conduct computational analyses and interpretation of conservation data*	*D2* *Organize measurement documents, resources and tools*	*D3* *Provide and promote clear and effective communication*	*D4* *Ensure the use of common energy systems, measures, and terminology*	*D5* *Apply assessments and measures for building (facility) energy systems*	*D6* *Facilitate project management activities, including scheduling*	*D7* *Generate electronic energy information (Excel data, PPT, charts, graphs)*	*D8* *Perform basic business accounting tasks (ROI, budgeting)*	
E. ***Track and report on energy consumption/ savings***	*E1* *Conduct goal setting and planning activities*	*E2* *Perform data analyses and interpretation using software tools*	*E3* *Conduct and facilitate energy report/data presentations*	*E4* *Write technical reports*	*E5* *Develop and maintain accurate records and documentation*	*E6* *Manage and ensure data accuracy*	*E7* *Benchmark energy usage and measure performance against baselines*	*E8* *Optimize energy systems performance*	
F. ***Communicate with colleagues and stakeholders***	*F1* *Communicate technical and programmatic information verbally, electronically and in writing*	*F2* *Facilitate meetings and other events*	*F3* *Document and track team decisions, agreements, actions, and results.*	*F4* *Engage in networking activities with colleagues and stakeholders*	*F5* *Resolve conflicts*	*F6* *Develop and deliver presentations*			
G. ***Develop/coordinate/ deliver education, training and awareness to colleagues and stakeholders***	*G1* *Develop/create visual communication tools (posters, signs, PPT, other electronic media, etc.)*	*G2* *Facilitate engagement of colleagues and stakeholders*	*G3* *Write technical documents*	*G4* *Develop and deliver presentations*	*G5* *Conduct or oversee education and training*				

Table 2. Summary of Occupational Skills and Priorities by Critical Work Function

Note: Occupational Skills are listed in order of priority, based on the average scores of ratings given by SMEs.

Critical Work Functions and Associated Occupational Skills
Critical Work Function A: Manage Energy Team/Stakeholders
1. Communication: verbal, written, technical
2. Leadership skills
3. Organizational skills
4. Time management
5. Facilitation skills
6. Setting priorities
7. Strategic planning
8. Team building
9. Reading and comprehension proficiency
10. Conflict resolution
Critical Work Function B: Develop and Track Energy Goals, Plans and Proposals
1. Solid basic math, algebra, statistics, data, analysis
2. Fundamental energy concepts knowledge
3. Analytical and policy interpretation skills
4. Strategic planning
5. Trending software skills (generate graphs, charts)
6. Fundamental electrical, mechanical and process skills
7. Organizational skills
8. Business fundamentals
9. Writing skills
Critical Work Function C: Develop and Manage Project Resources and Opportunities
1. Project management (budgets, schedules, scope)
2. Communication skills: verbal and written
3. Analytical skills
4. Solid data analysis: algebra, simple statistics, basic project costing, financial calculations
5. Ability to understand plant economics
6. Ability to define technical requirements and expertise
7. Project management software skills (GANTT charts, etc.)
8. Research skills

Critical Work Functions and Associated Occupational Skills *(continued)*
Critical Work Function D: Manage Identification and Implementation of Conservation Measures
1. Team leadership
2. Presentation skills
3. Basic business accounting (ROI, budgeting)
4. Verbal communication skills
5. Data interpretation skills
6. Basic math and algebra skills
7. Organizational skills
8. Project management skills/scheduling
9. General understanding of building (facility) energy systems
10. Knowledge of energy systems and units terminology
11. Computer skills (Excel, PPT, charts, graphs)
Critical Work Function E: Track and Report on Energy Consumption/Savings
1. Goal setting and planning
2. Technical writing skills
3. Attention to detail
4. Organization
5. Data presentation skills
6. Ability to keep accurate records
7. Strong Excel/PPT/charting skills
8. Ability to use data – charting techniques and formats
9. Data interpretation and analytic skills
Critical Work Function F: Communicate (Written, Meeting Facilitator)
1. Conflict resolution
2. Ability to network
3. Result focused (as opposed to task focused)
4. Enthusiasm, self-confidence
5. Willingness to take ownership
6. Ability to respect fellow members point of view (rhetorical sensitivity)
7. Time management skills/task management
8. Facilitation skills
9. Basic understanding of operation and process flow
10. Technical writing skills
11. Proficient reading & interpretation skills
12. Documentation skills (decisions, agreements, actions, etc.)
13. Presentation skills (preparing information, PPT)

Critical Work Functions and Associated Occupational Skills *(continued)*
Critical Work Function G: Develop/Coordinate/Deliver Education, Training and Awareness (Internal/External)
1. Ability to adjust to various schedule requirements (flexibility)
2. Technical writing skills
3. Recognizing target audience
4. Basic understanding of operation and process flow
5. Basic computer skills: Microsoft Office
6. Ability to motivate engagement of colleagues and stakeholders
7. Develop and create visual communication tools (posters, signs, PPT and other electronic, etc.)
8. Oral communication skills (includes group presentations)

Workplace Competencies – SCANS

Workplace competencies are basic academic and foundation skills needed to enter and advance in the work world. These competencies are based on input from a large national survey of employers across several broad workplace categories, which culminated in the 1991 report known as SCANS (*Secretary's Commission on Achieving Necessary Skills*, U.S. Department of Labor). The report identifies 37 foundation and workplace competencies required for work readiness that have been used widely for workforce policy and program development in industry and education.

The competencies are comprised of a three-part foundation of skills and personal qualities, and five workplace competencies needed for successful job performance in today's workforce (as listed in Table 3).

Table 3. SCANS Skills

Basic Skills	Thinking Skills	Personal Qualities	Worksite Competencies
Reading	Creative Thinking	Responsibility	Utilizing Resources
Writing	Decision Making	Self-worth	Interpersonal Skills
Arithmetic	Problem Solving	Sociability	Utilizing Information
Listening	Visualization	Self-management	Using Systems
Speaking	Knows/Learns	Integrity/Honesty	Using Technology
	Reasoning		

Manufacturing energy efficiency managers and other SMEs working in the field were asked to identify the level of competency for each of the 37 SCANS skills most often required for successful workplace performance. The *ADVANCE™ Workplace Standards Skill Inventory* was used to capture industry views on foundation skills for manufacturing energy efficiency managers. Sample survey questions are provided in Figure 1.

The information provided in Table 4 was compiled by taking a weighted average of all responses. This summary information provides a general measure of the basic workplace competencies required of energy efficiency managers and serves as a supplement to the technical skills identified in the energy efficiency manager skill profile.

Workplace Competencies Survey Results

A survey of SCANS skills and personal qualities for manufacturing energy efficiency managers was administered to focus group members, and later to a larger sample of employees serving in the role of energy manager or energy champion across the region. A total of 22 SCANS competency surveys were returned, and survey results follow.

The resulting scores indicate that respondents viewed nearly every quality as being of relative importance for energy managers, with the ability to work with and understand quantitative data scoring the highest. This is important when calculating energy costs and savings, and return on investment. However, the qualities that consistently placed among the highest priorities were qualities such as confidence, being a team player, self-motivation, and problem solving.

This reinforces what was learned during the interviews with industry stakeholders; namely, that technical skills are important, but even more important is that a successful energy manager should possess outstanding people and communication skills, and strong leadership and team player abilities. While not all energy managers will be required to perform complicated engineering analysis, they do need to be able to relate to and collaborate well with energy engineers.

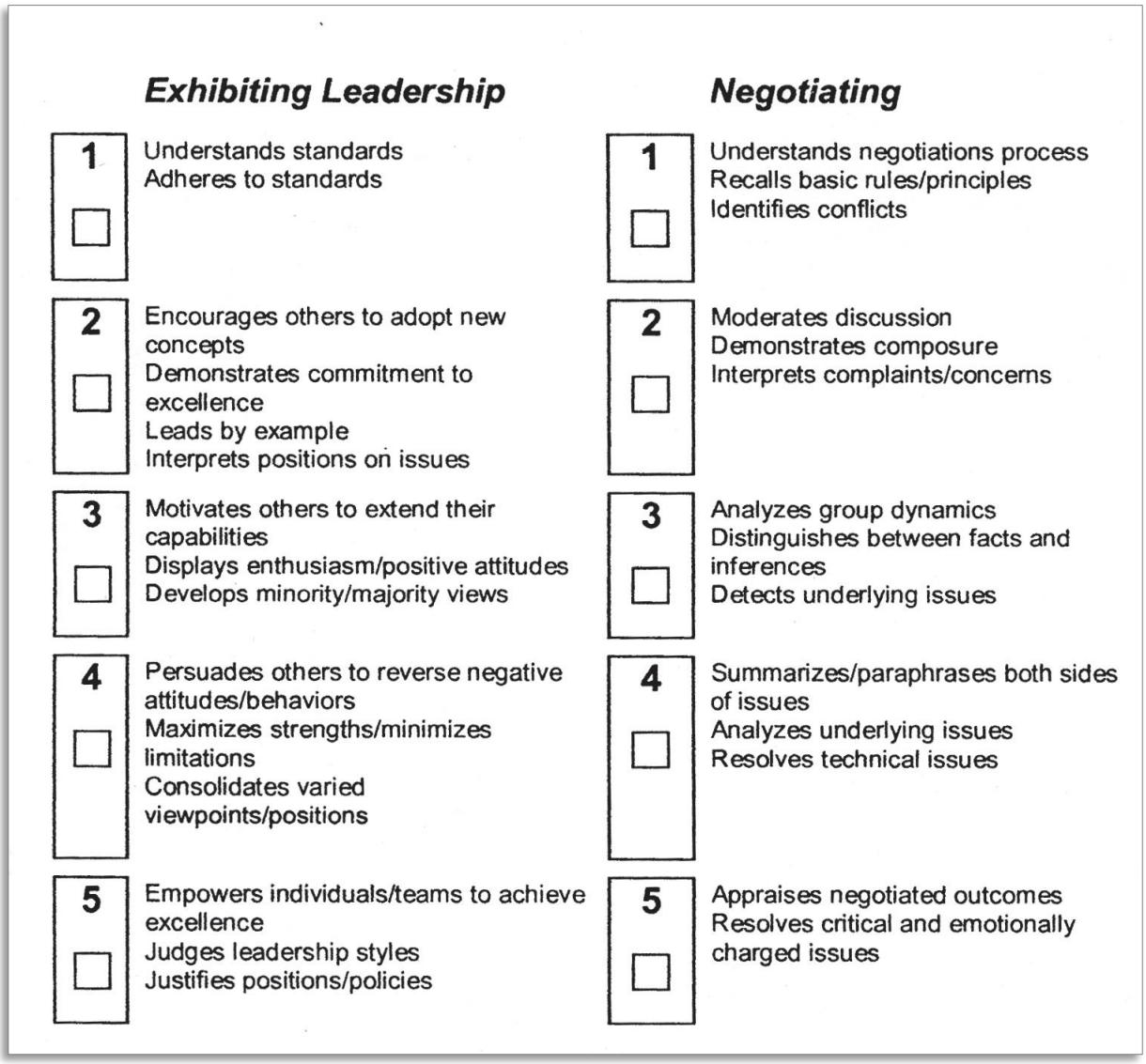


Figure 1. Sample Survey Questions from the ADVANCE™ Workplace Standards Skill Inventory

Table 4. SCANS Survey Results: Manufacturing Energy Efficiency Manager

Foundation Skills and Personal Qualities	Key: 1 = Basic Competency Level, 5 = Advanced Competency Level					Critical Competencies
	1	2	3	4	5	
Basic Skills						
Demonstrates Effective Reading Strategies						Identifies relevant details, facts, specifications, follows set of instructions, probes to gain knowledge/information and qualifies/analyzes information.
Demonstrates Effective Writing Strategies						Completes forms, writes simple documents and summarizes/paraphrases information.
Applies Arithmetic Processes						Performs basic computations; records and interprets numerical data.
Applies Mathematics Processes						Utilizes mathematical formulas and processes, summarizes and translates mathematical data.
Demonstrates Effective Listening Skills						Listens attentively, confirms information and interprets, clarifies and influences communication.
Demonstrates Effective Speaking Skills						Communicates appropriate messages, presents complex ideas and information; analyzes individual responses.

Table 4. SCANS Survey Results: Manufacturing Energy Efficiency Manager (cont'd)

Foundation Skills and Personal Qualities	Key: 1 = Basic Competency Level, 5 = Advanced Competency Level					Critical Competencies
	1	2	3	4	5	
Thinking Skills						
Applies Creative Thinking, Generates Ideas						Paraphrases/summarizes existing ideas, demonstrates creative thinking while problem solving and develops creative solutions.
Applies Decision-Making Strategies						Applies rules and principles to the situation; gathers information and analyzes the situation and information.
Recognizes and Solves Problems						Understands and appropriately refers the complaint or discrepancy; examines information, analyzes possible causes and recommends action plan.
Demonstrates Visualization						Applies appropriate principles to situation and uses previous training and experience to predict outcomes.
Knows How to Learn						Draws upon experiences and prior knowledge, interprets and applies new knowledge and experience.
Applies Reasoning Skills						Identifies facts, principles, and problems; applies rules/principles to procedure, uses logic to draw conclusions.

Table 4. SCANS Survey Results: Manufacturing Energy Efficiency Manager (cont'd)

Foundation Skills and Personal Qualities	Key: 1 = Basic Competency Level, 5 = Advanced Competency Level					Critical Competencies
	1	2	3	4	5	
Personal Qualities						
Demonstrates Responsibility						Performs assigned tasks, pays attention to details, works with minimal supervision, demonstrates enthusiasm, optimism and initiative.
Demonstrates Belief in Self Worth						Responds assertively, defends own beliefs and viewpoints, accepts constructive criticism and responsibility for own behavior and understands own impact on others.
Demonstrates Sociability in Groups						Responds appropriately to others; willingly helps others and establishes rapport with co-workers and customers; modifies behavior to environment and shows understanding/empathy for others.
Demonstrates Self-Management						Maintains self-control, demonstrates commitment to self-improvement, and applies self-management skills.
Demonstrates Integrity/Honesty						Demonstrates honesty and trustworthiness, accepts responsibility for own behavior, demonstrates commitment to personal improvement and recommends ethical course of action.

Table 4. SCANS Survey Results: Manufacturing Energy Efficiency Manager (cont'd)

Foundation Skills and Personal Qualities	Key: 1 = Basic Competency Level, 5 = Advanced Competency Level					Critical Competencies
	1	2	3	4	5	
Management of Resources						
Manages Time						Starts on time; performs a given set of tasks; efficiently manages time and adjusts schedule as required by supervisor.
Manages Money						Reconciles daily receipts and payments; performs routine recordkeeping.
Manages Materials/ Facilities						Maintains job-specific supplies and equipment.
Manages Human Resources						Recognizes job tasks and may distribute work assignments.
Management / Use of Information						
Acquires and Evaluates Information						Selects and obtains information relevant to the task; predicts outcomes and analyzes data.
Organizes and Maintains Information						Interprets information and applies processes to new information.
Interprets and Communicates Information						Recognizes accuracy of information, interprets information, and prepares basic summaries.
Uses Computers to Process Information						Performs basic data entry; utilizes integrated/multiple software tools; locates information and retrieves stored data.

Table 4. SCANS Survey Results: Manufacturing Energy Efficiency Manager (cont'd)

Foundation Skills and Personal Qualities	Key: 1 = Basic Competency Level, 5 = Advanced Competency Level					Critical Competencies
	1	2	3	4	5	
Interpersonal Skills						
Participates as Team Member	■	■	■	■		Actively participates in team activities and assists team members; demonstrates commitment and works to improve team skills.
Teaches Others	■	■	■	■		Models proper performance and attitudes; identifies training needs and conducts task-specific training.
Serves Customers	■	■	■			Demonstrates sensitivity to customer concerns and complaints; analyzes customer needs and demonstrates commitment to customer; relates to customer fears and concerns.
Exhibits Leadership	■	■	■	■		Adheres to standards; encourages others to adopt new concepts; demonstrates commitment to excellence and leads by example.
Negotiates Agreements	■	■	■			Understands negotiations process; identifies conflicts and demonstrates composure; interprets complaints and concerns.
Works with Diversity	■	■	■	■		Understands the legal aspects of discrimination; respects the rights of others and demonstrates awareness of diversity.

Table 4. SCANS Survey Results: Manufacturing Energy Efficiency Manager (cont'd)

Foundation Skills and Personal Qualities	Key: 1 = Basic Competency Level, 5 = Advanced Competency Level					Critical Competencies
	1	2	3	4	5	
Understanding/Management of Systems						
Understands System						Understands the organization and system hierarchy, follows procedures, and recognizes system strengths and limitations.
Monitors/Corrects System Performance						Monitors system performance, analyzes system operation, and distinguishes trends in performance.
Improves/ Designs Systems						Suggests system modifications/improvements and determines system components to be improved.
Use of Technology						
Selects Appropriate Technology						Knows available technology and understands the requirements of the task and technological results.
Applies Technology to Task						Understands technology applications and follows proper procedures; understands the operation/interaction.
Maintains/ Troubleshoots Technology						Identifies symptoms and follows maintenance procedures.

Verification Survey Results

Verification surveys were administered to determine if the critical work functions and tasks identified by the SMEs would be verified by a broader sample of stakeholders currently serving in an energy manager position. A total of 24 completed surveys were received. Figure 2 shows the results of the verification survey input from SMEs and stakeholders currently serving in positions similar to that of a manufacturing energy efficiency manager. The average scores for each critical work function are rated on a scale from 0 (not important) to 4 (critical), with associated standard deviations (variation) computed for each item. These results generally verify that the critical work functions included in the skill profile document are relevant to the industry at large.

Figure 2 shows the results of the verification survey input SMEs and stakeholders currently serving in positions similar to that of a manufacturing energy efficiency manager. The average scores and standard deviation (variation) for each critical work function are rated on a scale from 0 (not important) to 4 (critical). These results generally verify that the critical work functions included in the skill profile document are relevant to the industry at large.

The results in Figure 2 show that *Critical Work Function E-Track/Report Energy*, rated among the highest by just a slight margin. This area also showed the largest variation (standard deviation) in scores across all respondents. This variation is only slightly larger than the average for all items, and likely represents the varied priorities of Manufacturing Energy Efficiency Managers among different companies. The lowest rated critical work function was *A-Manage Energy Team*. It is worth noting that all critical work functions scored at or over 3.5, with a very low variation, which generally confirms that respondents view all seven critical work functions as very important to the work of Manufacturing Energy Efficiency Manager.

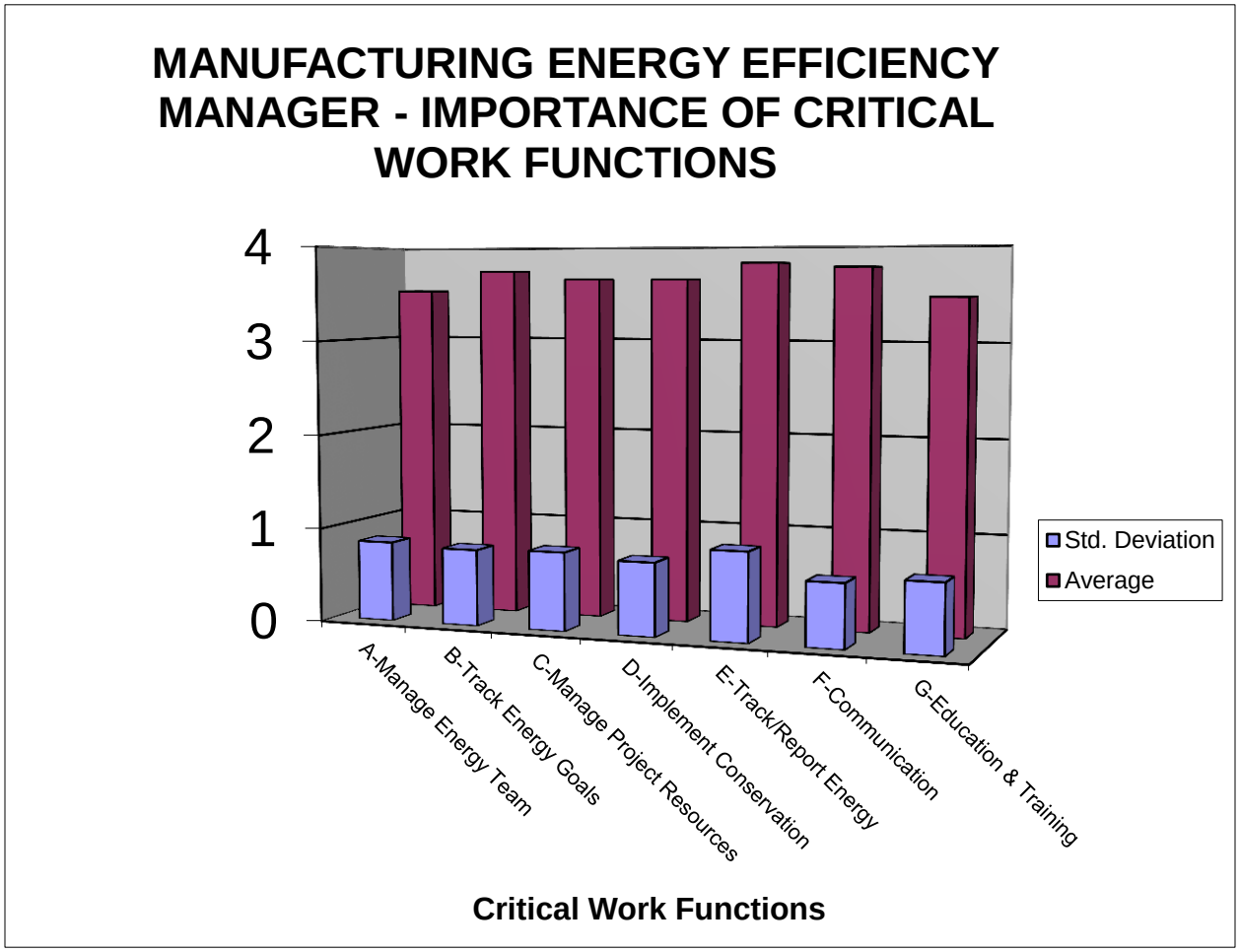


Figure 2. Manufacturing Energy Efficiency Manager – Importance of Critical Work Functions

Career Pathways

As highlighted earlier in this report, the employer input and data collected for this study suggests that a common, definitive career pathway for manufacturing energy efficiency managers does not exist. Every manager interviewed for this study, or participating in the focus group, indicated they came to their current position in a unique way, following a non-standard career trajectory that reflects their diverse academic and professional experiences, skills, and backgrounds. As previously noted, some possess considerable technical expertise, many are educated as engineers, and others came directly into their position after a number of years in other positions where they received most of their training on the job. What they share in common is reflected in the skill profile data presented in Table 3, which provides a useful summary of the critical work functions, key activities, skills, and competencies deemed to be important for all energy efficiency managers in the manufacturing sector.

No specific pathway models were found for manufacturing energy efficiency managers. Many different general career pathway models do exist, however, and there are some foundational similarities that – in combination with the skill profile data and findings presented in this report – could serve as the starting point for the position of manufacturing energy efficiency manager. It is clear from this research that further attention is needed to define a pathway for energy efficiency management occupations. Although it is beyond the scope of this report, the data presented in this study provides a useful foundation for designing a graphic and content model depicting the basic building blocks of workplace competencies, knowledge and technical skills that form the core of the manufacturing energy efficiency manager position.

One online model-building tool worth exploring is provided by the U.S. Department of Labor through the Career OneStop program.[17] This resource, illustrated in Figure 3, enables users to search a broad database of existing pathway/competency models, or to establish a competency model and a career ladder/lattice for occupational clusters where one does not already exist. Using this tool, a simple competency or career ladder/lattice model might be developed for manufacturing energy efficiency managers that could include a foundational tier comprised of education and training in leadership, motivation, team building, and customer service skills, as well as business, writing, economics, and quantitative skills. These skills were consistently identified among our interviewees as key skills and educational components of effective and successful energy efficiency managers, with the higher-level tiers geared specifically to the industry or occupation.

Review of this resource also revealed a general model established by the Center for Energy Workforce Development (CEWD) for careers in energy generation, transmission, and distribution.[18] Although the CEWD model is specific to the energy industry, it does not

incorporate energy efficiency occupations, and the model is too generic to effectively depict the specific manufacturing energy efficiency manager skills profile data developed in this report.

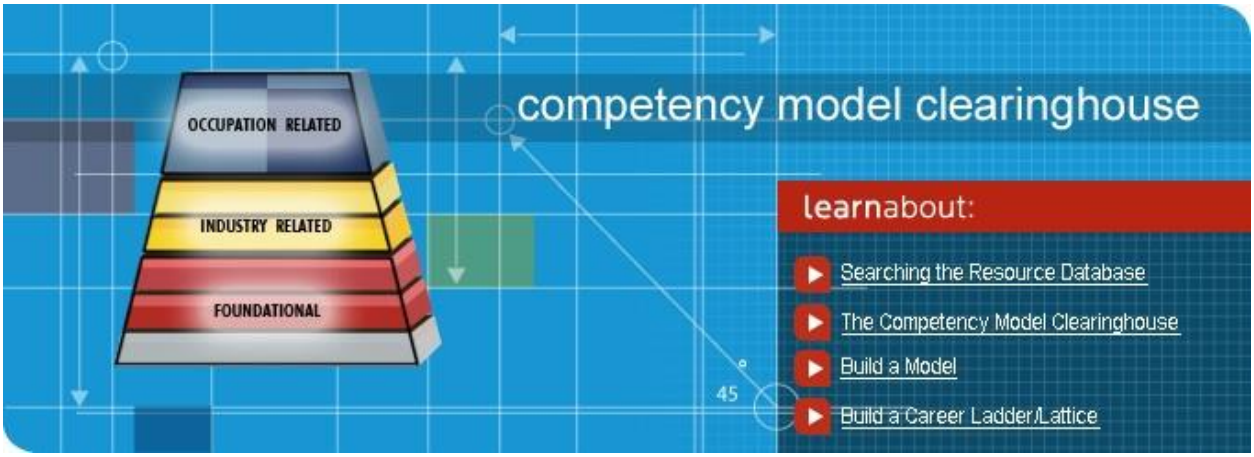


Figure 3. Career OneStop Tool

Source: http://www.careeronestop.org/CompetencyModel/

Education and Training

A plethora of technical assistance, education, and training-related resources are available to assist states, local governments, and industry in their efforts to achieve higher levels of energy efficiency, and some of those programs include training resources (see Appendix A). A number of these resources and programs are being implemented in Washington State, and a variety of training programs, certificates, degrees and certifications relevant to the energy efficiency sector are available.

Among the programs reviewed for this report, several are of particular relevance to the manufacturing energy efficiency manager occupation, as listed below. While none of the following programs are a precise fit for the position of manufacturing energy efficiency manager, they each contain relevant education and training content applicable to a defined energy efficiency management training program.

An existing program that is most relevant to this study is the energy management program offered through Edmonds Community College (EdCC). This program focuses on energy efficiency along with business and project management skills, areas also identified as key by stakeholders. The program is designed to teach students how to "manage and account for energy use as well as to analyze data, create reports, and how to lead projects," and includes a Building Operations and Maintenance for Energy Efficiency certificate program (http://www.edcc.edu/energy/). The certificate program includes curriculum in energy basics, energy management, energy efficiency, sustainability, and operations and maintenance.

The EdCC, in partnership with Cascadia Community College (CCC), the Pacific Northwest Center of Excellence for Clean Energy (PNCECE), and the WSU Energy Program worked with industry and labor representatives in Washington State on a three-year Advanced Technology Education Project funded by the National Science Foundation in 2010. This project, called Meeting the Challenge of Energy Management in a Carbon-Constrained World (http://cleanenergyexcellence.org/about/nsf-grant/), is addressing the need to train a skilled energy management workforce by bringing together industry, education, and labor in a collaborative partnership to develop:

- Skill profiles (in process) that specify the knowledge and abilities required for the development of a successful energy efficiency workforce with a focus on Energy Efficiency Program Managers and Commercial Building Analysts.
- Professional development opportunities for instructors across the region to incorporate these skill profiles into curriculum to ensure that new and modified programs are relevant to the needs of industry, and impart the core knowledge and skills that will help make students and incumbent workers successful.

- An Educators Association designed to sustain networking and professional development for educators across the state.

Another area of interest is the Associate of Technical Science degree program at Wenatchee College (http://www.wvc.edu/directory/departments/esrt/default.asp) that focuses on environmental systems and refrigeration technology. The program combines lectures with practical, hands-on lab work centered on refrigeration, HVAC (heating, ventilation and air conditioning), control systems, boilers, and welding, and emphasizes energy efficiency. While not specifically focused on energy management, the program does include energy efficiency, and prepares graduates for employment in industrial plants.

Grays Harbor College, in partnership with Centralia College, offers an Associate in Applied Science degree (http://www.ghc.edu/voc/energy.pdf) in energy technology power operations. While this program is designed for entry-level power generation positions, a number of courses in the program could be applicable for a manufacturing energy efficiency manager, including energy efficiency, refrigeration, HVAC, and plant maintenance.

Centralia College offers a similar degree program to Grays Harbor College in Energy Technology for Power Operations (http://cleanenergyexcellence.org/CollegePrograms/) that includes an emphasis on energy efficiency. Centralia College also manages the PNCECE, which is a Center of Excellence in Washington State created to help grow the state's economy by focusing on specialized workforce education and training for industries. The PNCECE focuses on energy technology courses and offers a comprehensive listing of colleges throughout the state that offer education and training programs in energy, many of which include coursework on energy efficiency.

The Washington State University offers undergraduate programs in electrical engineering through their Energy Systems Innovation Center (http://school.eecs.wsu.edu/undergraduate/ee). A wide variety of courses is offered, including one that focuses on renewable energy. However, there is currently no coursework through this program that covers energy efficiency or energy management.

As part of the College of Agriculture, Human, and Natural Resource Sciences, the WSU Energy Program (http://www.energy.wsu.edu/) focuses exclusively on energy efficiency and renewable energy efforts, including industrial energy efficiency and energy management. While the program does sometimes offer internships to students interested in getting hands-on experience in industrial energy efficiency, there are no education or training programs at the WSU Energy Program for this sector.

Outside of the formal education arena, Impact Washington (http://impactwashington.org/about-us) provides opportunities through their Washington Internship Program for students to get hands-on work experience in manufacturing environments throughout the state. Impact Washington helps manufacturers enhance their operations through a variety of approaches, including Lean manufacturing and energy efficiency.

The Northwest Food Processors Association (NWFPA http://nwfpa.org/) also serves as a connector between their member food processing manufacturers and students for internship opportunities. The NWFPA has had a robust energy efficiency initiative in place for many years, and many of their members companies have energy managers and energy champions in place. In fact, several of those energy efficiency staff members participated as SMEs and survey respondents for this workforce development project.

Other training opportunities include certification as a Certified Energy Manager through the Association of Energy Engineers, which carries a certain level of credibility within the industrial sector. The Institute for Energy Management Professionals also offers certification as a Certified Practitioner in Energy Management Systems which is designed to assist companies that are interested in implementing ISO 50001 or ANSI MSE 50021 energy management standards (http://www.aeecenter.org/i4a/pages/index.cfm?pageid=3351).

The Manufacturing Skill Standards Council (MSSC) provides an "industry-led, training, assessment and certification system (http://www.msscusa.org/) focused on the core skills and knowledge needed by the nation's front-line production and material handling workers." Courses focus on manufacturing and logistics, and are delivered in an online format geared toward students in high schools and community colleges, technical colleges, universities, employers, workforce investment boards, and private training companies.

Summary

While some existing education and training opportunities include energy efficiency and energy management in manufacturing, no programs have been developed specifically for the important role of manufacturing energy efficiency managers in the industrial sector. Research conducted during this project indicates that there is tremendous opportunity for improvement in this area.

Conclusions and Implications

This study sought to understand the prevalence and importance of energy efficiency in manufacturing, with a primary focus on key energy efficiency work functions, activities, workplace competencies and skills needed in manufacturing operations. The study identified and defined the workforce attributes of effective energy efficiency managers using a systematic process that relied on data from industry experts.

Several findings were identified that add to our understanding about the character of the energy efficiency professional in manufacturing. These findings should prove valuable in the development of workforce policies and practices related to energy efficiency, and in the content and delivery of related workforce education and training programs for energy efficiency managers. Some of the key conclusions and implications are discussed below.

Driving Energy Efficiency Successes

One message heard consistently during stakeholder interviews is that the position of energy efficiency manager constitutes a critically important role. The organizations who participated in this study have been widely recognized for their success in achieving greater energy efficiencies, accomplishments that they each attribute in large part to the hard work and skills of internal energy professionals. Without a champion to lead the cause of energy efficiency, it becomes much more difficult to accomplish conservation measures. The existing research and data collected for this study suggests that companies will continue to pursue energy efficiency goals, and that more manufacturers are looking to energy efficiency initiatives to lower operating costs, reduce environmental impacts, and to be responsive to consumers who increasingly expect sustainable business practices from manufacturers. The development and availability of qualified energy efficiency managers will enable manufacturers to pursue those goals and help Washington manufacturers to be competitive.

An Emerging Occupation

As noted throughout this report, there is no clearly defined career or career pathway in place for a manufacturing energy efficiency manager in Washington, and this finding appears to hold true at the state and national levels as well. The interviews and other data collected for this study suggest that the lack of a standard position description or career pathway for energy efficiency professionals in manufacturing is due in part to the evolving nature of the occupation. Across manufacturers the occupation requires many similar attributes and skill sets, but currently there is not a high degree of uniformity among the companies included in the study about how the position can be ideally structured, or the precise range of roles and responsibilities the occupation should encompass. This study indicates that manufacturing energy efficiency managers need technical skills and experience along with the leadership and communication skills essential to drawing together a team of people with varying skills, and

leading them in activities focused on the common goal of improving energy efficiency at the facility. In short, the manufacturing energy efficiency manager represents a relatively new occupation in manufacturing organizations, especially as a dedicated position, and thus its structure and roles are still emerging and evolving.

One Size Does Not Fit All

The position of manufacturing energy efficiency manager is unique, even within similar types of industries (e.g. food processing, pulp and paper, etc.). There is no 'one size fits all' definition of the position, even within the same manufacturing sector. As might be expected, the variation in position responsibilities and requirements among companies is also a function of the unique organizational structures, production systems and operational features of each company, which influences how each company constructs the roles and responsibilities of manufacturing energy efficiency managers.

Similarly, the roles and expectations of energy efficiency managers can vary depending on the importance attached to energy efficiency by corporate leadership, including whether energy efficiency is viewed as a primary or secondary goal. As an example, during interviews conducted for this study, it was discovered that one large multi-state manufacturer has energy goals established at each plant, with a defined energy champion leading plant energy teams to meet those goals. The company also has a corporate-wide energy goal that is supported all the way from the company CEO to each plant. In contrast, at another multi-state manufacturer, instead of corporate or plant-level energy goals, this company and their multi-state facilities focus on meeting greenhouse gas emissions (GHG) reduction goals; achieving greater energy efficiency is a secondary goal, yet it is through energy efficiency improvements that GHG goals are realized.

Need for Greater Coherence

There is strong interest among the stakeholders interviewed for this report in creating a higher level of coherence for the manufacturing energy efficiency manager occupation, and in establishing a pathway structure that can be used to align workforce education and training in industry and among postsecondary education institutions. Although it is beyond the scope of this study, the critical work functions, key activities, competencies and skills identified by this study provide a practical foundation for establishing a coherent structure for the occupation, which can also be used as the basis for structuring more cohesive position descriptions, career pathways, and industry training for incumbent workers. Greater definition by industry, beginning with the results of this study, should also help drive development of public education and training programs, educational pathways and career guidance services that can prepare students for successful careers in this growing field.

Implications

It seems likely that federal, regional and state-level policymakers and agencies will continue to support energy efficiency as a strategy for reducing emissions and conserving energy use in the region and state. Conservation programs have garnered strong public support, and existing programs have produced good long-term results. As a leader in the development of clean energy and energy efficiency, Washington has established a solid foundation for energy efficiency going forward, backed by aggressive goals for further efficiency gains as a strategy to meet projected future electricity load growth in the decades to come.

This foundation of energy efficiency success has not been lost among Washington's manufacturers. Whether linked to waste reduction strategies and economic competitiveness – such as through the implementation of Lean manufacturing methods, or in response to a changing marketplace in which customers have become increasingly interested in "green" products that are also produced in an environmentally-sustainable fashion – Washington manufacturers are becoming more focused on establishing and achieving energy efficiency goals.

The manufacturers participating in this study have invested heavily in achieving energy conservation through the strategies and actions they have undertaken. Aside from the many technology tools and enhancements that can be applied to enable improved efficiency in manufacturing, the results of this study show that a key success factor is the availability of a skilled manufacturing energy efficiency manager to coordinate, lead and facilitate the work inside of manufacturing plants. Indeed, the input from leading Washington manufacturers suggests that while a number of employees have some role in helping to achieve energy efficiency results, more firms are looking to a dedicated energy efficiency manager to serve in this pivotal role.

State Workforce Policy and Practices

Since the success of energy efficiency activities in manufacturing depends heavily on competent staffing to establish and manage project activities, state workforce development policies should support the development and use of education and training that reflects what manufacturing—and other industry sectors—says it requires of competent energy efficiency managers. To that end, the findings and skills profile completed by this project can be used by workforce development system stakeholders as a tool to emphasize the importance of a skilled workforce. Specifically, that the future success of industrial energy efficiency in Washington State—including the potential environmental, economic and competitive benefits it can deliver when effectively planned and implemented—relies not only on new technologies and technical systems, but also on the availability of highly-qualified employees who are responsible for

identifying efficiency opportunities, and who possess the skills necessary to plan, execute and evaluate efficiency solutions effectively.

The state should require that the skill profile created under this project be used as a foundation for the development of postsecondary education and training for future energy efficiency managers. Similar policies and practices already exist among the state's community and technical colleges, and among registered apprenticeship programs, which are required to incorporate industry-defined skill standards in proposing, developing or improving workforce programs. It seems reasonable to expect that new or existing programs that have industrial energy efficiency as a target of training should be required to incorporate the industry data generated in this project to guide new program designs, content and career development services.

Future Skill Panel funding recipients for energy efficiency-related workforce development projects should be expected to review and incorporate relevant aspects of the completed skills profile research to avoid duplication of effort, and to offer a common development process and tool for establishing new or improved education and training content. Because many of the functions and skills identified by this study are likely to be transferrable to other industrial environments, WTECB should also encourage the use of the manufacturing energy efficiency manager skill profile to inform development of education training in occupations and industries where energy management functions, activities and skills can help guide the workforce preparation of employees.

Long-term, state policy makers and workforce development partners should consider ways to incorporate skill profile information as part of the state's ongoing effort to align workforce and economic development strategies. Tools such as skill profiles can support the development and wider availability of a skilled energy efficiency workforce through relevant programs that are rooted in industry-defined skills, which in turn can help support the state's ongoing investments in achieving greater energy efficiency.

Industry Applications

Industry should also be encouraged to adapt and apply the findings from this research. For firms that are considering the pursuit of energy efficiency through the improvement of major industrial systems, the study findings and skills profile information provides valuable context and a consistent approach to defining the primary roles, functions and activities of effective manufacturing energy efficiency managers.

Manufacturers should be encouraged to use this research to define long term goals, staffing requirements, and potential projects that a dedicated energy efficiency manager might be expected to lead. Firms could easily adapt and apply the skills profile to create or update

manufacturing energy efficiency manager job descriptions, generate applicant interview protocols, or initiate internal job/task analysis projects, for instance.

For firms that are already engaged in efficiency projects, the data from this study provides a benchmark of functions, activities and skills from which performance measurement, staffing requirements and professional development options could be determined or updated. The skill profile could also be used by industry as a platform to engage regional education and training providers in discussions about industry's expectations and the structure and content of related preparatory programs. The basic Workplace Competencies (SCANS) defined in the study also provide a foundation for emphasizing the fundamental work skills expected of professionals in this position. These foundation skills can provide a common framework for discussions with K-12 students, teachers and program managers about the qualifications, competencies and potential pathways for students in energy efficiency.

Pathways and Programs

Colleges with energy efficiency training and education programs should use the results of this project to ensure that their current programs are aligned with the stated needs of manufacturing employers, and to strategize about ways that their program content, teaching tools and delivery options can be most effectively combined to position program completers for success. For those institutions who anticipate starting new programs or incorporating some elements of energy efficiency into existing programs, the profile results can provide a useful reference for program enhancements and curriculum content.

As noted earlier, the results of this study suggest that the pathway into the manufacturing energy efficiency manager position is not linear. Rather, manufacturing energy efficiency manager positions are destination points that are achieved through the culmination of workplace experiences, knowledge and skills that are gained over time while in the workplace. Therefore, a primary focus for employers should be on how to create pathways into the position for *current* employees who are gaining these experiences already, and who, by virtue of their interest and qualifications are best positioned to do this work. In short, employers and trainers should use the results of this project to identify and further develop promising internal candidates who have already begun to acquire the knowledge and skills needed to become manufacturing effective energy efficiency managers.

A long-term issue to explore is how new or current energy efficiency/energy management programs available through universities, community and technical colleges and other training providers can most effectively structure their program content and learning experiences to accelerate the transition of energy efficiency/energy management program completers into related employment in manufacturing. The application of structured Work-Based Learning experiences in manufacturing for postsecondary students interested in energy efficiency should

be encouraged so that students can see how their training could lead to a career in energy efficiency, and to more fully-engage manufacturing employers in developing a pipeline of future energy efficiency talent for their own organizations.

Workforce Stakeholders and Dissemination

Finally, the results of this skills profile project should be widely disseminated to workforce education and training partners, including industry, professional associations, and others who could benefit from the study findings. Some key dissemination partners include:

- The WTECB, through the energy careers web page on Career Bridge.
- The Pacific Northwest Center of Excellence for Clean Energy
- Center of Excellence for Aerospace and Advanced Materials Manufacturing
- Trade associations (e.g. Northwest Food Processors Association, Northwest Public Power Association, Center for Advanced Manufacturing Puget Sound)
- Energy efficiency agencies and councils (e.g. Northwest Energy Efficiency Alliance, Northwest Energy Efficiency Council, Bonneville Power Administration, Energy Trust of Oregon)
- Impact Washington

Appendix A: Summary of Industrial Energy Efficiency Programs, Policies and Resources

A wide variety of programs, policies, and resources exist on a national, regional and state level to support industrial energy efficiency efforts. The U.S. Department of Energy (DOE) offers a variety of outstanding resources, including education and training, technical assistance, and tools such as guidebooks, tip sheets, case studies and software through DOE's Advanced Manufacturing Office (AMO). AMO has developed these resources to help manufacturers identify, analyze, and implement energy savings opportunities in various systems/components that use energy in manufacturing plants and building. The resources are available to users at no cost by visiting AMO's Energy Resource Center.
(http://www1.eere.energy.gov/manufacturing/tech_assistance/ecenter.html)

Another DOE resource that provides technical assistance and solutions for energy efficiency is the Better Buildings, Better Plants Challenge. The initiative provides a framework for commercial and industrial building owners to reduce building energy use by a substantial percentage. The initiative also offers an opportunity for recognition at the national level to those companies that choose to sign on as a Better Buildings, Better Plants Partner, and commit towards achieving energy efficiency improvements.
http://www4.eere.energy.gov/challenge/home

DOE also offers a series of tools designed specifically for energy management, geared both at the consultant level, and directly for manufacturers. One such tool is called DOE eGuide Lite, which is designed to teach users the basics of energy use, how to track it, and how to reduce consumption by implementing energy efficiency improvements both at the processing level, and through behavioral changes at the workforce level.

The eGuide Lite is an energy management, self-guided software tool that can be downloaded for no cost at https://ecenter.ee.doe.gov/EM/SSPM/Pages/SSPM_UserHome.aspx. In addition to providing a basic level of energy management education, the tool also serves as a resource to help organizations prepare for energy management certifications like ISO 50001 and Superior Energy Performance (SEP).

The ISO 50001 is an energy management standard developed by the International Organization for Standardization, and designed to provide a framework for manufacturing companies to implement an energy management system. Certification is possible, but not mandatory. Some companies work towards certification as a way to show external parties their commitment to energy efficiency, while others choose to implement the standard solely for the benefits it provides. http://www1.eere.energy.gov/energymanagement/index.html

SEP offers manufacturers a way to go a step beyond the ISO 50001 standard and certification. In addition to implementing the ISO standard, participants also meeting additional requirements through SEP to achieve and document energy performance improvements. Participating manufacturing facilities that achieve the SEP certification are granted ANSI-ANAB accredited third-party verification for meeting the program's requirements. The Superior Energy Performance initiative was developed by the U.S. Coalition for Energy-Efficiency Manufacturing (U.S. CEEM), which is a partnership comprised of standards-making bodies, federal agencies, national laboratories, universities, and technical experts. The SEP initiative is a relatively new one, with currently just a small number of certified facilities that obtained their recognition through a series of pilot programs funded through DOE. The program is expected to official launch sometime in 2013. http://www.superiorenergyperformance.net/index.html

A workforce development aspect to the SEP program comes by way of Certified Practitioners in Energy Management Systems, and Certified Systems Practitioners. These practitioners provide assistance to companies engaged in SEP by assessing energy efficiency activities at the companies' manufacturing facilities to ensure they conform to the SEP requirements. Companies are not required to work with a Certified Practitioner, but doing so helps ensure that the SEP standards will be properly applied, and that certification is more likely to be achieved. Training is available to those interested into becoming a Certified Practitioner, with the main interest coming primarily from consultants, and a smaller level of interest coming directly from industry.
http://www.superiorenergyperformance.net/certified_practitioners.html and
http://www.ienmp.com/default.asp

Another excellent industrial energy efficiency resource comes from the Environmental Protection Agency's ENERGY STAR program. Similar to DOE resources, EPA offers tools to guide manufacturers through a step-by-step process towards implementing an energy management system at their facilities, and improving energy and financial performance for the company. The process involves making a commitment towards energy efficiency, setting and tracking goals, implementing an action plan, and recognizing the achievements of staff involved.
http://www.energystar.gov/index.cfm?c=guidelines.guidelines_index

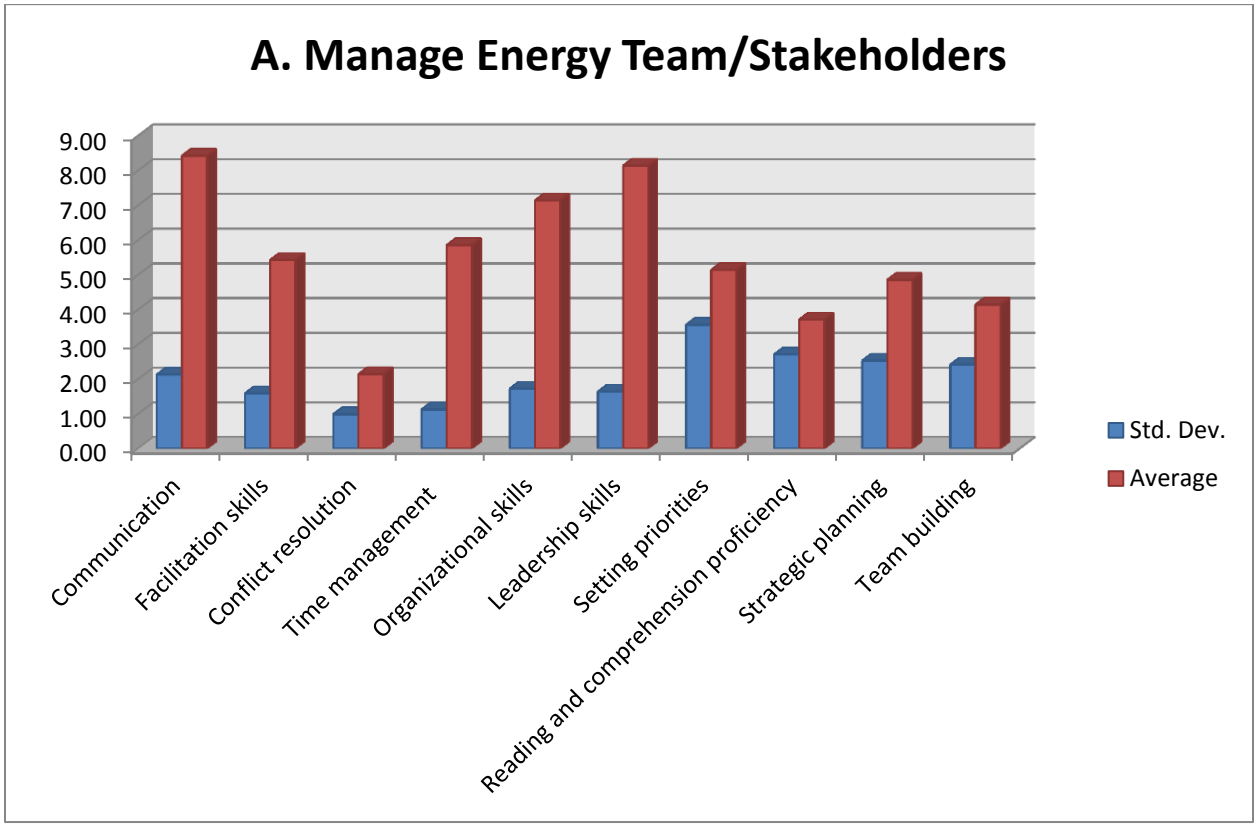
Manufacturers may also choose to work towards achieving an ENERGY STAR PARTNER certification by implementing and meeting a series of energy efficiency and environmental improvement goals. http://www.energystar.gov/index.cfm?c=industry.bus_industry_plants

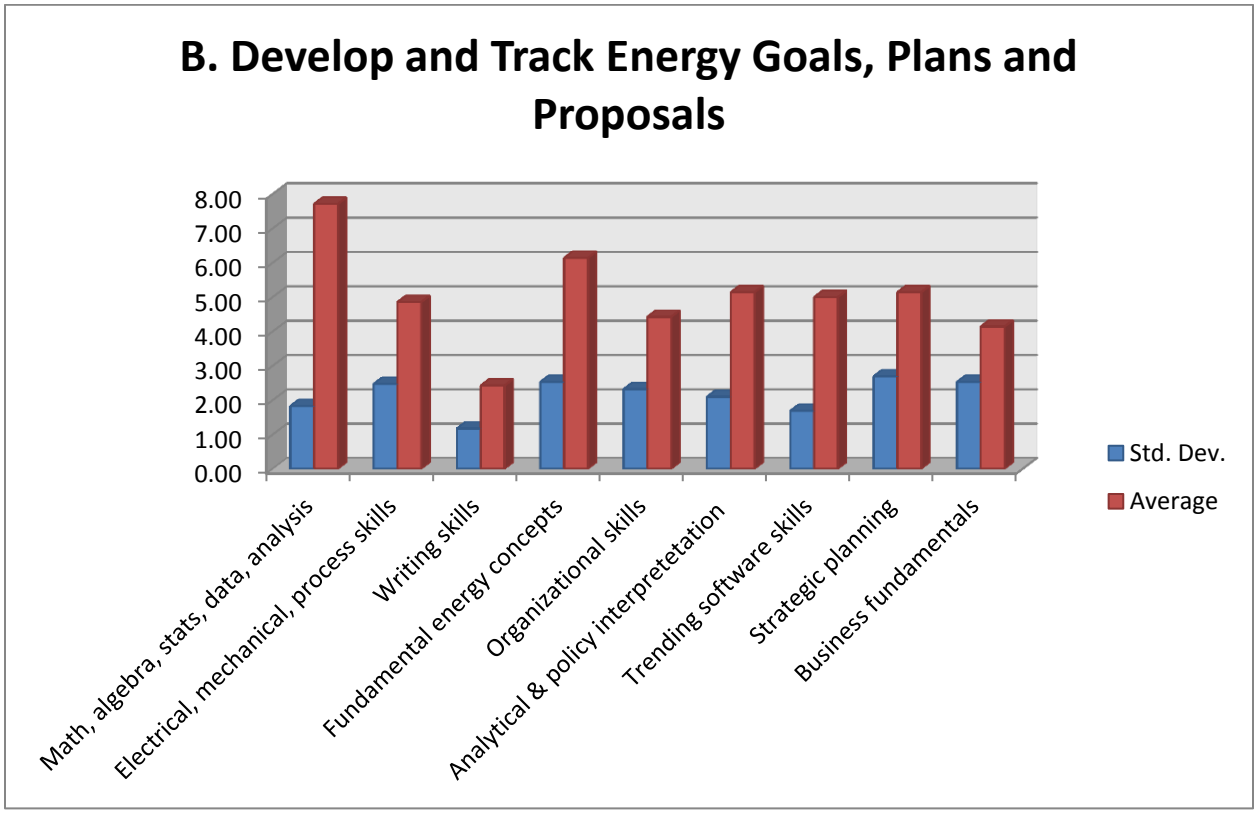
DOE has funded the Industrial Assessment Center (IAC) program for many years now, which is managed by Rutgers Center for Advanced Energy Systems. The program funds approximately 24 universities across the country to develop a program designed to give engineering students real world experience by conducting industrial energy assessments at small-medium sized

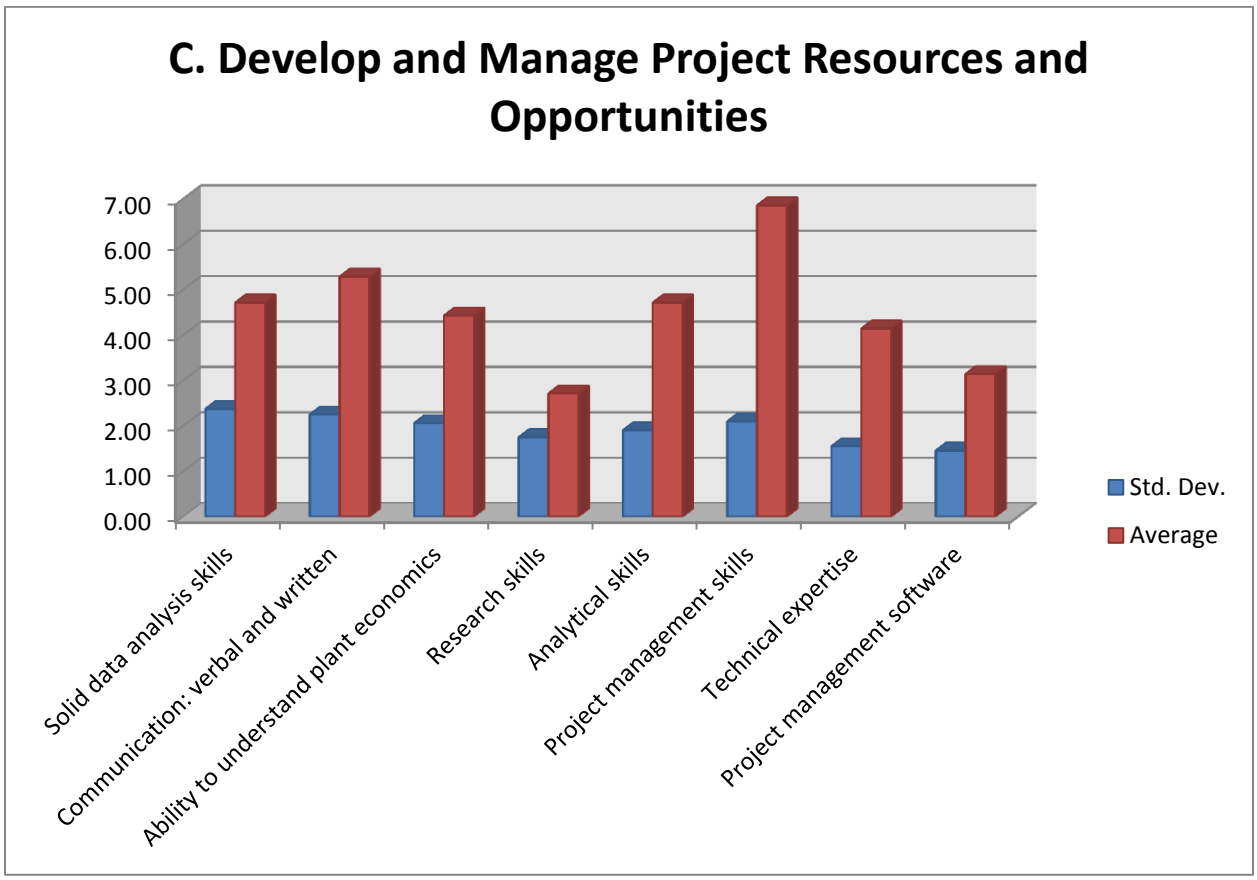
manufacturing facility within a given service territory. Every college designs their program slightly differently, but the goal of workforce development is the same. There is currently no IAC located within the state of Washington.

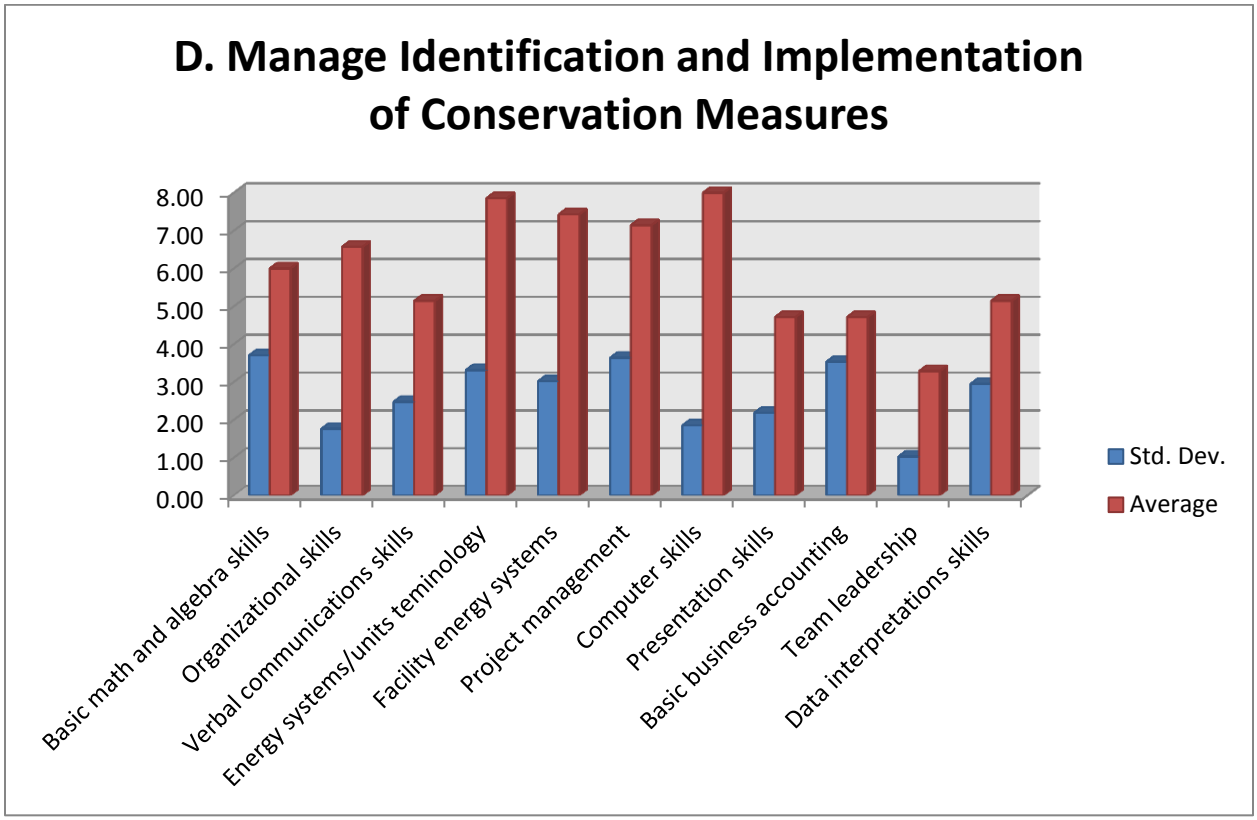
One program that warrants more research is DOE's Energy 101 initiative, which is a "a peer reviewed course framework for an interdisciplinary fundamental energy course using a systems-based approach that can be individualized by the nation's universities and community colleges." While not focused specifically on the position of industrial energy manager, or even industrial energy efficiency in general, the goal of the initiative is to increase career pathways to energy-related degrees and energy careers.
http://www1.eere.energy.gov/education/energy_101.html

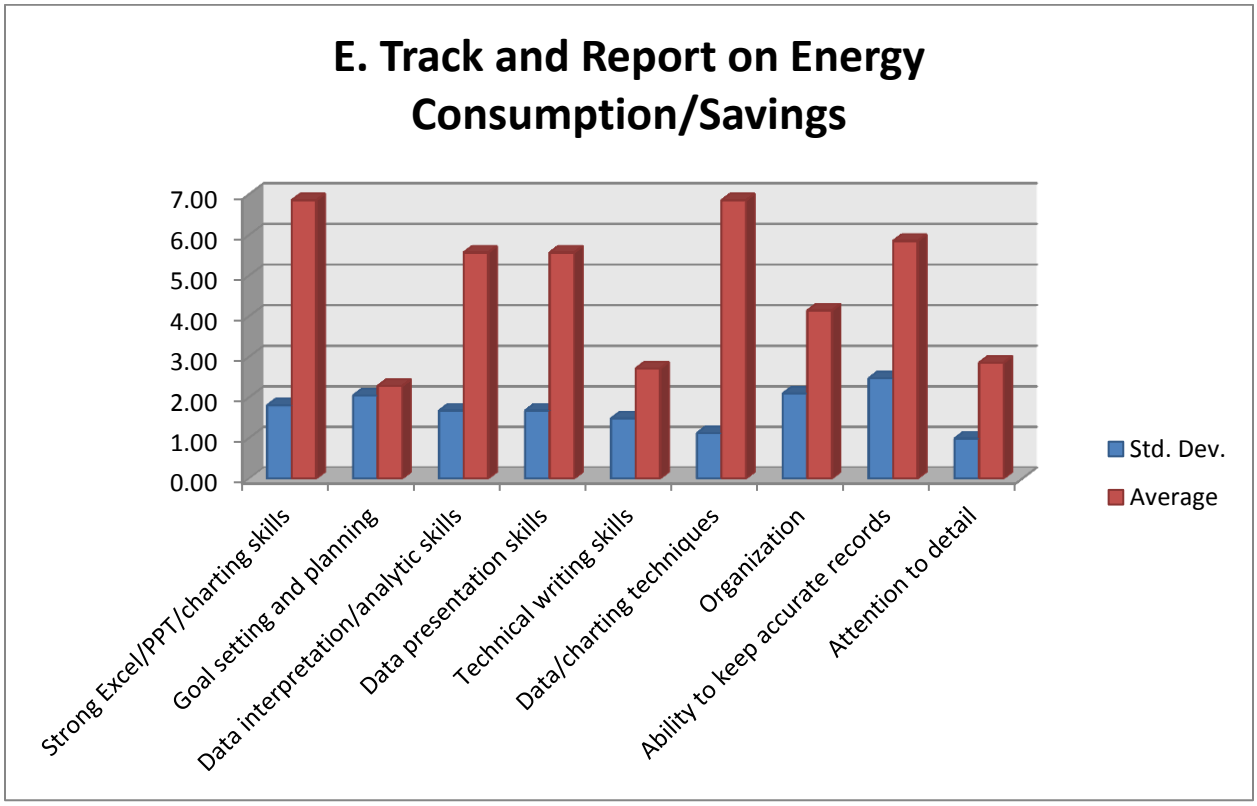
Appendix B: Manufacturing Energy Efficiency Manager Skill Charts by Critical Work Functions

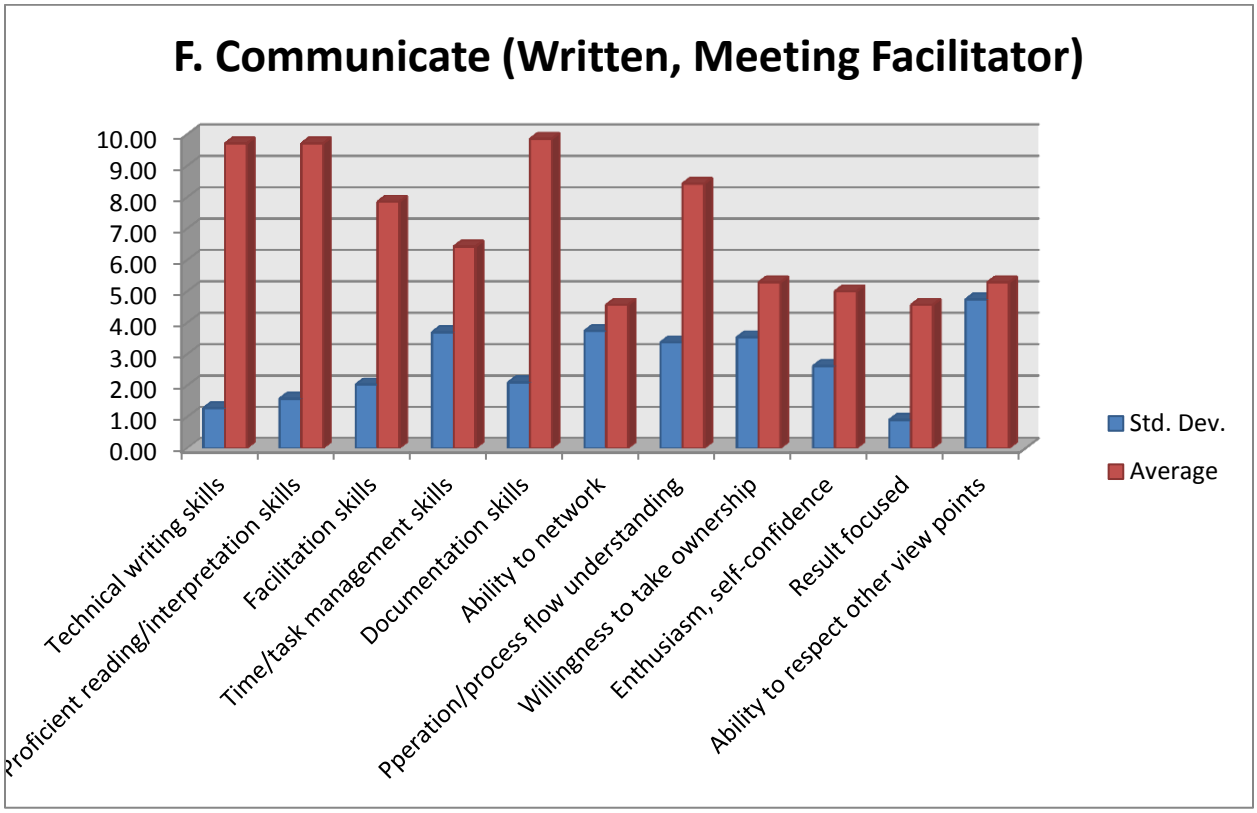


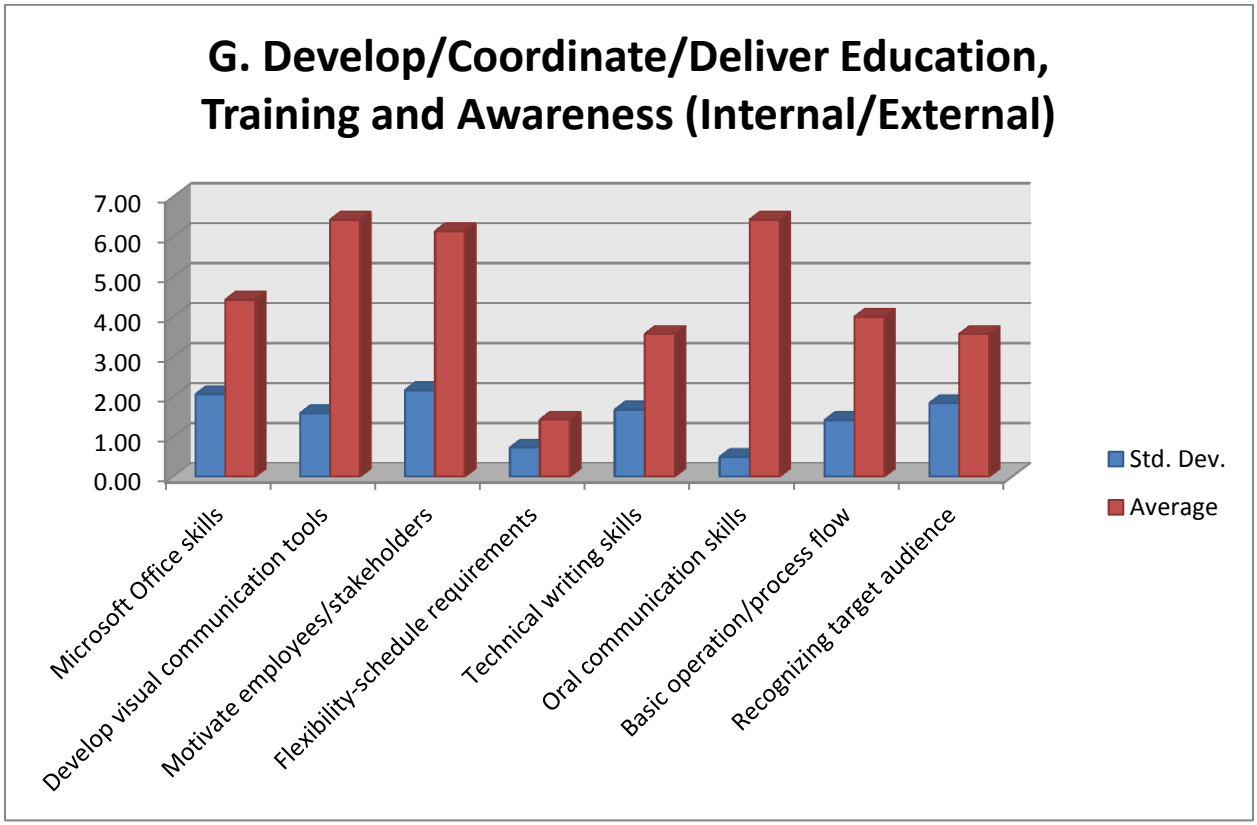

B. Develop and Track Energy Goals, Plans and Proposals
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Math, algebra, stats, data, analysis
Electrical, mechanical, process skills
Writing skills
Fundamental energy concepts
Organizational skills
Analytical & policy interpretetation
Trending software skills
Strategic planning
Business fundamentals
Std. Dev.
Average


C. Develop and Manage Project Resources and Opportunities
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Solid data analysis skills
Communication: verbal and written
Ability to understand plant economics
Research skills
Analytical skills
Project management skills
Technical expertise
Project management software
Std. Dev.
Average


D. Manage Identification and Implementation of Conservation Measures
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Basic math and algebra skills
Organizational skills
Verbal communications skills
Energy systems/units teminology
Facility energy systems
Project management
Computer skills
Presentation skills
Basic business accounting
Team leadership
Data interpretations skills
Std. Dev.
Average


E. Track and Report on Energy Consumption/Savings
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Strong Excel/PPT/charting skills
Goal setting and planning
Data interpretation/analytic skills
Data presentation skills
Technical writing skills
Data/charting techniques
Organization
Ability to keep accurate records
Attention to detail
Std. Dev.
Average


F. Communicate (Written, Meeting Facilitator)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Technical writing skills
Proficient reading/interpretation skills
Facilitation skills
Time/task management skills
Documentation skills
Ability to network
Pperation/process flow understanding
Willingness to take ownership
Enthusiasm, self-confidence
Result focused
Ability to respect other view points
Std. Dev.
Average


G. Develop/Coordinate/Deliver Education, Training and Awareness (Internal/External)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Microsoft Office skills
Develop visual communication tools
Motivate employees/stakeholders
Flexibility-schedule requirements
Technical writing skills
Oral communication skills
Basic operation/process flow
Recognizing target audience
Std. Dev.
Average

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