Today's Aging Workforce – Who Will Fill Their Shoes?

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Today's Aging Workforce – Who Will Fill Their Shoes?

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***Abstract*—Electric utilities depend on the knowledge and expertise of the power industry workforce to support the national electric power system. This paper examines the potential shortage of this needed expertise that, if not addressed, could have catastrophic effects on the industry and society.**

Studies show that the number of engineering graduates and skilled workers entering the workforce may not meet the imminent number of retirements. The soon-to-retire Baby Boomer Generation holds a wealth of knowledge and experience necessary to support current electric power systems. This presents a challenge to find replacements and transfer expertise accordingly.

Today, as an industry, we are challenged to find qualified personnel who understand the design, operation, and maintenance of electric power systems. With smart grid and green power initiatives getting traction, even more demands are being created for personnel equipped with these mixed and specialized skills to support the power system. The range of personnel discussed includes electrical line workers and engineers.

Recent reports show enrollments in engineering programs are increasing, possibly because of new initiatives, such as renewable energy, green solutions, and smart grid. However, the number of students interested in electrical engineering is declining, which leads to the aforementioned shortage of expertise to meet the demands of the industry. Electrical engineering programs aimed at providing graduates to the power industry have declined over the past two decades, and many of the faculty have retired and have not been replaced. It is estimated that 40 percent of senior faculty will be eligible for retirement within the next five years, and 27 percent indicate they may retire.

This paper discusses the state of the electric power industry workforce and plans to meet future labor requirements. The intent of this paper is not to present doom and gloom but to understand the current workforce predicament, discuss recommendations for the industry, and share positive examples of actions and existing programs to help address the problems we face. Examples from utilities and manufacturers include:

- **Programs presently being conducted by companies to interest students (K through 12 to postsecondary) in electrical engineering and provide real-life, hands-on experiences once in college.**
- **Company internship, apprenticeship, and education programs that ensure employees are getting the training necessary to prepare for long-term workforce needs.**
- **Recommendations on how to act now to understand and prepare for long-term workforce needs.**

I. The Power Industry Workforce Today

It is hard to imagine what it would be like to live without electricity or have unpredictable service as an everyday norm. We live in a society that expects safe and reliable electric power, yet we are facing a potential shortage of industry workforce expertise that could jeopardize the integrity of the national electric power system.

The soon-to-retire Baby Boomer Generation holds a wealth of knowledge and experience necessary to support the current power system. In the next five to ten years, 45 to 50 percent of the industry workforce may retire or leave. This presents a challenge to find replacements and transfer knowledge accordingly.

The electric power industry is facing many challenges beyond just an aging workforce. The power grid infrastructure is also aging and in need of maintenance, and assets need to be replaced. With smart grid and green power initiatives in process, even more demands are being created for personnel equipped with mixed skills to support the evolving power system.

The number of engineering graduates and skilled workers entering the workforce may not meet the imminent number of retirements. Furthermore, a perception exists among some students that careers in energy-related fields are obsolete and old-fashioned, making it difficult to build interest and attract candidates to careers in the industry.

This paper discusses the current workforce predicament in the electric power industry and makes suggestions on how to build up the necessary pipeline of talent (in particular, electrical engineers and electrical line workers) to prepare for long-term workforce needs.

A. Power Engineering

Power engineering is one of the oldest branches in engineering. The responsibilities of a power engineer span generation, transmission, and distribution of electricity and include the design and support of devices and apparatus for the conversion, delivery, and use of electrical energy. For the most part, the fundamental principles of power engineering remain unchanged. However, new advances in control and communications technology are continually being introduced to improve the overall capability and flexibility of the power system. Consequently, expertise is needed to support both traditional and new technology.

The aging workforce, combined with the decline in engineering graduates, has become a source of concern for the industry. In 2008, there were 12,300 electrical engineers working in electric power generation, transmission, and distribution in the United States, per the Bureau of Labor Statistics (BLS). The BLS predicts a decline in the number of electrical engineers being hired directly by utilities to 11,200 by 2018; however, there is a projected increase in the total number of electrical engineers in all industries.

There appears to be a forecasted shift in the utility workforce, with an increased projection for both consulting services and contractors. It appears that utilities may be decreasing their number of employees and outsourcing work. According to the "Third Annual Strategic Directions in the Electric Utility Industry Survey," 18 percent of utilities plan to use consultants and another 18 percent plan to use automation and process improvements to combat the aging workforce [1].

It is estimated that electric utilities alone will need more than 7,000 power engineers over the next five years and as many as two or three times more may be needed to satisfy the demands of all industries [2]. Currently, the number of career opportunities is expected to outweigh the supply of graduates. This situation may intensify as the primary producer of power engineering graduates (i.e., university programs) may be in jeopardy.

Fig. 1. Utilities need a skilled workforce to support the power system.

1) Power Engineering Programs Decline

In 2006, the U.S. Department of Energy reported to Congress on workforce trends in the electric utility industry. There has been a decline in power engineering programs at universities over the past two decades. At the time of the study, the estimate cited less than 30 programs in the United States and about 75 programs worldwide. Some top research schools have eliminated the power engineering focus from their electrical engineering programs. To make matters worse, many retired power engineering faculty have not been replaced. University-based power engineering programs are eroding without qualified replacements for retiring faculty [3].

In April 2009, the U.S. Power and Energy Engineering Workforce Collaborative reported on "Preparing the U.S. Foundation for Future Electric Energy Systems: A Strong Power and Engineering Workforce" [2]. This report included an action plan for industry, government, education, and research institutions and organizations to avoid letting a growing shortage of well-qualified electric power engineers slow progress in meeting critical national objectives. The report claims that fewer than five very strong university power engineering programs exist in the United States. The workforce collaborative included a list of criteria for what defines a strong program.

Of the approximately 40 percent of engineering faculty at universities in the United States who will be eligible for retirement in the next five years, an estimated 27 percent will retire. With about 170 faculty working full-time in power engineering education and research, there may be between 45 and 50 senior faculty members retiring. The workforce collaborative recommends hiring 80 new faculty over the next five years to replace those retiring [2].

While researching this topic, we discovered 70 institutions in the United States that claimed to have at least one faculty member conducting power-related research and/or had power-related courses in their curriculums, with 162 such institutions worldwide. While there are numerous reports and studies on this topic, most concur that there has been a steady decline in power engineering programs and that there is a need to invest in these programs, including hiring faculty, to meet the education needs of the present and future.

2) Power Engineering Graduates Decline

For nearly three decades, the United States has experienced a steady decline of engineering students with a power emphasis, as shown in Fig. 2. Today, there are only about 800 to 1,000 undergraduate degrees awarded annually in power engineering, compared to nearly 2,000 in the late 1970s. Enrollments for master and doctoral students in power engineering are both around 550, and 60 percent are international students [2].

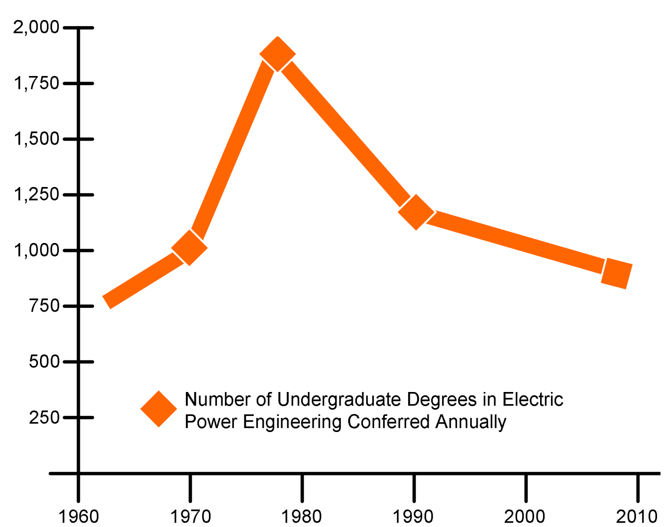

Fig. 2. United States electrical engineering degrees with a power emphasis conferred annually.

Several factors may be contributing to the decline in electrical engineering enrollments. Most high school students do not know much about engineering and do not feel confident in their math and science skills. In addition, few parents encourage their children, particularly girls, to consider an engineering career. Women comprise 18 percent of all engineering enrollments and only 12 percent of electrical engineering students. The overall number of students interested in electrical engineering is declining, and the shrinking pool of electrical engineering students limits the future supply of new power engineers [2].

As an industry, we need to understand generational differences, better communicate the image and importance of engineering fields, and attract talent to start careers in the power industry [4] [5] [6].

B. Electrical Line Workers

Electrical line workers provide the physical labor required to operate and maintain the electric grid. In one of the highest paid professions that does not require a postsecondary education, these workers erect poles and transmission towers and install or repair cabling to carry electricity from the power plant to the customer. They may work for construction contractors, utilities, or telecommunications companies [7].

This is a physically demanding and dangerous career in which workers often respond in bad weather or during natural disasters to repair power system damage, as shown in Fig. 3. Some workers responsible for interstate power grids or long-distance communications systems are often required to travel extensively and work long and irregular hours. Some are first responders, again with unpredictable work schedules, which result from being on call virtually 24 hours a day, 7 days a week. Despite safety procedures and training, the job is still among the most dangerous in the United States. Risks include electrocution, injury because of falls, and flash burns. The nature of the job can lead to quality-of-life concerns [3].

Fig. 3. Electrical line workers respond in harsh conditions.

In 2008, line workers held 284,900 jobs in the United States. Approximately 171,000 were telecommunications line workers, and the remaining 113,000 were electrical power line workers; about 52,000 worked for electric utilities. Most organizations expect up to 50 percent of line workers to retire in the next five to ten years.

The BLS projects a decline in the number of line workers being hired directly by utilities to 42,400 by 2018; however, there is a projected increase in the total number of line workers in all industries. In particular, there is a projected employment increase in construction and contracting during the same time period, adding about 10,500 more workers. Similar to our observations of the power engineering field, the consensus is that there is a shift in the workforce to an increase in construction and contracting, as shown in Fig. 4.

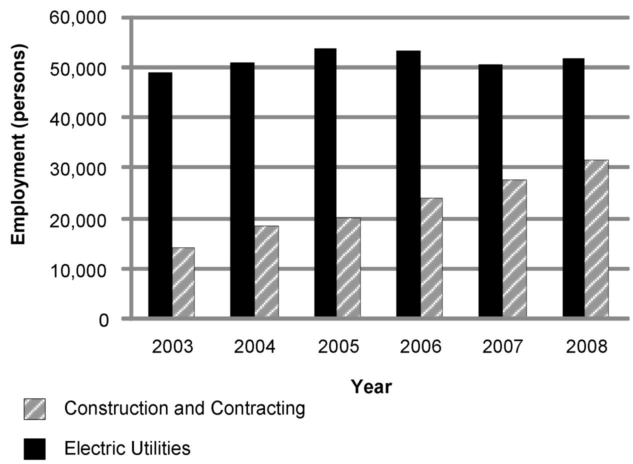

Fig. 4. Shift in the employment of line workers.

There are over 70 line worker schools and line worker training programs in the United States today, which is double the number from five years ago. Utilities and companies offer these programs for employees training to be journey-level line workers. It typically takes four or more years of training for an apprentice to become a journey-level worker. Mentoring and training from experienced journey-level workers are integral to the training process and are relied on by utilities.

Even with the increase of training programs, a significant forecasted shortage of line workers is feared, considering the changing economy, quality-of-life concerns, and the increasing number of retirements.

C. Pending Retirements Could Put the Electric Grid at Risk

More than 25 percent of the United States population is classified as part of the aging Baby Boomer Generation that is now nearing retirement. The 80 million Baby Boomers represent about 44 percent of the American workforce that has accumulated decades of experience and knowledge.

Over 50 percent of the utility workforce is 45 years or older, per the BLS, as shown in Fig. 5. Many positions within the utility industry are highly specialized, require years of training, and have accumulated historical knowledge of in-service power system assets. The loss of critical knowledge and the ability to maintain a reliable electric grid is at risk, and this potential loss of knowledge is a great concern [3] [8].

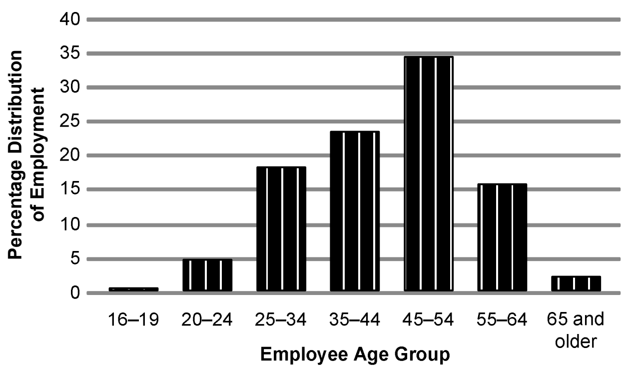

Fig. 5. Over 50 percent of the utility workforce is 45 years or older [9].

According to a study by U.S. Senator Maria Cantwell, "Meeting the National Demand for a Skilled Energy Force," more than half of the national science and engineering workforce will reach retirement age in the next 20 years. "The nation faces a critical shortage of power engineers in the years ahead. Workers with science and technology degrees will soon retire, creating a dramatic vacuum of employees available to satisfy a growing industry." [10]

II. Understanding the Generations

Power industry workforce demographics continue to change. Baby Boomers are beginning to retire, creating new openings for Generation X and Generation Y workers. Each generation possesses different characteristics, expectations, and approaches to work. They also have different technological upbringings, as described in Table I.

TABLE I
UNDERSTANDING GENERATION DIFFERENCES

Baby Boomer	Generation X	Generation Y
Born 1946–1964	Born 1965–1980	Born 1981–1993
TV	PC	Internet
Have technology	Use technology	Raised on technology
Comfortable with print	Computer savvy; expect up-to-date technology	Believe all information is a click away
Value ongoing training to keep skills up to date	Value skill-development training and accumulating transferable job skills	Thrive on flexibility and space to explore
Want to feel needed; want to be recognized for personal contributions	Like immediate tangible rewards	Seek to make a difference; desire to be a hero
Willing to mentor younger workers, but expect younger people to "pay their dues"	Enjoy freedom to get the job done in their own way	Partner well with mentors
Are process-oriented	Desire flexibility	Value guidance

The Baby Boomer generation, born between 1946 and 1964, represents the largest generation in the United States at around 80 million. Generation X includes those born between 1965 and 1980. Generation Y, sometimes called the "Echo Boomers" or "Millennials," was born between 1981 and 1993 [3] [8]. Organizations need to consider the differences of these generations to plan for future labor requirements and attract and retain new employees.

III. Planning for Future Labor Requirements

In order to meet future labor requirements, organizations need to understand the current state of the workforce and plan accordingly to meet future needs. This section provides short- and long-term recommendations to build interest in engineering and develop and retain qualified personnel.

A. Build Interest in Energy-Related Fields

Considering the perception among some students that careers in energy-related fields are obsolete and old-fashioned, it is vital to build interest for careers in this industry. Building interest includes communicating the image of engineers who work in the power industry in terms that the next generation of engineers will relate to. The youth of today want to choose jobs that make a difference in the world.

1) Become a Mentor

Formal and informal mentor programs allow mentors to share knowledge, experience, and advice with less experienced mentees. Likewise, emerging professionals gain access to information and guidance regarding their chosen career path. The alliance between the mentor and mentee often reduces knowledge gaps.

2) Expose Students to Math and Science Early

It is important to build interest in math, science, and engineering at an early age. Parents, teachers, and the industry have a responsibility to provide this exposure and opportunity.

A high-tech manufacturer in eastern Washington has hired an instructor to teach elective electronics courses to local high school students. The goals of this program are to expose students to the fundamentals of electronics and create interest for those who have not had this type of opportunity. At the start of the program, students were bused from the high school to the manufacturing facility. Today, the instructor has a convenient lab and classroom at the high school, as seen in Fig. 6.

Fig. 6. An electronics course sparks interest with high school students.

The program is now in its tenth year, and over 350 students have completed the electronics course. About 10 percent of these students have gone on to college with an engineering major. Most have pursued or intend to pursue careers in electrical engineering (a few have enrolled in mechanical and civil engineering programs). Another approximately 25 students are currently pursuing careers in high-tech or other skilled fields. About half of the students planning to pursue an engineering career said they never considered doing so before taking the course at school. The number of future engineers is expected to increase as more students participate in this program.

3) Participate in Internship Programs

Internship programs benefit employers and students. Students receive invaluable hands-on experience working side-by-side with professionals in the industry. Employers benefit from the added help to complete necessary work and have the opportunity to evaluate intern performance for potential full-time employment.

a) Western United States Utility Implements Internship Program

A western United States utility manages an organized internship program for upper-level students and college graduates who desire to enter the power industry. When the program began in 2003, the utility expected that an effective recruiting program would take years to show positive, long-term benefits. The goals of the program are to identify and hire the best candidates from diverse backgrounds and provide an invaluable experience of utility life. Selected schools all have strong power programs and are active members of PSERC (Power Systems Engineering Research Center).

Interns work on real projects in a specialty area, such as protection and control, substations, or project management, as opposed to working a rotation schedule. Interns participate in weekly group field trips to learn about all areas of the utility, regardless of group assignments. These outings include visiting generation facilities, touring substations, or observing line crews connecting a new service or pulling wire (Fig. 7). Since 2003, this utility has hired 40 percent of its interns as full-time employees.

Fig. 7. Interns participate in group outings.

b) Manufacturer Implements Internship Program

A large manufacturer in the power industry that has run a successful internship program for college students since 2001 has employed over 343 interns, converting 96 to full-time positions. Interns are assigned projects that put their skills and knowledge to the test, giving them an opportunity to gain invaluable real-life experience. They work alongside full-time employees and are given real problems to solve that have measurable effects on the company.

This program provides students an opportunity to develop job-related skills and an environment that encourages personal and professional growth (Fig. 8).

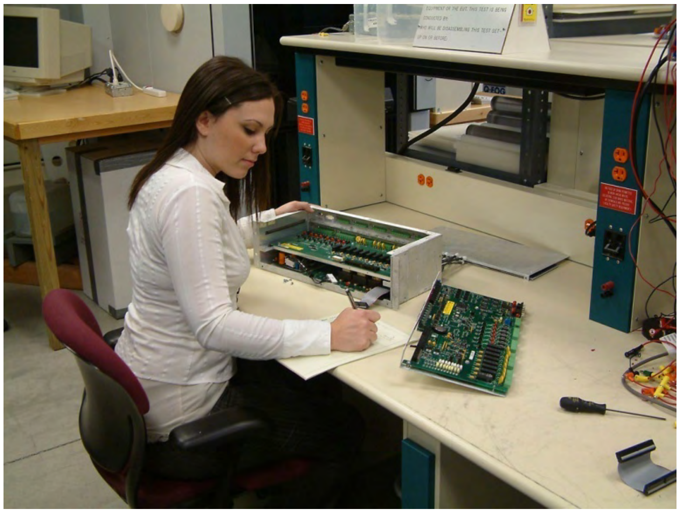

Fig. 8. Interns gain invaluable experience.

4) Sponsor Senior Design Projects at Universities

Colleges are continually looking for companies to sponsor senior design projects and mentor design teams. Sponsorships vary but may include financial, equipment, software, or tool donations. Additionally, technical experts may provide consultations. Through sponsorships, students are exposed to solving real-world problems, following engineering procedures, and working as a team to complete their assignments.

As an example, a design project for Washington State University (WSU) included developing settings for digital relays to retrofit electromechanical relays on nearly 50 distribution feeders in the campus steam plant, shown in Fig. 9. The project spanned several years, allowing multiple design teams to work on the upgrade.

Fig. 9. WSU steam plant.

The feeders supply power to approximately a quarter of the buildings on the WSU campus. Each feeder had three single-phase overcurrent relays that were replaced by a single digital overcurrent relay. The upgrade project also replaced older meters with new technology, as seen in Fig. 10, to enable energy studies and usage measurements for campus buildings.

Fig. 10. Students created settings for digital relays to replace electromechanical relays on feeders in the WSU steam plant.

The relay settings from existing protection could not be reused, because the university had substantial growth in more than 30 years since the relays were installed. Some of the protective relays were more than 44 years old.

Typical project teams consisted of three electrical engineering students, all in their final year of undergraduate power engineering. Teams reviewed the paper one-line diagrams of the university distribution system and developed models using commercial software. To build accurate models, the team evaluated the age and type of conductor for each feeder, fuse type and location for coordination in a fuse-saving design, motor contribution to fault current, and load conditions. All of the information was used to calculate fault current levels and coordinate the relays with fuses. It was also necessary to develop a plan for load shedding based on the importance of the loads fed by each feeder. Medical and lab facilities were given the highest priority and would be shed last, while classrooms and offices would be shed first. At the end of the project, the teams provided the electronic one-line diagrams, coordination study, load-shedding logic, and relay settings for each feeder.

This project represents actual work that electrical engineers perform to support the electric power system today. The experience gained from this design project resulted in several students going on to work as full-time employees of the manufacturer who supplied the newer digital equipment, while others went to work for electric utilities.

5) Volunteer as a Guest Speaker

Volunteer to speak at a university career day or as a supplement to ongoing curriculum, because students learn from professionals who share real-world problems solved by engineering.

Fig. 11. Guest speaker lectures to engineering students.

6) Participate in Industry Advisory Councils

Companies should participate in industry advisory councils at universities and colleges. This involvement provides an opportunity to work with engineering departments, faculty, and professors to offer advice for planning curriculum, staffing, and laboratory needs. Advisory councils also give companies and universities the ability to work together on issues, such as building interest to attract and retain students. The collaboration is an opportunity for industry employers to share hiring plans and expectations for new graduates entering the workforce. Contact electrical engineering department chairs at universities and colleges to participate in advisory councils.

7) Donate Equipment

Equipment donations are key to the success of most engineering programs. Laboratories with up-to-date, high-tech equipment provide students with invaluable hands-on experience using common industry tools and equipment. Putting state-of-the-art equipment in the hands of engineering students is an opportunity to rid them of perceptions that careers in energy-related fields are obsolete and old-fashioned.

8) Sponsor Visiting Professorships

Sponsor visiting professorship programs with universities to incorporate industry experts in the teaching and learning process, because students benefit from professional knowledge and experience through lecture and classroom interaction. Successful programs can range from one week to a year or more.

9) Attend Recruiting and Career Fairs

Employers should consider attendance at career fairs as more than just handing out gadgets but rather an opportunity to attract and hire qualified candidates. One manufacturer regularly attends engineering career fairs where practicing engineers participate as guest lecturers in the classroom and discuss a variety of topics. Two lecture examples are provided in the following paragraphs.

The first lecture on protective relay design was given to a power systems analysis course. The lecturer described the electronics, signal processing, and protection logic necessary to implement a simple inverse-time overcurrent element in a protective relay.

The lecture covered signal scaling, sampled data system theory, electronics design, digital filtering, magnitude and angle calculations, programmable logic, latching trip and close logic, and contact I/O operation.

The second lecture on metallic contact switching capacity was given to a power electronics class. The class learned why metallic contacts have trouble interrupting dc current and how to improve their ability to do so.

Following both lectures, students remained after class to ask questions and talk with the guest lecturer. This contact resulted in interviews with five highly qualified students that had not before considered electric power systems as an area of interest.

B. Manufacturer Implements Apprenticeship Program

A large manufacturer in the power industry has implemented an apprenticeship program for new employees who recently graduated with electrical engineering degrees. The goal of the program is to facilitate professional, technical, and leadership growth through a variety of learning activities in the first two years of employment to foster well-rounded employees exhibiting the qualities and core competencies discussed in this section.

1) Technical Expert

While this quality is obvious, competency is developed through mentor instruction, coursework, project work, and field assignments.

2) Excellent Communicator

Many engineers have the necessary technical knowledge required for their respective position. However, there is one quality that separates good engineers from great engineers and that is their ability to communicate their ideas to others. This includes writing papers, speaking at conferences, and even speaking effectively in small meetings.

3) Problem Solver/Innovator

Engineers encounter issues or challenges daily and need to think outside of the box, be creative, and innovate new solutions or approaches to problems. They are encouraged to be creative even if their idea might fail.

4) Value Driven

The manufacturer involved with this apprenticeship program feels that the company values and culture are important to the success of its business, and the mentor is a role model for the apprentice.

The two-year program includes formal training, mentorship, and field work to facilitate learning and development. Apprentices are assigned a formal training path of technical and nontechnical courses, starting with power system fundamentals. Apprentices are paired with senior-level engineers who are their personal mentor throughout the program. The mentors are not only technical experts but also great leaders and excellent communicators. The program is designed in a way that learning is a part of work, not apart from work. Field work provides daily opportunities to apply what apprentices have learned in the classroom and from their mentor within the context of their job description.

C. Utility Provides Preapprentice and Apprenticeship Program for Line Workers

As mentioned earlier, employer-sponsored apprenticeship programs typically last about four years. A western United States utility has established electrical trainee and apprenticeship programs for its company. The electrical trainee position is a preapprenticeship program that gives the employee an opportunity to become an apprentice with an end goal of becoming a skilled journey-level worker.

1) Electrical Trainee Program

Electrical trainees participate in an intensive on-the-job training program. Elements of the training program include basic electricity, math, algebra, physical fitness, pole climbing, safety, and on-the-job training, including experience with various electrical crews. The duration of this training program is normally expected to be one year. Satisfactory progress in required classes and on-the-job activities is required for continuing in the program.

2) Apprenticeship Program

Apprentices work under the direction of journey-level workers. As shown in Fig. 12, work includes assisting in the construction, maintenance, and repair of electrical overhead and underground distribution and transmission systems. Apprentices prepare and set line poles and guy wires; repair or replace damaged or decayed poles; select and install cross-arms, insulators, cutouts, switches, lightning arrestors, and other devices on wood and steel structures; and install transformers, transformer banks, and related connections on poles.

Fig. 12. On-the-job training for line workers.

D. Develop a Plan for Future Labor Requirements

Organizations need to plan for their future labor requirements in an increasingly competitive job market. In a study conducted in 2005 by the American Public Power Association (APPA), "Work Force Planning for Public Power Utilities: Ensuring Resources to Meet Projected Needs," 77 percent of the organizations polled did not have a formal plan for meeting projected workforce needs. The report outlines a seven-step workforce planning model that can be used to address workforce issues arising from anticipated retirements [11]. The seven steps include the following:

1. Link workforce needs to the strategic plan.
2. Conduct workforce analysis.
3. Identify future workforce needs.
4. Perform a gap analysis.
5. Develop a strategy.
6. Implement the strategy.
7. Monitor, evaluate, and revise the strategy.

IV. Training for the Next Generation of Power System Engineers

Considering the projected number of new hires combined with a retiring experienced workforce, meeting the demand for a knowledgeable workforce is a concern for many organizations. Organizations short on experienced staff or lacking formal training programs should leverage established training programs to improve the technical competencies of their workforce.

One manufacturer offers a training program with courses for engineers, technicians, power system specialists, and managers concerned with protection, monitoring, control, automation, metering, and management of utility and industrial electric power systems (Fig. 13). To date, this program has trained about 12,500 students in the power industry.

Fig. 13. Training the next generation of power system engineers.

V. Conclusion

If not addressed, a shortage of expertise in the power industry as a result of imminent retirements in the aging workforce could have catastrophic effects on the national electric power system and society.

An upside to the problem is that utility line worker programs are steadily increasing and providing a promising outlook for career opportunities to replace retiring personnel. Likewise, engineering positions in the power industry are in high demand, and employment opportunities are good for college students in this market.

As an industry, we must communicate the opportunities to these potential engineers and emphasize the important role they will play in the delivery of safe and reliable electric power. We need to make it clear that the fundamentals of engineering learned in school are applicable in their careers and that they will be continually challenged to learn, innovate, and support state-of-the-art technology to advance the capability of power systems today to meet the needs of tomorrow.

Work with your company human resources department to see what is being done to analyze the workforce, plan for pending retirements and new hires, and fill knowledge gaps. When recruiting employees, go through benchmarking activities to ensure salaries are competitive and attractive to new hires. Learn more by contacting companies that have already implemented mentorship and internship programs. Contact colleges and universities to get involved with industry advisory councils, participate in career fairs, or be a guest lecturer.

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VII. Biographies

Amy Grice received a BS in electrical engineering in December 2002 and a Master of Engineering and Technology Management in 2008 from Washington State University. She joined Tacoma Power in January 2003 as an engineer in the SCADA (supervisory control and data acquisition) department. Currently, Amy is a senior engineer in the protection and control department and manages the Tacoma Power engineering internship program, where she recruits and trains interns.

Jackie M. Peer has a BS in electrical engineering from Washington State University (WSU). In 1996, she joined Schweitzer Engineering Laboratories, Inc. (SEL) as an application engineer. She managed distribution engineering in research and development (R&D) and product marketing and presently is the R&D manager for precise time and communications solutions. Prior to joining SEL, she worked for the U.S. Army Corp of Engineers at a hydroelectric facility. She is a member of the American Marketing Association, IEEE, and IEEE WIE (Women in Engineering) and a senior member of the Society of Women Engineers. She also serves on the WSU Electrical Engineering and Computer Science Industry Advisory Board.

Greg T. Morris has an MBA from the University of Phoenix and a BS in mathematics from Ottawa University. He joined Schweitzer Engineering Laboratories, Inc. (SEL) in December 2001 as business manager for SEL University. He is now the regional sales and service director for the SEL western region. Prior to joining SEL, Greg worked for Honeywell, Inc. for 25 years in the automation and control solutions group, where his last assignment was director of training and information services. Greg is a member of the Manufacturers' Agents National Association.

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