

Gaps in the Energy Workforce Pipeline:

A 2007 Workforce Survey Report From the
Center for Energy Workforce Development



About CEWD

Formed in March 2006, the Center for Energy Workforce Development (CEWD) is a non-profit organization of electric, natural gas and nuclear energy companies and their associations – American Gas Association, Edison Electric Institute, National Rural Electric Cooperative Association, and Nuclear Energy Institute. CEWD was formed to help member companies work together to develop solutions to the coming workforce shortage in the industry. It is the first partnership between utilities, their associations, contractors and unions to focus on the need to build a skilled workforce pipeline that will meet future industry needs.

CEWD is working with secondary and post-secondary educational institutions and the workforce system to create practical solutions to address the need for a qualified, diverse workforce. CEWD has established a partnership with the International Brotherhood of Electrical Workers. The large contingent of the utility workforce that is represented by the union and the apprenticeship programs that train them are a critical element of the industry solution to workforce issues. In addition, CEWD has established partnerships with the Association for Career and Technical Education, the Energy Providers Coalition for Education, and the National Association of Workforce Boards.

CEWD's goals are to decrease the amount of time it takes to create educational programs, improve the skill levels of graduates, and increase the number of diverse, qualified applicants who want to come to work for utilities.

Center for Energy Workforce Development

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Gaps in the Energy Workforce Pipeline

2007 Workforce Survey Report

Executive Summary

Within the next five years, the Baby Boom generation will start to become eligible for retirement, sending ripples across the U.S. economy. The aging U.S. workforce presents a significant challenge to the energy industry, which faces the prospect of losing roughly half of its skilled workforce at a time when growing demands for electricity – coupled with a growing population and economy – are fueling demand for these workers. The NERC 2007 Survey of Reliability Issues states that the “Aging Workforce and a Lack of Skilled Workers” is ranked first among all business issues, with the highest likelihood and highest impact on reliability.

Americans are consuming electric energy as never before. Our use of cell phones, high-definition televisions, MP3 players, digital cameras, laptop computers and cordless phones helped create an unprecedented demand for uninterrupted power at home and at work. According to a 2006 report prepared by *The Brattle Group* for the Edison Foundation, American homes today are bigger and use 21 percent more electricity than they did three decades ago. Likewise, all industries rely heavily upon the latest technology and electronics to increase efficiency and stay connected to the American consumer.

Not only do we use more electric energy as individuals, the number of individuals using electricity continues to grow. The U.S. Census Bureau estimates that one baby is born every eight seconds in America, and that our population will grow 23 percent by 2030. Consequently, the Energy

Information Administration (EIA) expects national electricity consumption in the U.S. to grow by at least 40 percent by 2030.

Meeting new demands for electricity will require energy providers to make major investments in new power plants, as well as the transmission and distribution systems used to deliver electricity where

it is needed. Cambridge Energy Research Associates estimates that, nationwide, the electric power industry will invest approximately \$900 billion in infrastructure projects over the next 15 years.

Natural gas supplies about one-fourth of all energy consumed in the United States. It is one of the largest sources of energy for all major stationary consumers – residential, commercial, industrial and electricity generators. Significant growth is anticipated in natural gas demand over the next two decades, particularly for electricity generation.

At the same time, there will be the need to replace and install new pipelines at the local level to continue to deliver natural gas safely, reliably and cost-effectively.

In order to estimate the supply of workers in electric and natural gas related jobs that will be needed in the future, the Center for Energy Workforce Development (CEWD) has sponsored the first CEWD Workforce Pipeline Survey. This survey looked at workforce needs in the electric and natural gas utility industries and projected shortfalls for the next five years and beyond. The Nuclear Energy

Future Outlook

By 2012:

- More than half of all non-nuclear power plant operators may need to be replaced.
- 52% of Generation technicians will reach retirement eligibility.
- Nearly 40% of line-worker jobs may need to be filled.
- Roughly 46% of all engineering jobs could become vacant.

Institute (NEI) recently conducted a similar survey for the nuclear energy industry. Both surveys reached similar conclusions: If aging and experienced workers retire as they become eligible to do so, the energy industry, as a whole, will face critical labor shortages, with little time to train new hires.

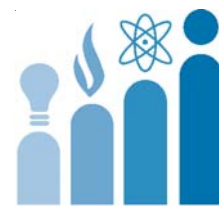
In short, the need for skilled workers has never been greater. Yet, this increased need hits just as our most experienced workers prepare to retire and the median age of U.S. workers also begins to climb. The U.S. Department of Labor reports the median age of American workers will reach 41.4 by 2012. The median age of the workforce surveyed in this report is already 45, and by 2012 will be nearly nine years older than the national figures. This indicates electric and natural gas companies could face a worker shortage earlier than most other segments of the U.S. economy. In fact, in some job categories, such as lineworkers and engineers, companies are already experiencing difficulty recruiting sufficient talent to match current needs.

Specifically, by 2012:

- More than half of all non-nuclear power plant operators may need to be replaced.
- 52 percent of Generation technicians will reach retirement eligibility.
- Nearly 40 percent of lineworker jobs may need to be filled.
- Roughly 46 percent of all engineering jobs could become vacant.

While the data does show that some companies have begun to hire replacement workers – particularly engineers – the number of new hires may not be sufficient to stave off potential gaps. Some companies have also implemented strategies to delay the need for replacements, such as offering incentives for employees to delay retirements. Others may turn to contractors, who traditionally supply supplemental labor for linework, plant outage work or scheduled maintenance, to meet their needs. However, those contractors are facing the same issues and report similar shortages in their workforce.

Other industries with similar skill sets, such as manufacturing and construction, are also competing for the same limited pool of workers. What's more, even companies that have worked to fill the



Electric and natural gas companies could face a worker shortage earlier than most other segments of the U.S. economy.

workforce pipeline should heed signals of an industry-wide shortfall, since companies facing more substantial shortages may try to hire away from those that are fully staffed.

And all will feel the pressure from an expanding industry, as new power infrastructure systems come on line to compete with existing systems for the same pool of labor. The data reported in this survey reflect direct hires for electric and natural gas utilities that will be needed to replace retiring workers. The figures shown represent current estimates of attrition from retirement and other factors. The study does not take into account the increased demand for workers that will emerge from the new electric transmission and distribution lines, natural gas pipelines and power stations scheduled for construction within the next few years. At this point, it is difficult to predict the number of workers that will be needed for new construction efforts until planning is completed by the utilities involved.

Though many workers may choose to delay retirement, the industry cannot afford to wait five years to see what happens. Many companies are already seeing the results of the first wave of retirements by having to hire double and triple the number of workers from the previous year. If aging workers do choose to retire en masse, companies will lose, along with them, a wealth of experience and institutional knowledge that cannot quickly be regained. For example, some positions, such as lineworkers, may require five years of training before workers are fully prepared to do the job.

As the data in this report reveal, new workers must be brought into the pipeline now, giving older, more experienced workers an opportunity to transfer knowledge and training before they move on.

Purpose

In recent years, many in the energy industry have reported difficulties recruiting young, skilled workers – particularly lineworkers and engineers. Meanwhile, general U.S. labor trends point to an aging workforce, making the need for younger replacement hires all the more critical. But until now, no data specific to electric and natural gas utilities have been available to document workforce needs or project shortfalls. While the Bureau of Labor Statistics identifies trends based on individual jobs, it does not collect or publish data in aggregate for electric and natural gas utilities industry-wide.

The Center for Energy Workforce Development (CEWD) undertook the challenge of collecting data for electric and natural gas utilities. This survey will allow utility companies and their associations to speak authoritatively about workforce issues and to target workforce solutions and resources in the most critical areas.

Survey Background

This survey collected data from 37 electric and natural gas companies, including eight of the 12 largest utilities in the United States. Data were also provided by the National Rural Electric Cooperative Association (NRECA), an industry organization representing more than 900 cooperatives from 47 states. The companies surveyed are regulated utilities or cooperatives that sell directly to residential, commercial or industrial customers. The companies that responded to the survey represent slightly more than 40 percent of all employees in electric and natural gas combination companies, all employees in electric cooperatives and a small percentage of employees in natural gas-only utilities.

Electric and natural gas utilities were asked to report data on expected attrition; current vacancies; and anticipated shortages, in the Generation as well as Transmission and Distribution sectors. The survey asked for detailed information regarding direct hires in five jobs considered the most critical in the industry: lineworkers, power plant operators, technicians, pipefitters/pipelayers and engineers. A copy of the survey instrument is included in the appendix, along with the assumptions that were made when analyzing the data.

Although the Total Company data did include nuclear employees for balancing purposes, this survey did not collect data specific to the nuclear power industry, nor did it collect data on supplemental labor. A related survey of nuclear energy workforce needs, however, was recently conducted by the Nuclear Energy Institute (NEI) and is being reported separately. The same methodology was used in both surveys, allowing for the potential to ultimately compile a joint report on the industry.

Summary Findings

According to the U.S. Census Bureau (with information on the nuclear industry from NEI), there are approximately 550,000 employees in the electric and natural gas utility industry. Of this number, a little more than 120,000 work in Generation (including nuclear) and an estimated 260,000 work in Transmission and Distribution (T&D).

The data collected from this survey show that, within five years, the electric and natural gas utility industry could potentially lose 40-50 percent of the employees in these functions, with projected losses for some positions as high as 60 percent of employees. The extent of the losses depends upon the job category, with Generation significantly more at risk than T&D.

The potential for retirements or losses through attrition varies by position and by function, as shown. For example, when the technician position is broken down further, 52.1 percent of technicians in the Generation function could be eligible to retire in the next five years. With an additional 8.4 percent loss due to normal attrition, that brings the potential for replacements in that position to just more than 60 percent.

The survey respondents provided information on the technician and pipefitters/pipelayers job categories for both Generation and T&D, and additional analysis follows in this report.

As shown in Figure 1, companies surveyed reported that only 13 percent of employees are below the age of 33. Though some in the industry are beginning to hire to ward off projected shortfalls, overall there remains insufficient capacity in the workforce recruiting and training pipelines to fill the expected need.

As the graph shows, attrition from retirement becomes a problem after workers reach age 52, increasing dramatically in subsequent age categories.

Table 1

Job Category	Percentage of Potential Attrition & Retirements	Estimated Number of Replacements
Technicians	51.4	30,000
Power Plant Operators	50.5	12,500
Engineers	46.1	15,000
Pipefitters / Pipelayers	45.3	8,500
Lineworkers	40.8	30,000

Figure 1

Age Distribution Electric & Natural Gas Utility Employees

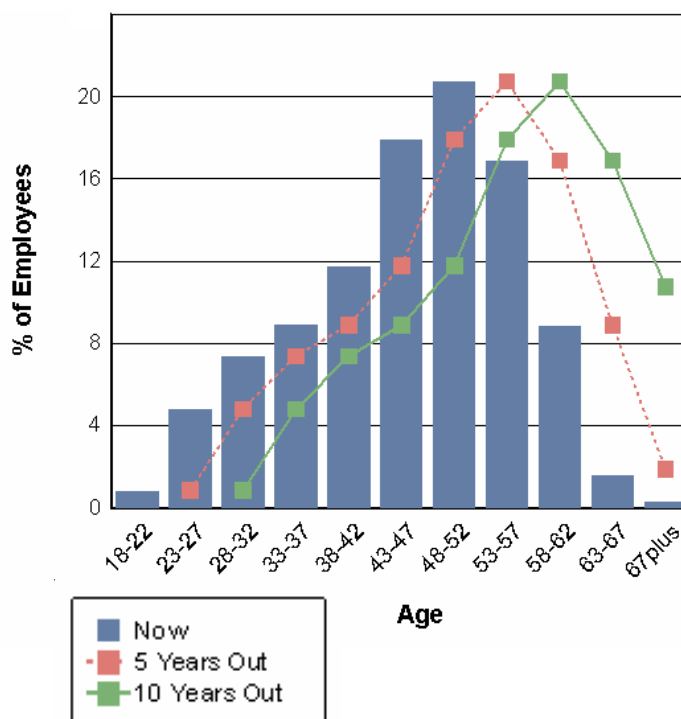
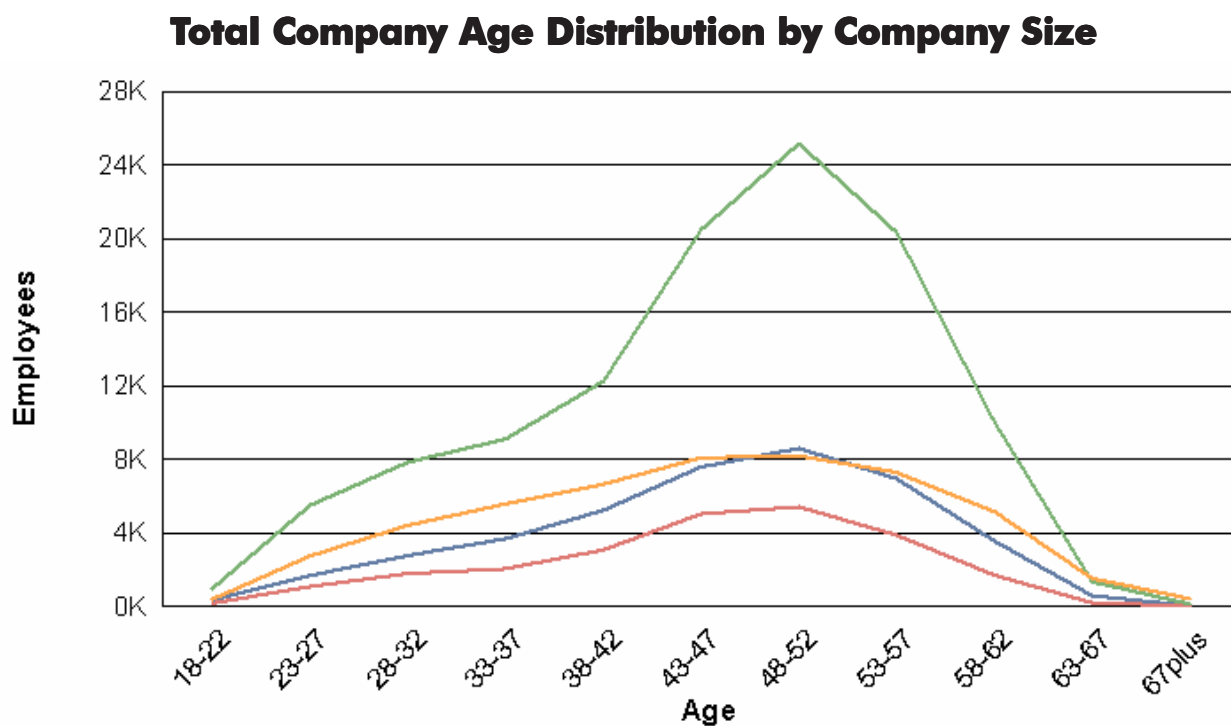
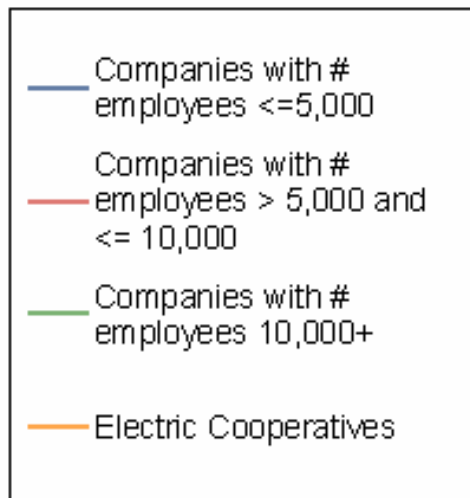


Figure 2



Age distribution also varies by the size and type of company. Survey results show that investor owned utilities (IOUs) have lower percentages of employees in the younger age groups than do electric cooperatives.



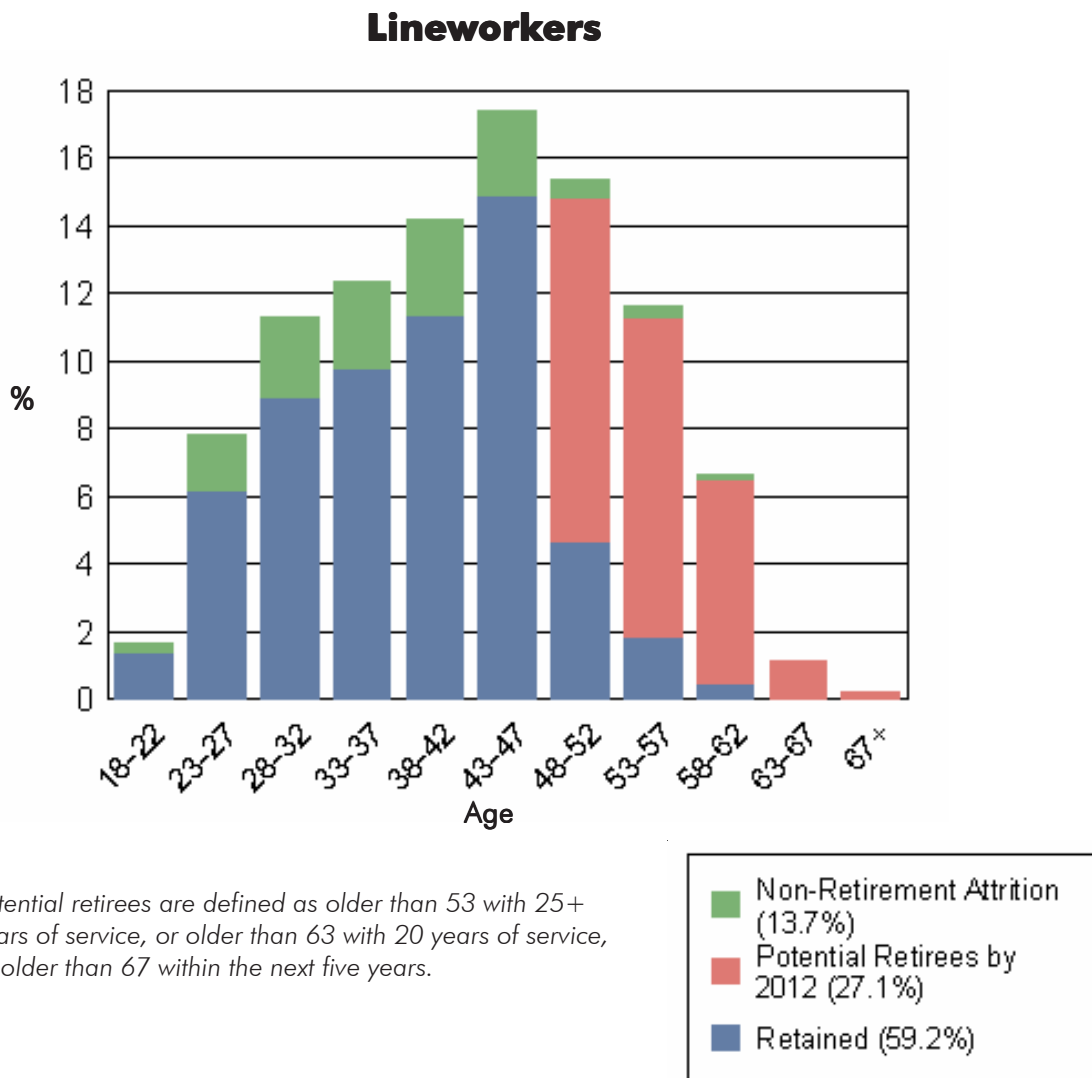
Results by Job Category

Lineworkers

Lineworkers make up about one third of all jobs in T&D. They are responsible for the installation and repair of overhead and underground distribution and transmission lines, poles, transformers and other equipment. Job titles include lineworker, line installer, lineman, linewoman, underground mechanic, underground specialist, towerman and towerwoman.

Lineworkers generally require five years of training before they reach journeyman status (a level of proficiency that no longer requires direct supervision). Because of this extended learning curve, it is particularly important to keep a constant flow of new hires in the lower age brackets, so that workers have sufficient time to get up to speed before they are needed to replace those who may be retiring or leaving to seek other career opportunities.

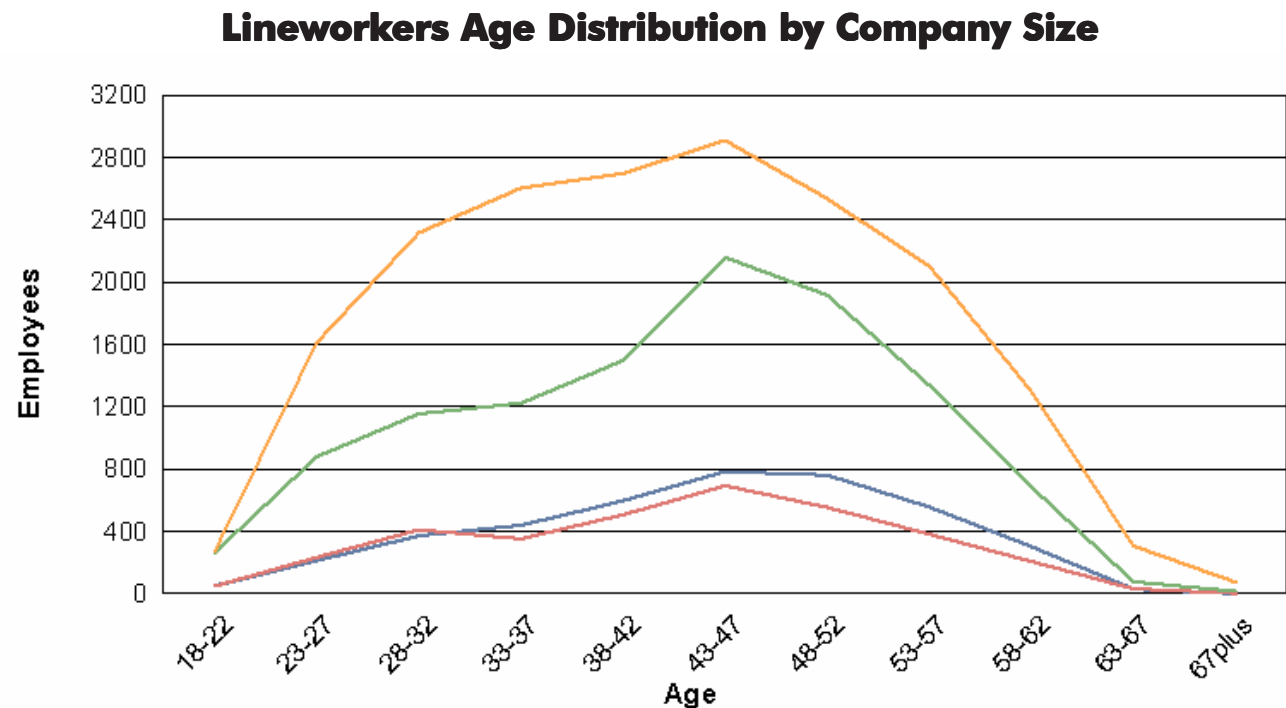
Figure 3



Results of the survey indicate that 27.1 percent of lineworkers are eligible to retire in five years, with an additional 13.7 percent who will potentially leave for other work. That amounts to an estimated 30,000 lineworker positions that could need to be filled industry-wide.

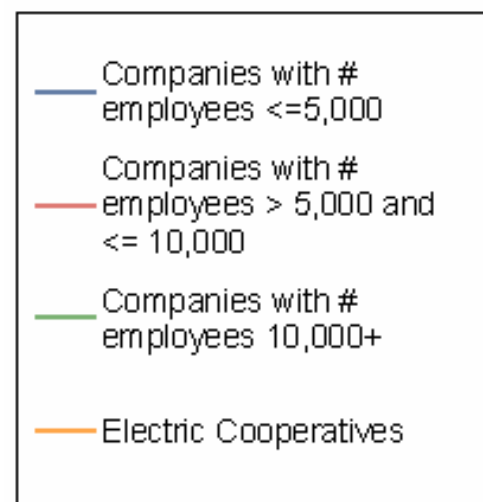
It is also interesting to note that lineworkers are the only job category surveyed where the number of workers begins to decline after age 47. For the other job categories, the number of workers does not begin to decline until after age 52. This difference may indicate that employees leave lineworker jobs for other positions due to the physical nature of the work.

Figure 4



Although there are some differences in the age distribution of lineworkers when comparing large companies to smaller companies, the most significant difference comes when comparing electric cooperatives to investor-owned utilities (IOUs).

NRECA reports that 36 percent of electric cooperative lineworkers are under age 37, while the IOUs surveyed show only 30 percent in this category.



Technicians

Generation technicians are responsible for the construction, assembly, maintenance and repair of steam boilers and boiler house auxiliary equipment. The job category includes boilermakers, mechanics, welders and instrument and control technicians.

The data clearly illustrate that a significant challenge exists for Generation technicians. If all of those who are eligible to retire exercise this option, the industry could lose 52.1 percent of its workers by 2012. Add to this those who leave through standard attrition, and the industry faces the potential need to replace 60.5 percent of its workforce over a five-year-period. When you consider that only 13.6 percent of Generation technicians are under the age of 37, compared to 26.2 percent of workers in other job categories, there are not enough younger employees to replace retiring workers.

Transmission and Distribution (T&D) technicians are those workers who install, repair and operate electrical and mechanical equipment. This includes inspecting and testing electrical equipment in power generating stations and substations. The job category includes substation mechanics, relay technicians, electricians and instrument and control technicians.

On the Transmission and Distribution side the data show roughly one-third of these workers could potentially retire within five years, as those who become eligible to retire choose to do so.

Including those who may leave for other reasons, the industry could potentially face replacing roughly 30,000 Generation and T&D technicians.

Note for Figures 5 and 6: Potential retirees are defined as older than 53 with 25+ years of service, or older than 63 with 20 years of service, or older than 67 within the next five years.

Figure 5

Technicians - Generation

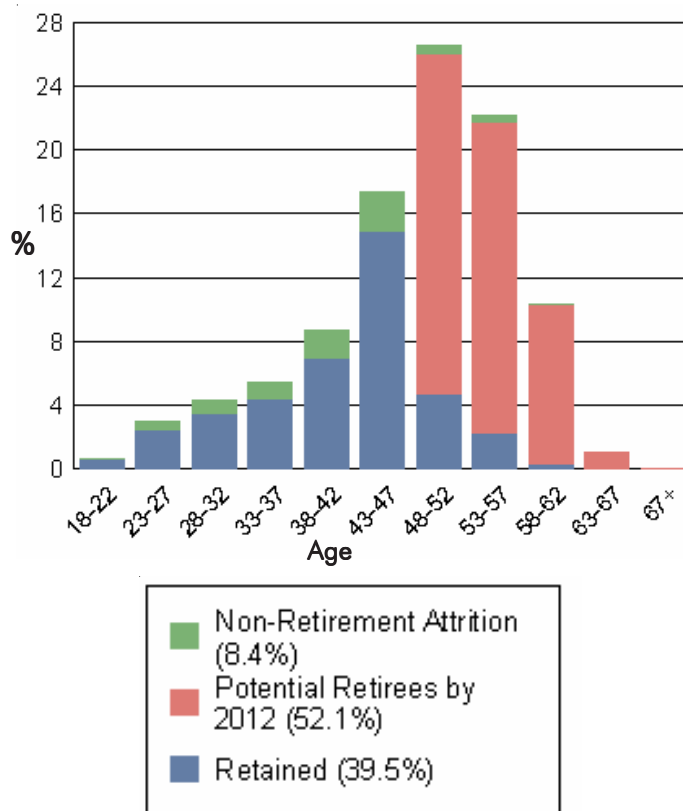
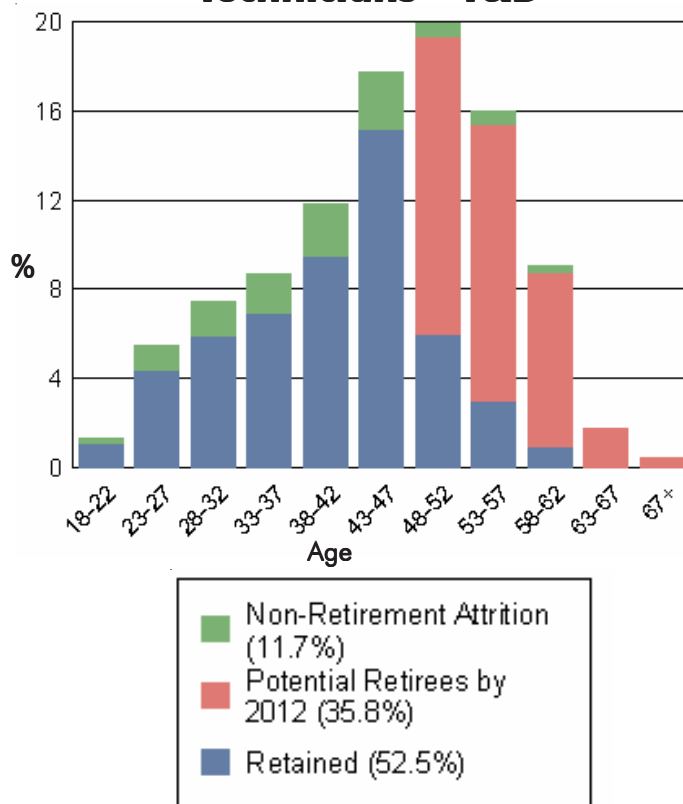


Figure 6

Technicians - T&D



Power Plant Operators

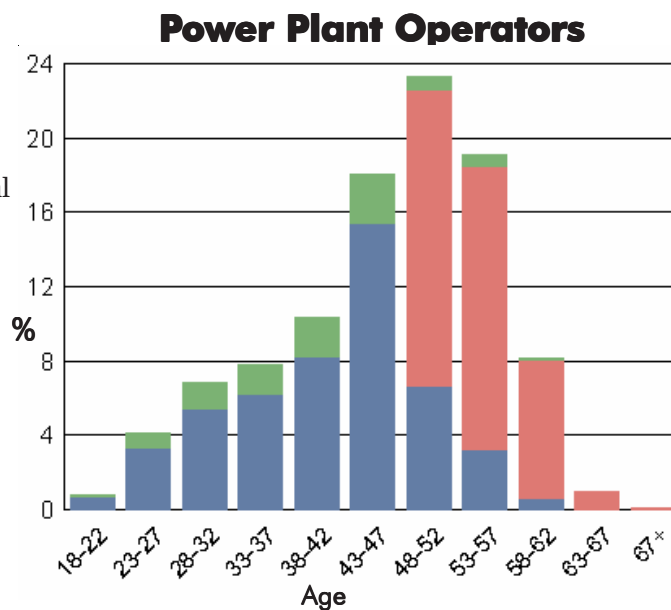
Power plant operators are responsible for the maintenance and operation of all primary and auxiliary equipment required to generate electricity or meet natural gas customers' demands. The job category includes power plant operators, natural gas station operators, technical operators and mechanical operators. Most of these jobs are within the fossil fuel, i.e., coal and natural gas, sector of the industry and all of them are in the Generation function.

As with Generation technicians, the picture presented by this data is a compelling one: Within five years, potentially half of all power plant operators, or roughly 12,000 employees, may need to be replaced.

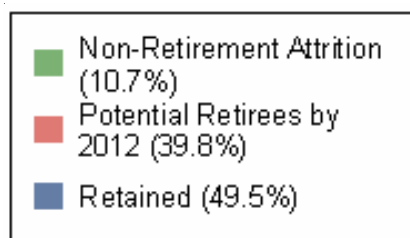
It's clear that for this job category the number of employees entering the pipeline will fall far short of projected needs. Only 19.7 percent of the job population is under the age of 37.

What's more, it takes anywhere from five to 10 years of experience before a worker is adequately trained to operate a power plant independently. Cross-training between those coming into the pipeline and those leaving it is critical.

Figure 7



Potential retirees are defined as older than 53 with 25+ years of service, or older than 63 with 20 years of service, or older than 67 within the next five years.



Pipefitters and Pipelayers

Generation pipefitters and pipelayers are responsible for the installation and maintenance of pipe systems and related equipment for steam, hot water, heating, sprinkling, and industrial production and processing systems. The category includes both welders and boilermakers.

In Transmission and Distribution, pipefitters and pipelayers are responsible for the installation and maintenance of natural gas mains and services, and also act as first responders to natural gas leaks. The category includes gas street leaders, utility mechanics, gas service specialists and welders.

Based on the data gathered in this survey, it appears that a significant need exists for pipefitters and pipelayers working in Generation (*Figure 8 on next page*).

There is the potential to lose more than 60 percent of these employees over the next five years. Since pipefitters and pipelayers are often hired as contract workers at electric power plants, and because contract workers were not included in this survey, it's difficult to make accurate projections for workforce needs in this subcategory.

Based on the data collected in this survey, it appears that roughly one-third of pipefitters and pipelayers in the Transmission and Distribution function will become eligible for retirement by 2012 (*Figure 9*). When combined with attrition for other reasons, the data show that the industry could lose about 43 percent of its workforce in this category over the next five years.

Approximately 8,500 pipefitter/pipelayer positions could become vacant in the industry due to retirements and other attrition over the next five years.

Figure 8

Pipefitters & Pipelayers - Generation

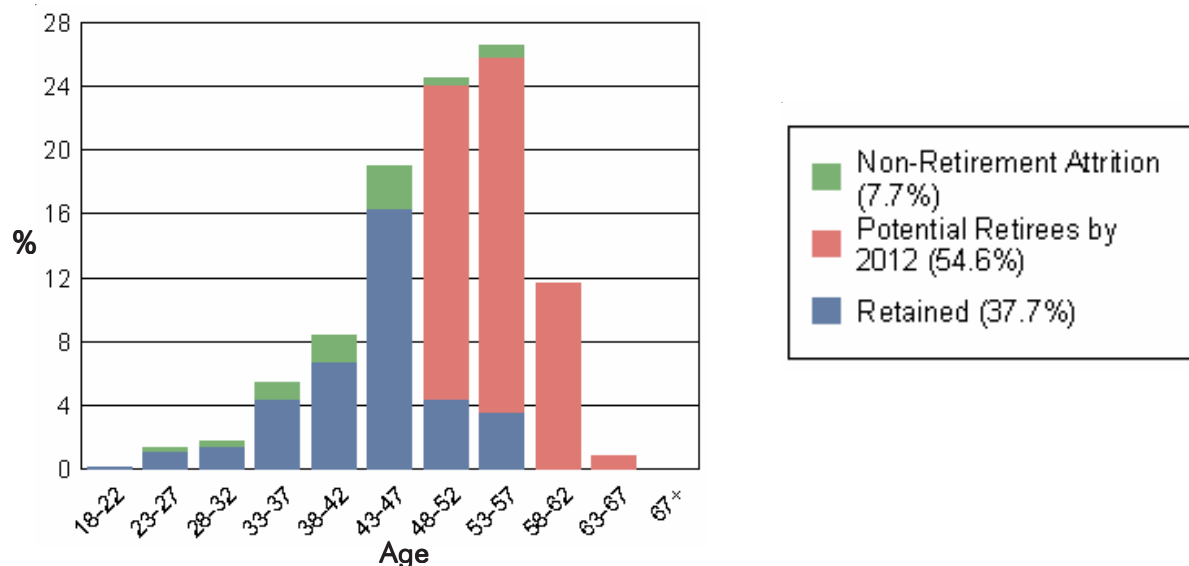
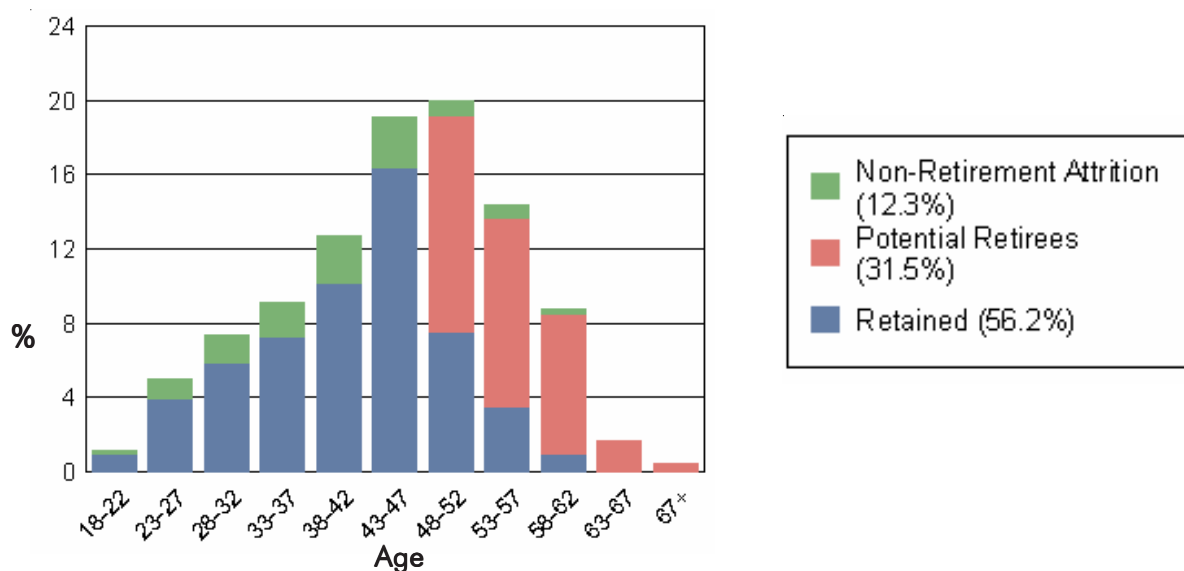


Figure 9

Pipefitters & Pipelayers - T&D

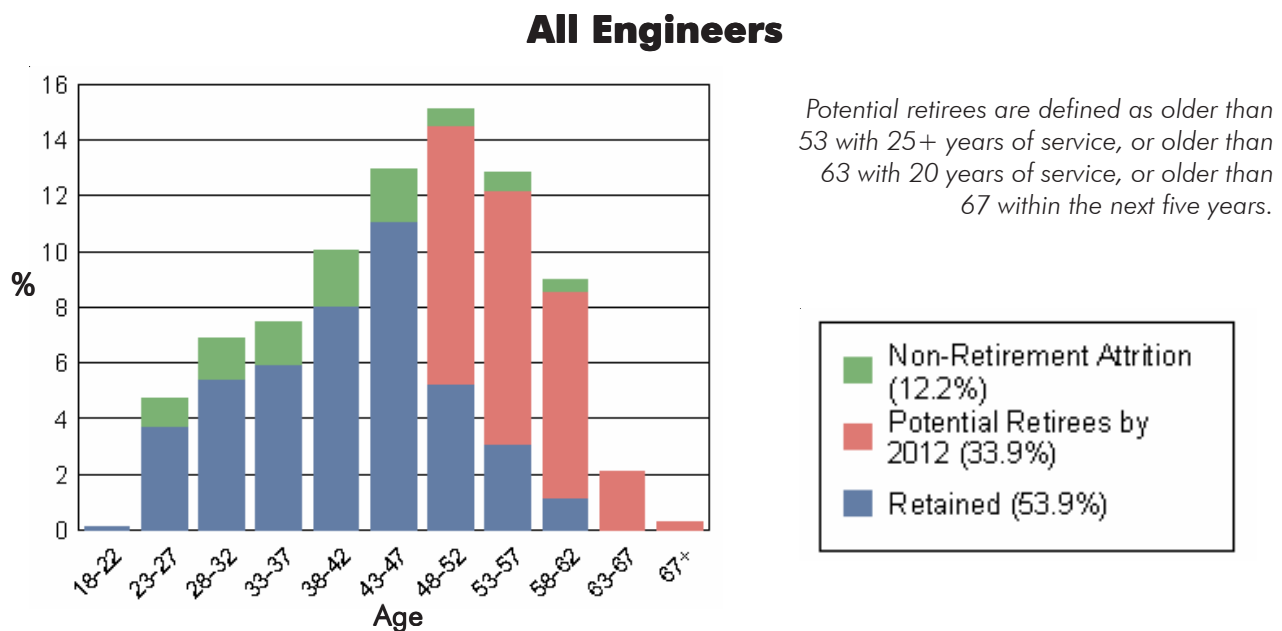


Note for Figures 8 and 9: Potential retirees are defined as older than 53 with 25+ years of service, or older than 63 with 20 years of service, or older than 67 within the next five years.

Engineers

Engineers fall into two general categories: those who work on electrical systems, equipment and facilities (power engineers); and those who work on non-electrical systems, processes, equipment and facilities. Both include people involved in planning, research, design, development, construction, installation, and operation of equipment, facilities and systems for the safe, reliable, and economic generation, transmission, distribution, consumption and control of electricity and natural gas. These jobs usually require a bachelors, masters, or in rare cases a Ph.D. in one of the engineering disciplines from an accredited four-year university. Power engineers typically have an electrical engineering degree. Not all companies distinguish between power engineers and other types of engineers, so the data were combined with other engineer data for consistency.

Figure 10



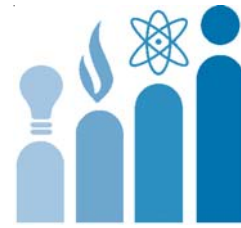
The data show that roughly one-third of engineers in electric and natural gas utilities will become eligible for retirement within the next five years. When non-retirement attrition is factored in, the industry could lose up to 46 percent of its total engineer workforce, or roughly 15,000 of its most experienced workers.

Looking specifically at power engineers, it appears that some effort has been made to hire mid-career engineers (those in the 38-42 age range) in advance of retirement, which would satisfy the need for a more experienced hire. However, it also appears that power engineers retire earlier than others in the industry or leave for positions in other areas or industries, as evidenced by the dip in those aged 53 or above. This makes it all the more critical to ensure an overlap of experienced and inexperienced workers so that knowledge may be easily transferred.

Energy companies need to have sufficient numbers of experienced engineers to replace those who may be leaving. Engineers – unlike other types of workers in the energy industry – come on the job with a certain skill level because of their specialized education. However, they generally require another three years of on-the-job training to learn the specifics of utility operations before they reach a sufficient experience level to work independently. In addition, industry experts report that they need at least 10 years of on-the-job experience to replace a seasoned engineer who retires.

Conclusions

The energy industry labor force, like the U.S. labor pool in general, is getting older. Overall, the electric and natural gas industry stands to lose between 40-50 percent of its workforce over the next five years, as a substantial number of employees reach retirement eligibility. Industry restructuring and hiring difficulties in the 1990s contributed to the general shortage of experienced workers moving through the pipeline, as have difficulties in recruiting younger workers in some sectors.



Technicians and power plant operators are at the greatest risk for turnover.

Problems exist across job categories, but appear greatest in Generation, where as many as 60 percent of skilled workers in some job categories may need to be replaced by 2012. Technicians and power plant operators are at the greatest risk for turnover, while companies face a different challenge with lineworkers, where numbers begin to decline at an earlier age.

Some companies have begun to address this problem in targeted areas (such as in engineering). But the number of new hires may not be sufficient to meet even current needs, let alone to fill shortages left by the retirements expected in the next five years. The problem may also be exacerbated by new power plant and energy infrastructure construction. Additional workers will be needed to build, repair and maintain systems and to staff new systems coming online over the next decade. Companies with full staffing will also be vulnerable to raiding from those stretched to meet the increased demand for workers.

Clearly, energy companies need to increase recruiting efforts and ramp up staffing. But with as many as 50 percent of workers vulnerable to turnover, filling entry-level positions can only be part of the solution.

Recommendations

The Center for Energy Workforce Development recommends a comprehensive approach to meeting workforce development needs that includes:

- ◆ Expanding the pool of entry-level workers entering the pipeline by creating career awareness campaigns and developing education programs to increase skill levels.
- ◆ Increasing efforts to decrease attrition and retain aging workers by offering incentives to delay retirement.
- ◆ Improving productivity and efficiency so that fewer workers are needed to get the job done.
- ◆ Increasing on-the-job mentoring programs so that knowledge can be transferred from seasoned workers to younger, less experienced hires.
- ◆ Developing apprenticeship programs that reduce the amount of time it takes for new employees to acquire needed competencies.

Appendix A

Assumptions

In analyzing the data, the following assumptions were made:

- ◆ In calculating average age, the weighted average uses the midpoint of each age group. For example, for the 18-22 age group, 20 was used as the midpoint.
- ◆ In calculating retirement attrition, potential retirees were defined as those older than 53 with 25 years of service or more, or those older than 63 with 20 years of service, or those older than 67 within the next five years (2007-2012).
- ◆ Non-retirement attrition was based upon a 3.69-percent rate, which was weighted across age groups. This percentage was derived from a three-year average of four larger companies (those with more than 10,000 employees).

Estimates on the number of new workers needed was extrapolated based on industry data from the U.S. Census Bureau, NEI, EEI and NRECA.

Appendix B

Definitions

JOB CATEGORIES

Lineworkers

This job category is responsible for the installation and repair of overhead and underground distribution and transmission lines, poles, transformers and other equipment. Titles include lineworker, line installer, lineman, linewoman, underground mechanic, underground specialist, towerman, and towerwoman.

Power Plant Operators

This job category is responsible for the maintenance and operation of all primary and auxiliary equipment required to generate electricity or meet natural gas customers' demands. Titles include power plant operator, technical operator and mechanical operator.

Technicians (T&D)

This job category includes the repair of both electrical and mechanical equipment. This includes inspecting and testing electrical equipment in generating stations and substations. Titles include substation mechanic, relay technician and electrician. This category also includes instrument and control technicians.

Technicians (Generation)

This job category is responsible for the construction, assembly, maintenance and repair of steam boilers and boiler house auxiliary equipment. Titles include boilermakers, mechanics, welders and instrument and control technicians.

Pipefitters & Pipelayers (T&D)

This job category is responsible for the installation and maintenance of natural gas mains and services. Also included are first responders to natural gas leaks. Titles include gas street leader, utility mechanic, gas service specialist and welders.

Pipefitters & Pipelayers (Generation)

This job category is responsible for the installation and maintenance of pipe systems and related equipment for steam, hot water, heating, sprinkling and industrial production and processing systems. Titles include welders and boilermakers.

Power Engineers

This job category focuses on electrical systems, equipment and facilities rather than on mechanical systems and other non-electrical systems involved in electric and natural gas energy services. It includes people involved in planning, research, design, development, construction, installation and operation of equipment, facilities and systems for the safe, reliable and economic generation, transmission, distribution, consumption and control of electricity. This category requires a bachelors, masters or, in rare cases, a Ph.D. in any engineering discipline (commonly an electrical engineering degree) from an accredited four-year university.

All Other Engineers

This job category focuses on non-electrical systems, processes, equipment and facilities involved in electric and natural gas energy services. It includes people involved in the planning, research, design, development, construction, installation and operation of equipment, facilities and systems for the safe, reliable and economic generation/supply, transmission, distribution, consumption and control of electricity and natural gas. This category requires a bachelors, masters or, in rare cases, a Ph.D. in any engineering discipline (commonly a civil or mechanical engineering degree) from an accredited four-year university.

BUSINESS UNITS

Total Business Unit – T&D

These positions are those that deliver natural gas and electricity to end-use customers (residential, commercial and industrial). Electric transmission positions work with higher voltages (230-500kv), while distribution handles lower voltages (4-26kv). Natural gas transmission delivers service through high-pressure systems, for example from companies such as Transco; distribution delivers service through local mains and services.

Total Business Unit – Generation

These jobs produce electricity, either through hydro, fossil fuel (oil, natural gas and coal) or nuclear energy. Power plant operations manage the production cycle.

Total Company

The survey data include all direct employees for each company. It does not include contract employees or supplemental labor.

Appendix C

2007 CEWD Workforce Survey Questions

Question 1:

Who is the person and company responding to this survey?

Name:
Title/Department:
Company Name:
Telephone Number:
Fax Number:
Email Address:

Question 2:

What is your expected attrition for the following years?

Please provide data in total head count of full-time equivalent positions. All data should be projections for the specified year end.

Attrition is defined as leaving the fossil or gas portion of the company for which you are responding, e.g. transferring to a position outside fossil or gas would count as attrition, moving from one fossil or gas plant to another should not be counted.

Transmission & Distribution Attrition

TRANSMISSION & DISTRIBUTION				
Year	Retirement	Non-Retirement Attrition	Total Attrition	Total Population
2006				
2007				
2008				
2009				
2010				
GENERATION				
Year	Retirement	Non-Retirement Attrition	Total Attrition	Total Population
2006				
2007				
2008				
2009				
2010				
TOTAL COMPANY				
Year	Retirement	Non-Retirement Attrition	Total Attrition	Total Population
2006				
2007				
2008				
2009				
2010				

Question 3:

What is the total number of current vacancies within the group for which you are reporting that you anticipate will be filled from outside your fossil or gas organization?

Vacancies should be defined as vacancies approved by management to be filled.

T&D Vacancies:

Fossil & Gas Generation Vacancies:

Total Company Vacancies (include Nuclear):

Question 4:

Our preliminary research indicated that you were most concerned about shortages with the job categories included in the survey. Do you anticipate critical shortages in other job categories? Please list them here.

DETAIL BY JOB CATEGORY

LINEWORKERS

This job category is responsible for the installation and repair of overhead and underground distribution and transmission lines, poles, transformers and other equipment. Titles include line worker, line installer, lineman, linewoman, underground mechanic, underground specialist, towerman, towerwoman.

Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

POWER PLANT OPERATORS

This job category is responsible for the maintenance and operation of all primary and auxiliary equipment required to generate electricity or meet gas customers' demands. Title would include power plant operator, technical operator, mechanical operator. DO NOT INCLUDE NUCLEAR.

Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

TECHNICIAN (T&D)

This job category includes the repair of both electrical and mechanical equipment. This includes inspecting, testing electrical equipment in generating stations and substations. Titles would include substation mechanic, relay technician, electrician. This should also include Instrument and Control technicians.

Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

TECHNICIAN (GEN)

This job category is responsible for the construction, assembly, maintenance and repair of steam boilers and boiler house auxiliaries. Titles could include boilermakers, mechanics, and welders. This should also include Instrument and Control technicians. DO NOT INCLUDE NUCLEAR.

Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

PIPEFITTERS & PIPELAYERS (T&D)

This job category is responsible for the installation and maintenance of gas mains and services. Also included is first responders to gas leaks. Titles would include gas street leader, utility mechanic, gas service specialist, and welders.

Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

PIPEFITTERS & PIPELAYERS (GEN)

This job category is responsible for the installation and maintenance of pipe systems and related equipment for steam, hot water, heating, sprinkling and industrial production and processing systems. Titles include welders and boilermakers. DO NOT INCLUDE NUCLEAR.

Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

POWER ENGINEERS

This job category focuses on electrical systems, equipment, and facilities rather than on mechanical systems and other non-electrical systems involved in electric and natural gas energy services. It includes people involved in planning, research, design, development, construction, installation, and operation of equipment, facilities, and systems for the safe, reliable, and economic generation, transmission, distribution, consumption, and control of electricity. A requirement of this category is a bachelors, masters, or Ph.D. in any engineering discipline (although commonly an electrical engineering degree) from an accredited four-year university. DO NOT INCLUDE NUCLEAR.

Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

ALL OTHER ENGINEERS

This job category focuses on non-electrical systems, processes, equipment, and facilities involved in electric and natural gas energy services. This job category includes people involved in planning, research, design, development, construction, installation, and operation of equipment, facilities, and systems for the safe, reliable, and economic generation/supply, transmission, distribution, consumption, and control of electricity and natural gas . A requirement of this category is a bachelors, masters, or Ph.D. in any engineering discipline (although commonly not an electrical engineering degree) from an accredited four-year university. DO NOT INCLUDE NUCLEAR.

Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

TOTAL T&D

Include jobs in the organizations that deliver gas and electricity to end use customers (residential, commercial and industrial). Electric transmission is higher voltages (230-500kv) while distribution is lower (4-26kv). Gas transmission is high pressure delivery, generally from companies such as Transco; distribution is delivery through local mains and services.

Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

TOTAL GEN

Include jobs in the organizations that produces electricity, either through hydro, fossil fuel (oil, gas and coal). Power plant operations manage the production cycle. DO NOT INCLUDE NUCLEAR.

Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

TOTAL COMPANY

Include jobs for all direct employees in your company. Do not include contract employees or supplemental labor. INCLUDE NUCLEAR IN TOTAL COMPANY.

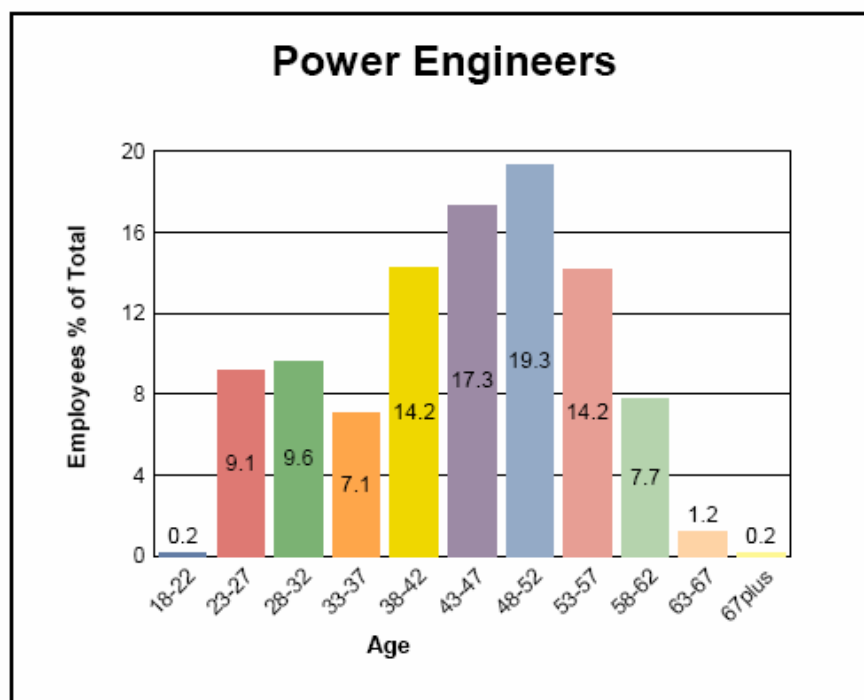
Years of Service	18-22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	58-62	63-67	60 plus	Grand Total
1 to 5												
6 to 10												
11 to 15												
16 to 20												
21 to 25												
26 to 30												
31 plus												
Grand Total												

Appendix D

Supplemental Information on Power Engineers

Survey respondents were asked for specific data on power engineers. Not all companies distinguish between power engineers and other types of engineers, so the data were combined with other engineer data for consistency. The data on power engineers are shown here for information purposes only.

Figure 11



Supplemental analysis of the state of power engineers was provided by the IEEE Power Engineer Society.

Formed in March 2006, the Center for Energy Workforce Development (CEWD) is a non-profit consortium of electric, natural gas and nuclear utilities and their associations —Edison Electric Institute, American Gas Association, Nuclear Energy Institute, and National Rural Electric Cooperative Association. CEWD was formed to help utilities work together to develop solutions to the coming workforce shortage in the utility industry. It is the first partnership between utilities, their associations, contractors and unions to focus on the need to build a skilled workforce pipeline that will meet future industry needs.



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