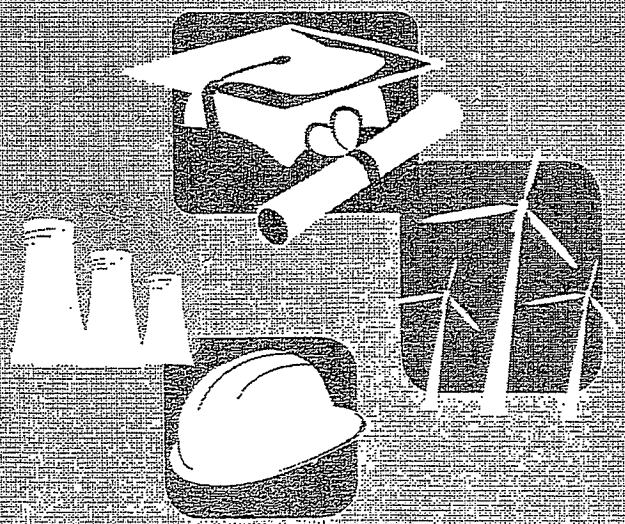
National Commission on Energy Policy

NATIONAL COMMISSION ON ENERGY POLICY'S

TASK FORCE ON AMERICA'S FUTURE ENERGY JOBS



Disclaimer

This report is a product of a Task Force with participants of diverse expertise and affiliations, addressing many complex and contentious topics. It is inevitable that arriving at a consensus document in these circumstances entailed compromises. Accordingly, it should not be assumed that every member is entirely satisfied with every formulation in this document, or even that all participants would agree with any given recommendation if it were taken in isolation. Rather, this group reached consensus on these recommendations as a package, which taken as a whole offers a balanced approach to the issue.

It is also important to note that this report is a product solely of the participants from the NCEP convened Task Force on America's Future Energy Jobs. The views expressed here do not necessarily reflect those of the National Commission on Energy Policy.

Acknowledgements

The National Commission on Energy Policy would like to express its thanks for the strong support of its funders. The Commission was founded in 2002 by the William and Flora Hewlett Foundation and its partners.

Special appreciation is due to Norm Augustine and Senator Pete Domenici (ret.) for their valuable contributions to this effort. The NCEP staff gratefully acknowledges the substantial guidance, research, and support offered by M.J. Bradley & Associates, LLC throughout the course of this effort. In particular, Michael Bradley, Managing Director, Carrie Jenks, Senior Consultant, Tom Curry, Policy Analyst, and Kathleen Robertson, Policy Analyst, were essential members of the project team as was Elizabeth Ewing, of Ewing Smith Consulting, LLC. Additionally, special thanks to Ian Copeland, President, and Rick Franzese, Senior Development Manager, both of Bechtel Power Corporation, for generously lending their expertise to the Task Force. Thanks also to Todd Barker, Partner, of the Meridian Institute for his guidance during the second and third Task Force meetings, and to Revis James, Director of the Energy Technology Assessment Center at the Electric Power Research Institute for allowing the Task Force to draw on the EPRI analyses in this area.

Foreword

Jobs, energy, and climate change—these issues are not new, but they have converged with greater urgency in the political spotlight over recent months. Efforts to advance climate legislation in Congress have re-energized a long-standing debate about the jobs and competitiveness impacts of greenhouse gas constraints, even as immediate measures to stimulate the economy have emphasized the job-creating potential of clean energy investments. In this fast-changing context, one central premise is beyond dispute: Transforming our nation's energy systems represents an enormous undertaking. It will require not only new, low-carbon technologies and systems, but people with the expertise to create those technologies and to plan, design, build, operate, and maintain those technologies and systems.

In this report, the Task Force on America's Future Energy Jobs makes the compelling case that our nation's educational infrastructure must be improved and realigned to produce the next generation of professionals needed to orchestrate this critical transformation. The themes and recommendations that emerge from this assessment particularly resonate with the two of us. Our own long careers, spanning both the public and private realms, reflect a deep commitment to this nation's continued global leadership in the domains of science and technology—and a deep conviction that strength in these areas is essential to America's continued prosperity and security. Through independent paths we have, in our own ways, become students of the U.S. K–12 educational system and we have concluded it is dangerously close to failing on a number of crucial fronts. By grappling with these issues as they relate to the energy sector, the Task Force has made an important contribution. We hope it will further motivate the movement to finally reform our nation's educational systems. Indeed, we hope this report is viewed as a call to action—one that comes at a rare moment when new political will and financial resources are being directed to major investments in our nation's energy and education sectors. Implementing the recommendations in this report would represent a major step forward in dealing with some of the most difficult challenges our nation confronts in this century. We can't think of a better time than now to get started.

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Advisors to the Task Force on America's Future Energy Jobs provided invaluable technical input and information but did not participate in Task Force decisions aimed at developing policy recommendations. Therefore, Task Force advisors do not endorse the recommendations put forward in this white paper.

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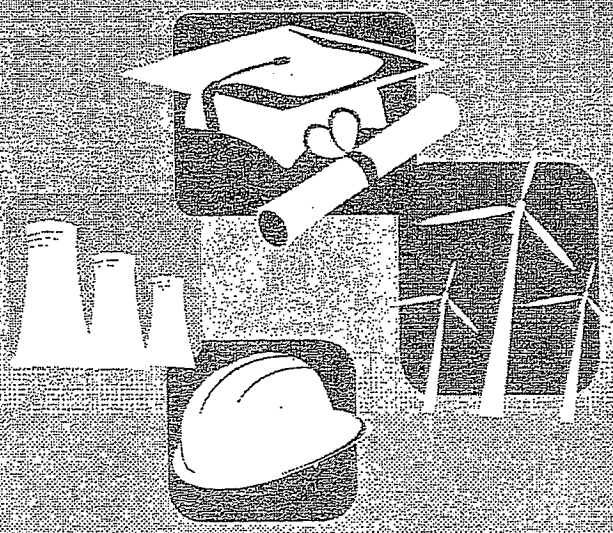

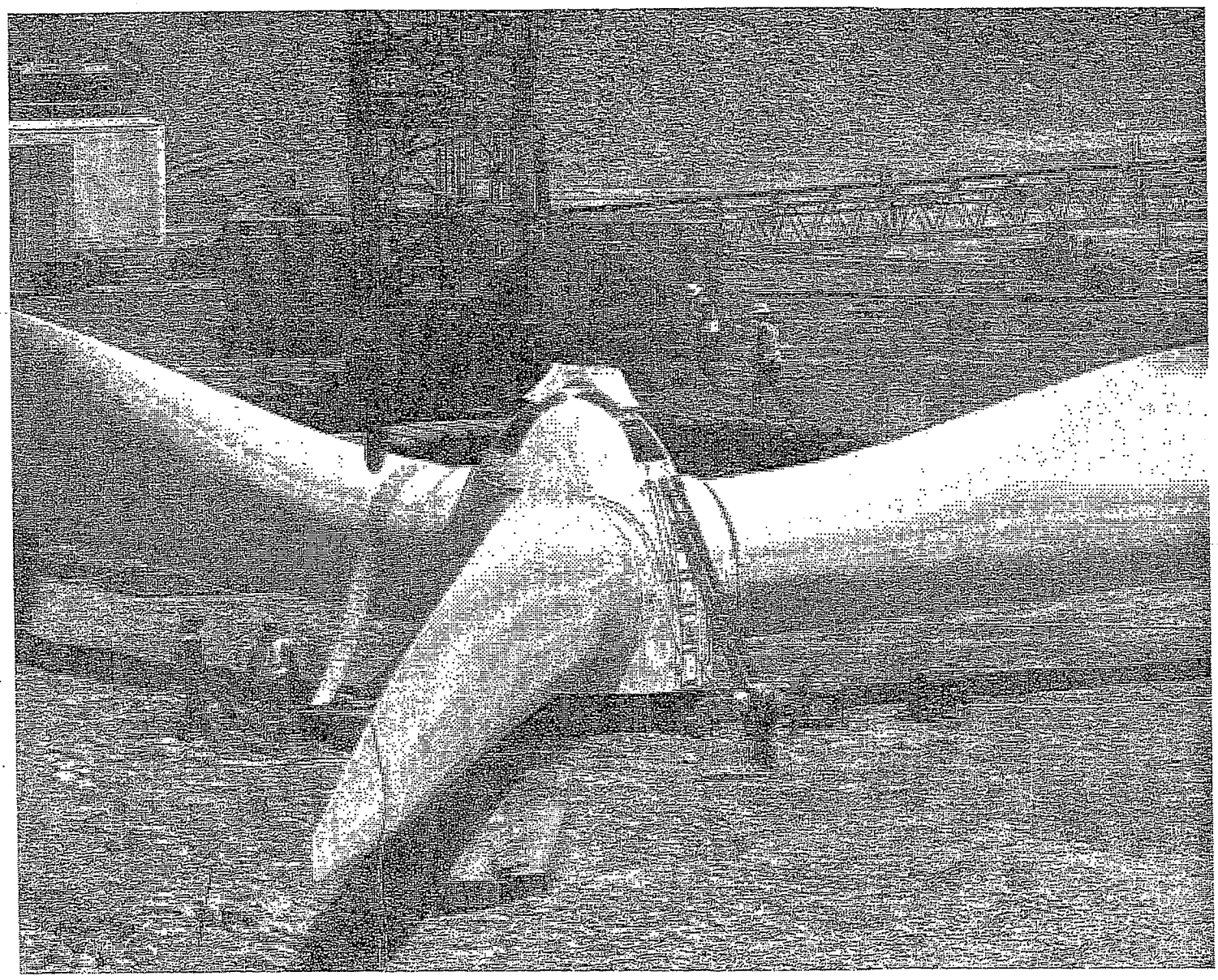

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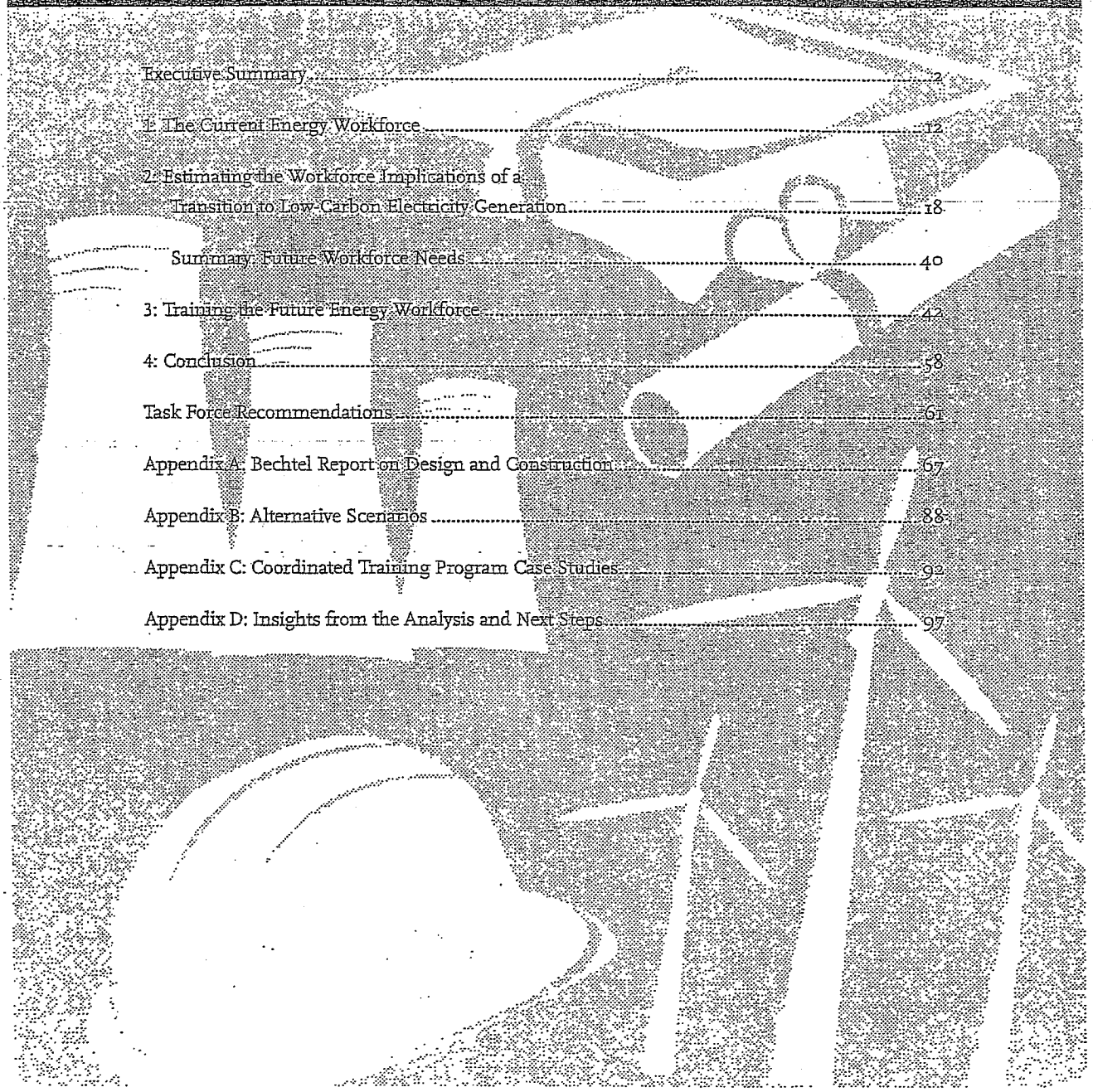
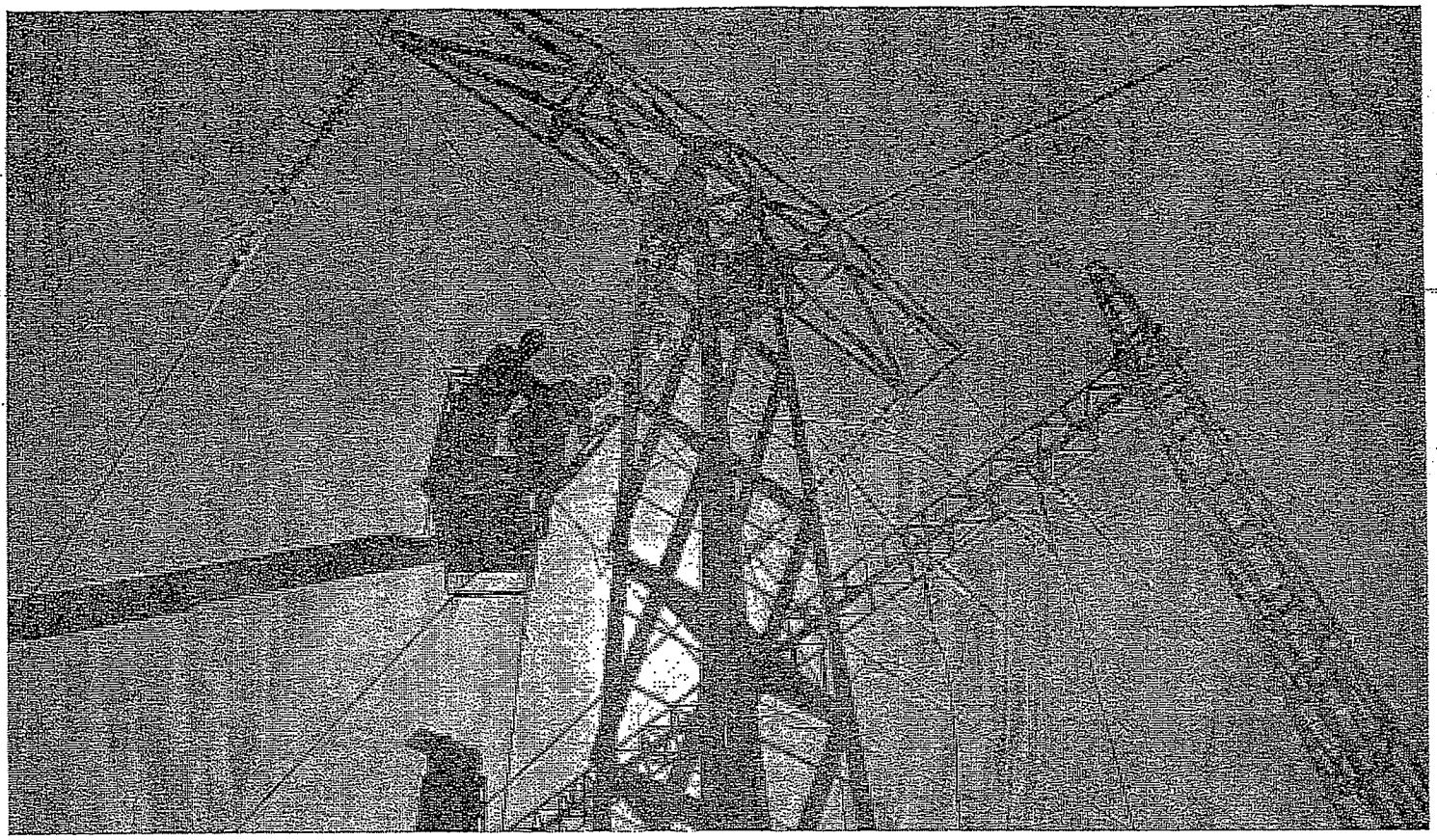


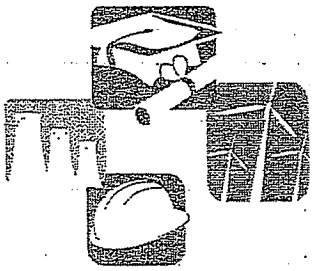
EXECUTIVE SUMMARY

In January of 2009, the National Commission on Energy Policy (NCEP) convened a group of stakeholders with expertise in the workforce of the U.S. electric power industry. The NCEP Task Force on America's Future Energy Jobs brought together representatives from labor, the electric power industry, and the training and educational sectors to explore—over a series of three meetings in six months—the existing demographic makeup and anticipated workforce needs of the electric power sector, along with the training institutions and programs that support this sector. This report summarizes the insights and conclusions resulting from this effort.

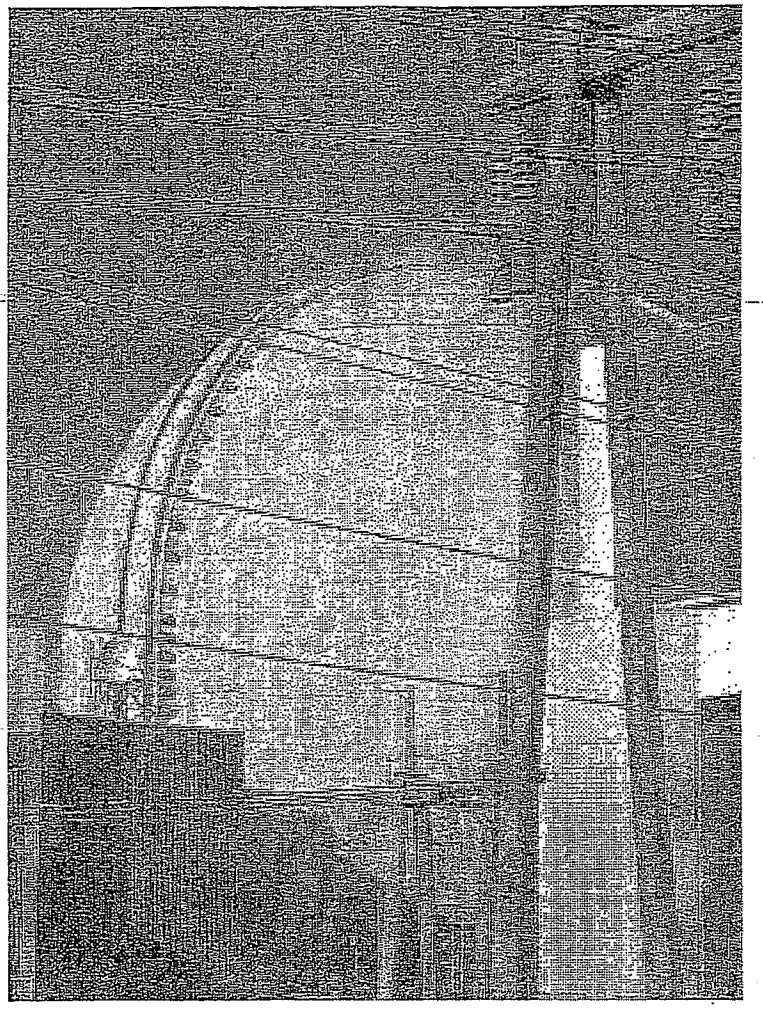


Broadly speaking, the Task Force believes the United States is facing a critical shortage of trained professionals to maintain the existing electric power system and design, build, and operate the future electric power system. The implications of this shortfall are wide-ranging and, in the view of the Task Force, of national significance. The ability to maintain a highly reliable, economically affordable electric power system while modernizing the nation's generating infrastructure to support an advanced, low-carbon technology portfolio is in serious jeopardy. This report highlights the main forces driving this situation and lays out a series of recommendations for addressing the dominant workforce challenges that will confront the electric power industry over the next several years. Ensuring the proper systems and institutions are in place to respond to these challenges is important, not only in terms of advancing critical public policy goals with respect to energy, the economy, and the environment, but because a substantial opportunity exists to create new high-skill, high-paying jobs in the energy sector at a time when growing numbers of Americans are unemployed or underemployed and face the prospect of financial insecurity.

Since the formation of this Task Force, the nation has experienced significant political and economic changes. The Obama Administration is committed to an energy policy that aims to reduce the nation's consumption of fossil fuels and contribution to global greenhouse gas emissions. At the same time, an unprecedented economic crisis has crippled global financial markets, halted global economic growth, and led to massive job losses in the United States and elsewhere. Against this backdrop, the Task Force set about examining the workforce supply and demand dynamics in the electric power industry. The recently enacted American Recovery and Reinvestment Act (ARRA) will likely provide a near-term infusion of resources that have



THE UNITED STATES IS FACING A CRITICAL SHORTAGE OF TRAINED PROFESSIONALS TO MAINTAIN THE EXISTING ELECTRIC POWER SYSTEM AND DESIGN, BUILD, AND OPERATE THE FUTURE ELECTRIC POWER SYSTEM.



the potential to facilitate many of the actions recommended in this report. To ensure that these short-term investments build the long-term capacity needed to address multi-decade challenges like climate change, policymakers should consider the actions recommended in this report when reauthorizing the Workforce Investment Act (WIA) and crafting climate and energy legislation.

Data and Definitions

NCEP conducted significant background analytical work to better assess the challenges that are often reported anecdotally by concerned parties. One of the most important conclusions from this work is that data collection and measurement systems needed to gauge the state of our nation's energy workforce are woefully inadequate. For this reason, the NCEP team endeavored to commission new work and access available information to characterize the challenges. While the data collected and presented in this report represent a significant contribution to the debate, we believe that this assessment is best used as an illustrative guide to current workforce issues. We have not attempted to develop a precise projection of future workforce needs. Additionally, our report is not intended to take the place of state and regional workforce assessments that can provide the insights needed to identify specific focus areas for individual training programs or education systems. As described further in the report, we believe that bringing together major stakeholder groups at a local or regional level is the best way to evaluate specific training needs.

A theme that seems to resonate broadly across the energy workforce debate is that "green jobs" are a positive outcome to be promoted. However, a universally accepted definition for what constitutes a green job does not exist. Organizations of all types tend to attach the "green" label when describing activities they support and promote, which highlights the ambiguity in using the term. While it is generally safe to assume that jobs directly involved in the deployment of energy efficiency and renewable energy technologies would be considered "green," a number of complexities quickly emerge as soon as one attempts to apply even this seemingly simple definition. For example, a lineworker building a transmission line that connects a wind farm to the electric grid would be viewed by most people as having a green job. If that same transmission line carries electricity generated from nearby coal-fired power plants, the "greenness" of that job may not be as clear. This example illustrates that the skills needed to perform what many think of as a green job are often the same as or very similar to traditional energy-related jobs.

The NCEP Task Force on America's Future Energy Jobs believes debating the definition of green jobs may become a distraction. In fact, we do not use this term elsewhere in this report. Rather, because our effort is focused on workforce needs associated with building and supporting energy infrastructure for a future low-carbon energy system, we believe the term "future energy job" is more appropriate for our focus. It implies that all types of jobs that support an energy system consistent with a long-term goal of reducing greenhouse gas emissions should be seen in the same light. Some of the jobs related to the transition to a carbon-constrained economy will be new and will require new skill sets. But many more will use skills that are already in demand today, such as those required for sheet metal workers, transmission lineworkers, and electricians.[1] In effect, if the underlying policy framework reflects the objectives embedded in the term "green job" then future energy jobs *are* green jobs.

Overarching Challenges

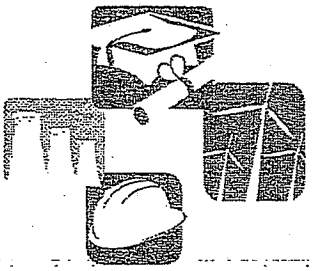
As a starting point, Task Force members shared a common recognition that the electric power sector faces near- and long-term workforce challenges. Its workforce is aging and will need to be replaced. Facing a wave of retirements over the next decade, the electric power industry will need to expand hiring and training programs just to maintain the level of qualified workers required to operate existing facilities. In fact, new workers will be needed to fill as many as one-third of the nation's 400,000 current electric power jobs by 2013.[2] In the face of this surge in demand, companies are finding that applicants for open positions at electricity companies are not as prepared as they were in decades past. Companies are finding that U.S. students are not graduating at the same rates in the relevant fields and with the same qualifications as in the past. While the Task Force focused on direct electric power sector jobs, the Task Force members recognize that other economic sectors, such as the manufacturing sector, face similar demographic, education, and training challenges.

In the long-term, the deployment of new technologies and generating assets—including new energy efficiency, nuclear, renewable, advanced coal with carbon capture, and smart grid technologies—will require new design, construction, operation, and maintenance skills. This is an important opportunity for new job creation and economic growth. If too few individuals with the necessary expertise are available when they are needed, workforce bottlenecks could slow the transition to a low-carbon economy *regardless* of the commercial readiness of the underlying technologies. If the result is to delay the efficient adoption of improved low-carbon alternatives, workforce shortages would represent more than a lost opportunity—they could impose substantial costs, both in terms of economic burden and environmental damages and could damage U.S. global competitiveness.

Task Force Approach

The Task Force focused on three broad categories of jobs:

- Jobs associated with operating and maintaining the existing electric power infrastructure;



THE NCEP TASK FORCE ON AMERICA'S FUTURE ENERGY JOBS BELIEVES DEBATING THE DEFINITION OF GREEN JOBS MAY BECOME A DISTRACTION ... WE BELIEVE THE TERM "FUTURE ENERGY JOB" IS MORE APPROPRIATE FOR OUR FOCUS.

[1] Apollo Alliance and Green For All with Center for American Progress and Center on Wisconsin Strategy. "Green-Collar Jobs in America's Cities: Building Pathways out of Poverty and Careers in the Clean Energy Economy." 2008. Available http://www.green-forall.org/resources/green-collar-jobs-in-america2019s-cities.

[2] While the Task Force future scenarios focus on electric power generation, transmission, and distribution, we recognize that electric utilities are frequently integrated with natural gas utilities and that natural gas utilities face similar workforce pressures. According to the Bureau of Labor Statistics, natural gas utilities employ about 106,000 people. The CEWD data referenced in this report combine natural gas utility workforce estimates with the electric utility workforce estimates.

- Jobs associated with designing and building new generation to meet future low-carbon energy needs; and
- Jobs associated with operating and maintaining the electric power industry of the future.

The first chapter summarizes the Task Force's findings on existing power industry labor markets. Rapid attrition due to retirements from an aging pool of workers is the primary concern. Chapter 2 examines what happens when an expected surge in demand for new low-carbon energy technologies is layered on top of this declining base. Comparing pending workforce requirements against the existing education and training pipeline is the focus of the third chapter. Chapter 4 presents suggested policy solutions and Task Force recommendations. We summarize key insights from each chapter along with our primary recommendations below. References for the data are included in the corresponding chapters.

Chapter 1 Critical Insights – Existing Electric Power Sector Workforce

- The electric power generation, transmission, and distribution industry employs about 400,000 people.
- A large fraction (30–40 percent) of electric power workers will be eligible for retirement or leave the industry for other reasons by 2013.
- Of the 120,000 to 160,000 electric power workers that will be eligible for retirement or leave the industry for other reasons by 2013, industry surveys suggest 58,200 will be skilled craft workers and another 11,200 will be engineers.
- While recent industry estimates anticipate that workers will delay retirement due to the current economic downturn, it is impossible to predict how long workers will extend em-

ployment. There is a concern in the industry that delayed retirement could lead to more acute worker shortages at some point in the future if many workers retire around the same time.

Chapter 2 Critical Insights – Potential Workforce Demand Surge under a Federal Climate Policy

- In addition to needing skilled workers to replace retiring workers, the industry will need skilled construction workers to design and construct new electric sector infrastructure. We estimate that in 2022, design and construction work for the electric sector will require about 150,000 professional and skilled craft workers from the construction sector. This construction workforce is about 40 percent the size of the existing electric power workforce.

- Demand for skilled workers to operate and maintain the electric generation systems of the future will increase steadily as new technologies come online. The number of additional workers that will be needed by 2030 is roughly 60,000—an increase of almost 15 percent.

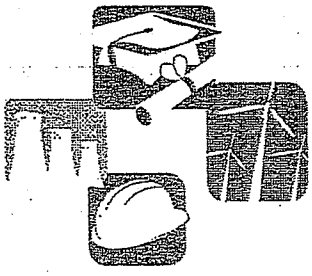
- The deployment trajectory for new generation technologies directly impacts workforce demand. In scenarios with steady annual deployment of new generating assets, workforce demands will peak at a lower level and will be spread out over more years. In scenarios where construction is delayed and several generating assets are planned to come into operation in the same year, the workforce peak is higher and the demand is more concentrated around the peak year. This variability reinforces the need for local and regional assessments of workforce demand as climate policy becomes clearer.

- The industry needs to prepare to meet a long-term, sustained need for training, beyond the retirement gap.

- With respect to the design, construction, and operation and maintenance (O&M) of infrastructure and supporting technologies:

  - Demand for construction labor to build new high-voltage transmission lines and substations is expected to spike, especially in light of the transmission investments anticipated under the recent economic stimulus package. We estimate the peak demand for construction labor and skilled crafts to be about 10,000 to 15,000. However, policy and regulatory delays have affected the construction timetable of a number of proposed transmission lines. These delays increase the uncertainty around projections of future workforce demand.

  - The near-term deployment of smart grid technologies will require over 90,000 workers. However, smart grid deployment will result in about 25,000 electricity power industry workers looking to transition to new positions. This supply of workers highlights the need for training programs that

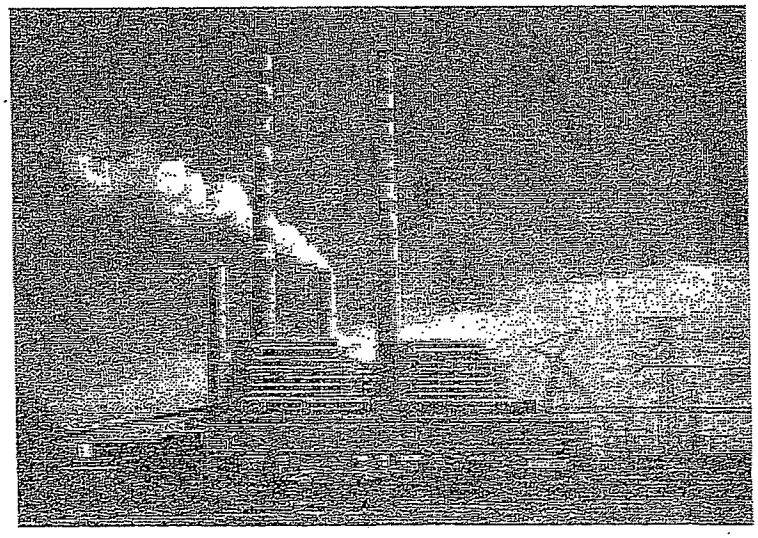


A LARGE FRACTION (30–40 PERCENT) OF ELECTRIC POWER WORKERS WILL BE ELIGIBLE FOR RETIREMENT OR LEAVE THE INDUSTRY FOR OTHER REASONS BY 2013.

retrain existing workers to take advantage of new opportunities within the industry.

- Construction and maintenance of CO_2 pipelines as part of a commitment to expanded carbon capture and storage (CCS) will marginally add to the demand for skilled workers. While not directly calculated as part of the NCEP Task Force estimates, additional workers will be needed to retrofit fossil fuel-fired power plants with carbon capture technologies.

- Running energy efficiency programs requires people to design and administer programs and people to promote those programs and sign up new customers. We estimate that utility or other third-party managed energy efficiency programs in the United States will require all or part of the time of approximately 11,000 employees per year through 2030. Additionally, we expect the program managers to hire contractors to implement or deploy efficiency technologies. These contractors are expected to significantly outnumber the number of direct employees required to administer and promote customer-side efficiency programs and could number in the thousands for each program. While these jobs will be an important component of future energy jobs, the Task Force decided not to seek to quantify these jobs.



Chapter 3 Challenges – Training the Future Energy Workforce

- Challenges to preparing students in grades K-12:

  - Low Graduation Rates. Of the approximately four million students who will begin high school this fall in the United States, less than three million are expected to complete high school.

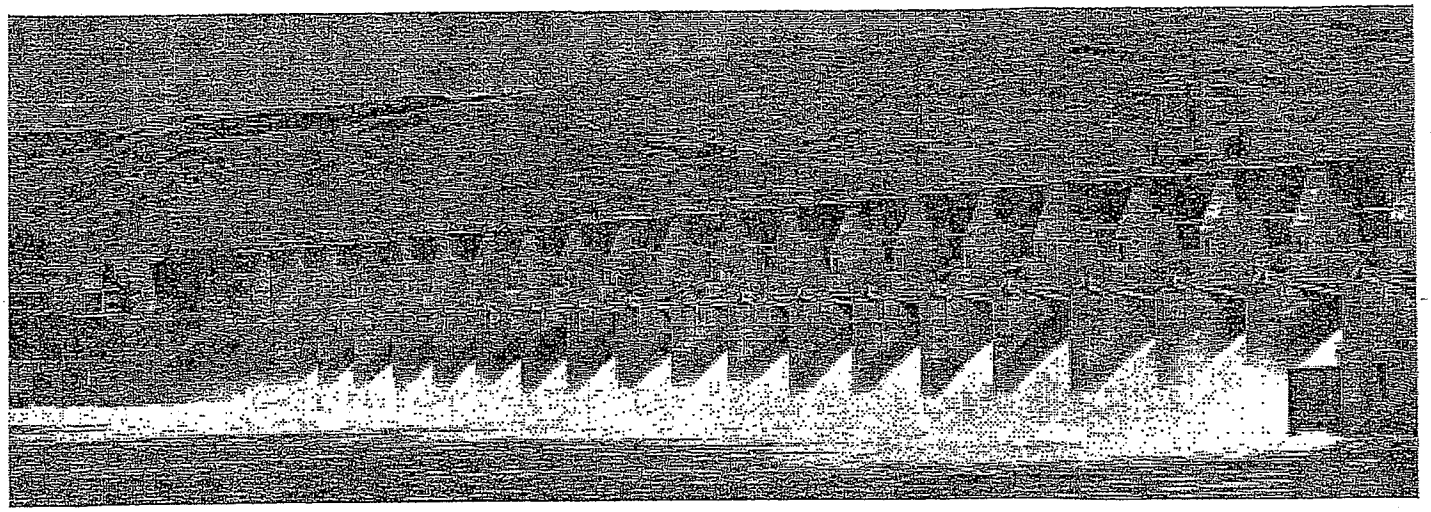
  - Lack of Technical Skills. Of those who complete high school, many are ill-prepared to pursue a career that requires basic technical skills.

  - Lack of Industry-Specific Training for Educators. Teacher training and retraining is a key component of repairing our basic educational system.

- Challenges to training and educating skilled craft workers:

  - Individuals can acquire the technical skills and training to enter the skilled craft electric power or construction workforce from several types of institutions or programs, including:
    - community colleges,
    - community-based organizations (CBOs),
    - apprenticeship programs,
    - company-specific training programs, and
    - worker retraining programs.

  - Understanding the Electric Power Sector Demand for Skilled Workers. A key chal-



lenge is aligning training programs with the demand for workers. This challenge is compounded by the current system used by the Bureau of Labor Statistics (BLS) to estimate future industry demand. That system relies on historical trends to project future industry growth and does not include estimates for replacing positions lost through retirements or other attrition.

- Lack of Communication among Stakeholder Groups. Compounding the assessment challenge noted above is the fact that better communication is needed among stakeholders—particularly between training institutions and the electric power sector.

- Lack of Credential Portability. A lack of standardized skill sets and curricula for some of the skilled crafts within the electric power sector presents a significant challenge for students, community colleges, and employers. This issue is specific to a subset of skilled crafts within the electric power sector—it does not apply to skilled crafts in the construction sector.

- Collecting and Tracking Skilled Workforce Data. Information on the number of people that pass through existing training systems and their ultimate employment is currently not well captured.

- Costs of Education. Even students who have adequate education in technical skills may have trouble paying for post-secondary education.

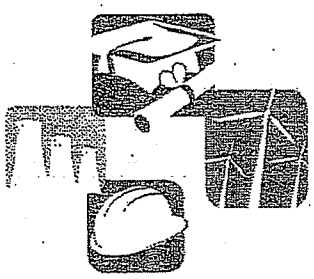
- Improving the Image of Electricity Industry Careers. Students and parents often do not view apprenticeship programs or other programs outside the four-year degree construct as providing similar or better opportunities for career and salary potential.

- Lack of Career Preparatory Skills within the Workforce. Because of a lack of technical skills among the potential workforce, introductory courses have become more prevalent at the community college level.

- Challenges to training and educating engineers:

  - Lack of math and science skills in the population of high school graduates.

  - Mobilizing the Research Community. Professional engineers are needed to develop, design and implement new, low-carbon technologies that produce electricity. There is a need for active and invigorated research programs in power engineering and related areas. To appropriately engage students, faculty need to be engaged through the development of research programs, including



A LACK OF STANDARDIZED SKILL SETS AND CURRICULA FOR SOME OF THE SKILLED CRAFTS WITHIN THE ELECTRIC POWER SECTOR PRESENTS A SIGNIFICANT CHALLENGE FOR STUDENTS, COMMUNITY COLLEGES, AND EMPLOYERS.

programs that are multidisciplinary in their approach and thinking.

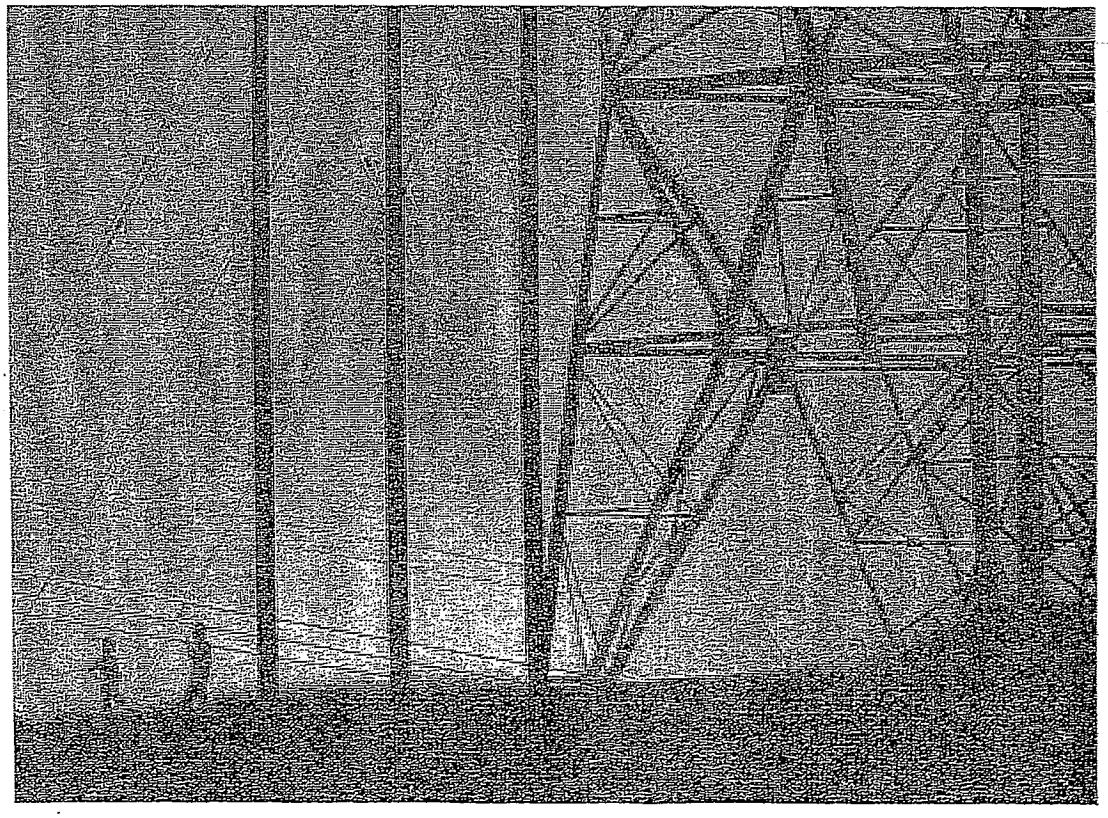
- Encouraging Students to Work in the Electric Power Sector. In addition to stimulating research, it is important to foster mechanisms for pulling both research and students into the electric power sector.

- Costs of Education. The cost of education in the United States is daunting and can be a barrier to entry.

Task Force Recommendations

The workforce challenges identified by the Task Force are significant and addressing them will take a concerted and sustained effort by many stakeholders. To advance that process, the Task Force developed a set of five primary recommendations for federal policy. The recommendations, summarized here, are available following the conclusions in Chapter 4 of the report. While these recommendations are specifically focused on the development of direct future energy jobs associated with design, construction, and operation of assets in the energy sector, many of the insights could be applied to job training associated with deploying energy efficiency and manufacturing the materials and equipment needed to build and operate the future energy system.

Recommendation 1: Evaluate regional training needs and facilitate multi-stakeholder energy sector training programs across the country. In addition to the work currently underway at the Department of Labor (DOL) and the Department of Energy (DOE) to address the workforce gaps associated with



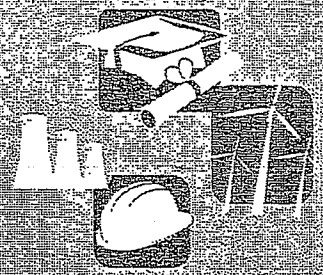
projected retirements and the initiatives in the American Recovery and Reinvestment Act of 2009, Congress should appropriate funds through existing funding mechanisms that allow DOL and DOE to work with existing state or regional energy workforce consortia or establish new state or regional energy workforce consortia, as appropriate. These consortia should be tasked with evaluating near- and long-term needs for a skilled workforce. As a part of this evaluation, DOL, DOE, and each state or regional energy workforce consortium should seek to identify policy uncertainties that are currently delaying, or have the potential to delay, the deployment of new generating assets and infrastructure. In the regions of the country where the energy workforce consortia highlight workforce gaps, Congress should provide financial resources and coordination assistance for the development of locally or regionally coordinated workforce training programs targeted to the needs of the energy sector. DOL should use the Green Jobs Act or other appropriate federal funding mechanisms to award funding for this purpose through a competitive process to programs that meet established criteria.

Recommendation 2: Improve energy sector workforce data collection and performance measurement metrics and tools. Improve the collection, management, and availability of workforce data for the energy sector to facilitate future efforts to measure progress and identify emerging workforce needs.

Recommendation 3: Identify training standards and best practices for energy sector jobs. DOL, in consultation with industry, labor, and education stakeholders, including ED and DOE, should develop a repository of best practices for electric sector job training that is widely accessible, transparently managed, and maintained by a public entity. This repository should include existing skill standards and registered apprenticeship programs for electric sector jobs. The purpose of the repository should be threefold: (1) it should be a resource for employers to evaluate training programs and potential employees, (2) it should be a resource for individuals to evaluate training options as they move through a career, and (3) it should be a resource for educators as they develop courses and curricula. As a part of this initiative, DOL, in consultation with stakeholders, should identify skill areas where best practices or training standards do not exist or should be expanded, and work to fill such gaps.

Recommendation 4: Provide funding support to individuals seeking energy sector-related training and education. Using existing funding mechanisms as appropriate, provide financial support, targeted to those most in need, to individuals that wish to pursue energy-related technical and professional training or retraining and to students interested in pursuing post-secondary degrees in engineering and other energy-related technical fields.

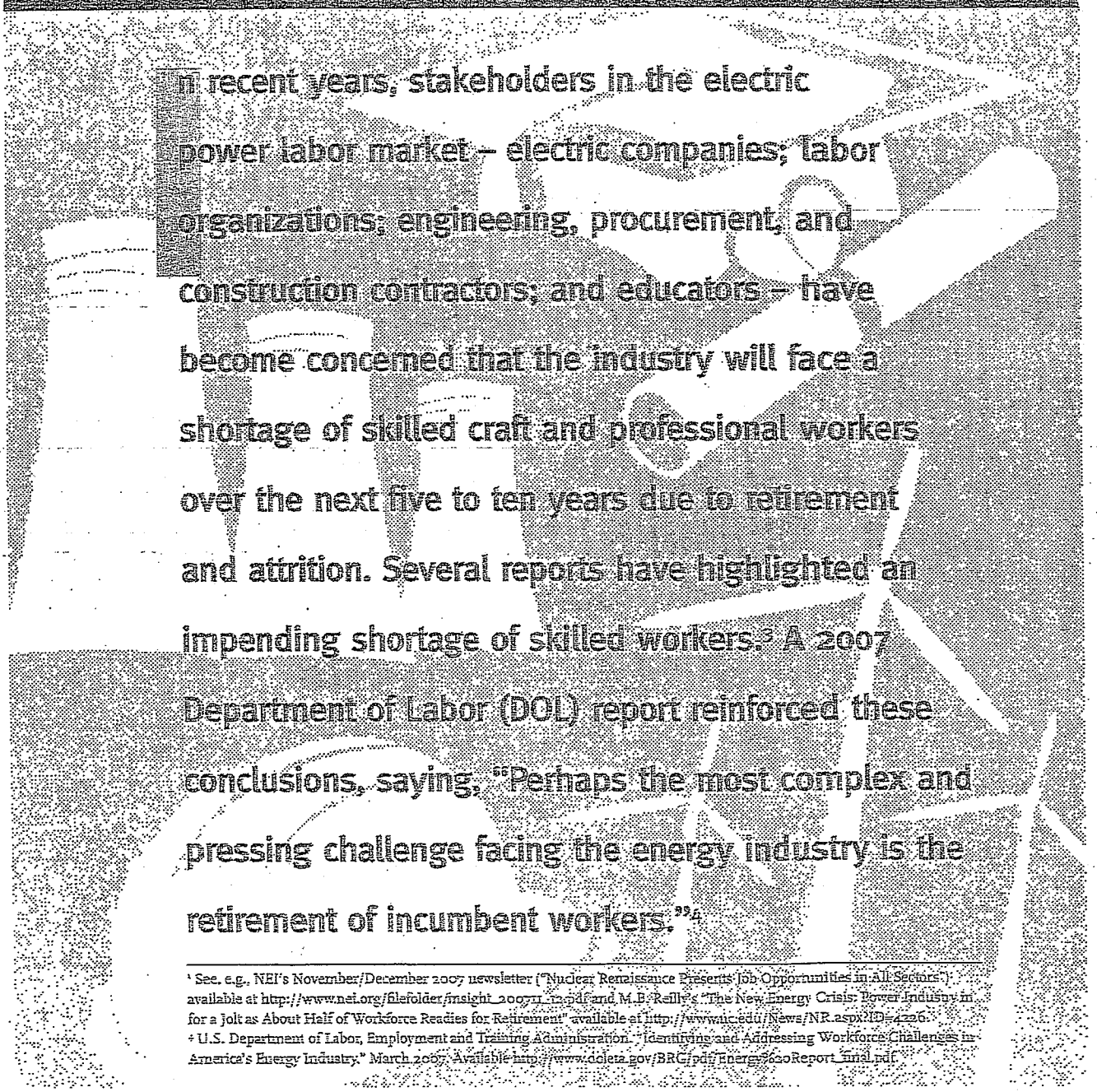
Recommendation 5: Aggressively focus on revitalizing the math and science skills, education, and career counseling of individuals who have the interest and skills to work in the energy sector. Enhance science, technology, engineering, and math training for K-12 students, adults who wish to enter the energy workforce, and teachers and instructors. Engage the next generation of scientists and engineers in the energy sector by following through on and enhancing commitments to expanding U.S. investment in research and development. Increase awareness of employment opportunities in the energy sector.



IN ADDITION TO STIMULATING RESEARCH, IT IS IMPORTANT TO FOSTER MECHANISMS FOR PULLING BOTH RESEARCH AND STUDENTS INTO THE ELECTRIC POWER SECTOR.

CHAPTER 1:

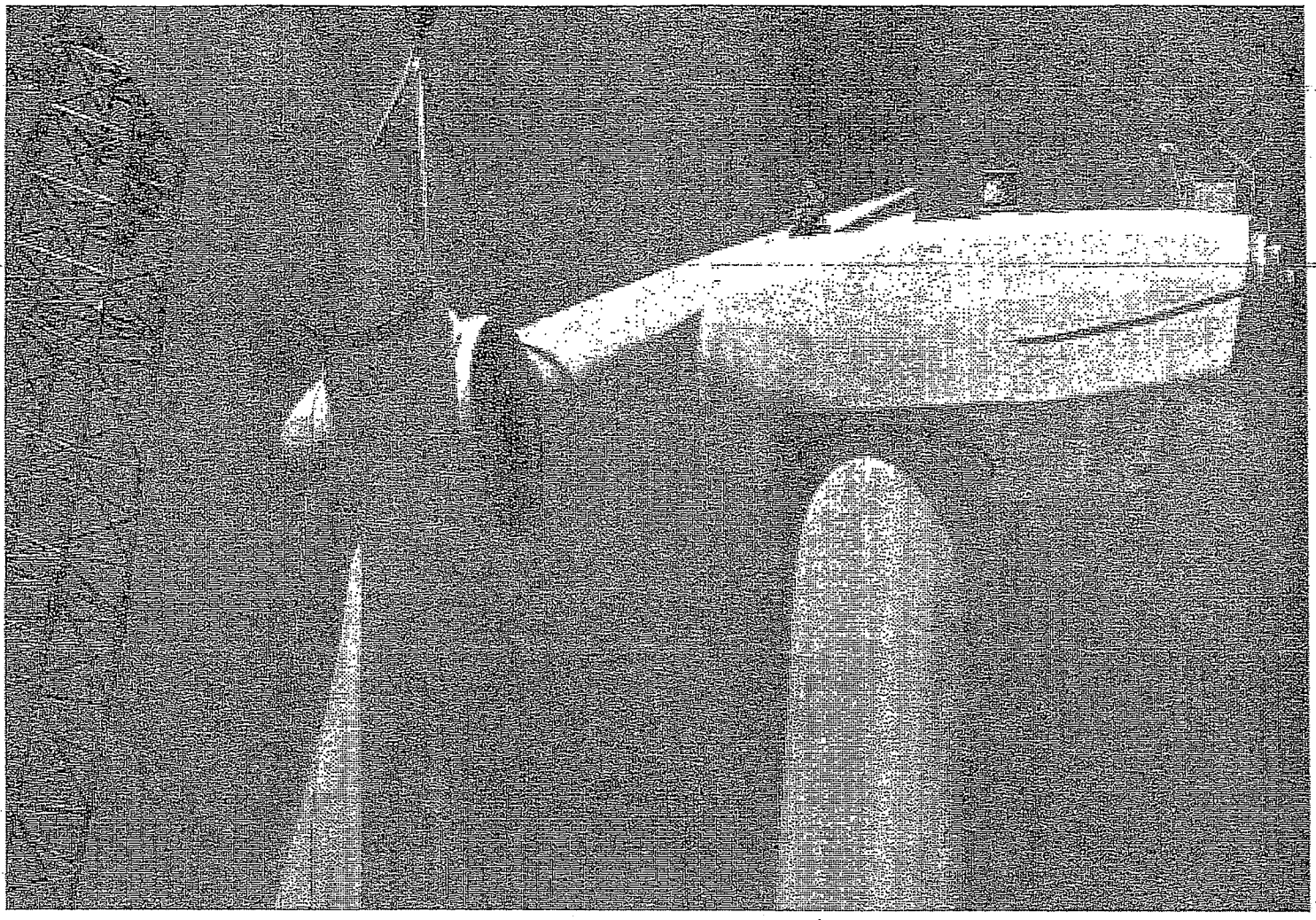
THE CURRENT ENERGY WORKFORCE



In recent years, stakeholders in the electric power labor market – electric companies; labor organizations; engineering, procurement, and construction contractors; and educators – have become concerned that the industry will face a shortage of skilled craft and professional workers over the next five to ten years due to retirement and attrition. Several reports have highlighted an impending shortage of skilled workers.[3] A 2007 Department of Labor (DOL) report reinforced these conclusions, saying, "Perhaps the most complex and pressing challenge facing the energy industry is the retirement of incumbent workers."[4]

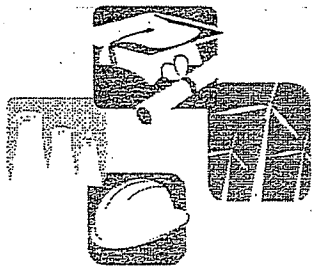
[3] See, e.g., NEI's November/December 2007 newsletter ("Nuclear Renaissance Presents Job Opportunities in All Sectors") available at http://www.nei.org/filefolder/nsight_200711_12.pdf and M.B. Reilly's "The New Energy Crisis: Power Industry in for a Jolt as About Half of Workforce Readies for Retirement" available at http://www.nic.edu/News/NR.aspx?ID=4226.

[4] U.S. Department of Labor, Employment and Training Administration, "Identifying and Addressing Workforce Challenges in America's Energy Industry," March 2007. Available http://www.doleta.gov/BRG/pdf/Energy%20Report_final.pdf



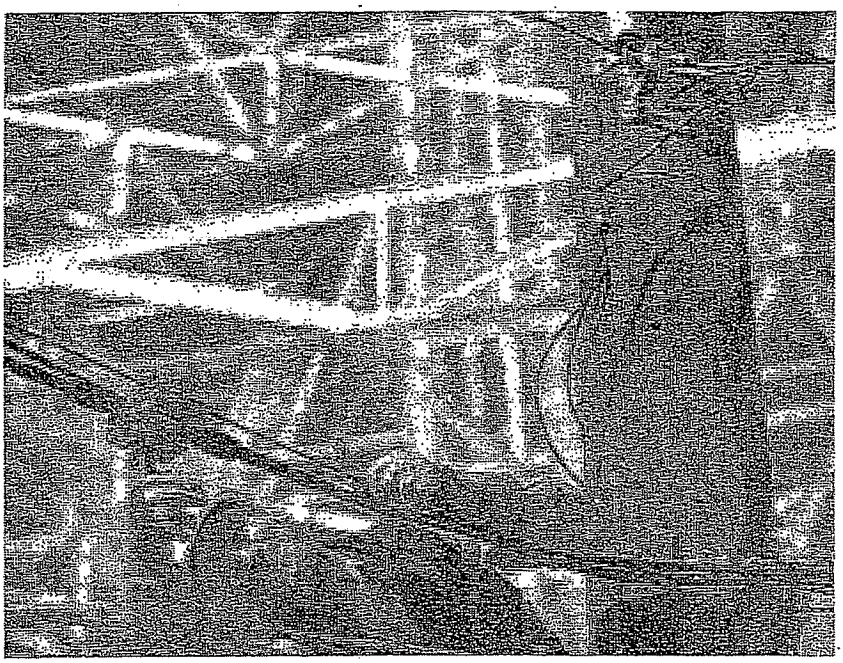
The U.S. Department of Labor reports the median age of American workers reached 40.7 in 2008.[5] By comparison, the median age of energy workers in 2008 was 45.[6] Estimates of the average age of the electric power workforce range from the mid-40s to 50; both *Electric Light & Power*, an industry publication, and DOL found the average age of electric power workers to be nearly 50 in 2006 and 2007, respectively.[7,8] These older demographics present a particular challenge to the industry because most electric power employees traditionally retire at age 55.[9]

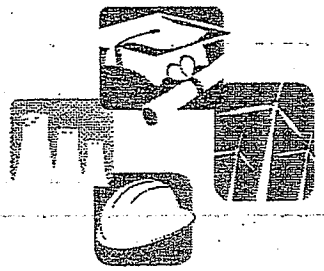
Over the past five years, however, the electric power industry has made an effort to address workforce issues, with the result that the average age of the workforce appears to be declining. A 2007 survey by the Center for Energy Workforce Development (CEWD) found that the average age of utility workers declined from 45.7 in 2007 to 45.3 in 2008.[10] Surveys of pub-



ESTIMATES OF THE AVERAGE AGE OF THE ELECTRIC POWER WORKFORCE RANGE FROM THE MID-40S TO 50.

[5] U.S. Department of Labor, Bureau of Labor Statistics: http://www.bls.gov/opub/working/page2b.htm.
[6] CEWD. "Gaps in the Energy Workforce Pipeline: 2008 CEWD Survey Results." October 2008. Available http://www.cewd.org/documents/CEWD_08Results.pdf.
[7] Electric Light & Power: http://uaelp.pennnet.com/display_article/256344/34/ARTCL/none/none/.
[8] U.S. Department of Labor, Employment and Training Administration. "Identifying and Addressing Workforce Challenges in America's Energy Industry." March 2007. Available http://www.doleta.gov/BRG/pdf/Energy%20Report_final.pdf.
[9] Ibid.
[10] CEWD. "Gaps in the Energy Workforce Pipeline: 2008 CEWD Survey Results." October 2008. Available http://www.cewd.org/documents/CEWD_08Results.pdf.





NEW WORKERS WILL HAVE TO COME FROM A TRAINING SYSTEM THAT NEEDS TO BE REFOCUSED AND REINVIGORATED.

lic power companies by the American Public Power Association (APPA) show a drop in the average age of the public power workforce from 48 in 2005 to 43 in 2008.[11,12]

The declining average age of electric power workers suggests that the industry has recognized the impending shortage and has begun accelerating the hiring of younger workers. However, the same survey data suggest that a wave of employees will become eligible for retirement in the next five to ten years. As discussed in more detail below, the electric power industry estimates that 30 to 40 percent of its workforce, which numbers about 400,000 employees, will be eligible to retire in the next five years.[13] To make up for these retirements, the industry will have to hire new employees at a much higher rate.

As discussed in Chapter 3, new workers will have to come from a training system that needs to be refocused and reinvigorated. The number of people who have trained to become part of the electric power sector workforce has fluctuated over the years in response to the needs of the industry, macroeconomic conditions, the attractiveness of alternate career paths, and other factors. After a period of relatively rapid growth in the 1970s, when electricity demand grew 5 percent annually, the industry experienced much lower demand growth in the 1980s and 1990s.[14] The advent of a competitive market for electric power companies led to an increased focus on productivity, which dampened hiring trends and led to an overall decline in workforce levels through the end of the 1990s.[15] Because the industry's demand for new workers slowed significantly over this period, companies scaled back internal training programs. At the same time, the pool of qualified candidates for jobs and training programs decreased dramatically.

To address the anticipated shortfall of skilled workers, industry stakeholders formed CEWD in 2006. CEWD is a non-profit consortium of electric, natural gas, and nuclear utilities, and their associations that is tasked with addressing the industry's workforce training and education. CEWD's membership includes public, private,

[11] APPA. "Growing Your Employees of Tomorrow." 2008. Available http://www.appanet.org/files/PDFs/2008WorkforceSurveyReport.pdf.

[12] APPA. "Work Force Planning for Public Power Utilities: Ensuring Resources to Meet Projected Needs." 2005. Available http://www.appanet.org/files/PDFs/WorkForcePlanningforPublicPowerUtilities.pdf.

[13] While the Task Force future scenarios focus on electric power generation, transmission, and distribution, we recognize that electric utilities are frequently integrated with natural gas utilities and that natural gas utilities face similar workforce pressures. According to the Bureau of Labor Statistics, natural gas utilities employ about 106,000 people. The CEWD data referenced in this report combine natural gas utility workforce estimates with the electric utility workforce estimates.

[14] Badrul Chowdhury. "Power Education at the Crossroads." IEEE Spectrum, October 2000.

[15] U.S. Department of Energy. "Workforce Trends In The Electric Utility Industry: A Report To The United States Congress Pursuant To Section 1101 Of The Energy Policy Act Of 2005." August 2006. Available http://www.oe.energy.gov/DocumentsandMedia/Workforce_Trends_Report_090706_FINAL.pdf.

[15] U.S. Department of Energy. "Workforce Trends In The Electric Utility Industry: A Report To The United States Congress Pursuant To Section 1101 Of The Energy Policy Act Of 2005." August 2006. Available http://www.oe.energy.gov/DocumentsandMedia/Workforce_Trends_Report_090706_FINAL.pdf.

and government-owned utilities as well as the major utility trade associations: the Edison Electric Institute (EEI), American Gas Association, Nuclear Energy Institute (NEI), and the National Rural Electric Cooperative Association.[16]

Operation and Maintenance of Existing Generating Assets and Transmission Lines

Figure 1 shows the age distribution of the electric power sector workforce as surveyed by CEWD in 2008. The CEWD survey included respondents from 56 investor owned utility and all rural electric cooperatives, representing about 46 percent of the workforce.[17] CEWD grouped survey respondents into four categories:

- Non-retirement attrition (those who leave the industry for reasons other than retirement),
- Potential retirees by 2013 (those eligible to retire, based on age and years of service),[18]
- Possible retirees by 2013 (employees eligible to retire who could possibly delay retirement due to the current economic climate),[19] and
- Retained employees.

About 30 percent of the workforce falls into the non-retirement attrition and potential retirement categories, and about 10 percent falls into the possible retirement category. That translates into a potential need to replace 30–40 percent of the total workforce by 2013. BLS estimates that about 400,000 people are employed in the electric power generation, transmission, and distribution industry and about 50 percent will retire or leave the industry for other reasons within 10 years.[20] Based on these estimates, about 120,000–160,000 workers in the electric power industry will need to be replaced by 2013 and about 200,000 will need to be replaced by 2018. Figure 2 compares these numbers.

Figure 1. Potential and Possible Employee Attrition and Retirements in the Electric and Natural Gas Industry by 2013

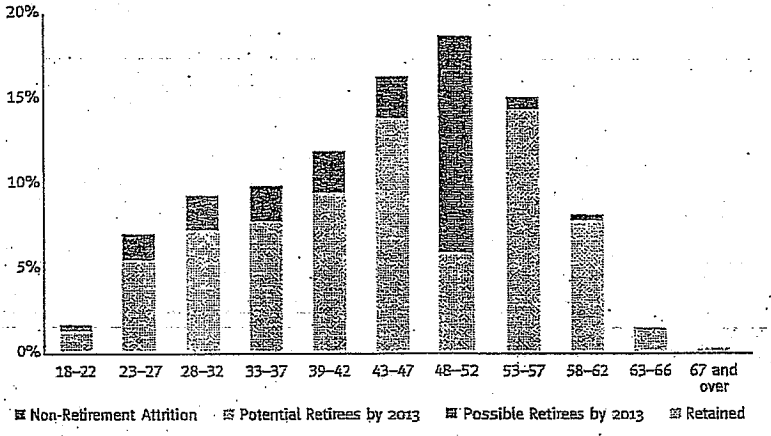
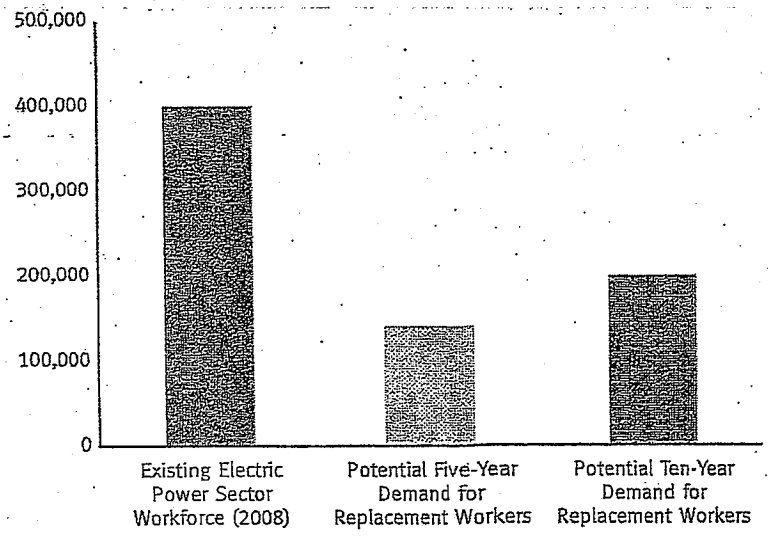
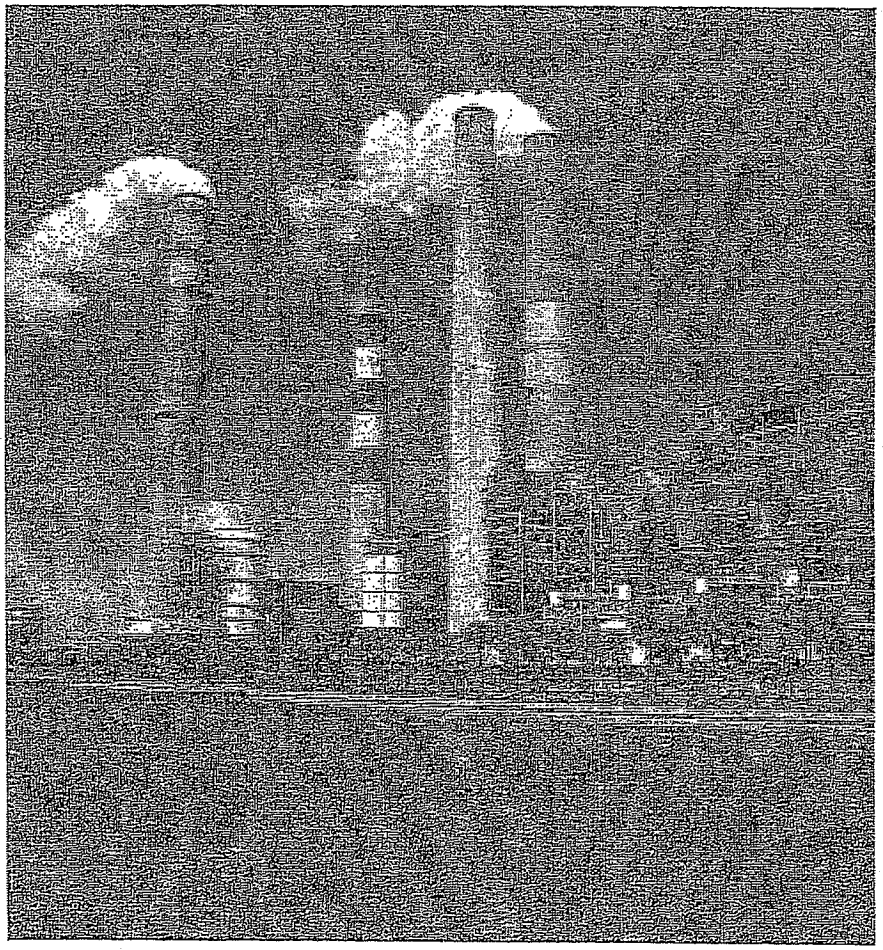


Figure 2. Comparison of the Workers Needed to Replace Workers Retiring or Leaving the Industry for Other Reasons to Existing Employment Levels



[16] CEWD, EEI, and NEI are advisors to the Task Force on America's Future Energy Jobs.
[17] CEWD. "Gaps in the Energy Workforce Pipeline: 2008 CEWD Survey Results." October 2008. Available http://www.cewd.org/documents/CEWD_08Results.pdf.
[18] CEWD defined potential retirees as employees who within the next five years will be older than 58 with more than 25 years of service, older than 63 with 20 years of service, or older than 67.
[19] CEWD defined possible retirees as employees who within the next five years will be older than 53 with more than 25 years of service.
[20] U.S. Department of Labor, Bureau of Labor Statistics. "Career Guide to Industries, 2008-09 Edition, Utilities." Available http://www.bls.gov/oco/cg/cgs018.htm.

CEWD is particularly interested in assessing the need for employees with technical skills, such as skilled craft workers and engineers. These positions require significant training, and thus are an area of great concern for the industry, including members of the Task Force. For example, according to CEWD, a pipefitter retiring with 30 years of experience would need to be replaced by a pipefitter with at least five years of experience.



In its 2008 survey, CEWD collected information on the potential for retirement in five key job categories: technicians, plant operators, pipefitters/pipelayers, lineworkers, and engineers.[21] Table 1 shows the detailed results of the CEWD survey by job category.

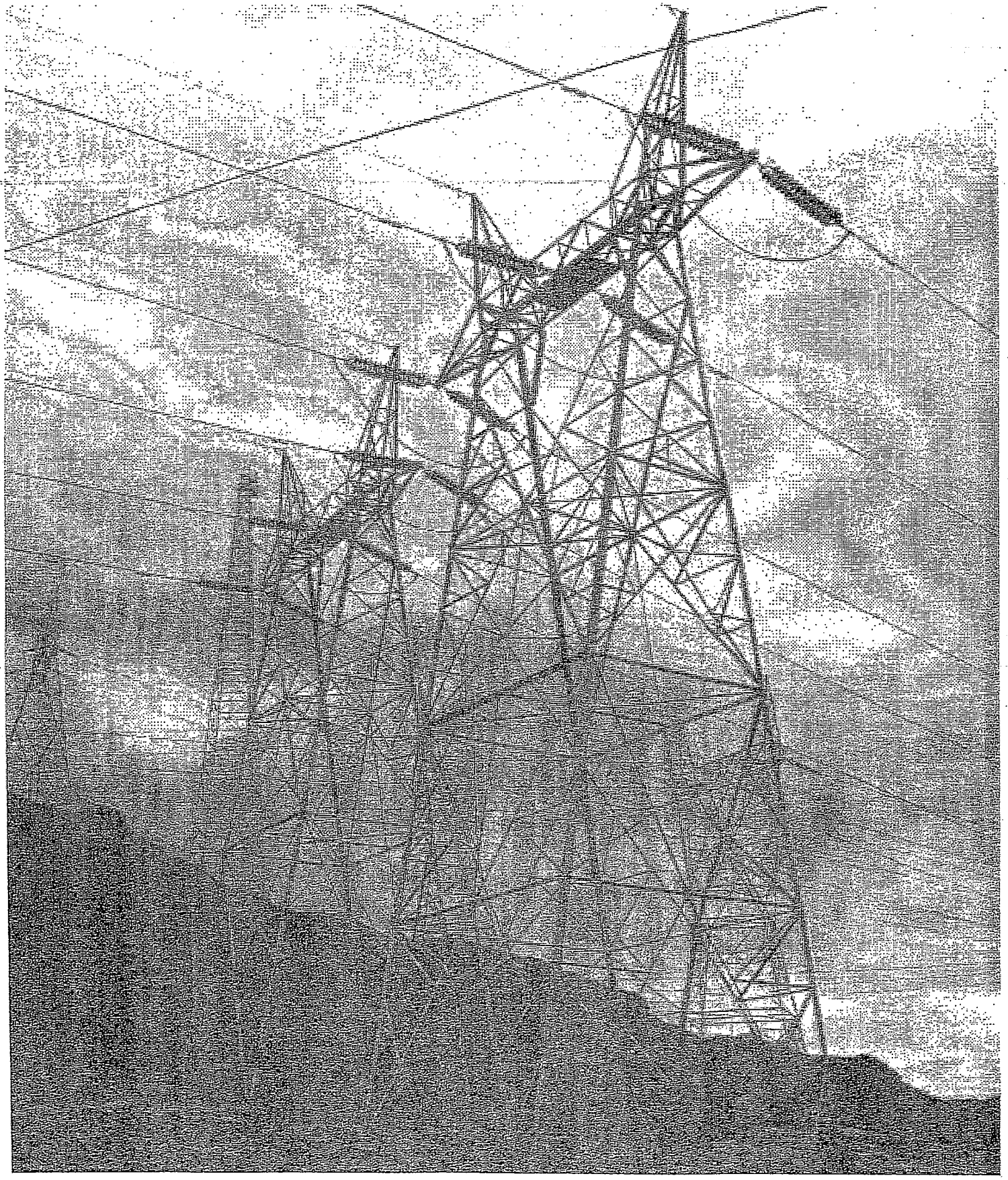
Table 1. CEWD Survey Results by Job Category

Job Category	Estimated Number of Potential Replacements by 2013
Electric Power Skilled Craft	58,200
Technicians	20,300
Non-Nuclear Plant Operators	8,900
Pipefitters/Pipelayers	6,500
Lineworkers	22,500
Engineers	11,200

CEWD defines technicians to include a broad range of skilled crafts including electricians, boilermakers, carpenters, millwrights, machinists, and operating engineers. CEWD research suggests that individuals frequently enter the workforce as technicians and then move into more specific skilled crafts.

While CEWD has focused its efforts on the broader electric and natural gas sector, NEI has been conducting workforce surveys specific to the needs of the nuclear industry. In 2007, the U.S. nuclear industry employed about 56,000 people. Through 2012, NEI expects a need for about 6,300 workers to replace those lost through general attrition and another 19,600 to replace retiring workers. This totals about 45 percent of the current nuclear power workforce. [22]

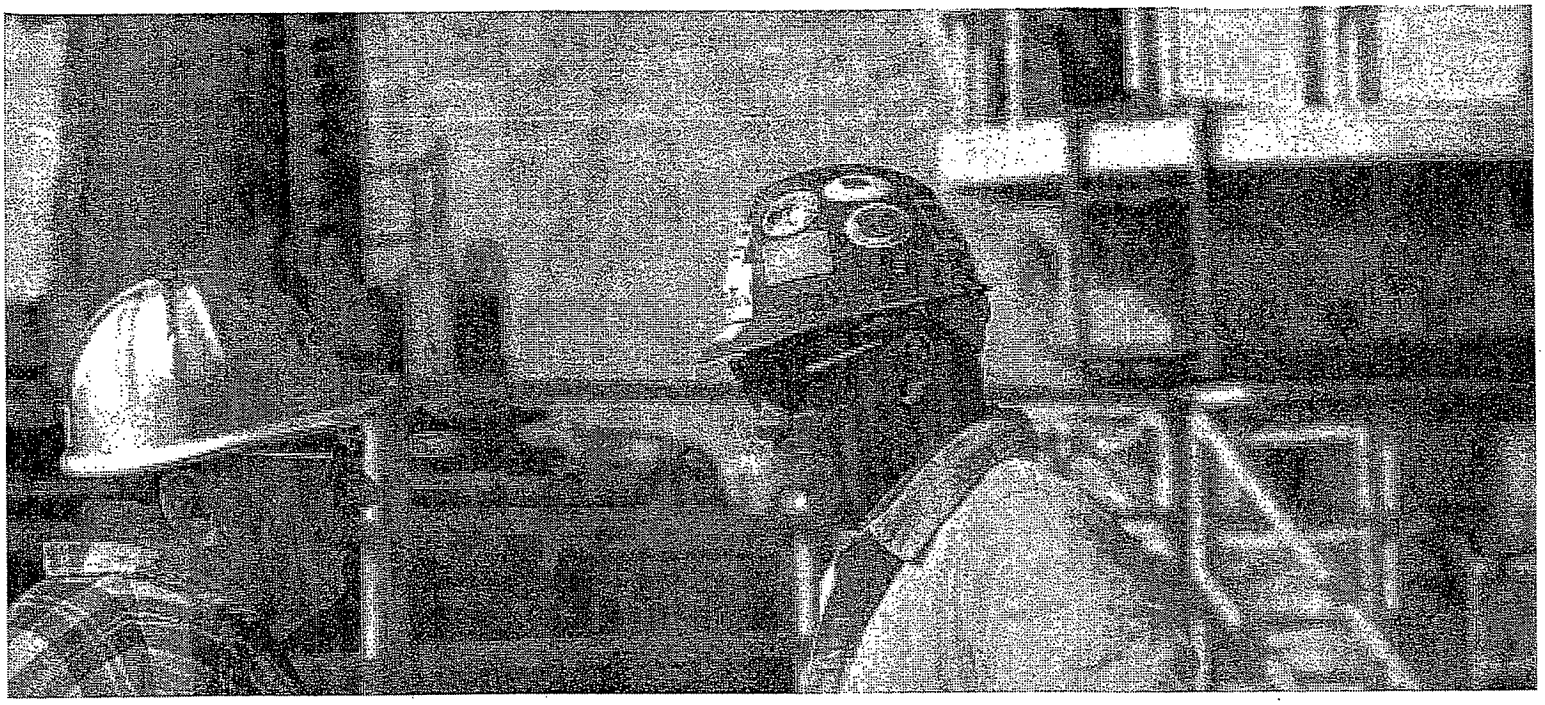
[21] Because the CEWD assessment includes natural gas distribution, the CEWD data include a higher demand for technicians, engineers, and pipefitters/pipelayers than would have been the case if only the electric utility sector were considered.
[22] Carol L. Berrigan, Director, Industry Infrastructure, Nuclear Energy Institute. "Testimony for the Record to the U.S. Senate Committee on Energy and Natural Resources." November 6, 2007. Available http://energy.senate.gov/public/_files/CBerriganTestimony110607.pdf.



CHAPTER 2

ESTIMATING THE WORKFORCE IMPLICATIONS OF A TRANSITION TO LOW-CARBON ELECTRICITY GENERATION

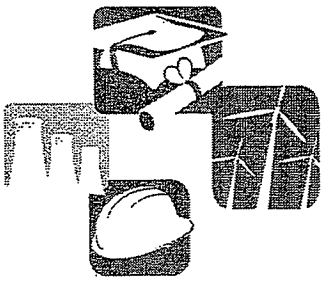
Forecasting the long-term pace and trajectory of future trends in the electric power industry is challenging in any economic and political environment. The task is even more challenging today, given the high degree of uncertainty that surrounds any prediction of future economic growth, climate policy, or technological development. These uncertainties serve, however, to reinforce the importance of understanding how policy decisions made today can affect the workforce needs of tomorrow. If the United States is going to substantially reduce its greenhouse gas emissions over the next two decades while continuing to meet the electricity demands of the economy, new low-carbon electricity generation and supporting infrastructure will need to be designed, built, and operated.



That means the electric power industry will need to do more than replace the workers who currently operate and maintain the existing infrastructure, it will need to engage workers from the construction sector to build new generating assets and it will need to expand its own workforce to operate and maintain those new assets.

Task Force members are concerned about the ability of the existing training system to handle the combined demand for technically-skilled workers to both replace retiring workers and support the rapid construction of new, low-carbon generation capacity. While the United States has yet to adopt a clear national climate policy, the Task Force sought to develop national-level estimates of the demand for labor to build and maintain low-carbon generation at the scale needed to achieve meaningful reductions in greenhouse gas emissions. After considering a number of modeled technology pathways, the Task Force decided to use an analysis developed by the Electric Power Research Institute (EPRI).[23,24]

The EPRI Prism analysis represents one scenario for how the United States might reduce power-sector greenhouse gas emissions over the next 20 years using a mix of low-carbon generation technologies (e.g. wind, solar, nuclear, and coal with CCS) in combination with additional energy efficiency measures.[26] This scenario was attractive to Task Force members because it was technology driven, assumed a balanced mix of low-carbon options, and was not based on a particular climate policy. The decision to use the Prism analysis to develop a scenario of future workforce needs, however, does not imply an endorsement of a particular deployment pathway, nor does it mean that Task Force members agree with the technology and



THE ELECTRIC POWER INDUSTRY WILL NEED TO DO MORE THAN REPLACE THE WORKERS WHO CURRENTLY OPERATE AND MAINTAIN THE EXISTING INFRASTRUCTURE, IT WILL NEED TO ENGAGE WORKERS FROM THE CONSTRUCTION SECTOR TO BUILD NEW GENERATING ASSETS AND IT WILL NEED TO EXPAND ITS OWN WORKFORCE TO OPERATE AND MAINTAIN THOSE NEW ASSETS.

[23] Electric Power Research Institute. "The Power to Reduce CO_2 Emissions: the Full Portfolio - 2008 Economic Sensitivity Studies (EPRI Report 1018431)," December 2008.

[24] Note that the EPRI analysis consists of two distinct elements. The first is the Prism analysis, which is an estimate of electricity sector CO_2 emissions reduction potential based on a hypothetical technology scenario. The second is driven by results from the Model for Evaluating Regional and Global Effects (MERGE) energy-economic analysis, which examines the optimum portfolio of low-carbon energy technology over time under an assumed economy-wide CO_2 emissions constraint.

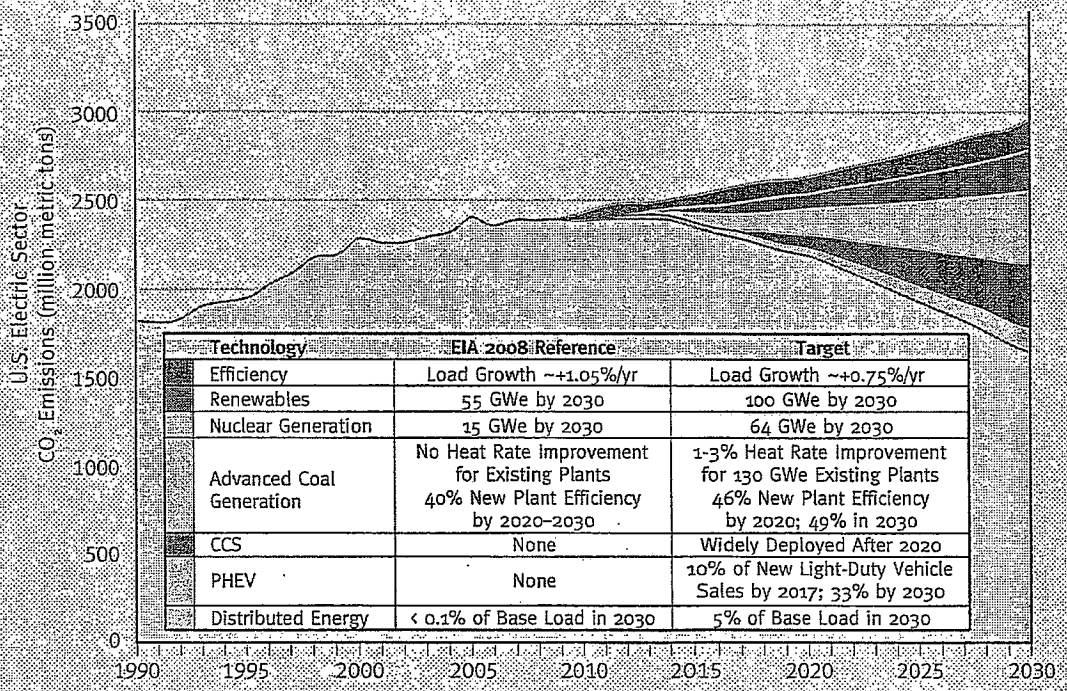
[25] Electric Power Research Institute. "The Power to Reduce CO_2 Emissions: the Full Portfolio - 2008 Economic Sensitivity Studies (EPRI Report 1018431)," December 2008.

[26] Although the EPRI Prism includes CCS on either supercritical or integrated gasification combined cycle (IGCC) plants, the Task Force modeled IGCC with CCS.

EPRI PRISM

EPRI Prism uses projections from the federal Energy Information Administration (EIA) Annual Energy Outlook 2008 and assumes an average annual electricity demand increase of approximately 1 percent. This leads to an estimated increase in total electricity demand of 20 percent above current levels by 2030, which in turn implies that approximately 210 gigawatts (GW) of new generation capacity will need to be added between 2007 and 2030. Under the Prism scenario, utilities achieve this increase in capacity by deploying roughly 80 GW of nuclear, 90 GW of coal with CCS, 40 GW of wind, 1 GW of solar thermal power, and 300 megawatts (MW) of solar photovoltaic power by 2030.[25] As a result, the industry's greenhouse gas emissions decline by 45 percent below projected business-as-usual levels by 2030. Results from the EPRI Prism analysis are illustrated in Figure 3.

Figure 3. EPRI Prism



Technology	EIA 2008 Reference	Target
Efficiency	Load Growth ~+1.05%/yr	Load Growth ~+0.75%/yr
Renewables	55 GWe by 2030	100 GWe by 2030
Nuclear Generation	15 GWe by 2030	64 GWe by 2030
Advanced Coal Generation	No Heat Rate Improvement for Existing Plants 40% New Plant Efficiency by 2020–2030	1-3% Heat Rate Improvement for 130 GWe Existing Plants 46% New Plant Efficiency by 2020; 49% in 2030
CCS	None	Widely Deployed After 2020
PHEV	None	10% of New Light-Duty Vehicle Sales by 2017; 33% by 2030
Distributed Energy	< 0.1% of Base Load in 2030	5% of Base Load in 2030

policy assumptions that were used to develop the Prism analysis. Rather, the Prism analysis simply provided a reasonable approximation to evaluate the possible future technology needs of the power sector and allowed the Task Force to impute potential workforce demands.[27]

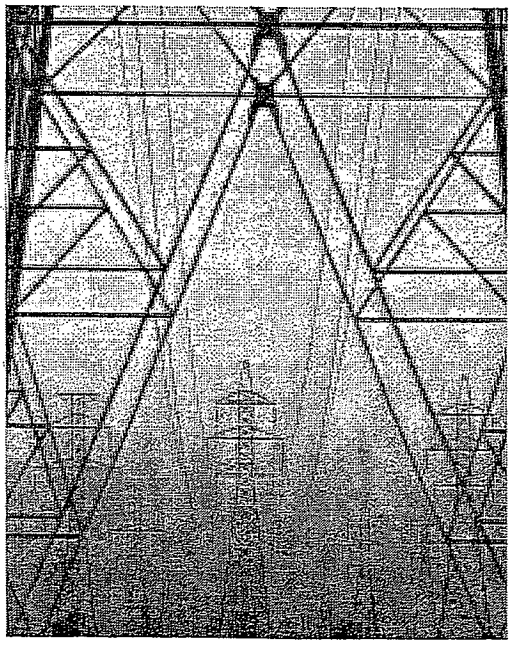
Working from the Prism analysis, the Task Force developed national-level estimates of the numbers and the types of workers that would be necessary to implement different low-carbon technologies at the scale assumed by EPRI. These estimates are intended to outline general trends and needs rather than forecast specific

[27] The features that made the Prism scenario attractive to Task Force members as a basis for estimating workforce needs are also important for understanding the limitations of the EPRI analysis. As the Prism is based on technological feasibility, it does not include the policy interventions that would likely be necessary to bring about a low-carbon transition, such as a CO_2 price or other potential technology incentives like a renewable electricity standard. The Prism also does not consider potential constraints such as technology, materials or workforce availability.

needs by individual job type. The Task Force was particularly interested in evaluating the need for technically skilled workers. These workers fell into three broad categories:

- Skilled craft electric power workers;
- Skilled craft construction workers; and
- Engineers.

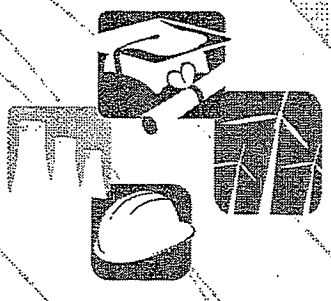
Skilled craft electric power workers include those individuals who work within the electric power sector to operate and maintain generating assets and supporting infrastructure. Skilled craft construction workers, by contrast, are generally hired by electric power companies to build generating assets and support infrastructure. Skilled craft construction workers are not specific to the energy industry. Rather, they are generally employed in industrial construction and cross over into heavy- and light-commercial construction. As considered by the Task Force, engineers work in both O&M and design and construction jobs. They perform the technical work associated with designing generating assets and supporting infrastructure and the technical work associated with running energy systems.



The Task Force identified and assessed potential workforce demands through 2030 across the following categories:

- Design and construction of new generating assets;
- O&M of existing generating assets and transmission lines (discussed in Chapter 1);
- O&M of new generating assets;
- Development and operation of the supporting infrastructure; and
  - Design, construction, and O&M of new high-voltage transmission lines;
  - Deployment and O&M of smart grid technologies; and
  - Design, construction, and O&M of CO_2 pipelines;
- Deployment of energy efficiency technologies and measures.

To generate a rough estimate of the number of workers needed in each category, the Task Force drew upon the expertise of its members and advisors. However, it is important to emphasize that the Task Force does not believe these estimates can or should take the place of state and regional workforce assessments. Greater geographic specificity is needed to identify focus areas for individual training programs or education systems. As the U.S. Congress moves forward with climate policy, the Task Force hopes that the rough estimates developed for this report can be helpful in future efforts by federal agencies and state and regional workforce boards to develop more refined workforce estimates. (Appendix D further discusses the Task Force's approach for developing the workforce estimates in this report and some areas for additional refinement.)



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