

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

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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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# 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



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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.<sup>1</sup> 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.<sup>2</sup> 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;



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<sup>1</sup> 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.greenforall.org/resources/green-collar-jobs-in-america2019s-cities>.

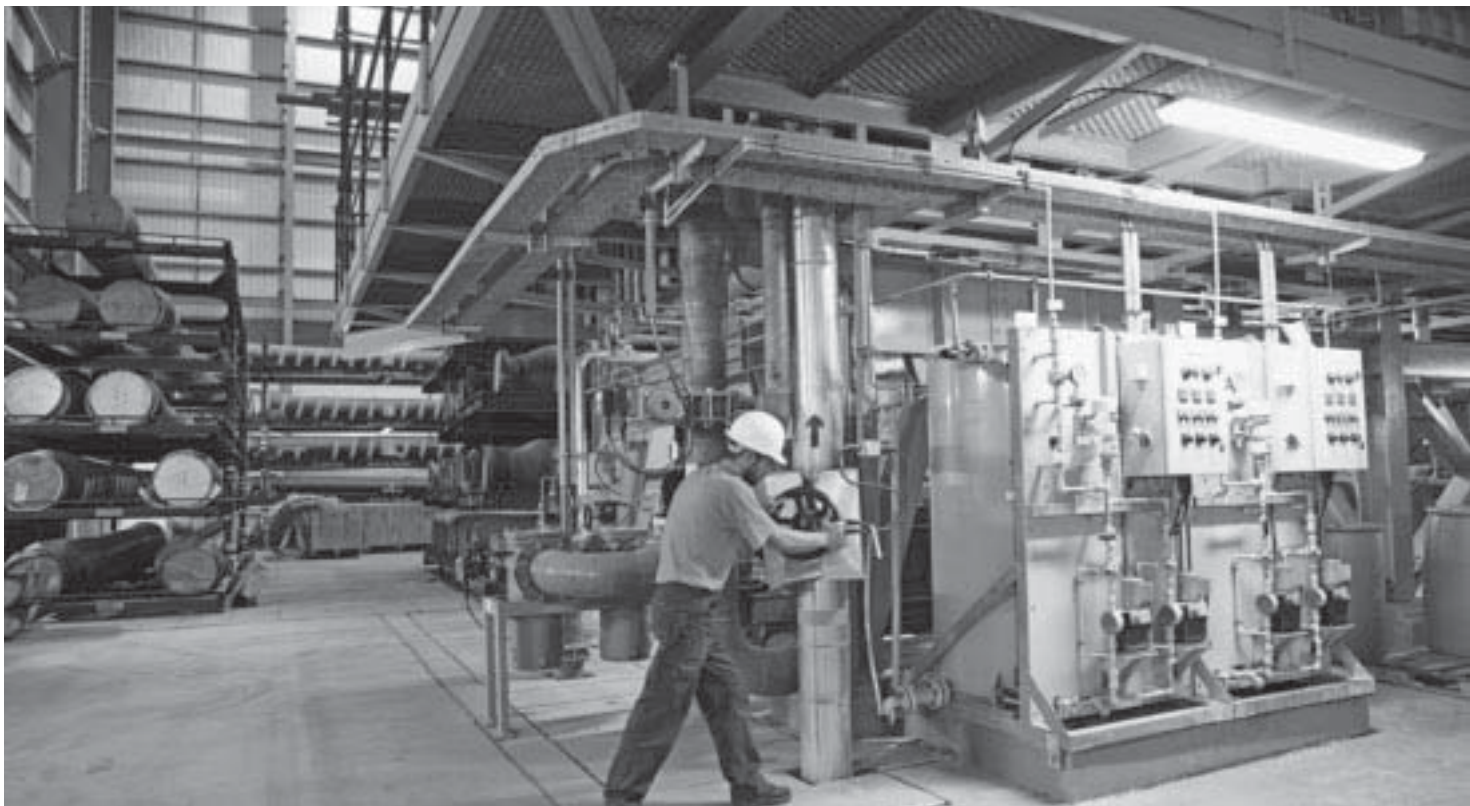
<sup>2</sup> While the Task Force future scenarios focus on electric power generation, transmission, and distribution, we recognize that electric utilities are frequently integrated with natural gas utilities and that natural gas utilities face similar workforce pressures. According to the Bureau of 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



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

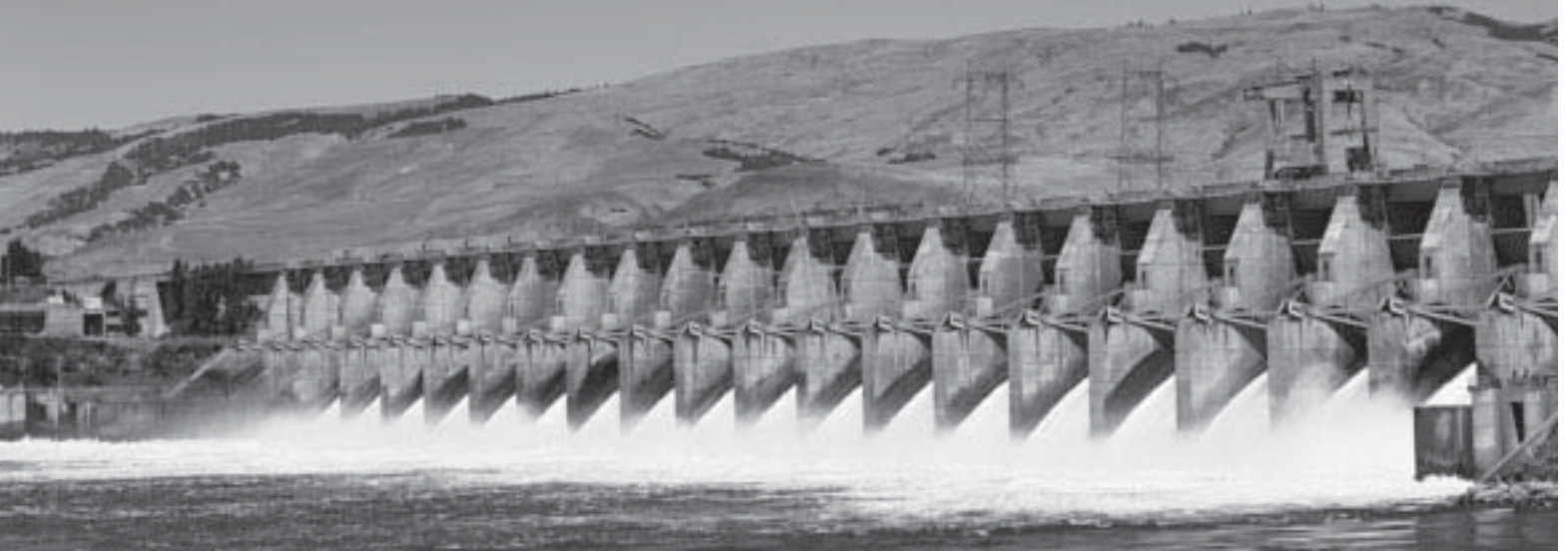
- Construction and maintenance of CO<sub>2</sub> pipelines as part of a commitment to expanded carbon capture and storage (CCS) will marginally add to the demand for skilled workers. While not directly calculated as part of the NCEP Task Force estimates, additional workers will be needed to retrofit 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 pro-



grams 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-



challenge 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



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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 recom-

mendations 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.

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557 lbs net greenhouse gases prevented

4,264,960 BTUs energy not consumed

1,414 lbs ghg emissions not generated

1.5 barrels fuel oil unused

not driving 1,400 miles

planting 96 trees





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