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Brief Background on Workforce Challenges

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Rising worldwide demand for energy is sparking private-sector investment in alternative, renewable fuels and power sources. Nations whose regulatory policies favor energy innovation will be better positioned to benefit from energy technology breakthroughs that could transform their economies.

The September ESIS dialogue will explore how energy has become a factor in America's economic competitiveness. In addition, ESIS seeks to identify the critical competitiveness issues that will shape the nation's energy future.

One of the critical challenges facing America's private and government employers is the ability to recruit and retain a skilled workforce. Without a steady supply of highly skilled and educated employees, U.S. efforts to create and sustain a more competitive energy industry will be hindered.



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Key Workforce Challenges Facing the U.S. Energy Sector¹

1. Rising demand for well-educated and skilled workers

Energy companies are experiencing all of the workforce challenges faced by other U.S firms, but the problems are more severe than in other sectors:

- The average age for workers in the energy industry is near 50, whereas the average age of all U.S. workers is just above 40.²
- At least half of electric utilities' technical workforce may retire in the next 5 to 10 years.³
- America's oil and gas workers average 50 years in age. Half are likely to retire by 2010. Retirements will occur at all skill levels — from equipment operators and truck drivers to scientists and engineers. There is an inadequate supply of qualified replacement workers. For example, enrollment in U.S. undergraduate petroleum engineering programs fell 79% between 1982 and 2004.⁴
- Demand for 250,000 replacement workers in the energy utility field (2007-2017) is projected to far exceed current supply -- not including thousands more needed to fill related construction jobs.⁵
- By 2010, the shortfall in the supply of electric lineworkers may be as high as 10,000 — 20% of the current number working for utilities or outsourcing companies.⁶

2. Insufficient supply of qualified workers

Energy production and distribution companies are concerned that younger workers will not have the skills or experience needed to successfully replace retiring workers:

- Utility employers report that their pre-employment tests reveal “dismal” performance by job applicants and an absence of skills essential to understanding energy technology and innovation.⁷
- In a 2005 survey, U.S. power companies indicated that the leading skill deficiencies among energy sector job applicants were **Technical Knowledge** (56% of applicants), **Math Ability** (54%), and **Communications Skills** (54%).⁸
- The number of U.S. high school students proficient in math and science concepts important to work in the energy sector has declined. The National Center for Education Statistics reported that the percentage of 12th graders rated “proficient” in science fell from 24% in 1996 to 20% in 2005; students scoring “below basic competency” rose from 43% to 46%.⁹
- The United States and Canada are graduating an insufficient number of geoscience majors.¹⁰
- The energy sector’s efforts to recruit new workers will be helped by its highly competitive wages and benefits. In 2006, the average hourly wages of non-supervisory utility workers were \$27.42, compared with \$16.76 average hourly wage production and non-supervisory workers in the rest of private industry.

3. Preparing workers for current and developing energy industries

In diversifying energy supply from oil, gas, and coal to renewable energy alternatives, the U.S. energy sector and the nation must address two critical challenges:

- Recruiting an adequate supply of workers to sustain the current energy infrastructure, and
- Recruiting employees with the skills demanded by renewable energy alternatives.

Traditional power generation, delivery, and services will be in demand for decades to come. Coal, oil, and natural gas are expected to represent roughly **80%** of world energy supplies 25 years from now.¹¹

Yet, power utilities will begin to offer more renewable energy options to commercial and residential customers. Between 2005 and 2030, U.S. energy demand for hydropower, biomass, wind, solar, and geothermal sources is projected to rise more than 45%.¹²

Significant demand for workers, at various skill levels, will occur in traditional positions as experienced energy workers retire. These include:

- Power line workers;
- Mechanics, installers, and repairers;
- First and second line supervisors;
- Plant maintenance staff;
- Skilled laborers;
- Electrical, mechanical, and civil engineers;
- Customer service; and
- Nuclear plant construction and maintenance.

The discovery and application of renewable energy alternatives will create new job opportunities as well. Companies that develop wind, solar, biomass, geothermal, and hydropower sources will all require skilled employees in:

- Sales, marketing, and customer service;
- Business support services — accounting, finance, human resources, and information technology;
- Research and development of renewable energy sources and application; and
- manufacturing and installing commercial and home energy-saving devices.¹³

In addition, each renewable energy source will create demand for a wide range of technical jobs:

Wind

- Mechanical engineers and technicians
- Electrical engineers and technicians
- Aeronautical engineers
- Construction workers

Solar

- Electrical, mechanical, and chemical engineers
- Materials science specialists
- Physicists
- Construction workers
- Architects and builders

Biomass

- Chemists and biochemists
- Agricultural specialists
- Microbiologists
- Engineers

Geothermal

- Geologists, geochemists, and geophysicists
- Hydrologists and hydraulic engineers
- HVAC contractors

Hydropower

- Geologists, geochemists, and geophysicists
- Electrical engineers and technicians
- Mechanical engineers and technicians
- Biologists
- Ecologists
- Construction workers¹⁴

As renewable energy sources play a greater role in supplying power to homes and industries, significant new jobs will be created:

- Solar electric installations grew by over 20% in 2006. According to the Interstate Renewable Energy Council (IREC), if the goals of the Photovoltaic Industry Road Map are achieved, direct industry employment would increase from 20,000 to 62,000 by 2015.
- IREC also predicts global clean-energy markets will quadruple in the next decade for several technologies, including biofuels, wind power, solar photovoltaics, and the fuel cell and distributed hydrogen market. Gross revenue is projected to increase from \$55.4 billion in 2006 to over \$226.5 in 2016.¹⁵
- A 2004 report by the University of California Berkeley's Renewable and Appropriate Energy Laboratory titled *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?*, concluded that renewable energy industry technologies generate more jobs per average megawatt of power in construction, manufacturing, and installation than coal and natural gas industries.
- According to a 2003 Council of State Governments (CSG) report, the economic multiplier effect is greater for renewable energy investments than for conventional energy firms. For example, in Nebraska, investments on renewable energy had a multiplier of \$2.32 to \$1.00 while the multiplier for conventional fossil fuel sources was \$1.48 to \$1.00. CSG says there is a growing trend to use renewable energy investments to stimulate state and local economic development.¹⁶

Energy Workforce Solutions

America's energy sector is exploring specific solutions to closing the skills gap in critical occupations. Since its workforce will transition to a new generation ahead of other sectors, the energy industry has a compelling need to identify and implement effective education and training strategies without delay.

Recent initiatives undertaken by energy companies in partnership with educators, labor unions, and government agencies include:

- **Energy career academies in high schools.** Established in 2001, Gulf Power Academy at West Florida High School is a three-year industrial electricity program that provides national industry certification to students preparing for careers in the electric utility industry. Gulf Power Company funded the start-up and helped develop a course curriculum that stresses the understanding of all aspects of the electricity industry. Graduates have surpassed industry standards on national certification tests and roughly half of the students were immediately hired as entry-level employees at Gulf Power Company. The majority of the other Academy graduates furthered their education at community colleges or universities.

- **Energy skills programs linking high schools and colleges.** PSEG in New Jersey has rapidly expanded a high school internship and training program that leads to an Associates degree in energy utility technology at several New Jersey community colleges. In 2006, PSEG and Thomas Edison State College also developed the nation's first bachelor's degree in energy utility technology. Both degree programs emphasize the technical knowledge and problem-solving skills necessary to design, install, operate, and maintain energy systems.

- **Energy sector apprenticeships.** The New York State Research and Development Authority invested in seven accredited solar training centers and continuing education programs across the state, including one with the *International Brotherhood of Electrical Workers' Joint Apprenticeship and Training Committee*. According to IREC, the program serves as a model that should be replicated.

Green Energy Ohio has also developed a PV installer apprentice program in partnership with the Florida Solar Energy Center and the Great Lakes Renewable Energy Association. The Florida Solar Energy Center is the nation's largest state-supported research and training institute, offering a range of continuing education courses, distance learning, and videoconferencing capabilities.

- **New college-level energy curriculum.** Idaho State University’s “Energy Systems Technology and Education Center” has received a \$600,000 National Science Foundation grant and a \$2 million Community-Based Job Training Grant from the U.S. Department of Labor to develop and disseminate a standardized *Instrumentation and Control Engineering Technology* curriculum for the energy sector nationwide, leading to an Associate of Applied Science degree. By 2009, Idaho State University will also produce Associate degree curricula for *Energy Systems Electrical Engineering Technology* and *Energy Systems Mechanical Engineering Technology*. The programs — developed with partners in industry, the community, government, and education — will provide competency-based skills training across all energy types including fossil, hydroelectric, renewable, and nuclear energy sources.

The National Science Foundation has also invested in Wisconsin’s Consortium for Education in Renewable Energy Technologies to help implement an interdisciplinary approach to technical education in renewable energy. Its programs offer classroom, online, and workplace-based training to incumbent workers and students seeking renewable energy careers.

- **Energy industry alliance for online education.** The Energy Providers Coalition for Education (EPCE) is a national alliance working to engage the energy industry’s workforce through quality online education. Expanding beyond standard job training, EPCE’s online programs are contextualized credit-bearing courses leading to certificates and Associate’s and Bachelor’s degrees. These programs offer interested job candidates and incumbent workers technical skills as well as academic knowledge needed for industry career paths in electric utilities, nuclear power, and gas distribution.

EPCE members, representing over two-thirds of the industry, develop and sponsor online curricula with qualified accredited high schools, colleges, and universities. This collaborative strategy ensures continued program expansion across electric utilities and the energy industry at large.

- **Energy centers of excellence.** Energy employers have begun creating “Energy Centers of Excellence” in which utilities, unions, schools and colleges pool their resources to:
 - Identify local energy workforce skill and training needs;
 - Ensure that the academic credentials are benchmarked to industry standards;
 - Offer students and workers choices of energy career opportunities, and access to appropriate training and employment opportunities;
 - Provide technical assistance to help communities served by the sites to address current and projected workforce skill shortages;
 - Develop curriculum and certification in critical skill areas; and
 - Serve as a clearinghouse of information on model programs, company best practices, and other resources/tools that can improve workforce development efforts.

Model “Centers of Excellence” include the **Employ Florida Banner Center for Energy** at Lake-Sumter Community College which features a Boot Camp for entry-level line technicians and a web site to recruit candidates for energy openings statewide. Another successful partnership is the **Center of Excellence for Energy Technology** at Centralia College in Washington State. Working with local utilities and the International Brotherhood of Electrical Workers Local #77, the center sponsors a range of training programs for utility skills, including an interactive television course that reaches trainees in remote locations.

Energy suppliers and thought leaders have proposed several additional strategies that could address the critical workforce challenges identified above. Among those recently proposed:

- **Recruiting technical staff from the U.S. military** and declining industries that already have a majority of the skills needed to fill critical openings in the energy sector.
- **Raising awareness and understanding of the energy sector career opportunities among students and younger workers through online,**

easy-to-access information on energy sector careers. Sample websites include: *www.GetIntoEnergy.com* and state-sponsored resources such as *www.NJNextStop.org*.

- **Increasing support for government-sponsored energy research and education programs.** The National Academy of Sciences recently joined its counterparts in 12 industrial nations in calling for aggressive funding of research on renewable energy sources and for increased technology exchanges involving energy efficiency.

Questions for Discussion

1. How seriously will a shortage of skilled workers affect America's ability to meet workforce demand in the energy and utility sectors and to develop and deploy alternative strategies?
2. To what extent are the education backgrounds and skills possessed by current energy sector workers relevant to the development of alternative energy options — including new technologies and energy saving strategies?
3. How can our private-sector and education institutions facilitate opportunities to transition workers from industrial sectors that are shrinking to new job opportunities in the energy sector?
4. To what extent must American education and training institutions alter current practices to prepare sufficient numbers of new employees with the education and skills needed in current and emerging energy sector jobs?

End Notes

¹ The U.S. Bureau of Labor Statistics describes an “energy sector workforce” of one million employees, including 523,800 workers employed by fossil fuel, nuclear, and natural gas utilities; 123,000 employed in oil and gas extraction jobs; and 72,000 in coal mining. See U.S. Department of Labor, Employment and Training Administration, *Identifying and Addressing Workforce Challenges in America's Energy Industry* (Washington, D.C.: Author, 2007).

² U.S. Department of Labor, Employment and Training Administration, *Identifying and Addressing Workforce Challenges in America's Energy Industry*, U.S. Bureau of Labor Statistics.

³ Center for Energy Workforce Development, *An Action Plan for Workforce Development* (Washington, D.C.: Author, 2007).

⁴ National Petroleum Council, *Facing the Hard Truths About Energy: A Comprehensive View to 2030 of Global Oil and Natural Gas* (Washington, D.C.: Author, July 2007); Society of Petroleum Engineers, *Skills Shortage: The Way Forward* (Richardson, TX: Author, 2002); Independent Petroleum Association of America, 2005; Dr. Mukul Sharma, University of Texas/Austin, 2005.

⁵ Center for Energy Workforce Development, *Midwest Regional Meeting Presentation* (Washington, D.C.: Author, May 2007).

⁶ U.S. Department of Energy, *Workforce Trends in the Electric Utility Industry* (Washington, D.C.: Author, August 2006).; U.S. Bureau of Labor Statistics, 2006.

⁷ Center for Energy Workforce Development, *An Action Plan for Workforce Development*.

⁸ Utility Workforce Planning Network, *Workforce Aging and Turnover in the U.S. Electric Industry: Challenges and Opportunities* (Washington, D.C.: Author, November 2005.)

⁹ National Center for Education Statistics, U.S. Department of Education, *Digest of Educational Statistics* (Washington, D.C.: Author, 2006).

¹⁰ National Petroleum Council, *Facing the Hard Truths About Energy*.

¹¹ Ibid.

¹² U.S. Energy Information Agency, *Annual Energy Outlook 2007* (Washington, D.C.: Author).

¹³ John J. Heldrich Center for Workforce Development, *Occupational and Skill Demand in New Jersey's Utilities Industry* (New Brunswick, NJ: Author, 2006).

¹⁴ U.S. Department of Energy; *Energy Power and Career Guide* (Washington, D.C.: Author, n.d.), accessed at www.khake.com.

¹⁵ Testimony before the House Subcommittee on Energy and Environment, June 19, 2007.

¹⁶ Council on State Governments, *Renewable Energy and State Economies* (Lexington, KY: Author).