Smart Grid Education and Workforce Training Center

Mohammad Shahidehpour, *Fellow IEEE*

THE U.S. Power and Energy Engineering Workforce Collaborative estimates that there are about 800 to 1,000 undergraduate students graduating each year with an interest in electric power engineering jobs. In addition, the U.S. enrollment for masters and doctoral degree students in power engineering are around 550. About sixty percent of graduate students are international. Electric utilities alone will require an estimated 7,000 new hires in power engineering over the next five years. After factoring in the workforce needs of other industries, the power engineering employment could easily be doubled to 14,000 over the same time frame.

While the exact future power engineering workforce needs are can be difficult to project, doubling the number of student graduations over the next five to eight years is a reasonable estimate. Over the next five years, approximately 45 percent of engineers in electric utilities will be eligible for retirement or could leave engineering for other reasons. If they are replaced, there would be a need for over 7,000 power engineers by electric utilities alone: two or three times more power engineers may be needed to satisfy the needs of the entire growing market. Finally, even more faculty will be needed to increase the number of power engineering students to meet the demand for new engineers in the workplace. The pipeline of students entering the engineering disciplines is not strong enough to support the urgent and immediate need, with the published surveys indicating that most high school students do not know much about engineering and do not feel confident enough in their math and science skills to pursue an energy/engineering career. Furthermore, often career counselors and teachers know little about engineering as a career and are thus unlikely to encourage their students to become engineers. The industry has long-term needs that must be met with new engineers that are currently in grade schools. There should be a coordinated effort to reach into the K-12 pipeline.

The Smart Grid Education and Workforce Training Center is led by IIT, which consists of a team of over 100 participating members as shown in Table 1, including three domestic and five international universities, 49 community colleges, high schools, six city and government entities, eight labor unions and councils, one national laboratory, five power transmission and distribution systems operators, five professional training organizations, 16 smart grid manufacturers and software companies, and 13 energy system consulting companies.

The objectives of the Smart Grid Center will be focused on the development and deployment of training programs for the students and trainees from a wide spectrum of backgrounds. In particular, (1) The Smart Grid Center will offer state-of-the-art training topics in smart grid and related topics in electric power systems and sustainable energy in order to train the world's most qualified and strongest workforce to meet the global challenges of developing new energy infrastructure and to sustain the United States' leading edge in the production, delivery, and utilization of energy; (2) The Smart Grid Center will offer the most advanced education in program content, format, and organization and will continuously enhance the quality of training programs to respond to the evolving needs of its constituents. The Smart Grid Center will also provide access to a wide range of educational opportunities scheduled at times, places, and in formats that would fit students' availability and life styles –this includes students who live in rural areas as well as military service people who are overseas; (3) The Smart Grid Center will offer workshops, short-courses, and national conferences for educating stakeholders on critical issues related to smart grid development and implementation. The Smart Grid Center will also provide counseling, job placement, and retention of employment services to those who want a career in the emerging sectors of smart grid technology; (4) The world-class smart grid education programs developed in the Center are planned to be sustainable and to last much beyond the proposed three-year period of the DOE grant.

The Smart Grid Center will provide counseling, training, job placement and retention of employment services to those who want a career in the emerging sectors of smart grid. The Smart Grid Center is employment focused and calculates its success in one way: the number of persons who receive education, training and credentials that lead to sustainable employment in smart grid related areas. The Smart Grid Center will target the following categories:

A. New, sustainable green jobs / retrained U.S. Workforce

The Smart Grid Center will train the existing workforce in order to retain and expand the manufacturing jobs in the United States and meet the global and competitive challenges in Smart Grid innovations. Incumbent workers who need skill upgrades/updates related to energy efficiency to maintain

M. Shahidehpour is with Robert Galvin Center for Electricity Innovation, Illinois Institute of Technology (e-mail: ms@iit.edu).

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employment or advance in their careers (including minority contractors). Unemployed or underemployed individuals with experience in manufacturing, construction, trades, or industries or occupations with transferable skills who have been impacted by national energy policies (for training in energy efficiency and institutional retrofitting and renewable occupations). Unemployed individuals representing priority service groups – individuals Veterans, women and minorities, people with employment barriers, people with criminal records, people with disabilities, and disadvantaged youth and adults.

B. Labor

Many of the jobs impacted by Smart Grid energy efficiency initiatives are occupations that have significant Labor participation: electricians, carpenters, sheet metal workers, plumbers and transportation workers. The Smart Grid Center has the support of major Labor unions in the Midwest region as well as the umbrella organizations that represent them, including the AFL-CIO, the Chicago Federation of Labor and the Chicago and Cook County Building and Construction Trades Council. The Smart Grid Center will work with Labor representatives to develop curriculum that can be integrated into existing Labor training initiatives.

C. Veterans

The Smart Grid Center will provide energy training programs specifically tailored to the educational needs of Veterans. IIT will offer flexible distance learning courses to service people who are currently deployed –this means that they can begin planning for civilian transition even before they return. IIT's Yellow Ribbon program, which provides free tuition for returning veterans, will help ensure veterans interested in training will have access to IIT programs.

D. Chicago Public Schools

Student field trips to the Smart Grid Center will provide students with hands-on work-based learning opportunities, with "Energy Detective" programs that will engage K-12 teachers and students. The Smart Grid Center will also provide teachers with access to down-to-earth courses, workshops, and webinars on the Smart Grid, plug-in hybrid cars, and renewable energy topics so they can teach their students in practical, easy to understand terms.

E. Consumers

This initiative will put utilities on the path to an effective implementation of the Smart Grid, which will result in fewer, shorter blackouts for homes and businesses, cleaner energy and reduced carbon emission by reducing peak demand for electricity, enhanced U.S. energy efficiency and lower electricity bills.

Based on existing surveys, there are very critical needs for creating a competitive smart grid workforce. The diversity of the jobs needed requires a flexible rather than a one-fits-all strategy. Various options are needed to address the demand for a qualified workforce at different levels. The Smart Grid Center will adopt a multi-leveled approach to provide smart grid training for employment in various industries. Three levels of training will be provided: fundamental training, applied training, and advanced training. Fundamental training on smart grid will focus on the concepts of electricity and power, the basics of smart grid and the preparation of necessary knowledge for higher level of training. Fundamental training will begin with fun and engaging learning units for K-12 students, and will accelerate through the 48 community colleges all over the State of Illinois. Applied training on smart grid will focus on skills necessary to work in the smart grid industry. For those with relevant skills or experience, a layer of training in new energy efficiency and renewable energy skills (e.g., BPI certificated analyst training) will help them maintain their existing employment or to transition to new jobs. For new entrants or individuals who face employment barriers, there are opportunities to learn new skills and acquire good jobs, without a post-secondary degree (e.g., Illinois Home Weatherization Assistance Program). For small business owners and contractors looking to grow, short-term energy-related certifications can open new doors (e.g., RESNET certified auditor training that IIT will co-offer in partnership with Illinois Community Colleges). Advanced training will focus on individuals seeking a four year or advanced degree in smart grid. IIT, teaming up with Argonne National Laboratory and community colleges, will offer hands-on training utilizing various existing resources, including the on-campus perfect power smart grid prototype project, the wind energy consortium project, the wind integration project, the advanced power system operation simulation software, the advanced dispatcher training system (DTS) and distribution management system (DMS) provided by AREVA.

Key differentiators that distinguish the Smart Grid Center include its easily accessible geographic location in the center of the country, supplemented by distance learning programs, its existing smart grid programs funded by the DOE including projects that provide students with a living laboratory, and extensive collaborations with the DOE National Labs.

1) The Smart Grid Center will be established on the IIT's main campus, which is located less than 3 miles from the Chicago Downtown and will provide a convenient access for students and trainees. Chicago is also the home to one of the Nation's largest utility, Exelon/ComEd, who will look to the Smart Grid Center to provide training to upgrade the skills of its existing workers as well as to train new workers.

2) IIT is engaged with three ongoing smart grid and renewable energy projects currently funded by the DOE. First is the IIT's Perfect Power Project, second is the IIT's Wind Energy Consortium Project, and the third is the IIT's Wind Integration Project. The three project developments along with the software packages donated to the Smart Grid Center by industry partners would provide extensive smart grid training opportunities at IIT that are unavailable elsewhere.

3) IIT has extensive collaborative research programs with DOE National Labs, including the Argonne National Laboratory, and the National Renewable Energy Laboratory. IIT has offered joint master's degree programs with the

Argonne National Labs and is collaborating with NREL on wind integration projects. The close collaboration between IIT and the DOE Labs could take full advantage of the National Lab's research and educational resources for promoting the energy research and education agenda at the national level.

4) The Smart Grid Center will have the active participation of the IEEE Power and Energy Society (PES), which is the largest power and energy organization in the world. The PI is the VP for Publications in the IEEE/PES and serve on the executive Board of the IEEE/PES. IEEE/PES has close to 25,000 members who can interact with the Smart Grid Center in many ways: as students, as educators, and as advocates. The Smart Grid Center plans to offer classes at IEEE/PES conferences which attract thousands of participants from the various corners of the energy industry.

5) IIT has extensive experiences in workforce education and training and has been innovators in distance learning strategies since TV-based education started at IIT in the 1960's. IIT's efforts to attract remote site students through Internet-based courses started more than 10 years ago with students in several states in the U.S. and across the globe. IIT's Smart Grid Center for Professional Development (CPD) has been very instrumental in offering live training courses for several decades. IIT's engineering programs have over 100 years of experience in offering courses in power systems, power electronics, digital controls, communication, cyber security, computer science, industrial and organizational psychology, environmental management, entrepreneurship program, energy laws, and government policy. Such activities will enable IIT and its partners to establish a World-Class Smart Grid Education and Training Center that will facilitate the development of a well-trained and highly skilled electric power workforce which is vital to the implementation of a national smart grid initiative. The above objectives will be achieved by accomplishing the following phases and tasks.

Phase I – Establishment of the Smart Grid Education and the Workforce Training Center

Task 1.0: Secure the Designated IIT Smart Grid Center Space
Task 2.0: Acquire the Equipment and Furnish the Center
Task 3.0: Recruit the Smart Grid Center Staff

Phase II – Assessment of Training Needs for Smart Grid Workforce

Task 1.0: Identify Specific Job Classifications and Skill Deficiencies
Task 2.0: Identify Gaps in Training Needs

Phase III – Development of Smart Grid Workforce Training Programs

Task 1.0: Coordinate the Development of the Training Program
Task 2.0: Develop the Education and Training Courses
Task 3.0: Develop Teaching Materials and Textbooks on Smart Grid
Task 4.0: Call for Proposal on Smart Grid Course Development by Community Colleges

Phase IV – Deployment of Smart Grid Workforce Training Programs

Task 1.0: Offer Community College Level Courses on Smart Grid
Task 2.0: Offer University-level Degree and Certificate Programs on Smart Grid
Task 3.0: Offer Tailored Programs on Smart Grid
Task 4.0: Offer Smart Grid Educational Topics for High School Teachers and Students
Task 5.0: Offer Workshops and Public Outreach Seminars on Smart Grid

Phase V – Development of Strategies for Sustaining the Smart Grid Center Operation

Task 1.0: Assess the Viability of the Smart Grid Training Programs
Task 2.0: Assess the Operational Efficiency of the Center
Task 3.0: Develop and Deploy the Smart Grid Center Membership Program

Phase VI – Final Reporting

Task 1.0: Prepare the Final Report for the DOE.

The devastating economic effects of the current "financial downturn" include historically high unemployment rates, especially for returning veterans in the 20 to 24 year old age group, whose unemployment rate reaches double the national average. These Veterans are returning to the worst economy in decades, and many, who are unable to find employment, choose to utilize their G.I. Bill benefits and return to school to complete a 4 year or graduate degree.
IIT's distance learning course offerings will allow service people to begin training immediately –even before they return home from deployment. Through an analysis and comparison of civilian occupations impacted by smart grid technology against related military occupations, a high percentage of returning Veterans have the experience that qualifies them as excellent candidates for the smart grid training. Through participating in the yellow ribbon project, IIT helps Veterans who wish to pursue an engineering degree at IIT by providing tuition assistance that bridges the gap between the dollars the G.I. Bill covers and the cost of IIT tuition. This amounts to thousands of dollars per Veteran student.

Through partnering with the Illinois based Operation Green Jobs and the national Helmets to Hardhats program, IIT supports initiatives which connect National Guard, Reserve and transitioning active-duty military members with education, career training and employment opportunities within the construction and engineering industries. This includes partnerships with the IBEW, Sheet Metal Workers Union, SEIU, Teamsters, the Chicago Federation of Labor and the Chicago and Cook County Building and Construction Trades Council.

Mohammad Shahidehpour (F'01) is the Carl Bodine Distinguished Professor and Director of Robert W. Galvin Center for Electricity Innovation at Illinois Institute of Technology