WDI
Workforce Development Institute

Working Draft

Workforce Implications of Grid Modernization

A briefing paper

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"Ask utility executives what keeps them awake at night and workforce issues will likely loom large…with experienced workers now emboldened to revive their retirement plans, and far too few younger people ready to replace them, the talent gap that already threatened the industry pre-recession has reemerged." ***Power and Utilities Changing Workforce, Keeping the Lights On*** **(2013, Price Waterhouse Coopers)**

SUMMARY

This briefing paper discusses the Workforce Development Institute's (WDI's) U.S. Department of Energy Smart Grid Grant, our system of electricity in New York State, and the relationship of the workforce to its future. The paper is divided into two major sections:

1. Workforce Issues, Challenges and Opportunities, and
2. New York's Electrical System Today

New technologies are constantly evolving that impact the ways in which electricity is produced, transmitted, stored and used. New York's Public Service Commission's *Reforming the Energy Vision* (REV) proceedings will end with fundamental changes in how consumers are charged for electricity and how utilities are compensated. Will the workforce necessary to build, re-build, operate and maintain existing and new systems that generate and deliver electricity be available and ready? The manufacturing sector may provide forewarning for the electricity sector. In the U.S. we were not prepared for the resurgence of manufacturing and the new skills that are now required. Manufacturing jobs go unfilled because there were few effective collaborative efforts between businesses, education, government and others to train for the required skill needs. This is beginning to change.

Through such partnerships, between industry, labor, education, government and non-profits like the Workforce Development Institute, the workforce challenges in the electricity sector can be met. We must start now. The changes described in this paper are in progress; many more are in the planning stages and we must get ahead of the curve. The workforce development component cannot be an afterthought in electrical system modernization planning. WDI is facilitating collaborative efforts; needs to expand our efforts, and requires additional resources to remain in front of these trends.

WDI's INVOLVEMENT WITH ENERGY

The Workforce Development Institute (WDI) is a 501 (c)(3) non-profit with regional offices, statewide, and with a mission to assist working families through workforce, economic and community development services. WDI recognizes the pivotal role of the energy sector in our economy, the trend toward clean energy and is helping prepare the workforce for this transition. Energy is a source of good middle-class jobs. WDI's involvement with energy began

well over a decade ago and then developed into a focus on clean energy. WDI's workforce development grants have been distributed to train electrical workers represented by the International Brotherhood of Electrical Workers (IBEW), plumbers and pipefitters represented by the United Association (UA), industrial workers, equipment operators and many more members of the skilled trades. WDI has funded programs at community colleges to help advance their clean energy programs, such as the Wind Tech Maintenance Program at Clinton Community College. WDI is doing what it can by using its limited resources to fund training that supports the workforce needs of the energy sector.

Our roots in clean energy began through work with IBEW's electricians. We next led development of the New York State Apollo Alliance. We brought together unions, businesses, educators, environmentalists and environmental justice organizations. The NYS Apollo Alliance facilitated a conversation with workers and the public about employment issues associated with the reduction of greenhouse gases that contribute to climate change caused by global warming. This dialogue focused on the premise of a "just transition"; that the move to clean energy must protect the family financial security of current workers, while creating new jobs providing clean energy. WDI promotes collaboration between unions, environmentalists, businesses, government and communities in designing the emerging energy sector.

The work of the Apollo Alliance became an integral part of WDI. At the national level the Apollo Alliance merged with the Blue/Green Alliance (BGA); which began as collaboration between the Sierra Club and the United Steelworkers. WDI is a participant in the Blue/Green Alliance and facilitates its work in New York State. BGA now has a broader range of sponsors and mostly tracks and advocates for clean energy initiatives at the national level. WDI focuses on the sub-national level as the BGA affiliate for New York State.

WDI has developed and coordinates coalitions on clean energy topics such as solar, offshore wind and creation of a smart grid. Doing this, WDI established its reputation as a *convener* of people with contending points of view to talk about, collaborate and form consensus on emerging issues in the energy sector. WDI's goal is to foster a dialogue about workforce issues associated with grid modernization. At the request of the NYS AFL-CIO, WDI participated in the formation of the NYS Smart Grid Consortium and continues advising organized labor on energy related matters.

WDI's Department of Energy Grid Modernization Training Grant

WDI's energy work was enhanced by a 2010 Grid Modernization Training Initiative funded through the U.S. Department of Energy; the DOE Smart Grid Workforce Training Grant. In addition, WDI received a ten percent supplemental match provided by the NYS Economic Development Corporation. Prior to applying for the DOE grant, a partnership was proposed where WDI and an alliance of universities and community colleges would collaborate in applying for a grant. At the last minute the colleges chose to exclude organized labor and WDI. WDI decided to independently submit a proposal to serve frontline workers and strengthen the

state's capacity to implement a modernized grid. We partnered with IBEW's Northeastern Joint Apprenticeship Training Committee (NEAT). NEAT provides training for IBEW's outside line workers in eleven northeast/mid-Atlantic states. In less than two weeks before the DOE grant deadline, WDI staff prepared the application for training resources. We were successful with the application. The U.S. DOE wanted to strengthen New York's existing capacity and appreciated our relationship with the 2.5 million members of organized labor. The consortium of colleges did apply for a DOE grant without WDI and the unions. Their application was not successful.

The $3 million DOE grant was one of many issued as a part of the American Recovery and Reinvestment Act of 2009 (ARRA). Approximately half of the $3 million was made up of in-kind and cash matches. The hope was that modernization of the grid and its components would begin to rapidly expand and workforce training to do that expansion would be required. The training provided under the grant focused on two IBEW locals: Local 1049 in Long Island and Local 1249 in East Syracuse. The IBEW electricians at these two locals are the non-utility-based electricians who build and maintain New York's electrical grid. Utility based electricians are on the payrolls of the electrical utilities and acquire their training from these utilities. The electricians in Local 1049 and Local 1249 work for electrical contractors who often are hired by electrical utilities to supplement their own staffs. These two locals have their own training facilities.

The federal Department of Energy grant began on July 30, 2010 and was to end on July 29, 2013. It was extended through June 30, 2014. When the grant opportunity was first announced, it was thought the federal stimulus money that was designed to help end the recession would result in billions of dollars' worth of electrical grid improvements throughout the United States. New York hoped to get a larger share of this funding, but the largest shares of resources were granted to other states.

Anticipating greater federal support for New York's grid expansion, WDI proposed to train 450 new line worker apprentices and several hundred journey level workers. When the awards were announced and we knew there would be less work available, WDI and NEAT decided to limit training slots to match those jobs that would be available. One of the shortcomings of many job training programs is that more candidates are trained than jobs are available. Not being able to transition graduates into their profession is demoralizing for the trainees and discourages future applicants. Trainees defer alternative income and family time to commit to programs that promise entry into a new profession. Unions commit to intense training, good wages and need to keep faith with those they recruit. Our initial target numbers were not met for the reasons stated. Dropout rates for this profession are also high because it is difficult and dangerous work as stated above. Results and lessons learned are described further in this paper and can be used to guide future training.

Another aspect of workforce development is knowing what businesses are in the supply chain of a sector or industry. This knowledge can be helpful to foster a dialogue with the business community about training and skill requirements. In 2013 WDI developed a supply chain

database to support offshore wind development in New York and elsewhere in the United States. This database has been capturing information from New York State businesses that want to participate in offshore wind construction. The development of offshore wind will have major implications for the electrical system in New York and the workforce. Our supply chain database is helping prepare New York for this resource. The Chair of the NYS Public Service Commission has encouraged WDI to strengthen and expand this database model to include collateral companies that would benefit from grid modernization. Business development for New York State companies and job growth is the goal.

WORKFORCE ISSUES - CHALLENGES AND OPPORTUNITIES

Previous papers and reports discussing New York State's electrical grid emphasized the need for modernization. Few discuss the skills of workers needed for upgrading the grid or if so, tend not to mention how this will occur. The 2012 Energy Highway Blueprint issued by the New York Energy Highway Task Force does recommend support to train workers for grid modernization. It serves as a good summary statement for the kind of attention needed. The Report says, "The Energy Highway Task Force supports continuing public and private efforts to train new technical utility workers and utility engineers, as well as update and expand the skills of the current workforce and professional trades supporting the energy industry. Particular attention should be paid to workforce development in the urban, environmental justice communities where power plants are often located."[i] WDI agrees.

The report goes on to say, "While a declining skilled workforce has been an issue for a number of years, the need for introducing new skilled workers and cross training existing workers grows more acute as the impending retirement of large numbers of experienced electric utility workers becomes a reality."[ii] We need to get a clearer understanding of the aspects of cross training and move forward. WDI should focus on this issue and develop relevant information for policy makers.

The Energy Highway Blueprint cites a *New York State Transmission and Distribution Systems Reliability Study and Report* in saying that nationally nearly 50% of the skilled utility workforce will be approaching retirement or attrition in the next three years. The statement was made in a 2012 report, which means that we already are at that date.

The Blueprint says that, "Despite utility advancements and workforce productivity, additional skilled workers are needed, and fully developing workers with the necessary skills requires several years of training. Utilities, labor organizations, and several community colleges have partnered to develop curricula to provide educational background that enables workers to be qualified to perform electric line work in a shorter time." [iii]

Again, quoting the Energy Highway Blueprint, "With the adoption of Smart Grid advancements, existing employees may also require specialized training to become proficient at operating and

maintaining these advanced technologies." We need to help all concerned understand the emerging technologies. Furthermore, "The Energy Highway Task Force recommends that utilities, labor organizations, and community colleges be provided access, where practical, to observe construction and operation of the Energy Highway. One approach is to integrate credit-based on-the-job learning experiences with college curricula through cooperative education programs."[iv]

As noted above, the report *Power and Utilities Changing Workforce, Keeping the Lights On*, echoes our concern about having enough qualified workers to maintain and modernize the electrical grid. Turnover rates are rising. Unless we promote these jobs and expand access for minorities and women, few younger people will be ready to replace them. The talent gap that already threatened the industry pre-recession has reemerged. [v]

The authors of the PwC report analyzed data submitted by 29 utilities, representing nearly a quarter of a million employees. The findings show that utilities are losing employees at an accelerating rate. They go on to say, "we anticipate a future in which a much wider range of available technologies, resource scarcities and demographic shifts will impact the industry. Talent, moreover, will be even more critical to maintaining sustainable growth." [vi]

The report notes that the impact on utilities will vary, "…depending on the retirement and hiring profiles of each organization."[vii]

What Do Lineworkers Do?

What lineworkers do is best summarized in a listing by the National Labor-Management Cooperation Committee. The tasks are varied and the listing below doesn't begin to describe the detail or difficulty of the work. It does show the percentage of lineworkers specific duties and the range of work required:

96% Installing and Maintaining Transformers and Other Equipment
93% Stringing New Wire or Maintaining Old Wire
92% Supervising Journeymen and Apprentices
91% Installing and Maintaining Insulators
91% Establishing Work Position for Maintaining and Repairing Overhead Distribution or Transmission Lines
87% Planning and Initiating Project
81% Establishing OSHA and Customer Safety Requirements
81% Setting of Towers, Poles and Construction of Other Devices to Hold Electrical Wiring
69% Installing, Repairing and Maintaining an Underground Electrical Distribution System
65% Assembly and Erection of Substations
56% Installing, Maintaining and Repairing Traffic or Train Signals and Outdoor Lighting
50% Tree Trimming [viii]

In addition to the 3.5 years and 7,000 hours of on-the-job training, lineworker apprentices also are required to take 144 hours of off-the-job training as a minimum for each year of the apprenticeship. By the time an apprentice completes the training, they have to understand the electrical power transmission system and distribution, "from the ground up." [ix]

According to the NEAT, lineworkers, in addition to learning electrical work, learn elements of foundation construction, welding, heavy equipment operation, surveying, first aid, CPR, reading and other skills. Safety is an integral part of the training and is reinforced throughout. Beginning pay for apprentices is 60% of a journey-level lineworkers wages. Pay raises are included during the course of the apprenticeship program. [x]

What Does It Take to Become a Lineworker?

Becoming a Lineworker is not easy. The dropout rate during the initial training, often referred to as boot camp, is as high as forty percent. This was a popular topic during the 2014 National Training Institute for Electrical Workers at Ann Arbor, Michigan attended by WDI staff. There was general agreement among the electric utility trainers and trainers for IBEW locals that improved screening of apprentice candidates needs to occur and applicants need a better understanding of the rigorous nature of the training. Many apprentices drop out of the apprentice programs during pole climbing which involves climbing poles as high as eighty feet. Others have difficulty with math and the danger inherent in the work.

In New York, non-utility lineworkers are trained by the Northeastern Joint Apprenticeship and Training Program (NEAT). The qualifications are demanding and require physical agility, good math skills and passage of a drug test, plus much more. The apprenticeship program administered by NEAT is based on National Joint Apprenticeship & Training Committee (NJATC) curriculum and consists of:

- 7,000 hours of study, training and examinations; and
- Approximately 3-1/2 years of instruction and training.

Graduates of the apprenticeship program also are eligible to receive 25 semester hours of college credit.[xi]

Training for the Grid

The 2010 New York Independent System Operator report titled, *Envisioning a Smarter Grid for New York Consumers* says that, "the smart grid will result in significant job creation during its development and deployment and will transform the nature of many jobs in the electric power industry". The report goes on to say that, "New York has a number of well-respected institutions of higher education with strong engineering departments. Continued and increased interaction between the electric power industry and academic institutions is highly desirable to foster cooperation and convey to the entering students that this is a viable and attractive career area."[xii] WDI should facilitate a dialogue between outside line worker unions, businesses, academic institutions and students to enhance this effort.

There is no doubt that for grid modernization to occur there has to be a supply of well-educated power industry, college educated professionals, and that academic institutions and the electric power industry will need to collaborate so that curricula reflects the latest technology. However, there is no mention in the ISO report of the lineworkers and electricians who will do the actual installation of many modernized grid components. These critical jobs rely largely on apprentice training programs offered by the unions and paid for by the participating contractors or by the utilities. WDI should advocate for the workers to be included in these discussions.

During the 2013 National Joint Apprenticeship Training Conference in Anne Arbor, Michigan, Ed Hill, IBEW National President and Dennis Quebe, National NECA President (National Electrical Contractors' Association) cited Bureau of Labor Statistics figures that there has been a decrease of 10,000 apprentices since 2007, just at a time when the need is rising.[xiii]

A supply of well-trained lineworkers and other personnel are necessary for grid modernization. This training is done by unions whose members work for electrical contractors, and by the utilities which have their own training facilities. We need a clearer estimate of what the workforce needs for grid transformation will be. WDI needs to insert itself into this discussion and include representatives of lineworkers and other front-line employees. Workforce impact assessments related to building and re-building the electrical grid need to be more inclusive of those who are currently doing much of this work and the NYS Department of Labor, State Workforce Investment Board (WIB) and its thirty-three subsidiary local WIBs. There is a clear role here for WDI. Beyond our experience with workforce and energy issues and our relationship to organized labor, we offer technical support for the six labor representatives on the State WIB and two labor representatives on each of the thirty-three local WIBs With this as a backdrop, the workforce development system needs to have a flexible framework to train for what is known and prepare for the unknown transformation of New York's electrical system. The best workforce development system for lineworkers and utility workers is one that is well funded, collaborative, well -staffed and flexible so that it can respond to technological changes and electricity system initiatives that often are driven by government policy, grid expansion or modernization.

Recognizing the Skilled Trades

WDI is closely aligned with the New York State AFL-CIO which has approximately 2.5 million members. These members are part of a federation of 3,000 affiliated public and private sector, and building trades unions throughout the state. Most of the workers who are employed in the electric power industry in New York State are represented by one of these affiliated unions.

WDI also has working relationships with government agencies and educational institutions throughout the state. Some of the programs funded by WDI have assisted community colleges in building their workforce education programs. Workforce Investment Boards are partners to many of the programs that WDI funds as are numerous CBOs, community based organizations.

The 2014 draft *New York State Energy Plan* makes almost no mention of the workforce development issues covered in this briefing paper. Instead it tends to focus mostly on college level programs that train for power industry jobs. Here are a few excerpts from the draft plan:

Initiative 15 in volume one of the draft 2014 Energy Plan is:

> "*Foster a clean energy workforce targeting participants across all aspects of the energy sector."* [xiv]

The way to do this, according to the plan, is for:

> *"NYSERDA and SED to consult the clean energy industry members and the State's Regional Economic Development Councils to define regional workforce needs that can help shape curricula (including short courses and worker retraining), particularly at the State University of New York, City University of New York, community colleges and technical institutes."* [xv]

In Volume II of the draft Plan under the heading of ***A Clean Energy Workforce***, it says:

> "*New York boasts one of the most educated workforces in the country. As an example, 32% of those 25 years or older possess a Bachelor's degree compared with 28% nationally. However, there continues to be a critical shortage of skilled workers. To help bridge this gap, the state will look for opportunities to leverage the REDCs to identify workforce needs and engage industry to help shape curriculum particularly at SUNY, CUNY, community colleges, and technical institutes, including short courses and incumbent worker retraining."*[xvi]

There is not even a vague reference to the skilled trades or the training programs that are needed to ensure that New York has a sufficient number of electrical energy workers to build and maintain the grid. There is no mention of the safety certifications, crane operator certifications, or signaling certifications that need frequent updating. If a goal of the NYS Energy Plan is to have a prepared workforce, then it needs to consider labor and the skilled trades as stakeholders in the New York's energy future. WDI should work closely with the Governor's Office, the PSC and NYS Legislature to advocate for workforce impact analyses.

Lessons Learned from the Department of Energy Grant

The DOE Smart Grid Workforce Training Grant taught WDI lessons, many of which we did not fully appreciate when the training started. The overriding lesson is the paramount importance of safety and that cannot be stressed enough. Lineworkers manage electricity that is live. There is no second chance to get it right. Each year electrical workers are injured and some die on the job, in spite of the fact that safety was stressed throughout their training and is embedded in their work culture, which includes specialized clothing, footwear, equipment and tools. Their work also is often done under less than optimum conditions as witnessed during Hurricane Sandy and just about any snow, rain or ice storm where there is an outage. Outside

of the NYC, much of the repair and construction work is done high above the ground which adds to the risk and danger. The training that is done, frequently through apprenticeship programs and continuing education at the journey level, minimizes, but does not eliminate danger or risk. In NYC where much of the electrical infrastructure is underground, the dark, damp tunnels present their own form of danger and confinement.

WDI staff learned the following lessons from the DOE grid training project:

- Lineworkers who are responsible for building the electrical grid need a broader picture of smart grid technology and grid modernization goals. Future training should incorporate this for these workers.

- The DOE Smart Grid Workforce Training Grant enabled more diversified training for lineworkers. This includes obtaining certifications that they might not have gotten otherwise. For example, the Occupation and Safety Health Administration (OSHA) frequently changes its certification requirements that govern what lineworkers can and cannot do. They require continually updated training. When changes occur while on utility property where union contractors are sometimes located, this training grant allowed lineworkers to update their skills and certification(s). An estimated 25% of workers on utility properties are union contractor employees and this has been increasing as utility employees retire and are not replaced.

- Lineworkers often cross state lines. Yet the certifications between states and among states and the federal government are not uniform. (i.e. crane certification training and digger derrick certification differ by state). There needs to be an analysis of these differences with a goal of possible uniformity where it makes sense to do that.

- There is a need to track electrical workers' certifications nationwide and make that registry accessible in a crisis. Recent weather related disasters in the Northeast have underscored the need for a national database of lineworker certifications. During Hurricane Sandy, lineworkers often showed up at a site, but without the proper certification, they could not do the necessary work.

- Non-utility union contractor employees do not have access to utility training sites which means that they often learn new technology at a delayed pace. A regional training site, centrally located so it is accessible throughout New York would mitigate this problem. There is strong support for such a site by the electrical workers.

- Grid technology is changing very quickly. This is likely to continue as grid components incorporate greater efficiencies for generating, routing and tracking the use of electricity. The greater frequency of change directly correlates to the need for constant training and updated training curricula.

- Training is expensive, but the high priority placed on grid reliability means that keeping the skills of journey level workers and instructors current needs to be given more frequent attention so that needed resources are available.

- There is a need to extend what is being done in New York City to map the grid components electronically so that problem determination and analysis can be done from a central command. With this type of mapping throughout New York and elsewhere, staff with the appropriate qualifications and equipment can be deployed quickly to fix the identified problem(s). This could be done with greater speed and accuracy; especially if it is accompanied by a skills and certification inventory.

- For purposes of possible future federal training dollars, there is a need to extend these dollars to other states. The Northeast Joint Apprenticeship Training Program (NEAT) covers eleven states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont), but the WDI grant training was limited to New York State apprentices and journey level workers. Extending training to other states within each NEAT jurisdiction would ease the problem of mixed skills and qualifications when workers cross state lines; particularly during emergencies.

- Movement of lineworkers from union contractors to utilities can be problematic for these contractors who invest training dollars, only to sometimes see as many as thirty percent of their workforce hired by a utility. The primary reason for this movement appears to be that less travel is required when working for a utility; specialization opportunities are available with a utility, and regular work hours are more of a norm. Generally, contractor employees need to be more diverse in what they can do and must travel more frequently. Some employees prefer this to less diverse work and less travel while others do not; some of whom move to work for a utility. This movement may just be a fact of life, but it impacts turnover and training budgets for contractors.

- New training techniques via the Internet are maturing. An illustration of this is 3D Internet, which simulates a problem on the grid and allows the trainee to repair the problem through simulation. The consequences of a repair (either good or bad) are acted out on a computer screen. Some of these new techniques are already in the field, but they need wider deployment which takes funding. They are intended to augment and not replace hands-on training, and improve safety.

These are some of our findings and observations. The DOE grant has given WDI staff the opportunity to better understand the *ground level* workforce issues associated with grid modernization and training. These lessons could set the stage for future training as grid modernization takes hold nationwide.

Demographics Are Important

Planned changes to New York's system of electricity must consider worker demographics. There are approximately 36,000 jobs in New York State associated with electric power generation, transmission and distribution.[xvii] Many workers involved with grid modernization, which includes component manufacturing, lineworkers, inside electricians, equipment operators, back office people, and others are getting older. Baby boomers are now retiring in ever increasing numbers. As they leave, they take their operational knowledge with them which means younger workers can no longer reap the benefits of mentoring and technical insights that only comes with years of experience.

The importance of succession planning requires attention if grid modernization plans are to proceed with the safety and quality we all expect. Continuous development of New York State's lineworkers, utility workers, and the people who train them is of utmost importance and needs to be more highly valued and addressed by policy makers, utility regulators, government program managers and educators. A better understanding of workforce development needs will help ensure that electrical system modernization in New York can move forward.

Workforce Bottom Line Observations & Opportunities

Conversations about the electrical system workforce should take into account the following:

- Training the existing workforce to keep up with changes in technology needs to occur with regularity.
- Better cooperation and sharing of training facilities between electrical utilities and non-utility IBEW locals needs to occur.
- New York State's electrical grid must be rebuilt and modernized with greater focus on workforce impact analysis and analysis as changes to the grid are contemplated.
- Disruptive technologies are difficult to predict, and the grid and its components continue to change. More attention should be given to game theory as a training technique and alternative scenarios encountered in the field.
- Workforce training must be integral to plans as these changes develop, which includes identifying and remediating skill gaps as quickly as possible.
- The people responsible for maintaining and modernizing the electrical grid are aging, as baby boomers retire. A more detailed and updated analysis needs to be done on the real potential impact of this demographic change and shared with the workforce.

- There is a need to ensure that apprenticeship programs have the knowledge of scenarios and resources they need to recruit, screen and train the future utility and lineworkers.

- Apprentice programs need financial support and outreach assistance to recruit and develop more women and minorities into the line worker and utility worker occupations.

NEW YORK'S ELECTRICAL SYSTEM TODAY

What does New York State's electrical system look like today? Two excellent sources of information about this topic are:

1. New York State Energy Plan – *Transmission and Distribution Systems Reliability Study Report*, August 2012
2. New York Independent System Operator – *Power Trends 2014*

This paper touches on some of the main points of these two reports. Both deserve reading for an in-depth understanding of how New York State's system of electricity works.

According to the *Reliability Study* Report:

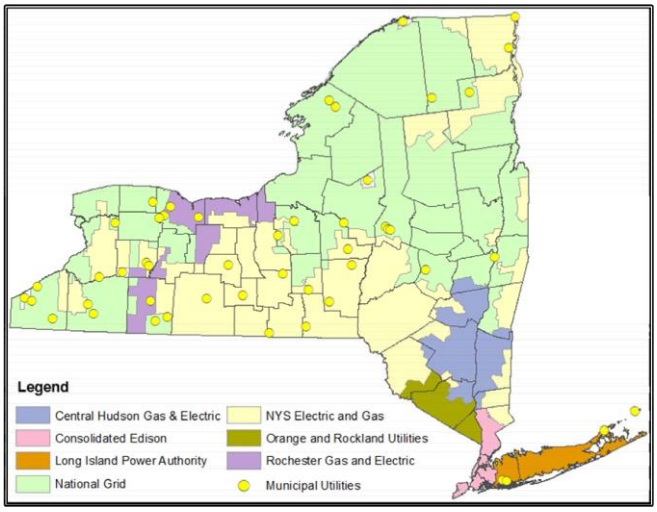
"In broad terms, the electric system is comprised of generation, transmission, distribution, and load. Each of these segments has multiple elements, each with its own operating characteristics and limitations. Reliability standards and rules are developed with an understanding of these elements." [xviii]

The report goes on to say, "Transmission and distribution are owned by respective owners, and who are generally responsible for providing energy to end-use customers."

New York is divided into electrical territories. These territories are described as follows:

- Six investor-owned utilities, regulated by the Public Service Commission (PSC), consisting of Central Hudson Gas & Electric, Inc., Consolidated Edison of New York, Inc., National Grid, Inc. (doing business as Niagara Mohawk Power Company), New York State Electric and Gas Corporation, Orange & Rockland Utilities, Inc., and Rochester Gas & Electric Company.
- The Long Island Power Authority (LIPA), which is not regulated by the PSC (now operated by PSEG Long Island).
- The New York Power Authority (NYPA), which is not regulated by the PSC and not a delineated service "territory", generates and delivers power to load-serving entities as well as municipal, industrial, and business customers.
- Forty-nine municipal utilities, many of which are regulated by the PSC because they do not solely receive power from NYPA.
- Four rural electric cooperatives, which receive power from NYPA and are not regulated by the PSC."[xix]

Figure 1 below from the report illustrates how New York State electric service territories are divided. [xx]



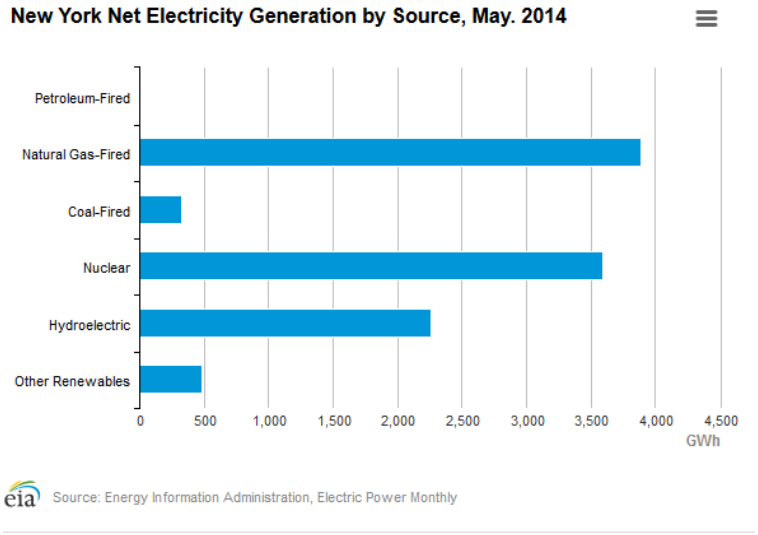
In additon to the utilities, there are many other players that influence the ways in which New York regulates, operates, maintains and builds its electrical infrustructure. This partial list includes:

- NYS Public Service Commission (regulates investor owned utilities or services offered by investor owned utilities) and its staff arm, the Department of Public Service.
- NYS Legislature (policy legislation)
- Governor's Office (policy direction, funding, state agency administration)
- New York State Energy Research and Development Authority (administers Renewable Portfolio Standard and Systems Benefit Charge, plus does R&D work relative to the energy sector)
- NYS Department of Labor (safety standard and wage enforcement, apprenticeship programs)
- NYS Educational Institutions (Colleges, Universities, Community Colleges, Technical Schools)
- Labor Unions
- Manufacturers
- Electrical Contractors and Contractor Associations (such as the National Electrical Contractors Association or NECA)

New York's Energy Mix

New York's total energy consumption is one of the highest in the United States, in part because of its dense population, but its per capita energy consumption is among the lowest.[xxi] Some of this is due to the high concentration of mass transit available throughout the state, particularly in the New York City Metropolitan area. The commercial and residential sectors are the leading

consumers of energy (this includes all forms of energy) followed by transportation.[xxii] The bulk of the state's electrical needs are provided by natural gas, nuclear and hydroelectric facilities. A small amount of oil and coal also used, according to the U.S. Energy Administration, four-fifths of New York's electricity comes from natural gas, nuclear and hydroelectric sources. It is important to note that New York's Renewable Portfolio Standard (RPS) requires that 30 percent of its electricity come from renewable sources by 2015, so the overall percentage of renewables in the mix will undoubtedly increase.



Throughout the U.S. there has been a growth of alternative forms of energy to grid-supplied power, mostly in the form of renewables. A new solar-power system is now installed on an American roof every three or four minutes.[xxiii] This development is having a dramatic effect on a grid that was designed for large, centralized power generators and has financial implications for the utilities which still are responsible for grid maintenance. New York utilities also are required to "net meter" excess energy from renewable sources within limits prescribed by the State's Public Service Commission. Net metering is a way to compensate utility customers who generate electricity from their solar panels or wind turbines in excess of what the customer may use.

All of this challenges the current model under which the utilities make money and price electricity, which is basically a supply and demand system. As more and more non-grid generated electricity is added to the mix, the current structural and pricing model no longer works well. That model, which includes how electricity is priced, is rooted in an old system of large power generators and not thousands of smaller power suppliers. Large generators will not go away any time soon, but they are being joined increasingly by their smaller partners like solar, wind, geothermal and biomass facilities. The challenge is to account for these changing sources of energy and assure that utilities have sufficient resources to maintain the grid infrastructure which is still needed for a viable system of electricity.

New York's consumers receive their electricity from an electrical grid that is linked throughout the eastern United States and Canada. In recent years, New York has been a net importer of electricity from neighboring states and Canada.[xxiv] At any given moment, it would be nearly impossible for a consumer of electricity to identify its source. The reason for this is that the 1990s saw a transformation of the electrical system to one that became driven by wholesale electrical markets. The Energy Policy Act of 1992, which resulted in Federal Regulatory Commission (FERC) order 888 in 1996, was intended to restructure the electric industry by requiring that transmission lines be open to competition.[xxv] As a result, utility companies frequently acquire electricity based on cost rather than locale. In the old days, before separating generation, transmission and distribution, it made sense for a utility to use its own generated power and transmission system, as long as it was available to meet demand. Under restructured system, generation and transmission became a matter of choice, often based on a best value approach. The Eastern Interconnection is one of three electric grid networks in North America and includes electric systems serving most of the U.S. and Canada from the Rocky Mountains to the Atlantic Coast.[xxvi] The Interconnection is also used for planning purposes and is referred to as EPIC or the Eastern Interconnection Planning Collaborative. It helps insure that electricity is available where and when it is needed.

Changes to New York's System of Electricity

The New York State Public Service Commission is doing a top to bottom re-examination of New York's energy industry and regulatory practices, referred to as *Reforming the Energy Vision*, or REV. So it's not just the grid that will change, but New York's whole system of electricity. REV is based on the fact that the design of the electrical grid has not significantly changed since inception. Large power stations generate electricity which is then transmitted from the source over high-voltage power lines. The electricity is reduced in voltage and distributed to consumers for their use. This system was designed before computers and electronic switches were available to manage our system of electricity. It also was designed when large, regulated sources of power generations were the norm.

The original grid design and pricing systems were not contemplating renewable energy sources and the thousands of points of entry to the grid that they create. Technology has changed rapidly over the years; grid design has not. According to a New York Times article on the subject, one change being considered by the PSC through the REV is that, "Instead of distributing electricity themselves, the utilities would effectively direct traffic, coordinating distribution of electricity produced by a multitude of smaller entities…" [xxvii]

In referring to the PSC staff report, the New York Times notes, "The new report predicts the gradual decline of the generating stations. In their place, the commission envisions rooftop solar panels, small wind turbines and small generating stations using natural gas to make both electricity and steam, which would be used for cooling or heating their immediate area. Some of these generators would be linked in micro-grids intending to stay afloat during a blackout".[xxviii] In all probability when REV proceedings are concluded, utilities will remain the operators of the distribution system for electricity. The electricity generators will become more and more diverse and numerous.

The work that The Public Service Commission is setting out to do is not easy. For a complete description of the purpose and blueprint for REV, the *NYS Department of Public Service Staff Report and Proposal for Case 14- M- 0101* dated April 24, 2014 is a must-read and can be found on the Public Service Commission's website (http://www.dps.ny.gov/). During the next several months, the Commission will consider how the existing electrical system can be more actively managed to accommodate more distributed energy sources, including micro-grids.

The Energy Highway Blueprint written by the Governor's Energy Highway Task Force calls for $5.7 billion in grid modification and construction over the next 5 to 10 years and as much as 3,200 megawatts of additional electric generation and transmission capacity, and the addition of renewable sources of energy. This will include a lot of work for people in New York's electrical sector.

Another influence that has led to a reformed energy vision is the greater resiliency that is needed for our system of electricity. Hurricanes Sandy and Irene were a wakeup call to the utilities, government officials, general public and the business community. Unfortunately utilities find it cheaper to repair breakdowns rather than rebuild the system to operate during such storms. With global warming and rising sea levels as a backdrop, the hurricanes, which did a tremendous amount of damage along the coast and inland, triggered an alarm that revealed the vulnerability of New York's electrical system. The challenge is whether the energy sector is prepared to finance long term infrastructure solutions or continue patchwork repairs.

The success of renewable sources of energy and the goals set by the Cuomo Administration to accelerate their deployment as a greater part of New York's energy mix also requires grid modernization. The current grid and pricing structure uses a stop-gap approach to accommodate these renewables. This worked as long as their penetration was minimal. With the price dropping out of the solar panel market and with the success of the NY-SUN program, which was extended to be a 10 year program, the 20th century utility model currently in use has to change.

The Department of Public Service Staff Report developed for the REV proceedings outlines some of the stresses of the current system and opportunities ahead that are worth repeating here verbatim.

These include:

- "The modern economy is increasingly dependent on electricity; the power needs of the digital economy increase the need for reliability and resilience in the power supply.

- Global markets increase competitive pressure on all sectors of the economy, and as the economy grows more dependent on electricity, there is increased pressure to eliminate inefficiencies in the power system.

- The state's electricity infrastructure is aging; capital investment needed in New York over the next 10 years is estimated at $30 billion.

- The sales base for utilities is relatively flat while peak demand continues to grow.

- An outlook of increasingly severe weather events may force a wider range of planning scenarios, and exacerbate the inefficiencies of building to meet unmanaged peak demand.

- Extreme weather, coupled with the resiliency and reliability needs of the digital economy, may impel customers toward self-generation solutions, while some self-generation solutions approach grid parity in cost.

- Heavy dependence on natural gas for electricity generation, caused by market forces and emission standards, has increased system vulnerability and price volatility at peak times, including winter peaks. This is largely because during extended periods of extreme cold or heat, over reliance on any one source of energy could cause supply shortages and price spikes. This increases the need for coordination of gas and electric infrastructure development and consideration of the downstream impacts on fuel availability and security.

- The need to reduce carbon emissions causes a trend toward more reliance on gas, with the attendant concerns described above, and also creates a need for the electricity system to accommodate larger contributions from intermittent resources such as wind and solar power.

- The potential for wide scale adoption of rechargeable electric vehicles could challenge the capacity of some distribution circuits." [xxix]

According to the DPS Staff Report, "These stresses are countered by, and give rise to, opportunities for a rethinking of the traditional model."[xxx] They include:

- "The digital economy and global competition have created new industries and technologies that enable changes in the roles of distribution utilities and customers.

- Developments in information technology improve utilities' ability to manage their distribution systems, including diagnosis of faults and rerouting of power flows, with real-time awareness and control.

- Developments in information technology make it possible for customers to manage their electricity demand without inconvenience, and enable utilities to coordinate customer- side resources to an extent not previously possible. This in turn enables more predictable and manageable system load with resulting system efficiencies.

- Increased reliance on electricity has created greater awareness among customers of opportunities to assume control over their energy decisions.

- Efficiencies of many Distributed Generation (DG) technologies including solar, Combined Heat and Power (CHP), and storage, are improving while costs are declining.

- A burgeoning industry has developed in building system management and industrial system controls, and the technology to enable integrated energy management in residential buildings is mature.

- Electric vehicles can potentially be used to provide ancillary services on distribution circuits.

- New York has a single-state Independent System Operator, which facilitates timely conforming of state initiatives with wholesale market rules.

- New York has mature energy efficiency, clean generation, and technology R&D programs run by NYSERDA and utilities.

- New York has established a Green Bank to facilitate financing of innovative market participants." [xxxi]

In addition to REV, there are many other public and private initiatives that will impact the production, transmission and distribution of electricity in New York. There are likely to be disruptive technology breakthroughs that are unknown at this point. The development of micro-grids, self-contained systems for generating and distributing power may become more common as a way to mitigate large scale power outages. Governor Cuomo announced funding for the development of 10 micro-grids totaling $40 million. Nassau and Suffolk Counties will receive another $10 million for micro-grid development.

One thing is certain; change is coming to New York State's system of electricity.

RECOMMENDATIONS AND CONCLUSION

The workforce needs of the electricity sector will undoubtedly change with developments in technology and public policy. As these changes occur, workforce training must be integral to the planning and dialogue.

WDI has been successful in fostering dialogue between New York State agencies, the skilled trades and others, which includes IBEW's outside lineworkers and utility workers. This segment of the workforce is often left out of policy and implementation discussions related to electrical system transformation. WDI has helped educate and inform program managers and

policymakers at various levels of government and elsewhere about the importance of the skilled trades to New York's workforce. We are prepared to enable further conversations among lineworker and utility workers' union leadership, statewide and regional workforce development organizations and NYS agencies like the Governor's Office, the Public Service Commission, NYSERDA, the Department of State and others that might be involved in some aspect of energy development and grid modernization in New York.

Recommendations

(Workforce)

- Improve the feedback loop from unions relating to developments in the electricity sector and union training needs that pertain to these developments.

- WDI should facilitate a dialogue between lineworker unions, contractors, utilities, academic institutions and government to identify workforce issues in the electricity sector (e.g. training, recruitment, retention) and work toward solutions.

- Apprenticeship programs need to be better understood and advertised so that guidance counselors, students and parents see the skilled trades as a viable career path. These programs need financial support and better outreach to bring women and minorities into the skilled trades that service the electricity sector.

- To augment, and not replace hands-on training, there needs to be wider deployment of 3D Internet training tools which requires funding.

(Policy)

- Utilities that seek electrical rate increases before the Public Service Commission should be required to include a workforce impact statement for grid modernization and infrastructure projects that are funded in whole or in part from ratepayer adjustments.

- The workforce development system, with the local workforce investment boards at the core, needs to have a flexible framework to train for skills needed to modernize our system of electricity and respond to changes in technology and public policies. WDI can assist with moving this discussion forward.

- WDI should be a member of the Smart Grid Consortium, as should someone representing the Statewide Workforce Investment Board. Presently the membership cost for industry and state policy leaders is $50,000. There is a "Research Leader" category that has a membership fee of $12,500. The Consortium should consider establishing a non-profit membership rate and a category for unions.

(Analysis)

- A more detailed and updated analysis should be done on the impact of an aging electrical sector workforce and the skills needed for replacement workers.

- WDI, working with its partners, should monitor and analyze federal, state and local policy initiatives and technology shifts that are likely to have a workforce impact, such as the outcomes of New York State's Reforming the Energy Vision (REV).

Concluding Remarks

Stephen Whitley, President and CEO of the New York State Independent System Operator commented in a June, 2014 press release that accompanied the NYISO *Power Trends* 2014 report.

> "New York faces a range of issues that impact reliable operation of the power grid and electricity markets, but active collaboration among stakeholders and across neighboring regions – along with continued analysis of economic trends, high-tech upgrades and thoughtful implementation of public policy – remain the best path for developing effective solutions". [xxxii]

This paper was prepared to document WDI's experience and insights, to convey the importance of workforce development as New York's system of electricity is transformed, and to foster discussions among unions, government, business and environmental advocates. New York State will incorporate new technologies, renewable forms of energy, micro-grids and more that is unknown. The Public Service Commission is taking significant steps to reshape the electrical system. In its deliberations for Reforming the Energy Vision the PSC, Governor's Office and our Legislature must consider how to best to address workforce development issues. WDI wants to help. We are prepared to facilitate conversations with organized labor and provide technical support to unions and workers who are on the frontlines of New York's electrical system.

With a commitment to the type of active collaboration Stephen Whiteley refers to above, the challenges going forward can be met, and the vision for a state-of-the art energy sector will be realized. WDI can play a constructive role to help New York move its energy agenda forward.

NOTES

[i] New York State Energy Highway Task Force Blueprint, page 51

[ii] New York State Energy Highway Task Force Blueprint, page 51

[iii] New York State Energy Highway Task Force Blueprint, page 51

[iv] New York State Energy Highway Task Force Blueprint, page 51

[v] Power and utilities changing workforce, Keeping the lights on, PwC Saratoga, December 2013, page 2

[vi] Power and utilities changing workforce, Keeping the lights on, PwC Saratoga, December 2013, page 4

[vii] Power and utilities changing workforce, Keeping the lights on, PwC Saratoga, December 2013, page 6

[viii] National Labor-Management Committee Website, http://www.nlmcc.org/content/Careers/New%20To%20Industry/Outside%20Line

[ix] Northeastern Joint Apprenticeship & Training Committee brochure, *Careers in the Outside Electrical Industry, page 2*

[x] Northeastern Joint Apprenticeship & Training Committee brochure, *Careers in the Outside Electrical Industry, page7*

[xi] http://www.neat1968.org/apprenticeship.htm

[xii] Envisioning a Smarter Grid for New York Consumers, ISO, Sept. 2010, page 24

[xiii] WDI Regional Director notes from 2013 NTI Training Conference

[xiv] NYS Draft 2014 Energy Plan, Volutme I, page 49

[xv] NYS Draft 2014 Energy Plan, Volume I, page 49

[xvi] NYS Draft 2014 Energy Plan, Volume II, page 122

[xvii] EMSI Complete Employment, 3rd quarter 2009

[xviii] NYS Energy Plan, Transmission and Distribution Systems Reliability Study and Report, August 2012, Page 9

[xix] NYS Energy Plan, Transmission and Distribution Systems Reliability Study and Report, August 2012, Page 9

[xx] NYS Energy Plan, Transmission and Distribution Systems Reliability Study and Report, August 2012, Page 10

[xxi] U.S. Energy Information Administration, www.eia.gov/state

[xxii] U.S. Energy Information Administration, www.eia.gov/state

[xxiii] Time Magazine, Green Revolution, June 16, 2014, page 43

[xxiv] U.S. Energy Information Administration, www.eia.gov/state

[xxv] Power Trends 2014, ISO Report, Page 11

[xxvi] Power Trends 2014, ISO Report, Page 65

[xxvii] State Energy Plan Would Alter New York Utilities, New York Times, May 4, 2014 Matthew Wald

[xxviii] State Energy Plan Would Alter New York Utilities, New York Times, May 4, 2014 Matthew Wald

[xxix] Reforming the Energy Vision, NYS Dept. of Public Service Staff Report and Proposal, pages 6 & 7

[xxx] Reforming the Energy Vision, NYS Dept. of Public Service Staff Report and Proposal, page 7

[xxxi] Reforming the Energy Vision, NYS Dept. of Public Service Staff Report and Proposal, pages 7 & 8

[xxxii] Power Trends 2014 Press Release, June 2014