2016 Symposium Focuses on Shaping Our Industry Evolution

Quanta Services was proud to host Utility Perspectives for the 14th consecutive year. We are grateful and honored by the interest and distinguished participation from leaders across the North American electric power and pipeline industries. Utility Perspectives is an annual, invitation-only, senior-level executive symposium hosted by Quanta Services. The day and a half event brings together energy industry leaders to share their distinctive viewpoints and discuss topics of critical importance to the industry. The symposium provides an interactive and open forum with keynote/featured speakers and panel discussions. Utility Perspectives is the only symposium that brings together executives, regulators, system operators and investors from both the electric power and pipeline industries at one defining event. As a result, the symposium offers executive leaders a unique opportunity to broaden their perspective and expand their vision.

The 2016 symposium was held at The Peninsula Hotel in Chicago. This contemporary, urban resort, considered a beacon of modern design and as fashionable as Chicago itself, provided a unique symposium location in the heart of a city at the center of the energy industry evolution.

While the speakers and panel discussions formed the core of the symposium schedule, various tours, activities and receptions provided additional opportunities to continue discussions, network with colleagues and make new acquaintances. Evening events featured a cocktail reception and dinner at The Field Museum, which included a private performance by the timeless Rock and Roll Hall of Fame singer-songwriter Peter Cetera.

This synopsis includes highlights from the speakers and panel discussions, while providing a glimpse of the 2016 symposium perspectives.
Speaker and Panel Discussion Highlights

**Featured Speaker: Terry Donnelly, EVP and Chief Operations Officer, ComEd**

Terry Donnelly welcomed symposium participants to Chicago and shared his perspective on the great past and future of Chicago and the energy industry. A few key points from his warm welcome and industry remarks are outlined below.

- **Chicago and ComEd have long history and bright future in shaping the evolution of the industry.** Samuel Insull is credited with creating the utility model in the early 20th century. He was one of the early proponents of regulated natural monopolies, and demonstrated how economies of scale and centralized generation could lower costs and make electricity available for broader segments of the market, leading to Chicago being known as “The Electric City” in the early 1900s.

- **The Illinois Energy Infrastructure Modernization Act having dramatic results on reliability and resiliency.** At last year’s symposium, Terry Donnelly described how the legislation that had been in place since 2012 was helping ComEd to make significant infrastructure investments in intelligent substations, underground cable replacement, pole replacements and remediation, advanced metering infrastructure, manhole refurbishments, storm hardening and distribution automation. This year he noted that these investments have resulted in the best system reliability performance in recent history for ComEd, including a 43% improvement in non-storm reliability, a 45% improvement in storm reliability, a 75% reduction in customer complaints and a 35% reduction in underground cable faults.

- **ComEd’s grid investments creating a future of many possibilities.** ComEd building “community of the future” in the Bronzeville neighborhood of Chicago. The 10 MW microgrid to be built by ComEd would be able to black start, island and cluster with the nearby Illinois Institute of Technology microgrid, making it the world’s first microgrid cluster. The microgrid cluster will not only provide better reliability and resilience, but will also be a platform for choices of the future.

- **Next Generation Energy Plan to shape ComEd’s future.** ComEd introduced legislation (the Future Energy Jobs Bill – SB2814) for a comprehensive energy solution aimed at protecting and creating jobs, delivering clean energy, jumpstarting solar development, doubling energy efficiency and providing $1 billion in low-income assistance. One key element of the proposed legislation includes a shift to a zero emission standard that would prevent nuclear plants from closing, and make Illinois one of the first states to put a value on environmental and economic benefits of nuclear power. Other key elements include demand-based rates that would reduce fixed customer charges by 50%, solar rebates and strengthened and expanded renewable portfolio standards. (Note: The Future Energy Jobs Bill was signed into law in Illinois on December 7, 2016.)
Keynote Speaker: General James L. Jones, Jr., Former National Security Advisor to President Obama, Former Supreme Allied Commander Europe, Combatant Commander USEUCOM and 32nd Commandant of the U.S. Marine Corps

General James L. Jones, Jr. has spent his life serving and protecting America and American ideals. As the Keynote speaker, he shared his thoughts on the evolving nature of national security and how cyber security in particular poses a significant risk to the energy and utilities industry. Some of the highlights are outlined below.

- **National security threats have changed.** In the past, national security was more bipolar, involving known enemies and relatively conventional warfare and arms races between the armies, navies and air forces. Now, national security is more multipolar, involving threats to the security of food, water, energy, health, climate and more from nation-states and non-nations. Residents, businesses and other non-combatants are increasingly at risk, particularly to cyber threats.

- **Cyber threats are evolving rapidly.** There have been many recent high-profile cyber security breaches. Three types of people: 1) been hacked and know it, 2) been hacked and don’t know it and 3) will be hacked. Technology advancements are outpacing our ability to regulate them. There is a need for international norms and treaties to deal with cyber threats, but currently moving too slowly to keep up with rapidly evolving threats.

- **Russia, China, Iran and North Korea in the cyber threat final four.** Russia is currently the biggest threat and has demonstrated their capabilities. Russian hackers were able to disrupt the Estonian and Ukrainian power grids. Russia believes similar events in the U.S. would cause chaos due to dependence on food refrigeration, banking and electricity in general. China has been primarily involved in business and military espionage, but, if attacked, we are not sure of the extent of their capabilities. Iran has invested heavily and demonstrated cyber capabilities in targeting banks and casinos. North Korea is a cyber wildcard given their capabilities and little to lose in using them. All of the final four are probably doing reconnaissance on the U.S. power grid.

- **To address rapidly changing cyber security threats, organizations must adapt and be proactive.** Cyber resilience involves anticipating threats, limiting damage and more quickly recovering from breaches. One hundred percent protection is not possible. Quick recovery is critical. Defenses must be active and not static. Insider threats are a major vulnerability – must perform follow-up background checks after initial screening. Additionally, as with the Marine saying that “everyone is a rifleman,” everyone in you company should be up on cyber security.
Featured Speaker: Former Commissioner Tony Clark, FERC

Former FERC Commissioner Tony Clark completed his four-year term in September. As a featured speaker, Former Commissioner Clark shared his perspective on key tensions in the energy industry that will shape its evolution going forward. Main aspects of these are outlined below.

- **More energy infrastructure needed vs. increasing difficulty to developing energy infrastructure.** We know the cost of not building energy infrastructure by looking at natural gas prices in different parts of the country. More electric transmission needed to connect and benefit from diversity of renewables. The shale revolution is, bar none, the biggest energy story of our generation. But, despite the value of energy independence, every energy infrastructure project has opposition. The opposition is no longer against individual projects, but against all projects.

- **Power of politics vs. independent regulatory model.** Independent regulatory model was put in place because some industries are too important to have politics involved. American regulators used to lecture the world about energy regulation, but events in the last few years have called the integrity of our regulatory model into question. Keystone pipeline had seven years of uncertainty and a billionaire sending $1 million dollar checks to politicians against the project. In Nevada, a solar developer commented that the state governor needed to get his commission under control. Unfortunately, the regulatory forum has become another forum for political issues.

- **Power of politics vs. power of markets.** As we have seen, markets can be ruthless and detrimental to non-favored resources. Low-cost natural gas generation sending market signals to close nuclear generation. But, closing nuclear plants results in the loss of jobs, tax revenues and zero emission value. If any region of the country could have a carbon market, the northeast U.S. would be it. But no state in the Northeast is moving to put a price on carbon emissions.

- **Central power vs. distributed energy resources at the edge of the network.** Represents the old vs. new utility model. Not unlike the transformation of the telecom industry. Ma Bell owned everything including the customer phones—the equivalent of a utility owning the electric appliances. The breakup of AT&T has made the telecom industry very nimble and needing little regulation. Moving to a more distributed utility generation model will require dealing with implicit subsidies, interconnection rules, marketplace rules and cyber security.
Bill Yardly shared his perspective on the case for natural gas in North America. Some of the main points for his case are outlined below.

- **Natural gas is abundant.** The U.S. and North America lead the world in natural gas reserves and production. The U.S. was making preparations to import liquefied natural gas (LNG), but extraction technology dramatically changed that. Now looking to export.

- **Natural gas is low cost.** The low cost of natural gas is lowering the cost of utility bills and other consumer products. The low cost of natural gas is estimated to save $800 per person per year in the U.S. This is also a huge benefit to U.S. manufacturers and petrochemical producers.

- **Natural gas power generation is very attractive.** Natural gas power plants have a smaller physical and carbon footprint than other fossil fuel plants. Natural gas power generation is a “secret friend” of intermittent renewable power generation. The day will come when complementary role with renewables will wane, but not there yet.

- **Natural gas is creating jobs.** The natural gas industry is creating jobs directly and indirectly across the economy, including natural gas resource development, pipeline infrastructure, distribution, power generation and industrial use.

- **The challenge is overcoming opposition.** There is well organized opposition to natural gas pipelines and power generation plants. Opposition is focused on all projects seeking permitting. They are able to quickly mobilize at the speed of Twitter. The message that seems to resonate is advocating the economic case for the most vulnerable among us and realigning to support power supply reliability.

- **Have seen success in some regions, tougher path in others.** In Florida, there were just two pipelines serving the state. Natural gas was the predominant source of electric power generation and demand was growing. We were able to secure permits and contracts and the pipeline is currently under construction. Contrast this with a project in the Northeast. Power supply prices in the region are tied to the price of gas. They have phased out coal and are phasing out oil-fired power generation. The share of natural gas power generation in the Northeast has grown from about 15 percent in 2000 to 50 percent in 2015. Ninety percent of the project was to use existing corridors to minimize disruption. This looked like a good project with a high probability of success. However, the Massachusetts Supreme Court ruled that local gas companies could not enter into pipeline contracts for electric companies.
Featured Speaker: The Honorable Philip D. Moeller, Senior Vice President of Energy Delivery and Chief Customer Solutions Officer, Edison Electric Institute

Former FERC Commissioner Moeller is currently responsible for policies related to energy delivery, all of which are focused on enhancing the reliability and resiliency of the grid and meeting the needs of the diverse set of customers served by EEI’s member companies. He shared his perspective on the increasing importance and challenges of energy delivery policies as the electric system undergoes rapid transformation at the wholesale and retail levels. Highlights from his speech and discussion are provided below.

- **The electric power industry business environment has changed significantly in just 10 years.** In the past, electricity demand and consumption was rising and forecasts were for that to continue forever. Security was about prevention of copper theft. Coal was 50 percent of the generation mix. We thought we needed to import massive amounts of LNG. Wind and solar were expensive novelties. Protesters were generally innocuous. Now, we have declining consumption and demand of electricity. Coal power generation has declined significantly and is now surpassed by natural gas generation. We are exporting massive amounts of LNG. Best-sellers are being written about grid security from cyber and terrorist attacks. Wind and solar power generation are significant factors in the generation mix and power markets. Protesters can and have been violent in their opposition.

- **What will we be talking about in another 10 years?** At some point as energy efficiency improvements diminish and EV adoption surges, we will see load growth again – but still a ways to go. Coal seems out of favor, but may not be down for the count. Grid resiliency is increasingly important and regardless of one’s personal views about climate change, most of the public believes it is a major issue and is resonating with regulatory agencies. Cyber security is a major issue and focus area that will continue to grow in importance. Storage as an energy resource is poised to enter the mainstream. How to treat and price storage will be an important topic. Should look for the NARUC manual on distributed energy resources rate design and compensation (released November 10, 2016).

- **Big challenges for RTOs.** Intermittent renewables are driving electricity prices down, creating problems for baseload providers. The big challenge for RTOs is to how to maintain low prices, but properly value baseload services. A larger dispatch footprint helps to integrate more renewables. Other major challenge, especially in the Northeast, is the harmonization of natural gas and electricity generation.

- **Time to get serious in advocating energy and energy infrastructure.** The protestors have become more intimidating. Industry needs to get more involved in collaborative discussions with regulators. Need to discuss what it takes to build, maintain and modernize energy infrastructure. The key is to provide better visibility for cost causation.
Morning Roundtable – Leadership in the Evolving Infrastructure Landscape

This panel brought together energy industry executives to share perspectives on the critical challenges and boardroom issues they face. The panel discussed a range of topics including energy infrastructure growth opportunities, changing politics and the evolving challenges of developing projects. Some of the highlights from this discussion are outlined below.

- **Energy infrastructure companies growing in different ways.** Panelists outlined the focus of their company’s growth efforts including acquisitions, multi-billion dollar projects, nation-building projects and project development outside of customary footprint. Projects include addressing GHG reduction commitments and aging infrastructure at home and new projects in Canada, U.S., Mexico and Australia.

- **Changing political landscape in Canada driving major shift in energy objectives.** Alberta elected first labor party in 44 years. Pushing a green agenda in Alberta to shut down the largely coal power generating fleet in favor of gas and non-gas baseload. Not much hydro in Alberta, but good wind resources requiring new transmission infrastructure investments. Canada in general focused on GHG objectives, but environmental groups not happy with GHG reduction or caps, but focusing on keeping fossil fuels in the ground. Canada one of the largest oil producers in the world, but still must import oil from rogue states such as Libya, Nigeria and others because of problems moving Canadian oil across the country.

- **Political agendas and cost realities at odds.** Reliability and affordability are increasingly important. However, political objectives and ambitions are forcing provinces to face options and realities – higher costs driving discussions of subsidies. Canada has long been challenged by a patchwork of policies and practices – in need of a national policy.

- **Permitting and approvals a risky business.** In the past, would always obtain permits for energy infrastructure – it was just a matter of when and with what conditions. Now permitting is a highly politicized process in the hands of elected officials and can take 10 years from conception to completion. The big question and risk in this environment is how much to spend on project pre-approval work. Developers must be engaged in 24/7 public and political campaign to promote public interests and work out First Nations concerns and challenges.

- **Communication and engagement are critical.** Developers are constantly engaged in community education and outreach. Social media and the opposition never seem to sleep. And, opposition only needs to stop one town or community to stall a project. Panelists agreed that the key was in first building consensus around the importance of investments, whether they are schools, bridges or energy infrastructure. Then can develop a long-term roadmap to address shared interests such as aging pipeline integrity, public safety and energy security.

Moderator:
Pat Wood, III – Principal, Wood3 Resources; Former Chairman, FERC

Panelists:
Siegfried Kiefer – President and Chief Operating Officer, ATCO, Canadian Utilities
Chris O’Riley – Deputy Chief Executive Officer and Capital Infrastructure Project Delivery, BC Hydro
Alex Pourbaix – Chief Operating Officer, TransCanada
Panel Discussion: Financial Perspectives from an Investment View Roundtable

This panel brought together financial authorities to share their perspectives on what’s driving North American infrastructure investment and their outlook for industry sectors. Highlights from the discussion are outlined below.

- **Technology continues to drive exceptional level of price deflation.** Pushing the cost curve on solar, offshore wind and storage. Solar costs expected to take another step change down resulting in new lows for solar PPA prices. Storage getting more attention and will continue to scale and drop in cost. But, wind is really what is impacting markets in terms of bulk additions and attractive economics on-shore and off-shore. Deployments will largely absorb near-term incremental demand growth.

- **Expanding EV focus is real.** States have been quite successful in greening the grid. So, the next stage in carbon reduction goals will be reducing transportation sector emissions. Big focus from both California and Massachusetts. What this will mean is greater electric demand growth (California targets are ~0.4% growth per year), greater dependence on the grid and opportunity for further reinvestment in the grid. And, this is happening despite no price on carbon.

- **Power will remain out of favor.** Adding doubts about prospects will compress multiples, potentially structurally. Volatility appears to have low expectations, but this could change as well. Strategies from IPPs are fundamentally “Right” – Build out retail where possible, add scale to the business to drive down costs, and focus on investing incremental cash in renewables if possible.

- **Utilities, especially distribution, remain a favorite.** Utility capital investment focus and need heavily on distribution assets and tougher/fewer opportunities in transmission. Bias is for mid-Caps with real organic growth. Focus is on Western U.S. opportunities.

- **M&A still very attractive.** Lots of M&A capital available from debt, equity, infrastructure/pension funds and international investors. Relative value of utilities is attractive vs. S&P and dividend yields are attractive vs. interest rates and bond yields. Distribution utility ROEs of 9-10 percent are tough to find elsewhere. “Everything is accretive” in the utility M&A space.
Panel Discussion: Energized Technologies Panel – Advanced Solutions for a Complex Grid

As the time allotted for utilities to perform the maintenance and construction of transmission projects under an outage becomes shorter and more challenging, utilities are exploring innovative options for their most critical projects. One of the more successful options has been to perform the work while leaving the lines in an energized state. This panel discussed the decision process that led to the choice of the live-line option and the benefits of this type of work on their key projects. Some of the main discussion points are summarized below.

- **Common characteristics among panelist companies performing live-line work.** Common characteristics included transmission systems with limited redundancy and serious outage constraints, many double circuit structures requiring outage of both circuits due to voltage induction, significant challenges in planning outages due to increased amounts of intermittent renewables and aging and problematic circuits in need of major work including reconductoring.

- **Safety is a primary driver and benefit of energized work.** The main safety hazard and source of incidents with non-energized work has been voltage induction. Also, planned outages can often lead to rushing and mistakes that result in injury. With energized work, a lot of planning is done up front – in one example given, over a year of planning was done for seven days of energized work. Procedures for live-line work are very detailed. Live-line crews are made up of the best of the best lineman with extensive specialized training and certifications. By the very nature of energized work, focus on the job is increased. Panelists agreed that their experiences with live-line work were that it was as safe as or safer than non-energized work.

- **Rest of the Business case for energized work.** Sometimes there are no options other than performing the work with lines energized. In other cases, energized work must be sold internally and externally. There is no rule of thumb for the cost premium of energized work over non-energized work. The cost of outages can be difficult to quantify in terms of direct, indirect and potential costs to customers and communities. Labor cost comparisons such as additional switching necessary or overtime costs for non-energized work vs. energized work is easier to determine.

- **Other considerations and prerequisites for energized work.** Engineering designs need to incorporate spacing requirements for doing live-line work. Important to be engaged up front on the design work. If new to energized work, need to do homework and check contractor credentials, experience and track record. Also, need to be aware of advanced planning, preparation and design requirements.
Panel Discussion: Global Challenges Roundtable – Infrastructure Security and the Grid

This panel addressed the energy and utility industry response to global geopolitical challenges, particularly physical and cyber security of North America’s infrastructure. As attacks have become more bold and sophisticated, there have been questions around what role the federal government and state commissions should play, as well as how much information utilities and the private sector should share with each other. Highlights from this discussion are provided below.

- **Important drivers for grid security.** Significant “security moment” risks to society, regulators, utilities/energy businesses, reputations and careers. Increasing pressure to do something. Viewed as not a matter of if, but when a security issue will occur. Physical and cyber security increasingly at the top of company’s and executive’s concerns.

- **Regulator engagement is essential.** This is rapidly evolving and not well understood topic about which regulators are interested in learning more. Ratemaking processes have to change. The first step has to be discussing with regulators and settling on risks. Only then can discussions turn to what to do, costs and how much to spend. Important to the federal government and make use of the resources and standards they are developing in this area.

- **Potential vulnerabilities evolving and multiplying.** Insiders to company are unwittingly or unwittingly a threat to security. One panelist commented that an initial internal phishing test resulted in 35 percent of employees falling victim and putting the company at risk. After training and awareness, the phishing test number is now less than one percent, which is still not good enough. Contractors, subcontractors and consultants are potential entry points/threats. They must be included in screening, training, communications and oversight requirements. Also, smart meters and EVs are potential cyber access points that must be considered and addressed.

- **Utilities have important security roles and responsibilities.** Utilities provide a critical resource and also have a duty and obligation to protect customer information. Utilities are responsible (and will be to blame) regardless of whether a breach or major disruption is due to customer access points, contractors or other suppliers. Utilities must prepare and engage in all aspects of security from intelligence, prevention, detection, response and recovery. We must be transparent with commissions to have them as collaborators and advocates instead of critics. Utilities must work to make critical parts of the system less critical by creating alternatives, options and work-arounds. Lessons can also be learned from other parts of the world that have had major security breaches – afterwards, some have noted that they should have been more direct and open about the threats instead of being overly concerned about spreading fear. In this way, they could have had frank conversations about risks that should be addressed and aligned actions accordingly.

**Moderator:**

**Brad Gammons** – Global Managing Director, Energy and Utilities Industry, IBM

**Panelists:**

**J. Tyler Anthony** – Senior Vice President and Chief Operating Officer, Pepco Holdings

**Pat Hogan** – Senior Vice President of Electric Transmission and Distribution, Pacific Gas and Electric

**Teresa Mogensen** – Senior Vice President, Transmission and President, Xcel Energy Transco at Xcel Energy
Panel Discussion: An Aging Electric and Gas Infrastructure Delivery System

The delivery of electricity and gas involves a vast array of infrastructure that is subject to aging and wear and tear. This panel of electric and gas utility executives discussed new ways to gauge and address the health of energy infrastructure. Highlights of the discussion are outlined below.

- **What’s driving aging infrastructure issues?** Much of the energy infrastructure in the U.S. was installed in the 1950s, 60s and 70s. Growth came in spurts and gaps. Age is one aspect driving infrastructure issues, but mainly how condition has changed over time due to use, elements, land movements and more. We should not view equipment aging as necessarily bad, but, rather, as a tribute and indicator of good design, purchasing, construction, workmanship, operation and maintenance over the years. Some infrastructure stands the test of time better than others. Common issues around addressing problematic vintages of underground cable, testing and treating large wood pole populations and addressing aging electric transmission lines and gas pipelines. Regulatory jurisdictions vary in mechanisms and support of addressing aging infrastructure issues.

- **Data use, limitations and next steps.** For some infrastructure we have more data and real-time information than we know what to do with. As for older equipment, we have much less information. In the process of making better use of data to better understand risks and performance, and to better direct spending to critical needs. Data and analytics have reinforced the fact that age is not the only factor. However, increasing data and understanding of the data has also increased concerns about what we do not know about our facilities. Going forward, focus is on data and analytical gaps and blind spots. We need to know if what we are doing is working.

- **Electric and gas aging infrastructure focus is on various risks.** The central focus for addressing aging infrastructure is on safety, environment, compliance, reliability and efficiency. Gas infrastructure has a tremendous level of compliance oversight. Electric infrastructure integrity oversight is moving in that direction. The risk management framework or process, however, is generally the same for electric and gas infrastructure. Another growing focus area is how renewables, distributed energy resources and grid investments are impacting decisions and investments regarding aging infrastructure.

- **Key metrics being used.** Traditional metrics of electric system reliability being used such as SAIDI, SAIFI and customer satisfaction survey scores. Additional metrics being used such as percent of customers exceeding a reliability threshold. Also, some working on worker productivity metrics. On the gas side, traditional metrics such as response time to gas leaks being used. Increased emphasis in California and other jurisdictions on public safety, including wire down and events triggering wildfires. In California, emphasis starting to shift to determining the effectiveness of investments.

Moderator:
Alison Silverstein – Consultant, Alison Silverstein Consulting

Panelists:
Kenny Mercado – Senior Vice President, Electric Operations, CenterPoint Energy
Ronald Pate – Senior Vice President, Operations and Technical Services, Ameren Illinois
Sumeet Singh – Vice President, Gas Assets and Risk Management, Pacific Gas and Electric
Panel Discussion: North American Pipeline Infrastructure Session – Evolving Market Demands

This panel discussed how the low price environment for oil and natural gas has affected the energy pipeline industry over the last year. While construction has slowed, new pipelines are still needed to meet demand for natural gas from various markets. Some of the highlights from this discussion are provided below.

- **Low energy commodity prices affecting pipeline infrastructure demand drivers.** The pipeline infrastructure development has been driven primarily by production/extraction needing to add connections to North American markets. Production-driven projects have been hit hard by low oil and gas prices. Other pipeline infrastructure drivers include projects to meet increased consumer demand, export to Mexico, LNG export from Louisiana, petrochemicals and coal power generation conversions.

- **Dealing with pipeline development opposition still a challenge.** Industry has excellent record of addressing stakeholders with real issues. Effectiveness in addressing NOPE (not on planet earth) or WANGO (war against natural gas and oil) opposition has been a different story. Must thoroughly deal with issues along right-of-ways and local communities or they will trip up the project down the road. Effective advocates have been end customers and communities benefiting from the energy extraction, infrastructure or end use. Need national leadership to advocate for how we bridge the energy gap from where we are now until we get to a largely renewable future – still a big gap and communication/education disconnects.

- **Must be proactive in addressing aging infrastructure and aging people issues.** Companies must be proactive in addressing pipeline integrity challenges or we will have to deal with the big, bad events and bad guy/company image that take years to recover from if ever. As an industry, should not need a significant incident to move forward. Should be active in using new technologies to enhance pipeline integrity issue detection. Some generational/Millennial differences, but, in general, new talent good with technology shift and direction. Have gotten better at succession planning, hiring and training. Still have significant challenges hiring in rural areas.
Morning Roundtable – Leveraging Technology Driven Change

By enhancing the grid, the industry has created a platform for new technologies to increase situational awareness, system reliability and efficiency. This executive leadership panel discussed the benefits of the new grid, how it is changing capabilities and where the next generation of technology is expected to take the industry in the next five years. Some of the highlights from this discussion are outlined below.

- **Batteries and storage rapidly moving from the next big thing to a big thing.** Not just a novelty or pilot/experiments anymore – discussion has shifted to how to treat it and value it. Storage is not just a power generation/supply asset – depends on what it is displacing. AEP has one battery installation that is treated as a transmission asset because that is what it deferred. Must consider too that current batteries will have a much shorter depreciation life than 40-50 year transmission or generation assets. ComEd is looking at using batteries at Wrigley Field to avoid reliability problems – even if power is restored within seconds, the lights take 20 minutes to be fully restored.

- **AMI proving benefits beyond meter reads.** Advanced metering infrastructure is proving beneficial in managing the grid, speeding restoration and connecting with customers. AMI providing better information about transformer loading and issues. Also, provides better outage detection information to avoid truck-rolls and speed outage location and restoration efforts. AMI is also valuable in detecting low/high voltage issues. ComEd shows a 30-point customer satisfaction survey score improvement for AMI customers vs. non-AMI customers. Real-time pricing is proving effective in peak shaving efforts while saving customers an average of 10 percent on their electric bills. A big concern and focus area for AMI is ensuring cyber security.

- **Continued grid security collaboration and investment needed.** A lot of technology transfer opportunities from other industries, such as defense. For example, have used ballistic walls that are easy to install and do not require a foundation. However, very difficult to provide comprehensive physical security of facilities. Must make changes to the design of the system so that no facility is too critical. Will not be a one-size-fits-all solution given the diversity of geographies and vulnerabilities. Need to make sure that as we become more digital and less manual or electromechanical that we do not become more fragile and more sensitive to disturbances. Federal government and commissions are looking for more security verification – can no longer just say, “don’t worry, we’ve got it all covered.”

- **Demonstrated grid reliability and resiliency improvement efforts resonating with regulators.** Should not lose sight of lessons learned from Metcalf substation incident or major storm damage to the grid – that we cannot build just enough to meet minimum requirements. Grid reliability and resiliency depends heavily on redundancy and additional capacity. Given recent events that have exposed vulnerabilities of our grid to storms and human attacks, grid investments to improve resiliency are resonating with regulators. Many investments are needed to avoid rare but “big, bad events.” Spare equipment analysis, storage and sharing programs are imperative now. ComEd customers served by 1960s and 1970s vintage underground distribution cable were experiencing 7,000 cable faults a year. Modern cable replacing the old and failure prone cable is “light years” ahead of the manufacturing processes and material quality control. Cable replacement projects eliminating problems for decades to come.
Panel Discussion: Utility Convergence Roundtable – Electricity and Pipelines

The convergence of electric utilities and pipeline operators to utilize common rights of way and create robust, combined balance sheets is forging partnerships that address energy issues across North America and both industries. This panel discussed the strength and impact of these partnerships. Some of the highlights from this discussion are outlined below.

- **Gas pipeline capacity fundamental to reliability of electric grid.**
  Gas pipeline capacity fine to support power generation in the summer, but winter is a big problem. We have proven mechanisms to drive electric transmission development, but no good way currently to deal with gas constraints and dependency for electric generation. Power producers are not incentivized to purchase long-term gas contracts, which are needed to build pipeline capacity. The question to be addressed is who should secure firm, long-term gas contracts. Continued coal and oil plant retirements will increase the pressure to find a solution. Alberta to face similar convergence issues as political shift pushing for replacement of coal plants with gas and renewables.

- **Resource adequacy planning has changed dramatically.**
  Traditionally, contingency planning assumed fuel certainty. Resource planning in the future will be about dealing with a broader set of contingencies – traditional transmission line outages and loss of generators, but also fuel contingencies and loss of renewable contingencies. Two biggest contingencies to deal with in the future will be loss of gas pipeline and loss of renewables. In this new resource-adequacy world, the gas system will need the capacity to serve as a shock absorber for growing contingencies.

- **What’s driving electricity and pipeline convergence?** Main convergence drivers are lack of growth, need to ensure resource adequacy and localized/better control of “outsider” resources. By combining electric and gas resource ownership, companies are better able to deal with contingencies. Pipeline companies are moving downstream and getting involved in power generation.

- **What else is needed to address interdependency issues?** At the end of the day, we don’t want the lights going out in the name of “greenness.” Until gas pipeline capacity issues for power generation are resolved, we need to keep baseload oil plants in the Northeast and baseload coal plants in Alberta. The permitting processes for gas pipelines and power plants are very different. Need to return to constructive regulatory and permitting process. FERC really needs to address fuel and generation interdependencies.
Panel Discussion: Energy Storage Panel – Technology Coming of Age

Through a diverse array of potential applications, energy storage is emerging as an integral component to a resilient and efficient grid. Power storage holds this promise by allowing for the smooth delivery of power generated from any source. This panel of experts discussed the applications, benefits and costs of these emerging technologies. Some of the highlights from this discussion are outlined below.

- **The potential applications and benefits of storage technology are huge.** Storage technology is seen as the solution for many power grid challenges. Storage technology is expected to help integrate vast amounts of intermittent renewable power, defer transmission and distribution load relief investments, provide balancing and ancillary services, improve reliability, improve power quality and improve system resiliency.

- **Pilots and specific applications of storage demonstrate potential value.** Large scale storage is being developed in record time to address regional shortfalls in Southern California. ComEd is using storage solutions to address pockets of poor reliability where customers are experiencing multiple interruptions each year. They are also using storage solutions to address low voltage issue at the end of long distribution feeders. Oncor described applications of storage solutions to address persistent, worst-performing circuits.

- **However, issues and challenges must be addressed for wider scale practicality.** Storage costs are improving, but are still economically challenging compared with other options. Compounding the cost challenges is the shorter life of batteries vs. traditional infrastructure solutions (10-15 years vs. 30-40 years). There have been safety issues with batteries and siting has proven to be an issue in some cases. Also, some pilots have been canceled due to environmental issues and concerns with the batteries. To illustrate the current economic challenges for storage as infrastructure deferral option, an example was given for replacing a 40 MVA substation transformer with a larger transformer to address load growth. The transformer could be replaced with a larger transformer for about $2.5 million and have a service life of 30-40 years. An alternative would be to add 15 MVA of battery storage, which would cost about $7.5 million (plus the cost of upgrading protection equipment) and have a service life of about 10 years.
Panel Discussion: North American Transmission Session

The shift toward a competitive process has caused some pause in near-term investment as industry participants establish a strategy for navigating this new and changing landscape. This panel discussed the interaction between merchant and regulated business models, coordination between incumbents and new entrants and how system planners and regulators must weigh reliability against the cost concerns of rate payers. Some of the highlights from this discussion are outlined below.

- **Prospects and challenges of private equity investment in public power transmission assets.** Gridliance—with oversight and financial support from Blackstone—is an independent transmission-only company focused on working with municipal utilities and electric cooperative to jointly plan, develop, own and operate transmission assets. Gridliance has multiple transmission co-development agreements currently and pursuing others within each regional transmission organization (RTO). Other than typical transmission development challenges related to siting and permitting, the more rapid pace of investment decisions and development expectations from private equity can sometimes clash with the slower pace of project development for the public power sector.

- **Interstate and interregional HVDC prospects and challenges.** Clean Line Energy is pursuing a series of long-haul HVDC projects aimed at delivering thousands of megawatts of low-cost renewable power from the windiest areas of the United States to communities and cities that have a strong demand for clean, reliable energy, but lack access to clean energy resources. Despite the benefits advocated of increased local tax revenues, construction and manufacturing jobs, land owner payments, and clean energy, gaining multi-state approvals has proven to be an extremely challenging and lengthy process.

- **Alberta transmission development success drivers.** AltaLink is Alberta’s largest regulated electricity transmission company and is wholly owned by Berkshire Hathaway Energy. Transmission development in Alberta has been driven primarily by industry power needs of the oil sands, which has cooled a bit. Now, given the political changes and new power sector agenda in Alberta, the transition to more renewable power is expected to drive electric transmission infrastructure development.

**Moderator:**
Nora Mead Brownell – Founding Partner ESPY Energy Solutions; Former Commissioner, FERC

**Panelists:**
Calvin Crowder – President, South Central Region, GridLiance
Johanne Picard-Thompson – Senior Vice President, Projects, AltaLink
Jayshree Desai – Chief Operating Officer, Clean Line Energy
The 2017 Utility Perspectives Executive Leadership Symposium

We sincerely hope that the 2016 Utility Perspectives Executive Leadership Symposium was an enjoyable and rewarding experience for those who participated, and we welcome any comments or suggestions on improving the event. Thanks again to all who helped make this event a success.

Please save the date for the Utility Perspectives 2017 event, which will be at The Fairmont Hotel in Austin, Texas, October 8-10, 2017. A towering icon within a vibrant Central Business District, Fairmont Austin is uniquely located amid the lush greenery of Palm Park and Waller Creek, within walking distance to the State Capital, restaurants, galleries and shops. Opening in August 2017, the 37-story luxury hotel will feature richly appointed guest rooms and suites, exquisite dining, a rejuvenating spa and modern meeting facilities. Austin offers rich cultural history, stunning outdoors and countless music venues that string together the Live Music Capital of the World.

More information about Utility Perspectives can be found at www.utilityperspectives.com.