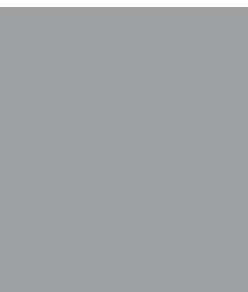
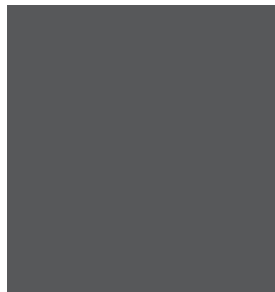
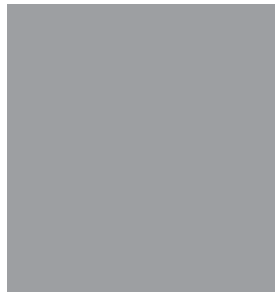


UTILITY PERSPECTIVES 2018



TORONTO, ONTARIO, CANADA | FOUR SEASONS TORONTO

Utility Perspectives Symposium 2018: Powering Insights



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the UP 2018 video*

Quanta Services was pleased to host, for the 16th year, this interactive and informative day-and-a-half event, which brought together leaders across the electric power, pipeline and telecommunication industries. We were excited to bring UP back to Canada, this time to the Four Seasons in Toronto, Ontario. We want to extend a very special thank you to Hyrdo One Inc., who graciously hosted us. We are grateful and honored by the level of participation from leaders across our industries. They are the heart of this event.

Utility Perspectives is an annual, invitation-only, senior-level executive symposium that brings together energy industry leaders to share their distinctive viewpoints and discuss topics of critical importance that we collectively face. An advisory committee of past participants and industry leaders formulate each year's programming. Utility Perspectives is the only symposium that brings together executives, regulators, system operators and investors from the electric power, pipeline and telecom industries at one defining event. As a result, the symposium offers executive leaders a unique opportunity to broaden their perspective and expand their vision.

Quanta Services founded UP to further its commitment to the future of the energy industry, and it has certainly come a long way since the inaugural event. Over the years, Utility Perspectives has been hosted across the United States, from coast to coast, and in Canada.

While the speakers and panel discussions formed the core of the symposium schedule, various activities and receptions provided additional opportunities for conversation, networking and entertainment. This year's event included tours of downtown Toronto, a visit to the NHL Hockey Hall of Fame Museum – and sampling of some of the city's best restaurants. Evening events featured a cocktail reception and dinner at The Toronto Museum of Art, which included a private performance by Dennis DeYoung, founding member of the rock group Styx.

This synopsis includes highlights from the distinguished speakers and executive panel discussions, for the purpose of providing a glimpse into the 2018 symposium's most interesting topics.



Welcome to Utility Perspectives 2018: Earl C. 'Duke' Austin, President and CEO, Quanta Services

Duke Austin welcomed and thanked the attendees for coming to the 16th Utility Perspectives. He emphasized that for Quanta to be successful, he knows that it needs a high degree of collaboration within the industry -- and sharing ideas at the UP symposium is a valuable way to learn from each other. He then reviewed how he and Quanta see several key issues affecting the industry:

- **Cybersecurity.** It is critically important to get this right. Quanta is a supplier to utilities and takes the responsibility seriously to ensure the highest level of cybersecurity. He encouraged utilities and suppliers across the industry to work together and continue to push each other to get better.
- **Policy.** Policy changes at the federal or state/provincial levels have a huge impact on the major projects that Quanta is involved with on behalf of its utility clients. Quanta frequently incurs project delays in ways that don't seem to always make sense. For Quanta to deliver on its project commitments on time and under budget requires greater certainty. "Give us certainty and we will succeed every time."
- **Grid Modernization.** Impacts can be seen from storm hardening, to increased fiber, to various IT related projects. Tangible system benefits are being seen today from recent years' emphasis on grid modernization. One additional impact that Quanta is seeing is the increased rates of urbanization, as many younger millennials move back into the city. This creates the need to upgrade and modernize some inner city networks that had not been as high a priority in the past.
- **Diversity.** It is vitally important for industry leaders to avoid surrounding themselves with too many like-minded individuals. If you do, then you may not develop a complete perspective on important issues. Companies also need to work hard to develop a diverse pool of talent from which to hire.
- **Labor.** A primary focus for Quanta is to ensure a highly skilled craft workforce to keep the industry moving forward. The industry is confronting a pending labor shortage, and Quanta has invested heavily in a solution. They built and continue to add to the Quanta Training Facility at the Lazy Q Ranch in La Grange, Texas. This year, Quanta increased its investment in people by acquiring Northwest Lineman College, an accredited college with four campuses nationwide. Through the NLC acquisition, Quanta will be able to build a pipeline of new workforce candidates. Once again, he reminded the audience, "it's all about getting better."



Welcome to Toronto: Greg Kiraly, Chief Operating Officer, Hydro One Inc.

Greg Kiraly has been the Chief Operating Officer of Hydro One Limited and Hydro One Inc. since September 12, 2016. Kiraly oversees the transmission and distribution value chain including Planning, Engineering, Construction, Operations, Maintenance and Forestry; Shared Services functions including Facilities, Real Estate, Fleet and Procurement; and the Telecom and Remote Communities subsidiaries.

He spoke about how Hydro One has had an eventful year, filled with many changes – and what he expects for the future.

- In the spring, Hydro One incurred 1.3 million customer outages. They then had a tornado touch down in the fall, which caused 400,000 outages. The most traumatic event was a helicopter crash in December 2017, which resulted in fatalities.
- Hydro One became a major issue in the recent Ontario election because the Province of Ontario owns 47% of Hydro One. Among the more significant issues was the commitment and cost to increase renewable generation. Under the recently elected Provincial leadership, the company will dramatically scale back the commitment to new renewables.
- The company has a significant focus on upgrading and automating the distribution system to improve services and reduce SAIDI. In recent years, investment has primarily gone into the transmission system. They recently shifted from a 10-year tree trimming cycle to a three-year cycle. The company has a new sense of purpose and reinforced values, with safety as their top priority.
- Another significant event is their announced acquisition of Avista Utilities, which is expected to close by end of 2018.



Panel Discussion: Geopolitics and North American Leadership

This panel discussed global influence on North America's infrastructure development and what impacts it may have on energy delivery. Topics ranged from global crude oil trade and renewable energy development, to government policy and regional activism – highlights are shown below.

Huge changes in the regulatory environment increases risks. In both Canada and the U.S., changes at the federal and the state/province level reflect large regional differences across each country. The most significant difference is attitudes regarding climate change. Provincial elections in Alberta and Ontario are causing reversals of what had previously been consistent trends regarding renewable energy. In the U.S., Trump has reversed several climate change related priorities, but as a result, many individual states are pushing their own agendas, which are even more aggressive. The result of political shifts is increased uncertainty, which challenges long-term investment plans.

Political uncertainty is having a noticeable effect. Alberta once had among the lowest tax rates in North America, but taxes today are higher than many provinces, and Alberta investment levels are at their lowest point in 40 years. In the U.S., recent talk of tariffs are increasing the cost of steel and aluminum. Meanwhile, several state PUCs are seeking to claw back tax benefits from the recently passed Tax Cuts and Jobs Act (TCJA).

Load growth trends are down overall, but with large regional variations. Ontario has seen its peak load decline from 27GW in 2006 to 24GW today. In west Texas, shale activity is driving load growth to the point where it is difficult to keep up with the demand. In areas where load growth is flat or declining, the threat of large industrials leaving the system is very concerning, and "death spiral" scenarios are common. With increased DER and closures of many large baseload generation plants, load flows are adjusting to the point we could someday be worried about "stranded wires".

Utilities need to re-establish trust with their stakeholders. Similar to other industries across North America, utilities recognize that each new generation would benefit from reaching out to renew trust with its customers, regulators and investors. Utilities need to do a better job of communicating their priorities and educating customers about the value of a well-maintained, robust electric grid in order to build support for what will be a significant new need for distribution investment.

Cyber security concerns require increased CEO focus. IT-related systems and infrastructure are almost obsolete within 10 years of being deployed, given how fast technology is evolving. Depreciation rules should be changed to support the increased CapEx needed to invest and maintain IT capabilities. In addition, we need to improve coordination between governments and industry to improve threat response capability. Cyber threats are evolving so rapidly, and their potential impact is so large, that every IT organization needs at least one "paranoid leader" on their team who would be more likely to believe plausible threat scenarios.

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

Panelists:

Siegfried Kiefer, President and Chief Strategy Officer, ATCO Ltd. and Canadian Utilities Limited

Greg Kiraly, Chief Operating Officer, Hydro One Inc.

Scott Prochazka, President and Chief Executive Officer, CenterPoint Energy

Wade Smith, Senior Vice President, Grid Development, American Electric Power (AEP)



Featured Speaker: Darlene Bradley, VP of Planning, Hydro One Inc.

Darlene Bradley is vice president of Planning at Hydro One. In this role Darlene creates value for Hydro One and its customers through the development of investment plans and strategies for the ongoing safe, reliable and affordable operation of the transmission and distribution businesses. With 29 years of experience at Ontario Hydro and Hydro One, Darlene has gained extensive experience and provided leadership in a diverse range of operational and strategic roles.

Bradley presented a high level overview of Hydro One's storm response to a high wind event when six confirmed tornados touched down in the Ottawa region on September 21, 2018.

The tornados came after what had already been a challenging weather year for Hydro One. During a six-week period in the spring of 2018, Hydro One experienced three major storm events that affected 1.3 million customers.

Transmission and distribution systems were both heavily impacted by the September tornados. More than 1,200 workers were mobilized and just under 500,000 customers were affected. 97% of these customers were restored within 48 hours. Most of the remaining customers required helicopters, ATVs and additional equipment skidded in due to remote access.

Once again, Mutual Assistance from partner utilities provided a valuable role in response. Through it all, Hydro One was able to operate quickly and safely to restore services in a manner which reinforced the key lesson of storm response, which is that providing timely and relevant information to customers is the biggest key to success.



Panel Discussion: The Great Debate – Where Does the Authority Lie

This panel addressed challenges to infrastructure development and evolving policies that could impact long-term visions of leading energy delivery corporations. Topics included environmental pushback ranging from endangered species challenges, 401 and 404 water permitting policies and how jurisdictions interact with one another to develop major policy. Among the main points discussed were:

Permitting a project is getting increasingly difficult. Historically, permitting could present some difficulties but was generally manageable, and some coordination and compromise was possible. Now, most projects require a separate process for Environmental Impact Statements, 404 permit from Corp of Engineers, and a 401 certificate. Each of these permits involves a public process, and each step generally has to be performed in series, which delays the overall permitting timeline. Fifteen years ago, a ~700 mile pipeline might require about 11 to 12 months to be permitted. This has now been extended to three to four years. The industry should explore ways to do a better job getting states involved earlier, or perhaps even relying on the EPA to serve a role as an adjudicator.

Project risks are larger and come from more directions than in the past. As permit cycles grow longer with greater public comment periods, project risks increase. Eversource and Hydro Quebec appeared to be ready to start construction on their Northern Pass pipeline in 2018, after nearly eight years in the permitting phase, when the project failed one of the last permitting hurdles and had to be canceled. Pipeline project development cycles across the country can now range from four years in Texas to 12 years in New York. When multiple states are involved, the regulatory risks increase dramatically.

An emerging public opposition to natural gas is growing stronger in pockets across the country. The intensity of opposition is inconsistent, and opinions can be divided even within the same state, but committed opposition to natural gas is a growing trend across North America. Natural gas was once seen as a “bridge fuel,” but now it is seen as “the next target”. Opposition on the west coast has become more organized, unified and sophisticated. The Massachusetts Attorney General said we have overbuilt gas pipelines in New England. New England, as a whole, has strong pressure to move beyond natural gas and promote large renewable projects, specifically offshore wind. An increasing number of policy makers are adopting a goal of 100% renewables, regardless of operational constraints. Too many people have an “all or nothing” perspective, and there is a strong need for compromise among all parties.

Moderator: Cristin Lyons, Partner and Energy Practice Leader, ScottMadden

Panelists:

Micheal Dunn, Chief Operating Officer and Executive Vice President, Williams

Brad Jones, President and Chief Executive Officer, New York Independent System Operator (NYISO)

William Quinlan, President and Chief Operating Officer, Public Service New Hampshire (Eversource Energy)

Kris Zadlo, Senior Vice President, Invenergy



Featured Speaker: Commissioner Neil Chatterjee, Federal Energy Regulatory Commission

Commissioner Neil Chatterjee was nominated to the Federal Energy Regulatory Commission by President Donald J. Trump in May 2017 and confirmed by the U.S. Senate in August 2017. He served as chairman from August to December 2017. Prior to joining the Commission, he was energy policy advisor to U.S. Senate Majority Leader Mitch McConnell (R-KY).

Chatterjee shared his insight into current and future challenges we collectively face as an industry.

- We see the movement to organized markets since the 1990s as a great success, which has lowered costs to consumers by about 12%. The challenge now is how to adapt these markets to deal with variable generation, state policies and growing cyber concerns.
- Renewable energy sources will see increasing growth due to declining costs, open energy markets and growing customer demand.
- Tensions are emerging between state policies and the ISOs, especially related to subsidization issues affecting wholesale market behaviors and states' rights. FERC needs to define the balance point.
- FERC needs to support upgrading the transmission system. Focusing exclusively on generation doesn't allow an observer to understand the entire system.
- Much of the infrastructure is more than 40 years old, and replacement has lagged in other sectors.
- Expectations are growing and evolving. In the past, the expectation was for low cost and system reliability, but this has changed to the desire for greater flexibility and resilience from threats.
- The transmission system is having trouble keeping up with policy and technology changes. FERC needs to incent more transmission work, because without a robust system, the generation sector could have problems.
- LNG exports create thousands of new jobs and support national geo-political interests by supplying LNG to allies. International gas demand is growing, and India alone could grow four to six percent per year until 2040. International sales of U.S. LNG fill a void to compete with other countries who are hostile to the U.S., and FERC is working hard and adding staff to respond to this demand.
- Cyber security has been a problem for a while. We need to prepare cyber plus physical security protections. One problem is that we have no standards for what security of the pipeline network should look like. This is an issue at which DOT needs to look more closely. DOT employees oversee 2.7 million miles of oil and gas pipeline assets, based largely on voluntary standards.



The Art of Learning: Aaron Howell, President, Northwest Lineman College

Aaron Howell is the President and founder of Northwest Lineman College, the nation's leading educational institution in energy delivery. Under Aaron's leadership, Northwest Lineman College has established four campuses, a video productions company, a manufacturing company, as well as designed and developed curriculum and training programs that have been delivered worldwide. Acquired by Quanta Services in January 2018, NLC has since expanded their training offerings to include telecom and gas distribution.

Aaron provided an overview of NLC and their philosophy and approach to training. It begins with careful selection from among applicants, repeated positive reinforcement and training programs designed to maximize focus on key



THE AMERICAN LINEMAN

Alan Drew, the son of a power company executive and a 2008 International Lineman Hall of Fame inductee, has been climbing poles since he was six years old. His lifelong dedication to the power delivery industry has made him a leading historian on its rich American heritage. Northwest Lineman College gave Alan the opportunity to explore and write an in-depth chronicle of the evolution of the trade; the result is *The American Lineman*.

Drew signed copies of *The American Lineman* at UP 2018 – as his last official event before retiring from the industry.

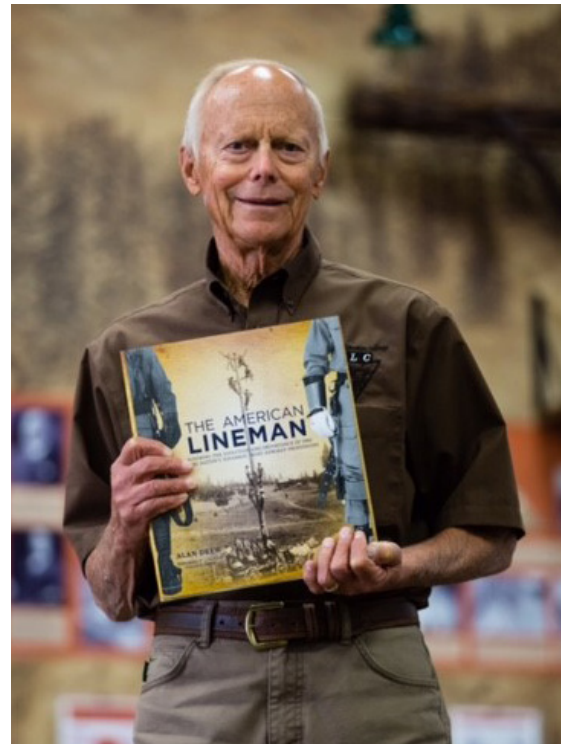
***The American Lineman** is dedicated to all power, communications, military, and traction linemen throughout the United States, both living and deceased, and is intended to be a tribute to your efforts, commitment, and accomplishments. Each of you has done your job regardless of the various types of associated risks.*

This dedication is also intended to recognize and foster appreciation for those linemen who have endured risk and hardships restoring service in the myriad of catastrophic weather events that have occurred over the years, and for the support, understanding, and sacrifices wives and families have made when the call of duty has beckoned.

Each of you, in some way, has helped install or maintain these vital assets of power, communications, and transportation systems, which are the lifeblood of our country. It is my sincere wish that this book will provide a small token of reward for your efforts.

Each of you is an American hero.

—Alan Drew



Featured Speaker: Honorable Bruce J. Walker, Assistant Secretary, Office of Electricity; Acting Assistant Secretary, Office of Cybersecurity, Energy Security and Emergency Response, United States Department of Energy

Bruce J. Walker was confirmed by the Senate as Assistant Secretary for the Office of Electricity (OE) at the U.S. Department of Energy (DOE) in October 2017. The focus of his responsibility is to provide leadership on a national level to modernize the electric grid, enhance the security and reliability of the energy infrastructure and facilitate recovery from disruptions to the energy supply both domestically and internationally. This is critical to meeting the nation's growing demand for reliable electricity by overcoming the challenges of our nation's aging electricity transmission and distribution system and addressing the vulnerabilities in our energy supply chain. He addressed many of these challenges and how to overcome them as an industry:

- **The DOE is focused on national security issues and looking closely at all forms of infrastructure interdependence.** The DOE is developing a national energy model that looks at electric, gas and other energy interfaces. The goal is to help prioritize investments to increase the resiliency of the grid. Over the last 15 years or so, economics and politics have driven most grid investments, which has had an unintended consequence of decreasing the overall resilience. Recent investments such as deployment of rooftop solar creates new potential vulnerabilities since there are no federal cyber regulations for inverters used by solar sector in DER and microgrids.
- **The DOE is building a North American Electric Resiliency Model.** This will provide greater situational awareness and ability to ensure continuity of government in case of attack or natural disaster, by being able to model and suggest the “next best step” under a variety of circumstances. One example it is pursuing now is to take a substation, and then deconstruct all the risks it faces, one at a time, to identify and then mitigate each of the vulnerabilities from both cyber and physical risk exposures. Seven separate National Labs are assisting on relevant portions of the model. For example, the electricity module resides primarily at Oak Ridge and Pacific northwest, while the gas module resides at Sandia and Argonne. A static model should be available by the end of 2020, and then work will focus on converting this to a real-time model.
- **The energy sector is clearly the primary target of cyber threats.** The threat, frequency and sophistication of threats are increasing. One example is what was learned from the VPN Viper router issue last year, which clearly demonstrated router penetration as a potential vulnerability. Ironically, the age and level of redundancy of our existing grid provided a layer of protection, since the older investments such as SCADA systems could still operate if attacked and provided needed functionality, even if it was in a labor-intensive and inefficient manner.



Panel Discussion: Microgrids, Storage and Utility Services

Utilities are beginning to view microgrids and energy storage as appealing ways to serve remote customers and are realizing how microgrids can deliver needed grid support services more cost effectively than building traditional, time-consuming transmission and distribution facilities. This panel looked at several examples of utility microgrids and how these projects are helping both customers and the utility. Key observations included:

More and more utilities are deploying microgrid projects.

Motivations, configurations and end-use customers differ, but many utilities are pursuing at least one microgrid project. Applications discussed by panel members included:

- Multi-technology projects including wind, solar, battery and gas on a unique location serving an existing customer
- Multiple projects where customers put energy storage on behind-the-meter applications on their site (lead acid and lithium ion batteries)
- High schools, military bases and residential developments

Consumers are eager to adopt storage solutions. Many projects are still not entirely cost-justified but make sense from the perspective of increased resiliency, and utilities are eager to demonstrate they are coming of age. Projects are rate based, government grant funded or paid by the customer and include:

- Selling Tesla PowerWalls to its customers as a DSM program. The units cost \$15/month with a 14 KWh storage capacity, and customers do not pay for recharge.
- Putting battery storage at police and fire stations, or community centers, to serve the customer and keep those facilities on-line during emergencies.

Utilities could help developers more with microgrid projects, but this is not happening yet. Utilities could help find optimal locations to improve project benefits, defer investments and improve reliability. In several states, there are regulatory restrictions on what utilities can do with customers, which limits cooperation. In other cases, the customer is driven by economics or a desire to leverage the utility's grid, which can also create challenges because of regulations or proper compensation. Utilities could help all parties do a better job of articulating the value of resiliency.

Moderator: Alison Silverstein, consultant

Panelists:

David Geier, Senior Vice President, Electric Operations, San Diego Gas and Electric (SDG&E)

Ronald Pate, Senior Vice President, Operations and Technical Services, Ameren Illinois

Chris Root, Chief Operating Officer, Vermont Electric Power Company (VELCO)

Joseph Svachula, Vice President of Engineering and Smart Grid, ComEd (Exelon)



Microgrids continue to face challenges in achieving more widespread adoption. A number of opinion differences remain, which will challenge more widespread support. These include:

- What is the value of grid connection?
- Is customer self-generation a good thing or a bad thing? What is reasonable compensation?
- How can we change net metering policies to avoid pricing disparities?
- What are utility scale storage solutions? Lithium Ion is not feasible at scale, but how do we explain the necessity of scale to public stakeholders?
- There is a misconception that rooftop solar plus storage makes you self-sufficient. Microgrids are complimentary to grid service, not an alternative. They can rarely stand on their own.

Featured Speaker: Honorable Sergio Marchi, P.C., President and Chief Executive Officer, Canadian Electricity Association

The Honorable Sergio Marchi was appointed President and Chief Executive Officer of the Canadian Electricity Association (CEA) in February 2015. As President of CEA, Marchi acts as spokesperson on issues of national concern to the electric utility industry.

The CEA works closely with the Office of Electricity on a variety of energy issues. The recent NAFTA compromise is a win-win-win result for all parties. Marchi spoke about three primary potential trends he sees when he looks to the future:

- A continuation of the non-regulatory environment promoting more open infrastructure and more investments in DER and smart meters, even though policies for these items still need to evolve.
- A transformative relationship between utilities and their customers. This will result from more technology-advanced customers with higher expectations. Utilities will move to become partners with customers and will see a rapid increase in DER and migration of customers.
- Commercial scale energy storage. The continued decline in process will make this a reality.

In the future, Marchi expects to see the following scenarios:

- Strong government policies supporting DER and new entrants, which could leave utilities with stranded assets.
- Utilities will adapt to increased DER and support the change. Policies will be developed to adapt and compete and maintain the focus on safety.
- Large scale renewable energy facilities will become even more numerous. Batteries will become economically competitive at scale. Renewables plus storage will somewhat lower the penetration of DERs if they can be developed in time.
- The political agenda will be driven by carbon policies. Electrification will increase in order to promote de-carbonization. Utilities will become national stakeholders, not just provincial.



Panel Discussion: North American Pipeline Infrastructure

Pipelines provide the critical link connecting North America's abundant supplies of natural gas, crude oil and LNGs to consuming markets. The shale revolution, the evolving price of oil, pipeline flows and the challenges of pipeline construction all effect infrastructure development. This panel reviewed these topics, as well as pipeline safety, the drivers behind an increase in natural gas demand for electric power generation and infrastructure development of LNG facilities for the export market.

The future of LNG exports is among the biggest uncertainties facing the gas sector today. Today, exports are about 3.6 bcf and are expected to rise to between five and six bcf over the next 18 to 24 months. The key uncertainty is regarding what the wave of new projects after that will look like. There are 14 to 15 large new projects in development. In addition, pipeline exports to Mexico will be a major theme, and Canada is looking to increase LNG and crude exports.

LNG is starting to see many new applications domestically in addition to exports. In markets such as the west coast, exports will be severely challenged and are still unlikely, but in Washington and California, projects exploring conversions of marine vessels, as well as heavy duty truck conversion, are being pursued as an environmental improvement. In addition, an ongoing manufacturing renaissance in sectors such as chemicals, methanol and ammonia is stimulating new demand. However, in many areas, gas faces strong opposition and is no longer seen as the clean fuel alternative by many public groups.

The "Trump Effect" has helped the pipeline sector. This administration is more favorable than the Obama administration, and many of the recent regulatory changes have been helpful. The collaboration among federal agencies has improved so that more things are getting done, but the role of the states and provinces is also increasing. Tariffs are an important and growing concern, and the law of unintended consequences makes many industry participants nervous about mention of "trade wars".

The "Trudeau Effect" has not been helpful to the Canadian gas or electric sectors. "Massive" new regulatory initiatives are creating more uncertainty in the markets. Environmental opposition to western projects is a negative factor, but utilities also need to do a better job of engaging the public earlier and more effectively. The public has felt surprised in the past, which is never a helpful situation.

Cyber security issues are a constant and increasing threat. The view of cyber risks has evolved in just the past six months. The gas sector can take guidance from what the electric sector has been doing. There is a need for more drills to help ensure companies are prepared to respond if something does happen. Most cyber hackers will be able to penetrate your systems, so the strategy should be preparation for the best response.

The gas pipeline sector should advertise its successes. Gas utilities survived Hurricane Michael with no service interruptions. A recent INGAA report cites 99.7% reliability, and the public should be made aware of this impressive track record. This attitude expands to safety, as well. Most utilities are expanding their safety tracking to include contractors. Companies may want to focus on "what failed" not "who failed".

Moderator: Donald Santa, President and Chief Executive Officer, INGAA

Panelists:

Chris Bloomer, President and Chief Executive Officer, Canadian Energy Pipeline Association (CEPA)

Victor Gaglio, Senior Vice President and Chief Operations Officer, Natural Gas Business, Piedmont Natural Gas (Duke Energy)

Andrew Harrington, Vice President, Projects, Enbridge

Jesus Soto Jr., Senior Vice President, Gas Operations, Pacific Gas and Electric (PG&E)



Wounded Warrior Outdoors

Wounded Warrior Outdoors (www.woundedwarrioroutdoors.com) is a non-profit organization exclusively founded to provide wounded servicemen and women with therapeutic outdoor adventures across North America. WWO gives deserving Active Duty Warriors in transition the opportunity of a lifetime in the wilderness location of their choice. **We call them “Adventures Enabled.”**

In lieu of gifts to each of our distinguished speakers, Quanta Services makes a donation to WWO each year at Utility Perspectives. Thank you to the speakers for making the event the high caliber that it is – and for supporting our donation with their time. At this year’s UP, two members of WWO presented to the group – as part of their discussion, they played the video below.



Sgt. Matt Amos presents on the importance of WWO at Utility Perspectives.



Scan this QR code to view a video from Wounded Warrior Outdoors



Dave Wabnegger (Quanta Services), Sgt. Matt Amos and Steve Peebles answer questions about WWO at Utility Perspectives.



Sgt. Matt Amos tells his story to the Utility Perspectives attendees.

Panel Discussion: Infrastructure Security for the Future

The electric power and pipeline systems are more vulnerable to cyber threats today than ever before. Cyberattacks on our system, as well as on foreign systems, require a constant upgrading of new cyber tools oriented toward operational technology, not just toward the identification of attacks. Infrastructure owners around the world are spending billions of dollars per year to protect their systems. This panel had a lively discussion of artificial intelligence, the outsourcing of critical skills and how we could potentially use these resources to secure our infrastructure services.

Utilities' supply chains represent a key vulnerability to cyberattacks.

Approximately 80% of utility cyberattacks come through their supply chain. A recent study found the utility was no longer doing business with 45% of the third parties in their supply chain. Meter data aggregators, a gift card promotions company and rooftop solar providers all have provided entry points in recent attacks.

Utilities offer a range of advice to fellow utilities to protect their systems.

Most panel members concurred that best practice would be to assume your utility system will someday be hacked. That means utilities should plan and drill continuously for how they will respond. They need a planned recovery plan before an attack happens. Utilities should plan in advance what their response might be to a ransomware attack that threatens to expose customer data unless extortion money is paid. Phishing attacks whereby an employee inadvertently opens an invasive email is perhaps the most common attack today. Utilities should test fake emails to employees to see how many open outside emails that they shouldn't. A success rate of one email opened out of 1,000 is the minimum standard.

Artificial intelligence will be the next industrial revolution. AI is expected by many to create more jobs and profit than anything that has come before it, yet we are still in the very early stages of developing AI capabilities. AI detects patterns very effectively. "Bad actors" will clone the everyday items such as siphoning off small checks in ways that won't be detected because individual thefts are relatively small. Panel members advised that since things are changing so rapidly, utilities should send their smartest IT people to more conferences, so they continue to be educated on emerging trends.

IT budgets will continue to increase. Most people cannot rationalize why IT budgets increase so rapidly. One utility panelist said that half of their data requests in a recent rate case were regarding IT spending trends. The problem is that the consequences from cyberattacks are significant. The average breach in the U.S. costs the utility \$4 million, and a single strand of fiber optic cable has more dollars flowing through it than any pipeline.

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

Panelists:

Tyler Anthony, Senior Vice President and Chief Operating Officer, Pepco Holdings, Inc. (Exelon)

Eóin Cooke, Vice President, Security and Information Services, AltaLink

Brad Gammons, General Manager, Global Energy Utilities Industry, IBM

Jason Sharpe, Senior Vice President and General Manager, ATCO

Robert Watson, President and CEO, Information Technology Association of Canada (ITAC)



Featured Speaker: Phillip Moeller, Executive Vice President, Business Operations Group and Regulatory Affairs, Edison Electric Institute

The Honorable Philip D. Moeller is Executive Vice President, Business Operations Group and Regulatory Affairs at the Edison Electric Institute (EEI). EEI is the association that represents all of the nation's investor-owned electric companies.

Moeller highlighted several trends affecting the electric power and pipeline industries:

- An electric grid based on one-way flow is turning into two-way flow. 75 million smart meters have been installed in the U.S. but are underutilized without “smart-rates” to go with them.
- Demand is flat. Rates and regulatory structures have a built-in growth assumption bias, which can cause tension in a flat growth scenario.
- The generation fleet is getting very clean, whether looked at from a SOx, NOx or CO2 perspective. We need to do a better job getting that message out.
- Gas and electric convergence increases risks. New England is the poster child for this problem. Another cold snap like the one in 2004 will be a big problem.
- The “No-Gas trend” will grow out beyond California. EEI will launch a program to validate whether a utility is doing everything that it can do to be sustainable, which will be rolled out at the November financial conference.
- Cyber concerns are growing. While the government utility sector is doing a lot in terms of drills and preparation exercises, they remain reluctant to talk about it openly. EEI has started the Cyber Mutual Assistance Program to cover electric, gas and water utilities in anticipation of an eventual successful cyberattack.
- Investor activism will increase. Millennials will inherit \$38 trillion, and they put an increased emphasis on areas such as staying green and sustainability.



He also discussed some emerging topics across the industries:

- A policy statement from FERC on natural gas pipelines related to downstream effects.
- Indication from FERC regarding where we are going with wholesale markets, including:
 - Courts seem to be allowing states to support nuclear without “meddling” in wholesale markets.
 - The line between wholesale and retail is getting increasingly blurry.
 - There is a policy question regarding whether storage should be regulated at the state or federal level.
 - There is a greater certainty on ROE policy needed for transmission.
- PURPA reform will have to be addressed. It is woefully out-of-date and puts the burden on the utility to buy expensive power they do not need from QFs.
- Wildfires will be an increasingly bigger issue for transmission operators. Utilities have been judged liable for billions of dollars in damages, even if they were only partially responsible. Look for utilities to add sensors to help turn the transmission network into a type of Fire Protection System.
- Changes in distribution rates are expected. The rate structure today is totally antiquated, and fixed costs should be itemized as at least 50% of the total cost. If this is not updated, attracting the necessary investment into distribution systems could be a challenge.
- Data privacy issues will continue to increase. Most PUCs rule that the “customer owns the data,” but that sharing that data is increasing.

Panel Discussion: North American Electric Transmission

The North American transmission grid is the critical infrastructure backbone of energy transportation. This panel addressed the challenges of permitting and building transmission in light of new and developing regulatory requirements – and discussed how transmission may look different in the decades ahead. Highlights included:

Transmission utilities face a series of challenges today. These include the regulatory environment, technology encouraging people to try “something different” (e.g. DER), and extreme NIMBY challenges to development. All of these illustrate the challenge for utilities to improve communication with stakeholders on “the need” for new transmission.

Large, multi-state transmission projects face enormous challenges. There are a large number of wind developments in the queue to beat the 2020 tax expiration and RPS deadlines, but the necessary transmission has not even begun. Examples from the Clean Line story and AEP’s Wind Catcher project in Oklahoma underscore the difficulties involved. A cottage industry has emerged in infrastructure resistance, with individuals using the internet to organize resistance and share success stories across North America.

Increasing storm intensity provides an opportunity to tell a good story. After Hurricane Harvey, CenterPoint had many crew trucks visible in damaged neighborhoods, and they effectively communicated their proactive response, in part by airing TV commercials. This reminded the public how hard CenterPoint was working to restore services. In the wake of Hurricane Harvey, the infrastructure near Corpus Christi built by AEP in the last 10 to 15 years held up well, which has bolstered the idea that new resilient designs and concepts are successful.

Baseload retirements affect transmission owners and grid resiliency. In what could be a warning sign for the future, when several generation plants in ERCOT unexpectedly announced they would retire, it reduced ERCOT’s reserve margins. This led to ERCOT calling a moratorium on transmission outages, which affected maintenance schedules and decreased resiliency. Shortly after, they had an event where a line outage was compounded by an incorrect wind forecast plus a fire outbreak, and suddenly they were grappling with 13 line trips, which would not have been the case before the plant retirements.

Moderator: Mark Bridgers, Principal, Raleigh, Continuum Capital

Panelists:

Calvin Crowder, President and Chief Executive Officer, GridLiance

Scott Moore, Vice President Transmission Operations and Project Services, American Electric Power (AEP)

Shawn Schukar, Chairman and President, Ameren Transmission Company

Kristen Senechal, Executive Vice President, Transmission, Lower Colorado River Authority (LCRA)



Panel Discussion: Grid Modernization and Financial Implications

This panel discussed the aging energy delivery infrastructures and their effect on energy end-use customers. Does the energy provider's view of the costs and risks of aging infrastructure align with the upgrade that advocates claim and with customer willingness to accept increased costs? How do we explain the value of new infrastructure investments, when there is little to no load growth and flat energy costs but rising energy bills? These questions and more were discussed with some highlights shown below:

Many factors are creating more and more uncertainty for utilities.

Many high-tech assets have shorter lives, while interest rates are rising and consumers are becoming more price sensitive. This is particularly true for lower economic consumers, as their utility bills become a bigger share of their disposable incomes. Natural disasters such as storms and wildfires are having greater economic costs, load growth in most areas are declining and business models need to adapt to keep up.

Is the utility culture too timid to fully embrace transformative technology?

The utility industry and executive leaders in general may have to change to manage uncertainty. Some newer concepts such as Performance Based Rates work well, but the initial transition to adopt PBR was difficult. Customers do not consistently think smart meters are a good development, deployment of SCADA seemed uneven, and technology adoption rates vary by application and by industry. Pilot programs are the time-tested way to deploy new technologies, but that can be a slow process.

Customers are learning to embrace transformative technology. Utilities need to recognize that 375,000 customers in California put solar on their rooftops because they want to control their own energy future. Customers value this control, perhaps more than utilities realize. The amount that people pay each year for internet services and cell phones has risen astronomically, yet customers are willing to pay this because they perceive they have a choice regarding whether to buy it and from whom.

Successful utilities may need to get ahead of what customers want by broadening their perspectives. Utilities could benefit by bringing in perspectives from outside partners – and focusing on understanding the customers' needs and wants as they consider adopting new processes.

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

Panelists:

Rudy Garza, Senior Vice President,
Distribution Services and Operations, CPS
Energy

Pat Hogan, Senior Vice President, Electric
Operations, Pacific Gas & Electric (PG&E)

Gary Smith, Executive Vice President,
Eastern Canadian and Caribbean
Operations, Fortis Inc.

Wayne Stensby, Managing Director,
Electricity Global Business Unit, ATCO
Group



The 2019 Utility Perspectives Executive Leadership Symposium

We sincerely hope that the 2018 Utility Perspectives Executive Leadership Symposium was an enjoyable and rewarding experience for those who participated, and we welcome any comments or suggestions as we continually strive to improve the event. Thank you, again, to all who helped make this event a success.

Please save the date for the Utility Perspectives 2019 event, which will be September 29 - October 1, 2019.

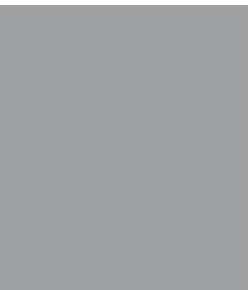
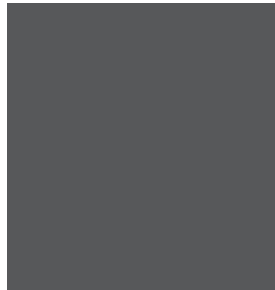
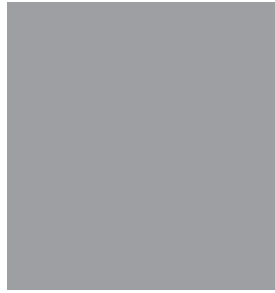
Quanta Services is excited about hosting the 17th annual Utility Perspectives Symposium, and we look forward to seeing each of you in San Diego.



If you weren't able to make it to Toronto, don't miss San Diego. Click on this video to see what you missed.

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

SEE YOU IN 2019!



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