Conference Overview

Engineers go to great lengths to ensure transmission and distribution facilities are designed to current standards and meet reliability and safety expectations. However, once installed, there are only a limited number of guides and standards available to manage the in-service condition and performance of these critical facilities. The Conference will provide insight on how utilities and the industry are managing the condition of T&D lines. The strategies to be discussed will include health indexing, risk assessment practices, work prioritization, condition assessment practices, new technologies, and data requirements.

Sessions

- Asset Management and the Importance of Managing Condition
- Condition Based Maintenance Strategies for T&D Lines, Highlighting the Benefits, Costs, and Risks
- How to Develop Health Indices & Assess the Likelihood of Failure
- Work Prioritization, Diagnostics, Risk Analysis, and Degradation Curves
- Condition Assessment for Various Components including Techniques and Technologies
- The Full Process Cycle from Data Collection to Use and the Creation of Gap Fillers for Failure Curve Models
- New Technologies and Industry Trends

For more information visit, www.ceati.com/TD2017
### Main Session - Meeting Room Bayshore 5-7

**7:30 – 8:30** Registration & Breakfast

**8:30 - 8:40** Opening Remarks & Welcome Address
- **Eric Valois**, Conference Co-Chair

**8:40 - 8:50** Conference Overview & Expected Results
- **George Juhn**, Conference Co-Chair

**8:50 - 9:20** Keynote Speaker
- **Hugh Irwin**, Dake Energy

**9:20 - 10:00** Session 1: Asset Management and the Importance of Managing Condition
- **Bojan Grabovac**, Toronto Hydro & **David Curtis**, CEATI International

**10:00 - 10:30** Break

**10:30 - 11:30** Session 2: Condition Based Maintenance Strategies for T&D Lines, Highlighting the Benefits, Costs and Risks
- **Lana Gilpin-Jackson**, BC Hydro & **Dan Mastrocola**, Hydro Québec

**11:30 - 12:30** Session 3: Work Prioritization, Diagnostics, Risk Analysis and Degradation Curves

**12:30 - 1:30** Lunch

**1:30 – 2:30** Session 4: The Full Process Cycle from Data Collection to Use and the Creation of Gap Fillers for Failure Curve Models
- **Boudewijn Neijens**, Copperleaf & **Robert Otal**, METSCO

**2:30 - 3:00** Break

**Main Session - Meeting Room Bayshore 5-6**

**Breakout Sessions 3:00 – 5:00**

**Session 1 & 2: Business and Strategic Direction as It Relates to Asset Condition and Management - Transmission**
- **Meeting Room Bayshore 5-6**
  - **3:00**
    - **David Curtis**, CEATI & **Lana Gilpin-Jackson**, BC Hydro
  - **3:05**
    - **Art Kruppenbacher**, Avangrid
  - **3:20**
    - **Russell Bolt**, TransPower
  - **3:35**
    - **Yury Tsimberg**, Kinectrics
  - **3:50** Discussion
  - **4:45** Day 1 Closing Remarks

**Session 1 & 2: Business and Strategic Direction as It Relates to Asset Condition and Management - Distribution**
- **Meeting Room Bayshore 7**
  - **3:00**
    - **Bojan Grabovac**, Toronto Hydro & **Dan Mastrocola**, Hydro Québec
  - **3:05**
    - **James Brown**, Enwin Utilities
  - **3:15**
    - **Carlo Recto**, EPCOR
  - **3:25**
    - **Eric Valois**, CEATI International
  - **3:40**
    - **Mark Newton**, Novinium
  - **3:55**
    - **Alexander Bakulev**, METSCO
  - **4:10** Discussion
  - **4:45** Day 1 Closing Remarks

**Session 3 & 4: Business Processes, Optimization, Data Gaps and Risk Assessment - Transmission**
- **Meeting Room Palma Ceia 1-3**
  - **3:00**
    - **Boudewijn Neijens**, Copperleaf & **John Liebrecht**, AEP
  - **3:05**
    - **Darryl Chipman**, Salt River Project
  - **3:20**
    - **Mike Kurecki**, Ameren
  - **3:35**
    - **Ben McKinsey**, HDR
  - **3:50** Discussion
  - **4:45** Day 1 Closing Remarks

**Session 3 & 4: Business Processes, Optimization, Data Gaps and Risk Assessment - Distribution**
- **Meeting Room Ybor**
  - **3:00**
    - **Thor Hjartarson**, METSCO & **Robert Otal**, METSCO
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    - **Jon Foreshee**, Oakville Hydro
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    - **Mike Porcaro**, National Grid
  - **3:25**
    - **Robert Otal**, METSCO
  - **3:45** Discussion
  - **4:45** Day 1 Closing Remarks

**6:00 - 7:30** Networking Reception – Meeting Room Bayshore 1-4 (Exhibition Hall)
### Main Session - Meeting Room Bayshore 5-7

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<td>8:45 – 9:45</td>
<td>Session 5: Condition Assessment for Various Components including Techniques and Technologies</td>
<td>Andy Stewart, EDM International &amp; Mehrnoosh Janbakhsh, Saskatoon Light &amp; Power</td>
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<td>10:15 - 11:00</td>
<td>Session 6: How to Develop Health Indices &amp; Assess the Likelihood of Failure</td>
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<td>11:00 - 12:00</td>
<td>Session 7: New Technologies and Industry Trends</td>
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### Breakout Sessions 1:30 – 3:15

#### Session 5 & 6: Acquisition of Condition Information and Inputs into Planning – Transmission
- Meeting Room Bayshore 5-6

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<td>1:35 Smart Insulators for Live Monitoring Of Leakage Currents On Transmission Lines</td>
<td>Jean-Marie George, SEDIVER</td>
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<td>1:45 The Latest Advancements in LineCore Sensor Deployment Methods</td>
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<td>2:05 Predictive Maintenance and Machine Learning for Transmission Structure Corrosion Management</td>
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<td>Alex Babakov, Aeriosense Technologies</td>
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<td>2:50 Non-Contact Transmission Line Monitoring using EMF Sensors</td>
<td>Nathan Pinney, Genscape</td>
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### Session 7 & 6: Acquisition of Condition Information and Inputs into Planning – Distribution
- Meeting Room Palma Ceia 1-3

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<td>2:05 3D Digital Asset Management for Distribution Networks: Technology Review and Case Studies</td>
<td>Nick Ferguson, NM Group &amp; Ben Mallen, Trimble</td>
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#### Agenda is subject to change without notice

### CEATI Group Meetings

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**Thank you to our Sponsors:**

- Distribution Line Asset Management
- Transmission Line Asset Management
- Smart Grid

**November 16-17**

All conference guests are eligible for a discounted rate of $124 (USD) subject to availability. Simply mention “CEATI International” when reserving.
George Juhn is currently the Technical Advisor of CEATI’s Transmission Line Asset Management Interest Group.

George has held several management and technical positions with responsibilities in T&D maintenance and asset planning, technical support, regulatory submissions and line design. He has a Bachelor Degree of Applied Science in Engineering from the University of Waterloo, (1982), and over 30 years experience in the management of transmission line assets. Mr. Juhn was instrumental in the implementation of Asset Management practices and maintenance planning during his career with Hydro One. He also developed and implemented transmission lines GIS application, asset data management practices, and witnessed at rate submissions. George recently completed transmission line studies on maintenance practices and cost optimization for the replacement of individual or grouped line components.

Eric Valois (P.Eng., MBA, CMA) has close to 40 years of experience working in the electrical utility industry. Over these years, he has gained direct experience in the planning, design, construction, operation and maintenance of Transmission and Distribution Systems. He has held leadership and management positions at Canadian utilities including BC Hydro, Ontario Hydro, Hydro Mississauga and St. Catherines Hydro. Mr. Valois graduated from Ryerson University in the Power System Program and is a registered Professional Engineer in the provinces of British Columbia and Ontario. During the last 20 years of his career at BC Hydro, he worked in various positions including responsibilities in design, distribution standards, operations, transmission services and distribution services.

Hugh Irwin, Duke Energy

Hugh has 39 years of experience working in the electric utility industry. His expertise particularly extends to Substantiation Maintenance, Circuit Breaker SME, Maintenance Procedure Development & Writing, and CBM development (sub equipment, etc.).

Throughout his career, Hugh has also undertaken various leadership roles, most notably, in Transition Project Management, Distribution Operations, Transmission Area Operations, Asset Management, and Control Center Support. Hugh initially received his BSc from Mercer University in Macon, Georgia, and the majority of his professional experience has spanned across various Transmission business units.
Session Chairs:

Bojan Grabovac, Toronto Hydro & David Curtis, CEATI International

Abstract:

Strategic decisions play a vital role in the management of distribution assets. With the regulatory landscape shifting towards stronger links between investments and measurable outcomes, it becomes even more important to ensure higher quality data is gathered to better inform the investment decisions. On the other side, getting good data to derive asset conditions may require operational compromises. This session will investigate the various approaches used, or ones that should be used, to construct asset condition assessments. What reliable and proven technologies can be used effectively to make this task easier and higher quality? Are there any adjustments, strategic or operational, that the utilities must make to enable the adoption of these new approaches? Finally, with the assumption that the condition of the assets can be linked to reliability, this new insight can provide information that can be valuable to certain customers. What kind of opportunities can utilities explore?

Abstract:

Managing Transmission Asset Condition is a vital aspect of asset management and provision of reliable service to transmission customers. This session will examine this issue from a number of perspectives. First, there is the strategic perspective. How does corporate strategy provide direction to managing transmission asset condition? What role does setting corporate objectives play in driving asset management and managing transmission asset condition. What strategic direction should transmission utilities take in their asset management system as well as managing asset condition when challenged by new business models?
Session 2: Condition Based Maintenance Strategies for T&D Lines, Highlighting the Benefits, Costs, & Risks (10:30 - 11:30am)

Session Chairs:
Adelana (Lana) Gilpin-Jackson, BC Hydro & Dan Mastrocola, Hydro Québec

Lana Gilpin-Jackson has over 20 years’ experience in design, construction, management, innovation, and business development. He is currently Vice President of an energy start-up, an independent consultant and a specialist civil engineer at BC Hydro with the Transmission Lines Strategy & Standards Group. He has published papers on technology, engineering, asset management, given lectures, and led seminars on a variety of topics. Adelana is recognized for innovation and holds technical patents in Canada and the United States for inventions that have impacted the design and maintenance of electric power transmission systems.

Dan Mastrocola is a professional engineer with over 25 years of experience working in the utilities industry. With a B.Eng. and B.A. in Economics, he has specialized in developing and implementing asset management programs. Dan has been part of the Hydro-Québec Distribution process since 2002. In 2007, he was tasked with the responsibility of developing a maintenance management program for Hydro Québec Distribution’s 1.8 million wood poles. The initial program he developed was approved by the Energy Board in 2009. In 2012 and in cooperation with the research arm of Hydro-Québec and Hydro One Networks, Dan commenced a study to develop a new method for assessing wood poles. The new concepts arising from this study were implemented into Hydro-Québec’s wood pole management program in the Spring of 2016.

Abstract: The dilemma of aging assets against a backdrop of insufficient funds, an aging workforce, reliability requirements, and the move from proactive to reactive asset management, is a common issue. Within this complex landscape, the objective remains to keep the lights on safely, reliably and at the lowest possible cost while keeping a wide variety of risks as low as reasonably possible. A “Condition Based Maintenance” strategy focuses on the actual condition of a transmission line asset in order to determine what maintenance is needed to respond to decreasing performance. This discussion will show that condition based maintenance has many benefits in efficiency improvement and risk mitigation, but the trade-offs should also be considered.

Abstract: By 2030, the requirements and demands on the distribution network will have changed in a profound manner from what we know today. Micro grids, electric vehicles, energy storage and solar are among the many elements that are and will continue to place increasing pressure on utilities to respond to the changes. These changes will not only influence how the network is configured and operated but will also have an impact on how utilities will manage their assets to ensure continued system reliability and performance. All of this, while dealing with regulatory requirements and minimal revenue growth under the current model.
Session 3: Work Prioritization, Diagnostics, Risk Analysis, and Degradation Curves (11:30am - 12:30pm)

Session Chairs:

John Liebrecht, American Electric Power & Thor Hjartarson, METSCO

John Liebrecht has a Bachelor of Science in Civil Engineering from Ohio Northern University and is a Registered Professional Engineer in the State of Ohio. He has worked as a Transmission Line Design Engineer in AEP’s transmission line engineering group and has spent several years as a Transmission Engineer with the T-Line Field Operations group having a direct involvement with scheduling and coordinating the construction and maintenance of transmission lines ranging from 69 kV to 765 kV. Mr. Liebracht has also worked with AEP’s Transmission Line Technical Support group to coordinate and develop budgets and work programs, and determine the resources required for construction and maintenance activities. His current role is with the Transmission Asset Management group and leads a team that is currently involved in establishing inspection and maintenance standards for all of AEP’s 35,000 miles of transmission lines.

Thor Hjartarson is an engineering leader with 25 years of professional experience in electrical and power engineering. He was recently the leader of a large asset management division with responsibilities for planning, smart grid engineering, reliability analysis, system studies, record management, data quality, mobility and GIS improvements. Mr. Hjartarson is one of the founders of the Health Index Methodology in utility asset condition assessment and has lead the comprehensive implementation of a risk based investment methodology at a major utility. In his previous consulting career, he has had experience with over 30 well known electrical power companies around the world.

Abstract: Prioritizing T-Line sustainment work can be a complicated undertaking. There are many factors and risks to consider when selecting candidates for component and structure replacement, or for complete line rebuild projects. These factors can have different “weight ratings” or “influences” depending on the region, operating company, grid and reliability impacts, customer service impacts, and regulatory issues. There is no magic formula that uses all of these factors to determine a “top 10” or “10 worst” list; however, it must be recognized that asset condition is a foundational criteria for sustainable investments. A method has been developed to identify project candidates and prioritize component and structure replacement projects, or line rebuild projects, by considering all of the above factors. This presentation will identify the project drivers, the prioritization process, and provide examples of the asset assessment process.

Abstract: The ability to be able to assess the accelerated degradation of asset infrastructure based upon condition, and utilize this information as part of a risk-based asset management framework to prioritize capital and maintenance investments which is becoming increasingly necessary for utilities to prudently justify their short-term and long-term investment plans to internal and external stakeholders, such as provincial and state regulatory agencies. This presentation will walk through all of the key stages of applying the utilities available asset registry and in-field telemetry in order to perform condition assessment, produce degradation curves, perform the system-wide risk analysis and ultimately prioritize investments across the system in a justified manner.
Session 4: The Full Process Cycle from Data Collection to Use and the Creation of Gap Fillers for Failure Curve Models

Session Chairs:
Boudewijn Neijens, Copperleaf & Robert Otal, METSCO

Boudewijn Neijens holds a Masters degree in Mechanical Engineering from the University of Brussels, an MBA from INSEAD in France, is a Certified Asset Management Assessor and holds a Certificate of the Institute of Asset Management. He is currently the Chief Marketing Officer at Copperleaf Technologies in Vancouver, BC. In this role Mr. Neijens works with large asset intensive corporations around the world to refine their asset management practices in the areas of Asset Investment Planning and Management, decision support systems and risk-based planning models. He is also the Chair of the Canadian chapter of the Institute of Asset Management; convenor of Cigré’s workgroup on the use of ISO55001 in utilities; and convenor of the ISO’s workgroup on ISO5500x.

Abstract: At the heart of a risk-based asset management program is a series of age and condition-based failure curve functions for each of the evaluated assets within a transmission and distribution system. These curves allow utility organizations to predict when assets will fail within their respective systems, such that they can derive proactive investment programs in order to sufficiently manage future risks.

Deriving these failure curves requires an optimal amount of data from the utility, including asset demographics and registry information. It is essential that utilities begin an asset management program with their current-state data, rather than waiting for “perfect” data to materialize. The reality is that data collection and optimization remains extremely costly, and that without an asset management program in place, it is impossible to know in advance how data will need to be sufficiently formatted in order to supply the various AM components, including failure curve calculations.

Ultimately, this presentation will go through the entire process cycle for data management and optimization, including data collection, data packaging (for use in a specific AM application, such as failure curves), data utilization and data validation, such that data is continually improved over time. Execution of this approach ensures that utilities are continuing to justify their investments in the most optimal manner while continuing to strive for continuous improvements.

Robert Otal is a Professional Engineer with over 10 years of experience working in the areas of asset management, risk management, strategic long-term and short-term investment planning, and IT solutions. Mr. Otal has led the development of distribution system plans to support the justification of investments as a part of electricity distribution rate filing applications. Robert has led the development and delivery of strategic engineering projects to optimize processes and improve justification and decision-making as part of asset management planning procedures. His areas of interest include risk based analysis and the optimization of distribution systems. Robert takes an active role in the engineering profession and is a member of the IEEE.
The Conference Attendees will divide into four breakout sessions to discuss the topics in more detail. Sessions 1 and 2 will be combined, as will session 3 and 4. However, they will be divided between Transmission and Distribution. Subject Matter Experts (SME’s) will share brief high-level presentations, after which, the audience members will participate in a focused discussion identifying and prioritizing knowledge gaps.

**Transmission Breakout Session 1 & 2: Business and Strategic Direction as It Relates to Asset Condition and the Management of the Assets**

**Chairs: David Curtis, CEATI International & Adelana (Lana) Gilpin-Jackson, BC Hydro**

David Curtis has been working in the electric utility industry in Ontario for over thirty seven years. During this time, David provided leadership in introducing the Asset Management concept and PAS55 to Hydro One and later reviewing the newly introduced ISO 55000 Asset Management Standard. David has appeared numerous times as a proponent before the Ontario Energy Board, served on the Independent Electricity System Operator’s Technical Panel and was the Canadian member on the C1 System Development and Economics study committee.

Lana Gilpin-Jackson has over 20 years’ experience in design, construction, management, innovation, and business development. He is currently Vice President of an energy start-up, an independent consultant and a specialist civil engineer at BC Hydro with the Transmission Lines Strategy & Standards Group. He has published papers on technology, engineering, asset management, given lectures, and led seminars on a variety of topics. Adelana is recognized for innovation and holds technical patents in Canada and the US for inventions that have impacted the design and maintenance of electric power transmission systems.

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<td>Avangrid’s Development of a Transmission Assessment Approach</td>
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<td>Asset Management Planning Levels</td>
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<td>3:50 - 4:45</td>
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Art Kruppenbacher is the Manager of Asset Management for Avangrid Networks, a division of AVANGRID, Inc. Avangrid Networks includes eight electric and natural gas utilities, serving 3.1 million customers in New York and New England. Avangrid owns and operates approximately 8,500 miles of electric transmission lines. Mr. Kruppenbacher and his team provide the Avangrid Networks business with information to better understand the health of its transmission and distribution assets, the risks associated with those assets, recommendations for interventions, and support for the investment planning process. The group works closely with operational, engineering, maintenance, and investment planning groups to coordinate and prioritize investments and maintenance needs.

Mr. Kruppenbacher has over 35 years of broad experience in field and corporate roles across numerous functions including engineering, operations, marketing and administration, and has worked in both electric and gas. He has a Bachelor’s degree in Agricultural Engineering from Cornell University and is a professional engineer licensed in New York State.

Abstract: This presentation will provide insight into Avangrid’s development of a transmission assessment approach, including a discussion on the challenges faced. The assessment results inform the maintenance and capital investment decision making process as work must be prioritized and compete for resources along with alternative projects.

Russell Bolt, TransPower New Zealand

Russell has 35 years industry experience in the New Zealand electricity transmission system. Commencing in the construction sector for 8 years then transferring to the maintenance team for 15 years. During this time Russell transitioned from a field based role into one of business unit management responsible for all maintenance activities for 5000 transmission structures.

In the past 12 years, Russell has been part of Transpower’s lines engineering team, responsible for the development and implementation of long term asset strategies, works planning, regulatory submission, and portfolio management during the current regulatory period.

Abstract: The objective is to formulate asset class strategies, apply the right processes to available data, and establish least-cost long-term management plans.

The establishment of the asset class strategy will typically provide a series of high level objectives, that require conversion into the long-term management plans. The processes used in this conversion are where complexity issues arise. These complexities may arise from incomplete or inaccurate data, generic assumptions, failure curves, isolated experiences, and local bias. This presentation will question, how do we frame the complexities and apply to the decision process, and identify the impact on the long-term management plan.
Yury Tsimberg is a Director of Asset Management with Kinectrics Inc., where he has been leading consulting services in Asset Management business area for several years. He has led successful completion of a number of Asset Management projects across North America, taught Asset Management courses world-wide, and has presented at many industry conferences and forums. Prior to joining Kinectrics, Yury spent 30 years with Ontario Hydro and Hydro One, where he worked in various electrical utility transmission and distribution business areas, including Asset Management, System Planning, Operations, M&A, Regulatory, Transmission Line Maintenance, and Customer Service. In his last position with Hydro One, Yury was a Manager of Asset Strategies and Standards Department, where his accountabilities included development of asset specific strategies, standards & policies for transmission and distribution assets, and the creation of new customized applications and tools for enabling utilization of “state-of-the-art” Asset Management techniques and methodologies.

Yury acted as the Canadian member of the international panel revising PAS 55 specification and was the only Canadian member on the NERC Committees developing North American transmission planning standards. He is currently Canadian representative and management team member as Asset Management Convener at CIGRE Study Committee SC1 “System Development and Economics”. Yury holds a Bachelor of Applied Science and a Master of Engineering Degrees in Electrical Engineering from the University of Toronto, and he is a Registered Professional Engineer in the Province of Ontario, Canada.

Abstract: Asset Management Planning encompasses 3 levels: Strategic Asset Management, Tactical Asset Management and Operational Asset Management. The presentation will briefly describe each of the levels, including types of decisions made, their relationship between them, and typical accountability for each within Asset Management organization. The presentation will also touch on how Life Cycle Cost approach is taken into consideration and how what are potential areas of “integration”.

Tel: 1.514.866.5377   Fax: 1.514.904.5038   events@ceati.com   www.ceati.com
Bojan Grabovac is currently the Supervisor of the Customer Experience and Reliability team at Toronto Hydro. He holds a B.Eng. in electrical engineering from Ryerson University and an MBA from Rotman School of Management at the University of Toronto. Before joining Toronto Hydro, Bojan worked at Bombardier Aerospace on the electrical system design for the Global business jet family of aircraft. At Toronto Hydro, prior to the current role, he managed a team in System Planning where he focused on asset management of the infrastructure in Toronto’s urban core. The role also required reviews and approvals of customer connection and the development of regulatory evidence and justifications for regulatory submissions. His current mandates are to understand the latest technologies and technical trends and, through innovation and foresight, drive improvements in reliability reporting and enhance the relationship Toronto Hydro has with its customers.

Dan Mastrocola is a professional engineer with more than 25 years of experience working in the utilities industry. With a B.Eng. and B.A. in Economics along, he has specialized in developing and implementing asset management programs. Dan has been part of Hydro-Québec Distribution since 2002. In 2007 he was tasked with the responsibility of developing a maintenance management program for Hydro Quebec Distribution’s 1.8 million wood poles.

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<td>3:15 - 3:25</td>
<td>Building a Risk Management Framework for Cable Condition Assessment</td>
<td>Carlo Recto, EPCOR</td>
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<td>3:40 - 3:55</td>
<td>Measuring the use and effectiveness of Cable Rejuvenation as an Asset Management Tool</td>
<td>Mark Newton, Novinium</td>
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<td>3:55 - 4:10</td>
<td>Application Of Reliability Forecasting Model To Identify Capital Spending Level Required To Maintain Or To Improve Reliability</td>
<td>Alexander Bakulev, METSCO</td>
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**Subject Matter Experts**

### James Brown, Enwin Utilities

Jim Brown is the Vice President of Hydro Operations at EnWin Utilities. He has over 17 years of experience in Electrical Distribution and a comprehensive knowledge of Asset Management, System Planning, Engineering, Operations, System Control, Conservation and Demand Management. Prior responsibilities include Metering, SCADA Development and Operation, GIS, OMS, Project Management, Cyber Security and Quality Assurance. Additionally, Mr. Brown has over 20 years of experience at a natural gas distributor.

**Abstract:** This presentation will outline how EnWin's Asset Management Plan is tied to the company's Vision, Mission and Business Values and how this drives the development of specific Goals and Strategies. The risk model in use at EnWin and how it is applied to pole assets will also be discussed.

### Carlo Recto, EPCOR

Carlo Recto graduated from the University of Alberta in 1999 with a degree in Electrical Engineering, after which he worked at Manitoba Hydro dealing with Distribution Planning and Protection, Design, HVDC, Substations, and Standards. In 2004, he relocated to Calgary to pursue a position at Enmax designing and overseeing Calgary's rapid growth in URD, LRT, Roads Projects, Customer Connections, Windfarms, Oilpatch, and Systems projects. In 2010, he transferred to Edmonton, to work at Epcor as the Manager of Distribution Standards, performing technical, management, and chairmanship roles, responsible for the development of Overhead, Underground and Network Standards, as well as Materials and Equipment specifications and selection.

**Abstract:** Medium Voltage (MV) Cable is a core asset in Epcor’s distribution system. Installations began over 40 years ago, and they continue to grow today at an even larger scale. To improve existing knowledge and to better manage MV cables as aging assets, a Risk based Asset Management Framework is being implemented, which will integrate Cable Condition Assessment.
Eric Valois, CEATI International

Eric Valois (P.Eng., MBA, CMA) has close to 40 years of experience working in the electrical utility industry. Over these years, he has gained direct experience in the planning, design, construction, operation and maintenance of Transmission and Distribution Systems. He has held leadership and management positions at Canadian utilities including BC Hydro, Ontario Hydro, Hydro Mississauga and St. Catharines Hydro. Mr. Valois graduated from Ryerson University in the Power System Program and is a registered Professional Engineer in the provinces of British Columbia and Ontario. During the last 20 years of his career at BC Hydro, he worked in various positions including responsibilities in design, distribution standards, operations, transmission services and distribution services.

Abstract: This presentation will document the current asset management practices of distribution utilities and determine if there is updated information that is pertinent to distribution utilities. It will present the results of a survey that gathered information pertaining to asset management practices of distribution utilities. The goal was to create a collaborative forum allowing participating utilities to learn from one another through exchange of ideas in order to (1) identify proven approaches and tools that can be used in the development and implementation of a superior asset management plan, and (2) identify decision support tools which can facilitate replace/repair asset management decisions.

Mark Newton, Novinium

Dr. Mark Newton champions product development and engineering at Novinium. He spent more than 17 years accelerating research, technology, and product innovation at W.L. Gore & Associates, the maker of GORE-TEX®.

Mark is a member of the American Institute of Aeronautics and Astronautics and the Instrumentation Society of America. He has authored more than 10 scientific papers and journal articles, and has been published in The Wall Street Journal, Fortune, and Men’s Health. He holds 6 patents. Mark holds a B.Eng. in Aerospace Engineering and Business from Kingston University and a Ph.D. in Environmental Physiology from the University of Portsmouth.

Abstract: The first commercial use of cable rejuvenation occurred over 30 years ago. Since that time, solid dielectric enhancement technology has been successfully implemented by numerous circuit owners worldwide, and has become a key asset management tool to improve cable reliability while maximizing return on investment.

This presentation will examine 30 years of data for cable rejuvenation including total length, segment length distribution, number of segments, injection methods, fluids, conductor materials, insulation materials, location types, and voltage class. The overall failure rate, failure rates by rejuvenation method, and failure rates by year following rejuvenation will be presented to analyze the effectiveness of the process.
Mr. Bakulev is an experienced professional with over 15 years of experience in utility asset management, investment and budget planning, as well as strategic management. He has extensive experience in long-term economic asset planning, business case development, financial modelling, risk-based investment planning for generation, transmission, and distribution companies in North America and Europe.

Abstract: System-wide reliability forecasting allows utilities to examine and assess the possible reliability improvements in the form of SAIFI, SAIDI and CAIDI metrics based upon the levels of investment being made to the distribution system. The reliability forecast can be modelled by performing statistical analysis of historical data with key internal and external reliability drivers as well as utilizing detailed asset failure analytical models and reliability improvement initiatives.

The project to develop such a model was performed for a Canadian utility. Interesting findings from the statistical analysis of each of the cause code will be presented, such as correlations to weather patterns, external economic activities, capital programs to install lightning arrestors or insulators, and other patterns. Defective equipment cause code was predicted based on a detailed failure equipment analysis, utilizing age and condition assessment profiles as well as system connectivity for modelling failure impacts on the customers. Long-term capital spending scenarios can be analyzed throughout the model to identify required spending levels to improve or maintain reliability, as well as an impact of system-wide reliability improvement projects can also be modelled and embedded in the scenarios.

As part of the presentation, the survey results of the CEATI DLAM Project T164700 #50/133 project will be presented. The survey was used to (a) assess the depth of currently-adopted reliability forecasting approaches, (b) quantify the quality and standards of the reliability data collection & reporting procedures, (c) identify statistical methods to derive correlation factors between key reliability drivers and cause code events, and (d) assess how the forecast results are integrated into the utilities’ current-state business model.
Transmission Breakout Session 3 & 4: Business Processes, Optimization, Data Gaps & Risk Assessment

Chairs: Boudewijn Neijens, Copperleaf & John Liebrecht, American Electric Power

Boudewijn Neijens holds a Masters degree in Mechanical Engineering from the University of Brussels, an MBA from INSEAD in France, is a Certified Asset Management Assessor and holds a Certificate of the Institute of Asset Management. He is currently the Chief Marketing Officer at Copperleaf Technologies in Vancouver, BC. In this role Mr. Neijens works with large asset intensive corporations around the world to refine their asset management practices in the areas of Asset Investment Planning and Management, decision support systems and risk-based planning models. He is also the Chair of the Canadian chapter of the Institute of Asset Management; convenor of Cigré’s workgroup on the use of ISO55001 in utilities; and convenor of the ISO’s workgroup on ISO5500x communications.

John Liebrecht has a Bachelor of Science in Civil Engineering from Ohio Northern University and is a Registered Professional Engineer in the State of Ohio. He has worked as a Transmission Line Design Engineer in AEP’s transmission line engineering group and has spent several years as a Transmission Engineer with T-Line Field Operations group having a direct involvement with scheduling and coordinating the construction and maintenance of transmission lines ranging from 69 kV to 765 kV. Mr. Liebracht has also worked with AEP’s Transmission Line Technical Support group to coordinate and develop budgets and work programs, and determine the resources required for construction and maintenance activities. His current role is with the Transmission Asset Management group and leads a team that is currently involved in establishing inspection and maintenance standards for all of AEP’s 35,000 miles of transmission lines.

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<td>Risk Prioritized Ranking of Circuits for Prioritization of Aging Infrastructure Replacement &amp; Capital Budgets</td>
<td>Daryl Chipman, Salt River Project</td>
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<td>Development of Transmission AM Programs</td>
<td>Mike Kurecki, Ameren</td>
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Subject Matter Experts

Daryl Chipman, Salt River Project

Daryl Chipman is a registered Professional Engineer in the State of Arizona and a senior engineer at the Salt River Project (SRP) working in Transmission Line Maintenance. He has worked for SRP in the electric utility industry for over 17 years. Daryl graduated with a Bachelor of Science degree in Electrical Engineering from Montana State University. He has been a speaker at utility conferences on various topics concerning the maintenance of power transmission assets. Daryl has also authored trade magazine articles, coauthored industry papers, and is coauthor of a line maintenance chapter in the industry handbook “Grigsby’s Electric Power Generation, Transmission and Distribution Handbook”. He is a husband and a father of three children and appreciates the outdoors.

Abstract: Salt River Project engineering groups recently endeavored to systematically evaluate and rank the risk of wood structures and their associated circuits on its 69kV transmission system. This multi-departmental effort created a system with inputs of GIS-based wood pole information, wood pole inspection results, and historical local meteorological data. The data was analyzed by a set of engineering structural loading algorithms that assigned a remaining strength margin score, which translated into a risk value. The entire circuit risk was further evaluated by accounting for guyed deadends and specially designed steel structures within the circuit. The outcome was a risk prioritized ranking of circuits. The list is now used to prioritize aging infrastructure replacement efforts and associated capital budgets. This multi-year effort is an example of overcoming data gaps, utilizing business processes, and applying a degree of optimization to provide an engineering-supported risk assessment.

Michael Kurecki, Ameren

Michael Kurecki is a Consulting (Senior) Engineer at Ameren working in Transmission Line Maintenance. He has worked for Ameren for more than 20 years, all in Transmission. Michael graduated with a Bachelor of Science degree in Electrical Engineering Technology from Southern Illinois University. He has also worked at a utility in Iowa, gaining experience in distribution design and operating, crew supervision, substation design and dispatch operations. He has also helped to introduce aerial inspection, maintenance and construction for Ameren. He is a husband and a father of three children and enjoys physical fitness and backpacking, especially Colorado’s 14,000+ mountains.

Abstract: Until 2010 Transmission within Ameren was separated amongst HQ engineering, operations and dispatch. In 2010 Ameren Transmission (ATX) became its own business segment within the corporation. The formation of ATX fostered an environment for comprehensively analyzing, enhancing and maintaining the transmission system. Initiating a 350+ mile 345 kV new line project, a NERC-mandated clearance analysis process, formalized maintenance procedures and a line performance improvement effort have fostered the development of several programs. Among them are a formalized project approval based on cost, a mapping and asset management tool, creation of a PM department, enhanced fiber communications network, creation of a construction department and economies of scale with civil/structural, substation, relaying, line, planning and operations groups.
Ben McKinsey leads HDR’s Utility Risk Assessment Program, focused on helping utilities proactively plan for wildfires and other disasters in their operating region. As a transmission project manager with more than nine years of experience, Ben has worked on transmission projects ranging from 25kV to 345kV across the country for both small county public utility districts and cooperatives and large investor-owned utilities. Ben also has experience as a program manager, helping utilities manage a large portfolio of related projects concurrently during all stages of the projects, including permitting/right of way, through design and construction.

Abstract: Risk is generally defined as “the positive or negative effects of uncertainty or variability upon utility objectives.” It is the product of the analysis of likelihood and consequences. As a part of developing short-term operation and maintenance plans as well as broader long-term planning efforts, utilities can evaluate the risk to infrastructure and the potential for performance failure to their power transmission system due to wildfire within their operating region(s). It is the primary intent of this presentation to provide utilities with a framework and risk visualization tool to support the decision making necessary to develop strategic and cost effective plans to reduce or minimize service failures as a result of wildfire, and thus, produce a system that exhibits long-term resilience to this threat.

By analyzing a utilities’ existing transmission infrastructure while also completing a review of the local characteristics of a wildfire to produce damage within the service area, utilities can gain perspective regarding their exposure to risk of service outages and capital losses. Once analysis of the system has been completed, utilities can prioritize short term maintenance and spending efforts to immediately address the highest risk areas, as well as evaluate long term capital budgets to help prioritize projects to reduce their unique relative risk profile and improve system reliability. Risk reduction can also be tracked over time to continually update their risk profile and support assessment of long term planning based on utilities’ upgrades and improvements. Periodic key factor updates may be scheduled to easily refresh the visualization tool to reflect changed conditions and support on-going planning and decision making efforts.

This approach to systematic risk assessment can be applied to evaluating disaster events beyond fire, including, but not limited to, wind/storm, seismic, flooding and mudslides, as well as other components of the infrastructure system, including distribution, generation and communications.
Distribution Breakout Session 3 & 4: Business Processes, Optimization, Data Gaps & Risk Assessment

Chairs: Thor Hjartarson & Robert Otal, METSCO

Thor Hjartarson is an engineering leader with 25 years of professional experience in electrical and power engineering. He was recently the leader of a large asset management division with responsibilities for planning, smart grid engineering, reliability analysis, system studies, record management, data quality, mobility and GIS improvements. Mr. Hjartarson is one of the founders of the Health Index Methodology in utility asset condition assessment and has lead the comprehensive implementation of a risk based investment methodology at a major utility. In his previous consulting career, he has had experience with over 30 well known electrical power companies around the world.

Robert Otal is a Professional Engineer with over 10 years of experience working in the areas of asset management, risk management, strategic long-term and short-term investment planning, and IT solutions. Mr. Otal has led the development of distribution system plans to support the justification of investments as a part of electricity distribution rate filing applications. Robert has led the development and delivery of strategic engineering projects to optimize processes and improve justification and decision-making as part of asset management planning procedures. His areas of interest include risk based analysis and the optimization of distribution systems. Robert takes an active role in the engineering profession and is a member of the IEEE.

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<td>Transition from Time Based to Condition &amp; Risk Based Asset Replacements</td>
<td>Jon Foreshew, Oakville Hydro</td>
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<td>Re-Evaluation of National Grid's Critical Scoring Model</td>
<td>Mike Porcaro, National Grid</td>
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Subject Matter Experts

Jon Foreshew, Oakville Hydro

Jon Foreshew is the Manager of Asset Management at Oakville Hydro. Over 9 years at Oakville Hydro, Jon has held various roles within the Engineering, Operations and Asset Management departments. Jon’s current focus is developing asset replacement strategies to ensure long term sustainability of the organization. Jon is active in business strategy development, the lead for corporate enterprise risk management and has primed many cross functional Business Excellence initiatives within the organization.

Abstract: To improve reliability and customer satisfaction while maintaining a competitive rate structure, Oakville Hydro is continually advancing their decision making for asset replacements. Transitioning from time based to condition and risk based asset replacements, Oakville Hydro performs predictive analysis to develop long term asset lifecycle strategies. They will share details of this business process change, their risk assessment approach, data gaps, lessons learned along the way and the next steps for the program.

Mike Porcaro, National Grid

Mike Porcaro is currently the Western Massachusetts Manager for the Distribution Planning and Asset Management department at National Grid. Engineers in Michael's group perform short-term and long-term planning & engineering analyses of electric systems. Their team additionally conducts system impact studies examining new Distributed Generation proposed for interconnection. Prior to Michael's time at National Grid, he spent 10 years at Vanderweil Engineers in South Boston as an engineer overseeing designers and drafters developing drawings for commercial building electrical designs. Example Projects included stadiums, data centers, laboratories, and college campuses, among others. Prior to Vanderweil, Michael worked at Eaton Electric for approximately 2 years, performing engineering support for field service work, which provided him with invaluable experience and exposure to field conditions and real-world design realities & challenges.

Michael completed his Undergraduate studies at Worcester Polytechnic Institute in 2004, where he graduated with distinction with a degree in Electrical Engineering, & a minor in Management Information Systems. He has since completed a Master's of Engineering Degree in Power Systems at Worcester Polytechnic Institute. He is also a licensed Professional Engineer in two states, and a holder of LEED AP accreditation in Building Design and Construction.

Abstract: In order to ensure the safety and reliability of the underground network system, National Grid has re-evaluated its critical scoring model for such systems. Through the evaluation of data such as area walking scores, equipment age, and sensible infrastructure development opportunities, National Grid seeks to better quantify the needs of its underground systems.
Robert Otal, METSCO

Robert Otal is a Professional Engineer with over 10 years of experience working in the areas of asset management, risk management, strategic long-term and short-term investment planning, and IT solutions. Mr. Otal has led the development of distribution system plans to support the justification of investments as a part of electricity distribution rate filing applications. Robert has led the development and delivery of strategic engineering projects to optimize processes and improve justification and decision-making as part of asset management planning procedures. His areas of interest include risk based analysis and the optimization of distribution systems. Robert takes an active role in the engineering profession and is a member of the IEEE.

Abstract: Underground cables remain a high risk asset for distribution utilities, due to the many degradation modes that can result in cable failure, coupled with substantial financial and customer impacts when an outage takes place. At the same time, it is critical for utilities to possess a data-driven strategy when replacing their underground cable population, due to the prohibitive costs and scrutiny that these investments are subjected to by both internal and external stakeholders.

Cable replacements can be prioritized based on asset condition and failure impact assessment approaches, whereby failure probability and impact are determined for each cable segment in order to quantify a risk of failure. Optimal timing of the cables replacement is based upon a balance of risk (including socio-economic criteria) and the necessary capital investments to offset these risks, whether through injection or cable replacement.

Unique data optimization techniques, such as censoring and truncation, can be applied to cable demographics and failure data in order to derive statistically sound failure probability curves for cables with different failure history. Cable failure modes can account for typical financial, customer (outage durations), environmental and safety impacts, and take into consideration feeder configuration and protection schemas to determine exact customer and load impacts for each cable segment.

From these results an optimal timing to intervene can be derived for each cable segment, along with the economically effective mitigation strategy – whether to replace the cable outright, or rejuvenate the cable using cable injection techniques, or just let the cable run to failure.

In addition, the failure probability curves can be used to derive the total reactive spending, total expected failures as well as forecasted reliability outcomes over a long-term period. Combination of engineering and economic principles can be applied on a system-wide basis for cables to derive the long-term investment strategy, which can be adjusted to account for system, resource and rate setting constraints.

Through this approach, utilities are able to develop the cable management program to prudently justify their investments to both internal and external regulators in a quantified manner in order to derive the most cost-effective investment program.
Session 5: Condition Assessment for Various Components, Including Techniques and Technologies

Session Chairs:

Andy Stewart, EDM International & Mehrnoosh Janbakhsh, Saskatoon Light & Power (8:45am - 9:45am)

Andy Stewart joined EDM International, Inc. in 1983 and is currently the company’s President. He holds a Bachelor of Science in Civil Engineering from the University of Rhode Island and a Master of Science in Civil/Structural Engineering from Colorado State University, where he helped develop reliability-based design procedures for transmission lines. Andy’s career encompasses engineering and Research & Development related to power delivery infrastructure and he holds several related patents. He chairs the IEEE Working Group on Management of Existing Overhead Transmission Lines where he recently led the formation of a Task Force on application of Unmanned Aerial Systems (UAS) to overhead lines. His Working Group has also developed guidelines to assist utilities in responding to the NERC Alert, and IEEE standards for collecting and managing inspection and maintenance data. Andy is a Director of Intec Services, Inc., a leading provider of T&D maintenance services, and a member of ASCE and the NACE/IEEE Joint Committee on corrosion of utility assets.

Mehrhoosh Janbakhsh, is a T&D senior project management engineer with Saskatoon Light & Power, in Saskatoon, Saskatchewan, Canada. She received her Electrical engineering Bachelor degree from Iran in 1997 and Master of engineering from University of Saskatchewan in 2011. She has about 18 years of experience in Telecommunications and power engineering. The distribution team that she is leading them now are responsible for any overhead & underground designs, customer connects along with updating the material specifications, and operations department technical support.

Abstract: This session will outline the inspection and assessment techniques that are currently being used to evaluate the condition of several categories of transmission and distribution assets such as structures/poles, conductors, insulators, etc. The session will also explore the technologies on which the inspection techniques are based and review their capabilities and limitations. In addition, promising new concepts and technologies that may advance inspection and assessment capabilities for various categories of assets within the next 10 years will be discussed.
Session 6: How to Develop Health Indices & Assess the Likelihood of Failure

(10:15am - 11:00am)

Session Chair:

Yury Tsimberg, Kinectrics

Yury Tsimberg is a Director of Asset Management with Kinectrics Inc., where he has been leading consulting services in Asset Management business area for several years. He has led successful completion of a number of Asset Management projects across North America, taught Asset Management courses world-wide, and has presented at many industry conferences and forums. Prior to joining Kinectrics, Yury spent 30 years with Ontario Hydro and Hydro One, where he worked in various electrical utility transmission and distribution business areas, including Asset Management, System Planning, Operations, M&A, Regulatory, Transmission Line Maintenance, and Customer Service. In his last position with Hydro One, Yury was a Manager of Asset Strategies and Standards Department, where his accountabilities included development of asset specific strategies, standards & policies for transmission and distribution assets, and the creation of new customized applications and tools for enabling utilization of “state-of-the-art” Asset Management techniques and methodologies.

Utility driven efforts in this area are well represented in this session, as 5 major North America utilities share their experience with condition data selection and the use of this data in making investment decisions. This presentation will introduce discussion to be shared during the breakout session, from Tucson Electric Power, Bonneville Power Administration, Hydro One, CentrePoint Energy and Duke Energy, after which, it will touch upon types of data/information typically gathered for transmission lines, and discuss how this fits into developing a Heath Index and the integration of system sustainment and planning needs.

Abstract: In order to sustain existing asset base in a cost-effective manner, investment decisions should be made based on asset condition rather than age. Health Indexing is one of the most widely industry accepted approaches to estimating the condition of assets based on available testing and inspection data/information, as well as exposure to stresses. Unfortunately, unlike station assets, transmission line assets are spatially distributed, which could cause the condition of various sections of the line to be different. At the same time, significantly less condition data and information is typically available for transmission line assets in comparison to station assets. Accordingly, it is important to utilize the available condition data and information to the fullest extent possible.

Yury acted as the Canadian member of the international panel revising PAS 55 specification and was the only Canadian member on the NERC Committees developing North American transmission planning standards. He is currently Canadian representative and management team member as Asset Management Convener at CIGRE Study Committee SC1 “System Development and Economics”. Yury holds a Bachelor of Applied Science and a Master of Engineering Degrees in Electrical Engineering from the University of Toronto, and he is a Registered Professional Engineer in the Province of Ontario, Canada.
Session 7: New Technologies and Industry Trends  
(11:00am - 12:00pm)

Session Chair: Richard Brown, Exponent

Richard Brown is the Director of the Engineering Management Consulting Practice at Exponent. He has published more than 90 technical papers related to asset management and performance management. Richard is the author of several books, including “Business Essentials for Utility Engineers” and “Electric Power Distribution Reliability” He is a registered professional engineer, and finally, Richard is a Fellow of the IEEE.

Richard earned his BSEE, MSEE, and PhD from the University of Washington in Seattle, and his MBA from the University of North Carolina at Chapel Hill.

Abstract: The maintenance of transmission and distribution lines has historically been accomplished through a combination of periodic inspections, periodic maintenance, and run-to-fail. Two factors are moving both transmission and distribution increasingly towards condition-based maintenance, where the condition of a component is periodically assessed and maintained accordingly. The first factor is the increasing importance of reliability for both transmission and distribution. The second factor is the advancement of technologies that enable condition assessment to be more varied, more accurate, more actionable, and more cost-effective. This session will cover the recent trends and emerging technologies in transmission and distribution line condition-based maintenance.

Breakout Sessions (1:30pm – 3:15pm)

The Conference Attendees will divide into three breakout sessions to discuss the topics in more detail. Sessions 5 and 6 will be merged, and divided again into transmission and distribution. Subject Matter Experts (SME’s) from Transmission and Distribution sessions 5 and 6 will share brief high-level presentations, after which, the audience members will participate in a focused discussion identifying and prioritizing knowledge gaps. Session 7 will encompass both, Transmission and Distribution topics. Session 7 will highlight new technologies and methods to acquire condition data and to better manage information. These technologies will be presented by experts in their application with some time set aside for questions and answers.
Transmission Breakout Session 5 & 6: Acquisition of Condition Information and Inputs into Planning

Chair: Yury Tsimberg, Kinectrics

Yury Tsimberg is a Director of Asset Management with Kinectrics Inc., where he has been leading consulting services in Asset Management business area for several years. He has led successful completion of a number of Asset Management projects across North America, taught Asset Management courses world-wide, and has presented at many industry conferences and forums. Prior to joining Kinectrics, Yury spent 30 years with Ontario Hydro and Hydro One, where he worked in various electrical utility transmission and distribution business areas, including Asset Management, System Planning, Operations, M&A, Regulatory, Transmission Line Maintenance, and Customer Service. In his last position with Hydro One, Yury was a Manager of Asset Strategies and Standards Department, where his accountabilities included development of asset specific strategies, standards & policies for transmission and distribution assets, and the creation of new customized applications and tools for enabling utilization of “state-of-the-art” Asset Management techniques and methodologies.

Yury acted as the Canadian member of the international panel revising PAS 55 specification and was the only Canadian member on the NERC Committees developing North American transmission planning standards. He is currently Canadian representative and management team member as Asset Management Convener at CIGRE Study Committee SC1 “System Development and Economics”. Yury holds a Bachelor of Applied Science and a Master of Engineering Degrees in Electrical Engineering from the University of Toronto, and he is a Registered Professional Engineer in the Province of Ontario, Canada.

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<td>Acquisition of Condition Information and Inputs into Planning</td>
<td>Natasha Gentry, Bonneville Power Admin.</td>
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<td>The Value of Nondestructive Testing for Unknown Transmission Foundations</td>
<td>Rakesh Khan, FDH</td>
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<td>Refurbishment Prioritization of Transmission Lines Using Priority Risk Indices (PRI)</td>
<td>Ibrahim Hathout, Hydro One</td>
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Subject Matter Experts

Dan Chapoton, Duke Energy

Dan Chapoton is a Lead Engineer at Duke Energy in Transmission Asset Management and has over 30 years of experience at Duke. Dan began his career in 1986 as a transmission line design engineer and in 2000 moved to transmission maintenance in both hands-on and engineering support roles. In 2005 he moved to transmission asset management, first in a field support role and most recently to the Equipment Engineering Unit. He is responsible for both the overhead and underground preventative maintenance inspection programs across all Duke Energy regions. Dan has a B.Sc. in Civil Engineering from NC State University and is a registered professional engineer in the State of North Carolina.

Abstract: Dan’s accountabilities include providing strategic guidance for line maintenance of aged components for 30,000 miles of overhead and underground lines in the 6 states that make up Duke Energy. He is challenged in evaluating practices and standards from their legacy companies with the goal of creating a common “One Transmission” strategy at Duke Energy. This strategy requires having an accurate accounting of the component assets and their respective locations, and a thorough knowledge of how implementing work programs must dovetail with ongoing construction projects and other initiatives.

He is also responsible for identifying the needed PM’s for line assets and their frequencies. Industry norms, other utility practices, and Duke Energy’s own knowledge all contribute to the right answer. Infrared, pole inspections, switch maintenance, and underground pipe type cable inspections are typical PM activities. Accomplishing all of this with limited O&M funding has been a huge challenge as Duke Energy tries to get more done with less money. Dan also interfaces with various utility commissions who mandate certain PM’s and frequencies. It is important that he does this while very diligently acknowledging the unique legacy of each of the companies that now comprise Duke Energy.

Natasha Gentry, Bonneville Power Administration

Natasha Gentry is the Manager of the Transmission Line Design Group at Bonneville Power Administration. She has more than 10 years of experience with transmission and distribution utilities in the areas of line design, clearance analysis, and transmission line component health. Natasha holds a Bachelor of Science Degree in Mechanical Engineering from Washington State University and a certificate in Transmission and Distribution Engineering from Gonzaga University.

Abstract: As transmission assets age and reach their end of life it becomes essential to collect and assess condition information and prioritize corrective work to ensure the continuing reliable and safe operation of the transmission grid. This presentation will discuss the approach used by BPA Transmission for conditional data collection, guidance provided to the maintenance staff for scoring asset health, and the prioritization criteria used by engineering and asset management groups for the programmatic planning of preventive and corrective work.
Abstract: Planning for maintenance activities involves employing the right people to the appropriate locations at the right time with the required tools, equipment and materials. Planning is not a silver bullet to solve maintenance issues but rather an enhancement that can transition the department from being reactive to proactive. Planning is one step in the condition based maintenance approach, which identifies future failures before they become breakdowns. By planning maintenance activities a maintenance department is able to increase equipment reliability, improve regulatory compliance and efficiencies, and reduce maintenance costs.

There are hurdles that need to be cleared when starting a maintenance planning strategy, including the resistance to change. As the results are not immediate, it takes time to show the value of a maintenance planning strategy. There may also be some upfront costs when developing the planning process, which may include training of personnel, investment in a work management system, as well as an increase in inspection activities. Maintenance planning can also force departmental reorganization and can change functions of certain positions.

Several difficulties associated with development of a planning function within the Tucson Electric Power (TEP) T&D Group include the resistance to change, labor agreements and organizational changes. Backlog management has its own challenges because of historical work orders and record keeping techniques. The types of inspections and their recording practices also don’t always provide useful information for the planning process. Work is being accomplished and the organization is moving forward, but it just takes time. Maintenance planning provides an organization with the ability to truly assess backlog and determine the amount of maintenance required. Planning opens communication channels between maintenance, operations and purchasing since activities are discussed in advance instead of solely in the event of an emergency. Planning can also help to determine manpower levels and allow the organization to assess the required work force based on system backlog, as well as help develop the budget, breaking down the required Capital and O&M.
Ibrahim Hathout, Hydro One

Ibrahim Hathout received a B.Sc. degree in Civil Engineering from Cairo University (Distinction with highest honor), and M.Sc. and Ph.D. degrees in Civil Engineering from the Universities of Windsor and Waterloo. He is currently the Senior Manager of the transmission engineering department at Hydro One. The department has 60 professionals responsible for all transmission line designs and station civil, mechanical and structural designs. Dr. Hathout has extensive experience in design, maintenance, rehabilitation and reliability analysis of structures. His research interests include reliability assessment, applications of fuzzy logic, neural networks, and expert systems for the damage assessment of existing structures. He has published over 55 technical papers in the general area of structural engineering and has written two chapters in reference books.

Dr. Hathout is the recipient of many prestigious scholarships and awards and is serving on several IEEE committees and working groups including the CSA C22.3 No.1 committee. Dr. Hathout was the 2012 recipient of the Hydro One President award for innovation.

Abstract: In the era of privatization, optimizing resources for refurbishing, upgrading, and maintaining transmission lines is of critical importance. Utilities and asset owners are turning their attention to return on assets (ROA) and asset management. System safety and uptime remain of prime importance. Hydro One, as with all other utilities, is limited in its means, as it is required to manage operations and maintenance costs. This paper introduces a new model and the associated computer program, for the prioritization of existing overhead transmission lines, for maintenance, or refurbishment. The model calculates the Priority Risk Index (PRI), which is the product of the line failure probability, line condition function, and cost of failure function. The failure probability of a line section is calculated using Monte Carlo Simulations, assuming that the line section is damage free. For a section between two dead-end towers, the limit state equation assumes that the line resistance is a random variable modeled using normal distribution. The resistance distribution of a line section is calculated using the maximum capacities of the suspension towers between the two dead-end towers. The environmental loading (demand) on the line is modeled as random variable using Gumbel or Gamma distribution.

The line condition function is obtained by combining the conditions of the line components using fuzzy weighted average formula. The components’ conditions are obtained using visual inspection, testing, age, and maintenance history of the line. In addition, tools have been developed to assist in determination of actual condition of the line components. One such tool is the image analysis expert system which allows the engineer to evaluate the actual structure condition by analyzing digital images of the existing steel towers.

The cost of failure function is a complex fuzzy function of many parameters, such as public safety, load supplied, impact on customers and system, etc.

The proposed computer model will allow asset owners and managers to optimize the use of available resources to achieve the maximum overall return on investment by allocating funds for the lines with highest Priority Risk Indexes (PRI). Illustrative example is presented.
**Distribution Breakout Session 5 & 6: Acquisition of Condition Information and Inputs into Planning**

**Chairs: Mehrnoosh Janbakhsh, Saskatoon Light & Power & Andy Stewart, EDM International**

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**Andy Stewart** joined EDM International, Inc. in 1983 and is currently the company’s President. He holds a Bachelor of Science in Civil Engineering from the University of Rhode Island and a Master of Science in Civil/Structural Engineering from Colorado State University, where he helped develop reliability-based design procedures for transmission lines. Andy’s career encompasses engineering and Research & Development related to power delivery infrastructure and he holds several related patents. He chairs the IEEE Working Group on Management of Existing Overhead Transmission Lines where he recently led the formation of a Task Force on application of Unmanned Aerial Systems (UAS) to overhead lines. His Working Group has also developed guidelines to assist utilities in responding to the NERC Alert, and IEEE standards for collecting and managing inspection and maintenance data. Andy is a Director of Intec Services, Inc., a leading provider of T&D maintenance services, and a member of ASCE and the NACE/IEEE Joint Committee on corrosion of utility assets.

**Mehrnoosh Janbakhsh**, is a T&D senior project management engineer with Saskatoon Light & Power, in Saskatoon, Saskatchewan, Canada. She received her Electrical engineering Bachelor degree from Iran in 1997 and Master of engineering from University of Saskatchewan in 2011. She has about 18 years of experience in Telecommunications and power engineering. The distribution team that she is leading them now are responsible for any overhead & underground designs, customer connects along with updating the material specifications, and operations department technical support.
Ed Mah is the Team Lead for Distribution Lines Asset Sustainment at BC Hydro. Ed has been with BC Hydro for over 13 years and has led projects related to design process improvement and field resourcing strategy in addition to his various asset sustainment responsibilities. Prior to joining BC Hydro, he was a Power Supply and Distribution Design Engineer at a transit system manufacturer/integrator. Ed started his career in Infrastructure Electrical Systems Design as a Project Engineer. He is a registered Professional Engineer in the province of British Columbia and holds an Electrical Engineering degree from the University of British Columbia.

Abstract: A disciplined approach in executing distribution lines inspections and data collection delivers invaluable information for planning and prioritizing future maintenance and capital investment. This includes using field technologies which integrate to enterprise systems to ensure planners have a clear picture of the asset population and their current condition. BC Hydro takes this approach using certified inspectors and a GIS based field application which passes information directly to our asset register. The data collected is then used to generate asset health indices, predict long term capital investments and provide asset defect information for short term maintenance and capital work allocation.

Dan Dodkin received his Bachelor of Science in Electrical Engineering from the University of Saskatchewan in 2003. Dan is currently a Senior Engineer in Transmission & Distribution Asset Management at ENMAX Power Corporation in Calgary, Alberta where he previously held positions in Construction Standards and Customer Projects. Dan is registered as a Professional Engineer in the Province of Alberta.

Abstract: This study firstly discussed the two general methods for asset health indices development: Weibull distribution method and condition assessment method. It clarified the reasons Weibull distribution method was chosen for ENMAX’s distribution pole health index development. Then it systemically discussed the failure data used for this study and the statistical method for generating Weibull distribution based on the selected failure data. Furthermore, the resulted service life was compared with a regional pole deterioration study performed by Oregon State University. Finally the obtained health indices were presented demographically and compared to ENMAX’s current pole maintenance/replacement strategies.
Jerry Ivey, Duke Energy

Jerry Ivey graduated from Clemson University with a BSEE in 1986. He has been working at Duke Energy for 31 years with various engineering, planning, research, and supervision responsibilities. His current role is Principal Engineer in the Distribution Power Quality, Reliability and Integrity Organization. Jerry has been married for 21 years to Carol Ivey with three children Drew, Gina and Kyle.

Abstract: Jerry will discuss Duke Energy’s Enterprise Distribution System Health Tool that will help with planning, creating efficient analyses, easier visualization and accessible reports to improve reliability.

Steve Norman & Eric Bergstrom, HBK Engineering

Donald Kleyweg has over 20 years of experience in the planning, design and construction of utility infrastructure with small and large scale multi-year project programs. Don has led HBK’s professional engineering staff in their performance of constructible and efficient utility infrastructure design and in the application of new technologies for advanced field data collection and infrastructure mapping.

Eric Bergstrom has worked in the utility industry for over 20 years designing and constructing for multiple utilities in dense urban areas. His utility experience ranges from telecommunications to gas and power transmission and distribution. Eric’s focus with HBK has been in the area of strategic business initiatives, including GIS and software solutions development in support of utility infrastructure programs.

Abstract: ComEd’s Infrastructure Modernization Act Programs represent a bundle of system upgrades through accelerated investment to address aging distribution infrastructure, storm hardening and expand smart grid technology. The goal is to upgrade ComEd’s underground electrical infrastructure to improve system reliability. The most complex infrastructure investment is the Manhole and Mainline Cable Program. The manhole portion of the program targets the assessment and refurbishment of approximately 32,000 manholes system wide. The cable portion targets cable in the City of Chicago and surrounding suburbs. The plan is to replace 599 miles of cable, of which 578 miles is housed in the conduit and manhole system.

The program requires collecting over 200 data points for each of the 32,000 manholes. The data includes the corrective maintenance required (hardware supporting the cable), identification of any defects in the cable and joints, and the structural conditions of each manhole. A by-product benefit was the integration of manhole locations into the data collection. The main challenge was to develop a tool to collect the manhole data during the assessment process. This tool needed to house data that could be retrieved at a later date to schedule cable replacement, track refurbishment material and review structural integrity. Additionally, the tool had to document the condition of the manholes both before and after refurbishments. The tool needed to be dynamic to support “desk” side review of the manholes for cable replacement planning. Finally, it had to coordinate street, utility and resurfacing project locations being performed in the City of Chicago in order to minimize impacts to residents and businesses.
Breakout Session 7: New Technologies and Industry Trends - Transmission & Distribution

Chair: Richard Brown, Exponent

Richard Brown is Director of the Engineering Management Consulting Practice at Exponent. He has published more than 90 technical papers related to asset management and performance management; is author of the books Business Essentials for Utility Engineers and Electric Power Distribution Reliability; is a registered professional engineer; and is a Fellow of the IEEE. Richard earned his BSEE, MSEE, and PhD from the University of Washington in Seattle, and his MBA from the University of North Carolina at Chapel Hill. He is a registered professional engineer.

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Smart Insulators for Live Monitoring Of Leakage Currents On Transmission Lines

Mr. Jean Marie George received his Electrical Engineering Degree from the HEI School in France and joined Sediver’s R&D team as Research Engineer in 1986. After working as Production Manager for the Composite Insulator Division as well as Quality Manager and Technical Director for North America, he currently serves as Scientific Director, with a scope of responsibilities covering all R&D and technical assistance activities worldwide. His cross-functional positions together with more than 30 years of professional experience have given him extensive expertise in insulator performance as well as research and development. He is an active member of CIGRE, IEEE, NEMA, ANSI and CSA.

Abstract: The impact of contamination of overhead line insulators by airborne dust deposits or salt fog conditions remains a potential threat for the continuity and stability of quality power delivery. Insulators themselves can be selected properly to deal with such conditions either through specific shapes and leakage distances, or by using hydrophobic materials such as silicone coatings or housings designed to keep leakage currents at low values. Pollution related flashovers are the result of excessive surface currents and maintenance teams often lack the information of critical threshold levels dictating washing cycles or other maintenance operations.

This presentation will describe a new technology where a toughened glass insulator designed with an integrated sensor communicating with a dedicated proximity network will have the ability to transfer data directly through the internet to a website where maintenance crews can see the leakage current and subsequently make the proper diagnostics and decisions. A description of the electronics and methodology will help understand the potential of this innovative technique where an insulator all by itself can manage the combination of the measure of the current and the communication to the user in an effective way.
Nicolas Pouliot, Hydro-Québec - IREQ

The Latest Advancements in LineCore Sensor Deployment Methods

Nicolas Pouliot is a mechanical engineer with a Masters Degree in Robotics and Mechanism Design. Following five years in the aerospace industry, he joined Hydro-Québec’s research institute, IREQ, in 2002. As an R&D project leader in the Inspection and Maintenance Robotics unit, he has been in charge of developing, testing and deploying various robotic solutions for challenging power line inspections, including LineScout and several non-destructive testing (NDT) technologies. Nicolas currently coordinates a team of 20 technicians and engineers that is dedicated to sensor and robot design, integration and navigation, testing and inspection projects in the field of T&D.

Abstract: In certain areas, the inner steel core of ACSR tends to thin over time. Corrosive environments, such as polluted sectors around industrial complexes, coastal salty air or in proximity to high-traffic roads that are de-iced during winter seasons, will tend to accelerate degradation. When this situation is overlooked to the point where the zinc layer no longer exists, steel corrosion occurs, reducing the overall strength of the conductor. Some spans are more affected than others, which means that taking samples from each span for destructive assessment is not an option. Consequently, a non-destructive testing approach that uses various sensor technologies appears to be the more logical approach.

Based on the Eddy Current Testing Method, LineCore technology was developed as a simple way to assess the progression of zinc thinning. Over the years, LineCore has been used on various types and sizes of conductors, and it has proven its value in identifying the critical areas. The unit is battery operated, transmits its data directly to the ground in real-time, and is very compact and lightweight. Being supported by its own sets of wheels, LineCore sensor was originally simply pulled by a rope or tugged by a teleoperated rover (such as LineROVer), allowing single-conductor spans to be assed efficiently. When obstacles are located on the span being examined, such as aerial markers or spacers in bundled-conductor spans, LineCore can also be installed onto the LineScout teleoperated robotic platform, making use of the LineScout’s capability to cross such obstacles. This allows the scanning of several consecutive spans in an efficient manner.

The latest and most innovative approach to deploy LineCore onto the grid was recently demonstrated: a custom-configured drone was fitted with a lighter version of LineCore and was safely landed onto a full scale transmission line. Once the sensor begins monitoring the ACSR inner condition, a set of motorized wheels...
Abstract: The application of digital asset management strategy to electricity distribution networks to drive asset performance has traditionally been encumbered or even precluded by poor asset information. Physical location, asset ID, age, rated capacity, connectivity and dependencies, performance (reliability, condition, serviceability), work records, design drawings, and asset imagery may all be absent, or held in disparate systems. Asset context, such as topology, clearances to vegetation and hard features, and dynamic changes over time, may also be lacking.

An increasing number of utilities are solving these challenges through the adoption of new technologies that deliver a cost-effective means of correcting or renewing asset information, with significant and demonstrable net benefits. This paper firstly provides a technical review and examples of digital asset management using 3D techniques. Case studies are then introduced to explain how three large electricity distribution utilities are deploying digital asset management to decrease asset maintenance costs and drive efficiencies on more than 100,000 miles of network. A detailed examination of the key technical components required to implement a digital asset management approach is then provided. This paper demonstrably concludes through the case study examples that obtaining 3D asset position and condition information as part of a digital asset management strategy drives intelligent decision making. This should be a key consideration for anyone applying asset management theory to distribution networks.
Predictive Maintenance and Machine Learning for Transmission Structure Corrosion Management

John Cancian has over 20 years of experience in utilizing analytics methods within a variety of engineering and business contexts, and is currently responsible for quantitative risk management solutions at Osmose. Previously, John led the Command and Telemetry team for the International Space Station and was the Infrared Discipline Chief at Pratt & Whitney, where he was responsible for the computational design for infrared signatures and material properties in aerospace applications. John has a B.Sc. in Engineering from the University of Connecticut, an M.Sc. in Aerospace Engineering from the University of Minnesota, an MS in Aeronautics and Astronautics from Stanford and an MS in Mechanical Engineering from Yale University.

Benjamin Butera has 12 years of experience in the energy sector utilizing data to automate and optimize various utility maintenance processes, and is responsible for product development at Osmose. Ben has first-hand experience designing workflows and software to capture, manage and process infrastructure condition data on telecommunications, distribution, transmission and transmission corridors. Previously, Ben was responsible for solution design at Clearion Software, a company specializing in utility vegetation management and risk management.

Abstract: The identification of corrosion damage in below grade structures and anchors is a challenge that traditionally involves significant cost and manual labor. In the gas pipeline industry, where the recognition of corrosion issues is widespread, technologies and methodologies for corrosion inspection have been optimized so that the need for direct inspection (and the associated excavation, labor and cost) is greatly reduced. Unfortunately, these technologies and methodologies do not translate well into the world of electric transmission towers due to
Increasing Unmanned Aircraft Inspection Efficiency Through Automation

Alex Babakov, P.Eng., received his Bachelors Degree in Engineering Physics from the University of British Columbia and is a registered Professional Engineer in the Province of British Columbia. Over the past 12 years, he has been employed as an electrical engineer with a focus on T&D Asset Management, Inspection and Testing. He has held positions at Powertech Labs and worked on the research and development of condition assessment techniques and tools for transmission and distribution utility equipment. Currently at Aeriosense Technologies, Alex leads the development of drone based inspection tools for infrastructure inspection. Alex has authored and contributed to reports and articles for CEATI, CIGRE, and T&D World.

Abstract: Unmanned Aircraft Systems (UAS) have the potential to provide a safe, cost effective alternative to the conventional inspection methods of overhead transmission infrastructure. However, current implementation of UAS have been limited to one-off inspections. A key factor preventing more widespread UAS inspections is the prohibitive cost. Requirements for a skilled drone pilot and manual navigation around transmission structures presents a significant challenge in reducing the cost of inspection.

During a recent inspection project, Aeriosense Technologies utilized an automated inspection process to perform visual and thermal inspection of an 18km long, 138 kV transmission line in Northern BC, Canada. The preliminary results show that the automated inspection is able to significantly reduce the cost of drone inspection compared to conventional methods, making drone inspection economically feasible. The automated inspection method provides the inspector with a flight control software and a flight path that targets the key locations and components on the transmission structure. The UAS automatically executes the flight plan, while the inspector is free to monitor the video feed and report their findings through the integrated reporting form.

Non-Contact Transmission Line Monitoring using EMF Sensors

Dr. Nathan Pinney leads technology and software development for non-contact electric transmission line monitoring at Genscape Inc. As a member of the R&D team since 2013, Dr. Pinney designs hardware and software solutions to provide real-time power grid awareness centered on Genscape’s novel EMF-based approach. He holds a PhD and MS in Computational Materials Science from the Materials Science Program at the University of Wisconsin-Madison, and a BS in Physics from the University of Kentucky. Nathan is a member of the IEEE Overhead Lines Subcommittee and the Corona and Field Effects Work Group.

Abstracts: Ground based electromagnetic field (EMF) sensor technology has long been used to monitor real-time flows on transmission lines throughout the U.S. This technology has now been further developed and is being deployed by utilities to accurately monitor advanced line parameters for increased asset condition awareness and intelligent utilization. Monitored parameters include current, sag (clearance), blowout (horizontal movement), conductor temperature, Power Factor, Dynamic Line Rating, and the detection of icing and galloping. The monitoring system utilizes ground level based EMF sensors, thus requiring no outages, allowing for simple installations and relocations while reducing install time, risk and cost. The presenters will discuss how this technology works, installation considerations, example transmission conductor assessments, how utilities have deployed the technology, and provide an analysis of specific results.
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