Conference Overview

In order to increase efficiency, minimize resistance losses over long distances and reduce costs, utilities have a vested interest in exploring High-Voltage Direct-Current (HVDC) options and in building Extra High Voltage Alternating Current (EHV AC) transmission lines to deliver power economically from remote, often resource-rich locations to the cities where the majority of people work and live.

Exceedingly high standards of engineering are vital to guarantee the safety, reliability, sustainability and cost-effectiveness of these transmission assets, as well as the obligation to ensure compliance with the aesthetic and environmental demands and constraints. To successfully achieve an optimal design requires a thorough understanding of the wire and support systems, including the numerous factors which influence the electrical and mechanical design aspects of the components within these systems.

This Conference shall provide the industry with state-of-the-art information on the best practices for design, construction and maintenance of EHV transmission lines through eight featured sessions led by the experts and authors of CEATI’s report entitled, “Best Practices Guide for the Design of 230kV to 765kV Overhead Transmission Lines”. The Breakout Sessions provide attendees with an excellent platform to exchange knowledge and information on new initiatives and recent technological advancements.

Sessions

- Electric and Magnetic Fields, Noise and Interference Issues in EHV Line Design – Gaps and Challenges
- Insulation Coordination in EHV Line Design
- Lightning Issues, Design Challenges and Mitigations
- Application of Non-Destructive Evaluation, Robotics and UAS in EHV Line Inspections and Component Evaluation
- Optimization of the Conductor Selection Process – Issues and Challenges
- Management of EHV Line Assets
- Mechanical Design of EHV Lines - Issues and Challenges
- Advances in HVDC Technologies

For more information visit, www.ceati.com/TX2016
### DAY 1 • November 1, 2016

#### 8:00 – 8:40 Registration & Breakfast - Exhibition Hall

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<th>Event Description</th>
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<tr>
<td>8:40 - 8:50</td>
<td>Opening Remarks &amp; Welcome Address</td>
<td>Dr. Asim Haldar, Conference Chair</td>
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<tr>
<td>8:50 - 9:00</td>
<td>Conference Overview &amp; Expected Results</td>
<td>George Juhn, Conference Vice-Chair</td>
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<tr>
<td>9:00 – 10:00</td>
<td>Key Note Speaker: Best Practices in EHV Line Design &amp; Asset Management</td>
<td>Dr. Robert Stephen, ESKOM (South Africa)</td>
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#### 10:00 – 10:30 Morning Break - Exhibition Hall

#### 10:30 – 11:15

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<tr>
<td>10:30 – 11:15</td>
<td>Session 1: Electric and Magnetic Fields, Noise and Interference Issues in EHV Line Design - Gaps and Challenges</td>
<td>Antony Britten, Gibb Africa (South Africa)</td>
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#### 11:15 - 12:00

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<td>11:15 - 12:00</td>
<td>Session 2: Insulation Coordination in EHV Line Design</td>
<td>Dr. Igor Gutman, STRI AB (Sweden)</td>
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#### 12:00 – 1:00 Lunch - Exhibition Hall

#### 1:00 – 1:40

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<tr>
<td>1:00 – 1:40</td>
<td>Session 3: Lightning Issues, Design Challenges and Mitigations</td>
<td>Dr. William Chisholm, METSCO (Canada)</td>
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#### 1:40 – 2:20

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<td>1:40 – 2:20</td>
<td>Session 4: Application of Non-Destructive Evaluation, Robotics and UAS in EHV Line Inspections and Component Evaluation</td>
<td>Andrew Stewart, EDM Intl. (USA), &amp; Dr. André Leblond, Hydro Québec TransÉnergie (Canada)</td>
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#### 2:20 – 3:00

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<tr>
<td>2:20 – 3:00</td>
<td>Session 5: Optimization of the Conductor Selection Process - Issues and Challenges</td>
<td>Dr. Dale Douglass, Douglass Power Consulting (USA)</td>
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#### 3:00 – 3:30 Afternoon Break - Exhibition Hall

#### 3:30 – 5:00

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<th>Time</th>
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| 3:30 – 5:00 | Breakout Sessions  
  - Session 1: Electric and Magnetic Fields, Noise and Interference Issues in EHV Line Design – Gaps and Challenges  
  - Session 2: Insulation Coordination in EHV Line Design  
  - Session 3: Lightning Issues, Design Challenges and Mitigations  
  - Session 4: Application of Non-Destructive Evaluation, Robotics and UAS in EHV Line Inspections and Component Evaluation  
  - Session 5: Optimization of the Conductor Selection Process – Issues and Challenges |

#### 5:00 – 5:05

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<tr>
<td>5:00 – 5:05</td>
<td>Day 1 Closing Remarks &amp; Announcements</td>
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#### 6:00 – 7:30 Reception - Conference attendees are invited. 
Cocktails and appetizers will be served in the exhibition hall.

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**Topics:***

- **Overhead Line Design & Extreme Event Mitigation (TODEM):** Extreme events mitigation, Maximizing utilization of existing transmission lines, Development of new technologies for transmission lines (monitoring, components life extension, new materials for conductors, structures, coating), Development of new transmission lines - constraints (environmental, visual, structural).

8:00 – 8:30 Breakfast - Exhibition Hall

8:30 - 8:35 Morning Announcements
John Sabiston, Conference Vice-Chair

8:35 – 10:15 Session 6: Management of EHV Line Assets
Robert Arthur, ESB Intl. (Ireland) & Ed Watson, Southern Company (USA)

10:15 – 10:45 Morning Break - Exhibition Hall

10:45 – 11:30 Session 7: Mechanical Design of EHV Lines - Issues and Challenges
Dr. Asim Haldar, CEATI International Dr. Leon Kempner, Bonneville Power Administration (USA) & Gopal Ji, PowerGrid (India)

11:30 - 12:15 Session 8: Advances in HVDC Technology
Dr. Dharshana Muthumani, Manitoba HVDC Research Center (Canada)

12:15 - 1:15 Lunch - Exhibition Hall

1:15 – 3:00 Breakout Sessions
• Session 6: Management of EHV Line Assets
• Session 7: Mechanical Design of EHV Lines - Issues and Challenges
• Session 8: Advances in HVDC Technology

3:00 – 3:30 Afternoon Break - Exhibition Hall

3:30 – 4:45 Reports from Eight Breakout Sessions
Session Chairs

4:45 – 4:55 Vote of Thanks
Aleksandra Modelewska, CEATI International

4:55 – 5:00 Closing Remarks
Dr. Asim Haldar, Conference Chair

Agenda subject to change without notice

CEATI Transmission Group Meetings

O/H Line Design & Extreme Event Mitigation
October 31
Room: Bayview 2/3

Transmission Line Asset Management
November 3-4
Room: Bayview 2/3

Power System Planning & Operations
November 3-4
Room: Crown Point
Dr. Asim Haldar received his Master’s and Ph.D. in Engineering from Memorial University of Newfoundland in 1977 and 1985 respectively, with a specialization in behavior of offshore structures. He has worked in the utility industry for over 35 years and recently retired from Nalcor Energy. Prior to his retirement, he was the Manager of Research and Development in the Engineering Services Division and was responsible for all engineering research activities. Additionally, he was also a lead engineer in the design and upgrading of more than 1500 km of existing and new HV and EHV lines.

Dr. Haldar is currently the Technical Advisor of CEATI’s Transmission Overhead Line Design and Extreme Event Mitigation (TODEM) Interest Group. He is an active member of the CIGRE Study Committee SCB2 (B2 23 on Foundations) and a Canadian delegate to IEC TC-11. He is the former Vice Chairman of Transmission System R & D Committee for the Canadian Electricity Association (CEA) and past Chair of TODEM (2006-08). Dr. Haldar has published over 80 technical papers and reports in his field of expertise (overhead line design issues and behavior of offshore structures). Dr. Haldar was a lead organizer and Conference Co-Chair of CEATI’s 2014 Conference on Line Design Asset Management.

Mr. 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 benchmarking studies on maintenance practices and cost on behalf of the TLAM group.

Mr. Sabiston is currently the Technical Advisor for CEATI’s Power System Planning & Operations Interest Group (PSPO). Prior to joining CEATI in mid-2014, John had a 36-year career with Hydro One Networks Inc. and its predecessor company, Ontario Hydro. John held various positions during his career mainly in the areas of power system planning and power system operations.

For his final five-years with Hydro One, he was Manager of Transmission Planning where he orchestrated numerous transmission projects with a cumulative value of $2 billion including a new 500 kV double circuit transmission line close to 200 km in length. He was heavily involved in assisting the proponents for a number of large wind and solar generation projects in connecting to the Hydro One grid in a safe, reliable and economic manner. He represented Hydro One on the Northeast Power Coordination Council (NPCC) for close to twenty-five years including a two-year stint as the Chair of the Task Force of Coordination of Planning (TFCP). He helped the NPCC in the adaptation of the mandatory NERC standards. John has a degree in Electrical Engineering from the University of Toronto and is a registered professional engineer in the Province of Ontario.
Dr. Rob Stephen was born in Johannesburg South Africa in 1957. He graduated from the University of the Witwatersrand in 1979 with a Bachelor of Science in Electrical Engineering. He joined Eskom Electrical Utility in 1980. Dr. Stephen holds both MSc, MBA degrees as well as a PhD in Objective Determination of Optimal Transmission Line Designs. He is currently the Master Specialist in the Technology Group in Eskom and is responsible for distribution and transmission technologies of all voltages covering both AC and DC. He is past chairman of Cigre SC B2 dealing with Overhead lines, is a member of the Cigre Steering Committee and has authored over 100 technical papers.
Session 1: Electric and Magnetic Fields, Noise and Interference Issues in EHV Line Design – Gaps and Challenges

The two separate topics of corona, audible noise (AN) and radio interference (RI) on one hand, and coupling and electromagnetic fields (EMF) on the other, are here combined into a single presentation. This will allow the line designer to better grasp the complex ways in which the key variables, in both categories, interact with each other, and how this can ultimately influence the choice of the line and conductor bundle configurations. Therefore, the presentation starts with a (very) brief review of the physical generation of corona and its manifestations; thereafter, it is explained how the corona variables and parameters affect the magnitudes of the magnetic field, electric field, and capacitive coupling. Coming out of this overview, brief reviews of somewhat counterintuitive, non-linear interactions will be given, for example, when the size of the conductor bundle is increased, the conductor surface gradient is disproportionately reduced, and so on.

Although much of the above theory and observations is quite well known, three aspects stand out, firstly judicious limitation of AN, secondly, RI is less important than it once was, and thirdly, limitation of EMFs remain critical, but questionable design targets. The corona/EMF interactions are illustrated by means of an introductory design study for a 500 kV double circuit tower. What is needed in complex design studies of this type is a consistent, systematic procedure for optimising a given design; this leads to the following topics for the afternoon breakaway: (a) Better ways of estimating fair-weather AN levels (b) Critical review and interpretation of international EMF standards (c) Determination of AN noise limits applicable to diverse environments (d) Mitigation of AN, EMF (e) Systematic optimisation procedure for corona and coupling requirements. The breakaway will explore the above technical points. An additional topic will be included; this will be as follows: why is there such a big difference between the ICNRP limits for exposure to magnetic fields (100 μT) and the low B field levels (a few μT) found to be significant in various epidemiological studies?

Session Chair

Antony Britten, Gibb Africa (South Africa)

A C Britten's entire career was spent in various technical positions in Eskom, the South African power utility, which gave him wide exposure in the high voltage and power electrical engineering disciplines. He retired in 2013, but has continued to work and consult on power transmission and corona topics. He was previously responsible for the selection of the corona and field effect limits, and confirmation of the insulation clearances for Eskom's first high altitude 765 kV transmission lines. He has contributed to the design of Eskom's compact 400 kV lines, and also to the refurbishment of the Apollo HVDC converter station. Mr. A. C. Britten holds graduate and post graduate degrees in electrical engineering as well a Graduate Diploma in Engineering. He is a registered Professional Engineer in South Africa and a distinguished member of Cigre.
Dr. José Antonio Jardini received his B.Sc., M.Sc. and Ph.D. degrees from the Polytechnic School at the University of Sao Paulo (USP) in 1963, 1970 and 1973 respectively. He worked at Themag Eng. Ltd (Engineering Company) in the area of Power Systems, Automation and Transmission Lines projects. There he joined important projects such as Itaipu (12,000 MW) 765 kVac (3 lines) and 600 kVdc (2bipoles) 900km transmission system and line design, and the planning of Amazon River tributaries' power plants and their transmission systems. Currently, he is a Full Professor in the Department of Engineering of Energy and Electric Automation at the University of São Paulo. He is a member of CIGRE and was the Brazilian representative in the SC38 of CIGRE and member of WG B4 (HVDC & FACTS power electronics). He is a Fellow Member of IEEE and Distinguished Lecturer of PES/IEEE as well as IAS/IEEE. His fields of interest include: Generation, Automation, Transmission Lines and Power Transmission and Distribution Studies. He is member of several CIGRE WGs: HVDC environment; HVDC Electrode Design; Conversion of AC Lines into DC; Connection of Wind Farms to Weak AC Network; and VSC Converter Modelling, Transmission Line Economics; AC and DC line Compaction; Ground Potential Rise due to Faults Near Lines; and Dynamics Line Rating. He has also held numerous volunteer positions at IEEE such as: South Brazil Section Chairman, Region Treasurer, IEEE Fellow Committee, Nomination Boards, Education Society Fellow Committee. Awards: IEEE HVDC Uno Lamm (2014); IEEE MGA Larry K Wilson (2010); IEEE innovation (2004); CIGRE B4 Technical (2011).

Brian Townsend is Manager of Project Engineering Services for AltaLink’s Projects group and a Senior Transmission Lines Engineer in Transmission and Distribution Operation and Design. AltaLink is Canada’s only fully independent transmission company, responsible for the maintenance and operation of approximately 12,000 kilometres of transmission lines and 280 substations in Alberta.
The goal of this session is to present best practices in the process of insulation selection and insulation coordination for the AC EHV overhead lines. This part of line design is considered to be a very important parameter because it has a significant influence on line cost and operational reliability. Two issues, i.e. optimal insulation selection for polluted/iced areas and insulation coordination regarding lightning and switching overvoltages will be presented. The presentation will start with a short theoretical background on types and levels of overvoltages and principles of insulation selection in polluted and iced areas. This will cover lightning overvoltages (origin, types of possible failures, influencing parameters), switching overvoltages (origin, types of possible failures, influencing parameters) and power frequency (origin, types of possible failures, influencing parameters). Both deterministic and statistical approaches will be covered with the examples from existing IEC, CIGRE and other standards/guidelines. Further, the presentation will concentrate on statistical approach, which is not new for insulation coordination, but is relatively new for the selection of insulators in polluted areas. Detailed discussion on input parameters needed for a comprehensive line design and ways to apply them in a practical manner will be discussed. A typical practical case study for the 500 kV AC overhead lines with defined design and environmental parameters will be presented using the Line Performance Estimator (LPE) software program following CIGRE/IEC design principles. The sensitivity analysis of outage rate when changing the pre-defined environmental parameters will be performed. Another part of sensitivity analysis of outage rate will include applying different modern technologies for the reduction of the level of overvoltages. Discussion on pollution and ice/snow performance of composite and cap-and-pin ceramic insulators and their impact on line design will follow (as well as different options for insulator strings, i.e. I-string, V-string, etc.).
Dr. Jens Martin Seifert, Lapp Insulators (Germany)

Dr. Jens Seifert is an expert in the field of insulation technology with an emphasis on air and gas-insulated systems as well as overhead transmission line technology. Insulation coordination, composite insulators, material and product engineering are the key fields he has been working on in the last 25 years. Jens was awarded his PhD for research on polymeric and composite insulating materials at the Technical University of Braunschweig / Germany under the guidance of Prof. Kärner. Since 1999 he is the Head of the R&D and Engineering Department at Lapp Insulators. In 2014 he was promoted to the CTO of the whole Lapp group. Jens is involved in various CIGRE working groups including SC D1 and B2 and in IEC TC 36 “HV Insulators”. In 2014 he was nominated to take the role of Chairman of IEC TC 36.

Dr. Jean-Marie George, Sediver (Canada)

Dr. Jean-Marie George received his Electrical Engineering degree in H.E.I, France. He joined the Sediver R&D team in 1986. After several years as Production Manager, Quality Manager and Technical Director for North America, he is currently the Sediver Scientific Director with a scope of responsibilities covering R&D and technical assistance activities worldwide. His cross-functional positions together with his 30 years of experience confer to Jean-Marie George an extensive expertise in the field of insulators. Author of numerous publications and patents, he is active in CIGRE, IEEE, CSA and ANSI.
Session 3: Lightning Issues, Design Challenges and Mitigations

For the most part, lightning performance of EHV transmission lines has met expectations. Even with double circuit towers of 60 to 100 m height, the high insulation strength of 500-kV lines and their large foundations have combined to give 99% reliability on lines that use pairs of overhead groundwires (OHGW). Applications with single OHGW (Germany, Austria 380 kV) and no OHGW (Canada, 500 kV) also met their design targets. Recently, however, work in Japan and China suggests that tall double circuit UHV towers are more vulnerable to shielding failures. Simple models such as the rolling sphere method with 20-m radius do not seem to apply when the bottom phase is 70 m above ground at the tower. This session will show how lightning mitigation using underbuilt shield wires (UBGW) or surge arresters on slim towers with reduced visual impact but higher surge impedance lead to new design choices and challenges.

Dr. William A. Chisholm, METSCO (Canada)

Dr. William A. Chisholm is an expert in effects of adverse weather on overhead power lines, including a PhD in lightning protection aspects. He obtained 31 years of R&D experience at Kinectrics, the former Ontario Hydro Research Division. In subsequent years, he completed many CEATI and EPRI projects, leading to the Zed Meter® and the Red, Blue and Gray books. He co-authored a IEEE/Wiley reference on icing performance and a McGraw Hill textbook. As an IEEE Fellow and former Chair of their Transmission and Distribution Committee, he made major contributions to several standards, working group reports and CIGRE technical brochures.
Subject Matter Experts

Dr. Pieter H Pretorius, Terratech (South Africa)

Dr. Pieter H. Pretorius received a B.Eng (Electrical and Electronics) degree from the Potchefstroom University in 1985, an M.Eng (Bio-Engineering) degree from the University of Pretoria in 1990 and a PhD from the University of the Witwatersrand in 2000. His career in earthing, electromagnetic compatibility (EMC) and lightning protection is founded on his interest in electromagnetics. He joined ESKOM in 1988 where he enjoyed career growth over a seventeen year period to the level of Corporate Consultant. Boundary conditions drew him to independent consultancy in 2005. He also engaged as a Senior Lecturer at the University of the Witwatersand for a short period. He has authored / co-authored more than 100 papers, has registered three patents and has contributed chapters and parts of chapters to the ESKOM Power Series and other books. He is registered as a professional engineer with the Engineering Council of South Africa and is a participating member in several CIGRE Working Groups.

Dr. Toshihiro Tsuboi, Tokyo Electric Power Company (Japan)

Dr. Toshiro Tsuboi is presently a Researcher within the High Voltage & Insulation Group, R&D Department at TEPCO Research Institute, Tokyo Electric Power Company Holdings, Inc. His areas of interest include Lightning Protection, Insulation Coordination, Computational Electromagnetics, EMC as well as High Voltage Engineering. He received his Bachelor's and Master's degrees from the Tokyo Institute of Technology, and his Ph.D from the University of Chiba. He is the Assistant Secretary of CIGRE SC C4 Domestic Committee of Japan, and has authored numerous publications.
Evaluating the condition of aging EHV transmission lines requires expertise and experience in a number of fields and technologies to provide accurate and reliable results. An area that is starting to make inroads in providing results in an effective and efficient manner involves the application of non-destructive methods and newer technologies using robotics and unmanned aircraft systems (UASs). The presentation and topics to be discussed by industry members and experts include the viability and effectiveness of these inspection and assessment methods and delivery technologies as applied to EHV transmission line components, (e.g., steel foundations, insulators, conductors, etc.). The emphasis will be on identifying those technologies that work well, discussing the potential for implementing up-and-coming technologies, as well as identifying areas needing improvement to ensure the reliability of these very important transmission lines.

**Session Co-Chairs**

Andy Stewart, EDM International (USA) & Dr. André Leblond, Hydro Québec TransÉnergie (Canada)

Andy joined EDM International, Inc. in 1983 and is currently EDM’s President. He holds a BS in civil engineering from the University of Rhode Island and an MS 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 R&D 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 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.

Dr. André Leblond received his Ph.D. degree in mechanical engineering from Laval University (Québec) in 1996. He joined IREQ in 1992 where he studied the modeling of wind-induced conductor vibrations. After the famous January 1998 ice storm, he was involved in the development of new de-icing techniques. Since the end of 2004, he has been working as a transmission-line engineer at Hydro-Québec TransÉnergie, where he has been continuously involved in studies and developments related to various mechanical aspects of transmission lines. He is an active member of several CIGRÉ Working Groups within Study Committee B2 and Convener of Working Group B2.52 on Robotics. He has contributed towards the preparation of three books.
Trevor Lorimer is from Durban, South Africa. He holds a BSc degree in mechanical engineering, and completed his MScEng degree at the University of KwaZulu-Natal in 2011. Following his studies, he went on to develop robotic power line inspection technology at the same institution. His work has been shortlisted as a finalist in at least two awards, and he is a co-inventor on a US patent.

Matthew Lohry, American Transmission Company (USA)

After spending nearly a decade as an electronics technician, Matthew Lorhy received his BS degree in Civil Engineering from the University of Minnesota-Twin Cities in 2008. He has been actively working in the transmission utility industry for eight years as a Transmission Line Engineer and is registered as a Professional Engineer in Wisconsin. He has spent the last 4-1/2 years at American Transmission Company, where he presently works as a Transmission Line Services Engineer. Matthew is responsible for line ratings, Transmission Line Standards, and is also the Concrete Foundations and Overhead Conductor Subject Matter Expert.
Session 5: Optimization of Conductor Selection Process - Issues and Challenges

The session describes and explains how the selection of phase conductor bundles affects almost all other mechanical and electrical aspects of EHV line design including right-of-way width, structure and foundation material cost, life cycle costs including conductor recycling, and both electrical and thermal power flow constraints. The phase bundle choice also impacts the visual esthetic impact of the line, the electric fields produced at ground level, electromagnetic and audible noise, maintenance cost, and is a minor factor in determining lightning performance and magnetic fields. The recent profusion of conventional and high temperature conductor choices offer the EHV line designer with a wide range of choices in choosing the “right” conductors for large transmission projects. Plans for the Breakout Session: Bundled HTLS Subconductors, Structure/ Foundation/ Line Cost and its impact of conductor choice, Visual Impact of conductor selection, Aggressive use of Underground cable as part of overhead lines, Conductor choices and Wind motion limits.

Session Chair

Dr. Dale Douglass, Douglass Power Consulting (USA)

Dr. Dale Douglass is an expert in statistical and dynamic thermal rating of overhead lines, substation terminal equipment, and power transformers, overhead line failure analysis and design, application of high temperature conductor, and limitation of wind-induced conductor motions. He has taught courses and given seminars involving transmission line design, uprating and line monitoring. In 2015, he became the Principal of Douglass Power Consulting, LLC, where he continues to provide consulting services on: high-temperature sag calculation; aging behavior of conventional and high-temperature conductors; real-time line monitoring and rating; and field evaluation of utility line thermal ratings. He continues to present courses on voltage and current uprating of lines, conductor selection, and field verification of line ratings in cooperation with PDC. Dr. Douglass received a BSME in 1963, and an MSEE and PhDEE in 1964 and 1967, respectively, from Carnegie Mellon University. In 1996, he was elected an IEEE Fellow for “contributions to understanding the characteristics and applications of overhead power transmission conductors”. He received a CIGRE Technical Committee award in 2007 and was made a Distinguished Member of CIGRE in 2012.
Subject Matter Experts

Dr. Bin Liu, China Electric Power Research Institute (China)

Dr. Bin Liu is the Associate Director of the Conductor Mechanical Property Laboratory at the China Electric Power Research Institute. He has over 8 years’ experience solving the electrical and mechanical engineering problems of power systems. His work involves the analysis of problems in “nonlinear vibrations” in general and on overhead power lines in particular. His major activities were devoted to (i) vibrations on overhead lines, including galloping, aeolian vibration and subspan oscillation, as well as control methods, (ii) analysis in ice or wind disaster on transmission lines, (iii) design on insulators, conductors and fittings, (iv) monitoring of power lines (meteorology, sag and vibrations), and last, but not least (iv) development on new conductors (large cross-sectional conductor, HTLS conductor). Bin Liu is an active member of CIGRE and IEEE, where he has served as member of several task forces of CIGRE Study Committee B2 on Overhead lines. He has published over 30 technical papers in peer reviewed publications.

Dr. Robert Stephen, ESKOM (South Africa)

Dr. Rob Stephen was born in Johannesburg South Africa in 1957. He graduated from the University of the Witwatersrand in 1979 with a Bachelor of Science in Electrical Engineering. He joined Eskom Electrical Utility in 1980. Dr. Stephen holds both MSc, MBA degrees as well as a PhD in Objective Determination of Optimal Transmission Line Designs. He is currently the Master Specialist in the Technology Group in Eskom and is responsible for distribution and transmission technologies of all voltages covering both AC and DC. He is past chairman of Cigre SC B2 dealing with Overhead lines, is a member of the Cigre Steering Committee and has authored over 100 technical papers.

Gordon Baker, General Cable (USA)

Gordon C Baker graduated from Queen's University, Kingston, ON, Canada. He has more than 37 years of experience in manufacturing, design and application of electrical wire and cable products. He started working in 1979 with Phillips Cables in Canada. In 1996 the Canadian Engineering office closed and amalgamated with US BICC Cables operation in West Nyack, NY. In 1999 the worldwide operations of BICC Cables was acquired by General Cable, USA. Gordon is a member of CSA Technical Committee on Overhead Electrical Conductors (C507), and a member of IEEE PES and Overhead Lines Committee. Gordon is also a member of the ASTM B01 Electrical Conductors Committee and served as Chairperson of that committee from 2002 to 2007. His current job title is “Manager, Applications Engineering” working for the Power Utility Division of General Cable Industries, Inc and is located at the Highland Heights, KY, USA head office location. Gordon's role within General Cable is to provide overhead conductor product and technical support for both US and Canadian customers.
EHV transmission lines form the backbone of the grid and for utilities can be considered mission critical assets. These elements of criticality require prudent and effective management processes to ensure the safe and reliable supply of power, both for the short and longer term. This topic shall provide asset management practices needed to manage the life of these assets that include condition assessment, asset health, life cycle cost, standardization, information management, performance evaluations and cost to achieve the desired results. Innovative techniques and solutions will also be discussed. A specific example with respect to ESB’s experience in the development of the condition assessment programme of a 400kV Overhead Transmission Line Network in Ireland will be presented. Since the completion of line condition assessments from 2011 to 2015, a capital programme involving life extension works to the 400 kV system commenced. It will become apparent that effective asset management involves the coordination of technical, financial, contract and in-house resources, and other business elements as well as the effective management of information to arrive at the best solutions. From these insights utility and industry participants will identify areas and technologies needing improvement to ensure the long-term viability of these critical assets.

Session Co-Chairs

Robert Arthur, ESB International (Ireland) & Ed Watson, Southern Company (USA)

Robert Arthur has over 15 years of engineering experience. After graduating from Dublin Institute of Technology with a Diploma in Applied Electronics, he spent 3 years working in the area of Electromagnetic Field (EMF) Assessments covering Human Health Surveys and Product Compatibility Testing. In 2004, Robert joined ESB International’s Asset Management Services (AMS) department where he worked for the next 5 years in Transmission Line Maintenance, EMF Consultancy and handled OHL Building Conflicts for ESB Networks. He has managed the Transmission Lines & Cables Maintenance group within AMS for the past 6 years. Robert holds an MSc in Electrical Power Systems from the University of Bath where he graduated from in 2013 with distinction. Robert has gained invaluable experience in planning specific maintenance inspections of the existing 400kV OHL network in Ireland, subsequent condition assessment programmes and finally the capital programme life extension works currently underway. He is currently seconded into a Project Management role handling the planning process for a proposed 138 km 400 kV OHL Interconnection between the Transmission Systems in the Republic of Ireland and Northern Ireland.

Ed Watson is the Supervisor of Transmission Line Support for Georgia Power; an operating company of Southern Company. In this role he oversees the maintenance of line facility data, the ground-line inspection and treatment program and the development of large capital maintenance projects. Over his 37 year career in the industry, Ed has worked in many diverse areas including distribution, marketing, planning and budgeting. He has an electrical engineering degree from the University of Alabama as well as an MBA from Georgia State University. In his spare time Ed enjoys water sports, tennis and occasional track time in his 1987 Porsche 944.
Subject Matter Experts

Dr. Ibrahim Hathout, Hydro One (Canada)

Dr. Ibrahim Hathout received a B.Sc. degree in Civil Engineering from Cairo University (Distinction with highest honor), and M.A.Sc., and Ph.D. degrees in Civil Engineering from the Universities of Windsor and Waterloo respectively. He is currently managing the transmission engineering department at Hydro One. The department has ≈70 professionals responsible for all transmission line designs and stations’ civil, mechanical, and structural designs.

Dr. Hathout has extensive experience in design, maintenance, rehabilitation, and reliability analysis of structures. His research interests include failure analysis, reliability assessment, and applications of fuzzy logic, neural networks, and expert systems to damage assessment of existing structures. He has published over 50 technical papers in the general area of structural engineering and wrote two chapters in two reference books on machine intelligence and pattern recognition. Dr. Hathout is the recipient of many prestigious scholarships and awards and is serving on several CSA and IEEE committees and working groups. Dr. Hathout was the 2012 recipient of Hydro One President Award for Innovation.

Russell Bolt, Transpower (New Zealand)

Russell has 34 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 11 years, Russell has been a 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.
Session 7: Mechanical Design of EHV Lines – Issues & Challenges

The purpose of this session will be to review the “best practices” of designing EHV lines. This presentation will include, but not be limited to, the topics including meteorological loads, development of structural configurations and clearance diagrams, loading and strength of overhead lines, analysis of various line components such as structure, insulators, foundation, conductors etc., vibration issues, challenges and mitigation techniques, as well integration of reliability and security in line design. The effects of line design on operations and maintenance of the line will also be discussed. Current standards for designing overhead lines for reliability and security (line cascade) will be reviewed and the session will identify some of the gaps that exist in current standards and provide guidance how to close these gaps. The session will also present some specific case studies on EHV line design.

Session Co-Chairs

Dr. Asim Haldar, CEATI International, Dr. Leon Kempner, Bonneville Power Administration (USA) and Mr. Gopal Ji, POWERGRID (India)

Dr. Haldar is the Conference Chair and Technical Advisor the TODEM group. His full bio is available on page 3.

Dr. Leon Kempner has over 40 years experience as a structural engineer for the BPA, US DOE. His assignments have included structural engineering analysis, design, and research of high-voltage transmission line facilities (towers, substation, and microwave structures). The last 19 years he has been performing seismic evaluation, quantification, standards development, and mitigation design of highvoltage transmission line facilities.

Dr. Kempner received a Ph.D. in System Science: Civil Engineering, Portland State University, 1997; M.S., Oregon State University in Civil Engineering, 1974; and B.S.C.E. University of Nebraska, Omaha, 1972. Dr. Kempner is a registered Professional Civil Engineer (PE) in Oregon and Washington.

Sh. Gopal Ji, presently working as General Manager (Engg TL), POWERGRID has a total of 38 years of Engineering experience, out of which, he served Trivani Structures Ltd., Naini, Allahabad for 12 years and balance period in POWERGRID. He has completed his Engg. Degree In Civil Engg. from V.R.C.E, Nagpur and Master’s Degree in Structures from Motilal Nehru Regional Engineering College, Allahabad. During these years, he extensively dealt with design of various types of towers installed in the country including Transmission Line Towers (up to 1200 KV), Transmission Line Pole Structures (up to 400 kV), River Crossing Towers (upto 240 M), Guyed Towers (up to 300m in height), TV Towers & Microwave Towers (up to 240m) and Flood Lighting Towers (at Jawahar Lal Nehru Stadium).

For completing the design of guyed towers he was placed with U.S.Consultant, Holmes & Narver Inc., CA for one & half years. Presently he is employed by POWERGRID to provide consultancy to various utilities in India and abroad.
Subject Matter Experts

Dr. Robert Stephen, ESKOM (South Africa)

Dr. Rob Stephen was born in Johannesburg South Africa in 1957. He graduated from the University of the Witwatersrand in 1979 with a Bachelor of Science in Electrical Engineering. He joined Eskom Electrical Utility in 1980. Dr. Stephen holds both MSc, MBA degrees as well as a PhD in Objective Determination of Optimal Transmission Line Designs. He is currently the Master Specialist in the Technology Group in Eskom and is responsible for distribution and transmission technologies of all voltages covering both AC and DC. He is past chairman of Cigre SC B2 dealing with Overhead lines, is a member of the Cigre Steering Committee and has authored over 100 technical papers.

Dr. Bin Liu, China Electric Power Research Institute (China)

Dr. Bin Liu is the Associate Director of the Conductor Mechanical Property Laboratory at the China Electric Power Research Institute. He has over 8 years’ experience solving the electrical and mechanical engineering problems of power systems. His work involves the analysis of problems in “nonlinear vibrations” in general and on overhead power lines in particular. His major activities were devoted to (i) vibrations on overhead lines, including galloping, aeolian vibration and subspan oscillation, as well as control methods, (ii) analysis in ice or wind disaster on transmission lines, (iii) design on insulators, conductors and fittings, (iv) monitoring of power lines (meteorology, sag and vibrations), and last, but not least (iv) development on new conductors (large cross-sectional conductor, HTLS conductor). Bin Liu is an active member of CIGRE and IEEE, where he has served as member of several task forces of CIGRE Study Committee B2 on Overhead lines. He has published over 30 technical papers in peer reviewed publications.

Dr. Prasad Yenumula, Duke Energy (USA)

Dr. Prasad Yenumula is a Principal Engineer from the Line Engineering Standards at Duke Energy. He earned his Bachelor’s, Master’s, and Doctoral degrees in Civil Engineering and MBA in Global Management. With a postdoctoral fellowship in engineering, he published more than 50 research papers in various journals and conferences. With over 20 years of electrical utility experience, Dr. Yenumula is responsible for several line projects and R&D work.

Dr. Yenumula is current Chair of EPRI’s Line Design Task Force and Vice-Chair of CEATI International’s TODEM Interest Group. He is a member (alt) of NESC - SC-5, EEI’s NESC/EURC Task Force, ASCE, ISSMGE, SEI and DFI. He is Duke’s Industry Advisor to NATF, NEETRAC, EPRI and CEATI. He is also in various other national standard committees such as ASCE 10 on lattice towers, ANSI C29 on insulators and on the ASCE-FRP Blue Ribbon Panel review team.

Dr. Yenumula is also a professor (adjunct) at Gonzaga University, Washington, and contributes to the development and teaching of the online transmission & distribution engineering Master’s program. He is currently co-authoring a textbook on transmission line structures and foundations which will be published later this year. He received twelve awards for his engineering, research and teaching efforts which include best Ph.D. thesis, best papers, and four Faculty of the Year awards.
In a low carbon world and the need for new renewable energy resources to supplement or replace conventional generation, high voltage direct current (HVDC) transmission has an important role. The best location for renewable generation is usually remote from load centres. The best wind or solar is usually offshore or in areas where few people live. HVDC provides the infrastructure to move this energy to where it is needed potentially with lower cost and environmental impact than AC transmission.

With the advent of voltage source converters using IGBT’s, the cost difference between AC transmission systems and those using HVDC has improved. This session will discuss the advances in HVDC technology including the advent of voltage source converters, highlight some of the new projects that use HVDC and discuss what the future may hold for HVDC.

The presentation will include discussions on maturity of different HVDC technologies, current trends and future developments to enable bulk power transfer over long distances as well as the developments on making interconnected Dc grids a viability. Advantages of converting existing AC lines to DC will also be addressed.

Three recent HVDC transmission links, one each from Europe, Asia and Africa will be discussed as case studies.

**Session Chair**

**Dr. Dharshana Muthumani, Manitoba HVDC Research Center (Canada)**

Dharshana Muthumuni, Ph.D., P.Eng., is the Managing Director of the Manitoba HVDC Research Centre, a division of Manitoba Hydro International. He has over 20 years of experience in engineering studies using a variety of simulation products, including PSCAD™ and PSS/E. His expertise is regularly sought out by clients around the world for his strong and wide ranging technical knowledge on power system behavior, model development, and simulation studies. He has lead the technical team to solve challenging problems, including HVDC and generation interconnections, wind integration into weak grids, FACTS based solutions, SSR screening techniques, and power quality and harmonics.

Dharshana has worked extensively and closely with equipment vendors to develop simulation models and techniques to address difficult interconnection problems. He has developed many customer custom models and simulations techniques for specific studies, including working closely with equipment vendors to address their simulation study requirements. In addition to his engineering study experience, Dharshana has been a key developer of the PSCAD simulation tool and has conducted training workshops on a variety of power system topics for his global clients. He has led engineering teams on a number of engineering study projects, including the Saudi Electric Company system operation and interconnection project. In his current position, Dharshana is responsible for overseeing the development and deployment of all MHRC's products and services including PSCAD™, HVDC Line Fault Locator System, Engineering Consulting, Training, and Research & Development.
Subject Matter Experts

Les Recksiedle, Manitoba HVDC Research Centre (Canada)

Les Recksiedle, P.Eng., CIM., Senior Engineering Manager, has over 40 years of experience and expertise in the electrical utility industry, including station apparatus design, specifications, bid reviews, contract negotiations, design reviews, factory acceptance testing (FAT), drawing approval for construction, installation supervision, pre-commissioning, commissioning, performance testing, as-built drawings, warranty, operations and maintenance (O&M), and life assessment. In addition, he has over 34 years of HVDC experience in the design, modification, O&M of the Nelson River +/- 500 kV, 3,854MW HVDC system. At the Manitoba HVDC Research Centre, Les is specializing in HVDC Systems, Power Apparatus, and Business Development. He is actively involved with IEEE Standards development and is currently Vice Chair of the Converter Transformer and Smoothing Reactor Subcommittee and Co-Chair of a joint IEEE/IEC Standard on DC Bushings (recently published). In addition, Les actively participates in CIGRE HVDC working groups and is a convener of B4.54 working group – Life Assessment and Extension of HVDC Converter Stations.

Antony Britten, Gibb Africa (South Africa)

A. C. Britten’s entire career was spent in various technical positions in Eskom, the South African power utility, which gave him wide exposure in the high voltage and power electrical engineering disciplines. He retired in 2013, but has continued to work and consult on power transmission and corona topics. He was previously responsible for the selection of the corona and field effect limits, and confirmation of the insulation clearances for Eskom’s first high altitude 765 kV transmission lines. He has contributed to the design of Eskom’s compact 400 kV lines, and also to the refurbishment of the Apollo HVDC converter station. Mr. A. C. Britten holds graduate and post graduate degrees in electrical engineering as well a Graduate Diploma in Engineering. He is a registered Professional Engineer in South Africa and a distinguished member of Cigre.

Dr. José Antonio Jardini, Engenharia de Sistemas Elétricos S/S Ltda (Brazil)

Dr. José Antonio Jardini received his Ph.D. from the University of Sao Paulo. Currently, he is a Full Professor in the Department of Engineering of Energy and Electric Automation at the University of Sao Paulo and a member of CIGRE. He was the Brazilian representative in the SC38 of CIGRE and member of WG B4 (HVDC & FACTS power electronics). He is a Fellow Member of IEEE and Distinguished Lecturer of PES/IEEE as well as IAS/IEEE. He is member of several CIGRE WGs and has held numerous volunteer positions at IEEE such as: South Brazil Section Chairman, Region Treasurer, IEEE Fellow Committee, Nomination Boards, Education Society Fellow Committee. Awards: IEEE HVDC Uno Lamm (2014); IEEE MGA Larry K Wilson (2010); IEEE innovation (2004); CIGRE B4 Technical (2011).

Dr. Jean-Marie George, Sediver (Canada)

Dr. Jean-Marie George received his Electrical Engineering degree in H.E.I, France. He joined the Sediver R&D team in 1986. After several years as Production Manager, Quality Manager and Technical Director for North America, he is currently the Sediver Scientific Director with a scope of responsibilities covering R&D and technical assistance activities worldwide. His cross-functional positions together with his 30 years of experience confer to Jean-Marie George an extensive expertise in the field of insulators. Author of numerous publications and patents, he is active in CIGRE, IEEE, CSA and ANSI.
Exhibition Space

Each exhibit registration includes the following:

- 10’ x 10’ (100 sq. ft) carpeted space
- Skirted 6’ table & 2 chairs
- Includes meals, access to all 3 tracks & proceedings package.

All refreshment breaks, meals, and networking reception will take place in the exhibition hall, ensuring face-to-face time with the conference attendees.

Booth Selection

Sponsorship Booths #1-11 include sponsorship benefits - more details available at http://www.ceati.com/TX2016

Standard Booths #12-26

Please note that exhibitor spaces for either option will be awarded on a first-paid first-served basis.

CEATI reserves the unqualified right to make changes in the floor plan or space assignments.
The CEATI Program Model provides electrical utilities with a cost-effective vehicle for sharing experiences and addressing issues pertinent to their day-to-day operations, maintenance and planning. In addition to serving as a strong technical resource tool through 18 focus areas across generation, transmission, and distribution, our participants support the development of industry open conferences and training workshops. This is where we invite you to come join us.

Our industry-open events bring manufacturers, service providers, consultants, and world-renowned technical experts together with some of the key-decision makers in the industry. These events present excellent opportunities for targeted networking and exposure to potential clients, placing you directly in front of the end-users of your company’s products and services.

Why Partner with CEATI Events?

Conference Location

Hyatt Regency Mission Bay
1441 Quivira Road
San Diego, CA 92109
+1-619-224-1234

All conference guests are eligible for a discounted rate of $159 (USD) subject to availability. Simply mention “CEATI International” when reserving.
Register online at www.ceati.com/TX2016

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- **Card No.**
- **Expiry Date**
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**Registration Fees & Discounts**

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*TLAM/TODEM/PSPO participating organizations may be eligible for a complimentary registration - contact the Program Coordinator for more information.*

**Exhibit at the Transmission Conference!**

- **Booth Registration (includes 2 standard passes)**
  - $2700 USD

- **Additional Exhibitor Passes**
  - $675 USD
  - Quantity: _______

For Exhibitors: All cancellations received 60 days prior to the event will be subject to a processing fee of 25% of the total amount. There will be no refunds granted after this date. Delegate substitution is permitted at no extra cost. Exhibitor registration and additional conference passes include proceedings package, access to the presentation room, breakfast, breaks, lunches and reception where indicated on the schedule.

**Important Information**

Registration fees include proceedings package, breakfast, breaks, lunches and reception where indicated on the schedule.

- Please check if you wish to be contacted about allergies or other dietary requirements.

Prices are in USD. Charges will appear as ‘CEATI International Inc’ and are subject to applicable taxes and fees.

All cancellations received at least 60 days prior to event will be subject to a $200 processing fee. There will be no refunds granted after this date. Delegate substitution is permitted at no extra cost.

Please note that all names registering for the event will be added to CEATI’s mailing list. If you do not wish to be included in this electronic outreach, please click on the ‘unsubscribe’ button in the email to remove yourself. By attending, you acknowledge that there may be photographs or videos taken of you during this event, and you consent to the use of these photographs or videos in future CEATI communications.

Completed registration forms can also be sent by email to events@ceati.com or by fax to (514) 904-5038