Exponent®
Engineering & Scientific Consulting

Richard Brown, Ph.D., P.E.

Principal Engineer | Electrical Engineering and Computer Science
Denver
+1-303-882-6469 | rbrown@exponent.com

Professional Profile

Dr. Brown is an internationally recognized expert in infrastructure asset management, power system reliability, major event performance, system hardening, reliability improvement, power delivery system planning, smart grid, system automation, distributed energy resources, risk assessment, and economic analysis. He has submitted expert witness testimony to regulatory commissions in the states of California, Florida, Maryland, Massachusetts, Virginia, Ohio, and Texas.

Dr. Brown has developed several generations of distribution system reliability assessment software tools, and has helped a large number of utilities to develop cost-justified reliability improvement plans. He is an experienced testifying expert in both regulatory proceedings and in civil cases.

Dr. Brown has extensive experience with extreme weather events including hurricanes, linear winds, tornadoes, fires, earthquakes, floods, ice storms, and winter storms. This includes post-event analyses to examine utility infrastructure performance, restoration performance, and storm cost recovery support. He is also one of the early pioneers in transmission and distribution system hardening against major weather events, and has helped several major utilities develop and implement infrastructure hardening programs. He led a consortium of Florida utilities under the direction of the Florida Public Utilities Commission do develop a probabilistic storm and restoration simulation to quantify the costs and benefits of hardening options. Dr. Brown was also retained by the Public Utilities Commission of Texas to quantify the costs and benefits of proposed system hardening legislation, and to recommend best practices.

Dr. Brown has extensive experience in electric system outage investigations including major urban interruption events in cities including Chicago, San Francisco, New York City, Calgary, B.C., Vancouver B.C., and Denver. He has also provided expert witness testimony for utilities facing civil actions after accidents involving electric utility system infrastructure.

Prior to Exponent, Dr. Brown held executive positions at ABB, KEMA, Quanta Technology, and WorleyParsons. He has published more than 90 technical papers, has taught courses in eleven countries, and is author of the books *Electric Power Distribution Reliability* and *Business Essentials for Utility Engineers*. Dr. Brown is a Fellow of the IEEE and a registered professional engineer.

Academic Credentials & Professional Honors

M.B.A., Business Administration, University of North Carolina, Chapel Hill, 2003

Ph.D., Electrical Engineering, University of Washington, 1996

B.S., Electrical Engineering, University of Washington, 1991

IEEE Fellow

Eta Kappa Nu

Beta Gamma Sigma

Licenses and Certifications

Professional Engineer, North Carolina, #23088

Academic Appointments

Adjunct Faculty Member, North Carolina State University, 2008-2013

Prior Experience

Vice President, U.S. Power Networks, WorleyParsons, 2012-2013

Vice President, Operations, Quanta Technology, 2006-2012

Vice President, Asset Management, KEMA, 2003-2006

Director of Technology, ABB Consulting, 2001-2003

Principal Engineer, ABB Power Distribution Solutions, 1999-2001

Senior Engineer, ABB Corporate Research, 1996-1999

Research/Teaching Assistant, University of Washington, 1994-1996

Electrical Engineer II-III, Jacobs Engineering, 1991-1993

Publications

Books, Book Chapters, and Theses

Brown RE. Business Essentials for Utility Engineers. CRC Press, 2010.

Brown RE. Electric Power Distribution Reliability, Second Edition. CRC Press, 2009.

Brown RE. Electric Power Distribution Reliability. Marcel Dekker, 2002.

Morrow DJ, Brown RE. Future vision: The challenge of effective transmission planning. Chapter 6, Power System Analysis and Design, 5th Edition, J. D Glover et al. (Editor), pp. 295-304.

Brown RE, Willis HL. Substation asset management. Chapter 19, Electric Power Substations Engineering, J. D. McDonald (Editor), Taylor & Francis (CRC Press), 2007, pp. 19-1 through 19-31.

Brown RE. Power System Reliability Section 13.5, Electric Power Engineering Handbook, L. L. Grigsby (Editor), CRC Press LLC, 2001, pp. 13-51 through 13-65.

Brown RE. Predictive Distribution Reliability and Risk Assessment. Chapter 3, IEEE Tutorial on Probabilistic T&D System Reliability Planning, A. A. Chowdhury (Editor), IEEE 07TP182, 2007, pp. 29-36.

Brown RE. Distribution System Reliability: Analytical and Empirical Techniques. Chapter 3, IEEE Tutorial on Electric Delivery System Reliability Evaluation, J. Mitra (Editor), IEEE 05TP175, 2005, pp. 39-51.

Brown RE. Reliability Assessment and Design Optimization for Electric Power Distribution Systems, Ph.D. Dissertation, University of Washington, Seattle, WA, 1996.

Brown RE. An Intelligent Overload Relay for Extruded Dielectric Transmission Cable, Master's Thesis, University of Washington, Seattle, WA, 1993.

Refereed Journal Papers

Brown RE, Wilson CS, van Nispen H. Becoming the utility of the future. IEEE Power and Energy Magazine Sept/Oct 2016; 14(5):57-65.

Brown RE, Morrow DJ. Future vision. IEEE Power and Energy Magazine 2007 Sept/Oct; 5(5):36-45.

Brown RE, Willis HL. The economics of aging infrastructure. IEEE Power and Energy Magazine 2006 May/June; 4(3):36-43.

Brown RE. Engel MV, Spare JH. Making sense of worst performing feeders. IEEE Transactions on Power Systems 2005 May; 20(2):1173-1178.

Brown RE, Humphrey BG. Asset management for transmission and distribution. IEEE Power and Energy Magazine 2005 May/June; 3(3):39-45.

Brown RE, Frimpong G, Willis HL. Failure rate modeling using equipment inspection data. IEEE Transactions on Power Systems 2004 May; 19(2):782-787.

Venkata SS, Pahwa A, Brown RE, Christie RD. What future distribution engineers need to learn. IEEE Transactions on Power Systems 2004 Feb; 19(1):17-23.

Li F, Brown RE. A cost-effective approach of prioritizing distribution maintenance based on system reliability. IEEE Transactions on Power Delivery 2004 Jan; 19(1):439-441.

Li F, Brown RE, Freeman LAA. A linear contribution factor model of distribution reliability indices and its applications in Monte Carlo simulation and sensitivity analysis. IEEE Transactions on Power Systems 2003 Aug; 18(3):1213-1215.

Li F, Freeman LAA, Brown RE. Web-enabling applications for outsourced computing. IEEE Power and Energy Magazine 2003 Jan/Feb; 1(1):53-57.

Brown RE, Hanson AP. Impact of two stage service restoration on distribution reliability. IEEE Transactions on Power Systems 2001 Nov; 16(4): 624-629.

Brown RE, Hanson AP, Willis HL, Luedtke FA, Born MF. Assessing the reliability of distribution systems. IEEE Computer Applications in Power 2001 Jan; 14(1): 44-49.

Brown RE, Burke JJ. Managing the risk of performance based rates. IEEE Transactions on Power Systems 2000 May; 15(2):893-898.

Brown RE, Marshall MM. Budget constrained planning to optimize power system reliability. IEEE Transactions on Power Systems 2000 May; 15(2):887-892.

Brown RE. The Impact of heuristic initialization on distribution system reliability optimization. International Journal of Engineering Intelligent Systems for Electrical Engineering and Communications 2000 March; 8(1):45-52.

Brown RE, Ochoa JR. Impact of sub-cycle transfer switches on distribution system reliability. IEEE Transactions on Power Systems 2000 Feb; 15(1):442-447.

Brown RE, Taylor TM. Modeling the impact of substations on distribution reliability. IEEE Transactions on Power Systems 1999 Feb; 14(1):349-354.

Brown RE, Ochoa JR. Distribution system reliability: Default data and model validation. IEEE Transactions on Power Systems 1998 May; 13(2):704-709.

Brown RE, Christie RD, Venkata SS, Fletcher RD. Distribution system reliability: Momentary interruptions and storms. IEEE Transactions on Power Delivery 1997 Oct; 12(4):1569-1575.

Brown RE, Gupta S, Christie RD, Venkata SS, Fletcher RD. Automated primary distribution system design: Reliability and cost optimization. IEEE Transactions on Power Delivery 1997 April; 12(2):1017-1022.

Brown RE, Gupta S, Christie RD, Venkata SS, Fletcher RD. Distribution system reliability analysis using hierarchical Markov modeling. IEEE Transactions on Power Delivery 1996 Oct; 11(4):1929-1934.

Chuvychin VN, Gurov NS, Venkata SS, Brown RE. An adaptive approach to load shedding and spinning reserve control during underfrequency conditions. IEEE Transactions on Power Systems 1996 Nov; 11(4):1805-1810.

Refereed Conference Papers

Brown RE, Hwang B, Touzel R. Demand response as a dispatchable resource. POWER-GEN International, Orlando, FL, November 2013.

Romero Agüero J, Brown RE. Distribution system reliability improvement using predictive models. IEEE PES 2009 General Meeting, Calgary, Alberta, July 2009.

Romero Agüero J, Brown RE, Spare JH, Phillips E, Xu L, Wang J. A reliability improvement roadmap based on a predictive model and extrapolation technique. IEEE PES 2009 Power Systems Conference and Exposition, Seattle, WA, March 2009.

Romero Agüero J, Brown RE, Spare JH, Phillips E, Xu L, Wang J. A reliability improvement roadmap based on a predictive model and extrapolation technique. DistribuTECH Conference and Exhibition, San Diego, CA, February 2008.

Brown RE. Asset management standards and guidelines. EPRI Fourth Power Delivery Asset Management Conference, Chicago, IL, October 2008.

Brown RE. Impact of smart grid on distribution system design. IEEE PES 2008 General Meeting, Pittsburg, PA, July 2008.

Xu L, Brown RE. A hurricane simulation method for Florida utility damage and risk assessment. IEEE PES 2008 General Meeting, Pittsburg, PA, July 2008.

Brown RE. Hurricane hardening efforts in Florida. IEEE PES 2008 General Meeting, Pittsburg, PA, July 2008.

Xu L, Brown RE. Simulation of hurricane damage to utilities in Florida. DistribuTECH Conference and

Exhibition, Tampa Bay, FL, January 2008.

Brown RE. Reliability benefits of distributed generation on heavily loaded feeders. IEEE PES 2007 General Meeting, Tampa, FL, June 2007.

Brown RE. Pole hardening following Hurricane Wilma. 2007 Southeastern Utility Pole Conference, Tunica, MS, February 2007.

Ramanathan B, Hennessy D, Brown RE. Decision-making and policy implications of performance-based regulation. IEEE Power Systems Conference and Exhibition, Atlanta, GA, October 2006.

Brown RE. The regulatory usefulness of reliability reporting. 2006 IEEE Rural Electric Power Conference, Albuquerque, NM, April 2006.

Butts M, Spare JH, Brown RE. Practical and verifiable reliability improvement at the Baltimore Gas and Electric Company. DistribuTECH Conference and Exhibition, Tampa Bay, FL, February 2006.

Brown RE. Project selection with multiple performance objectives. 2005 IEEE/PES Transmission and Distribution Conference and Exposition, New Orleans, LA, September 2005.

Brown RE, Spare JH. The effects of system design on reliability and risk. 2005 IEEE/PES Transmission and Distribution Conference and Exposition, New Orleans, LA, September 2005.

Brown RE, Spare JH. A survey of U.S. Reliability Reporting Processes. 2005 IEEE/PES Transmission and Distribution Conference and Exposition, New Orleans, LA, September 2005.

Zhou Y, Brown RE. A practical method for cable failure rate modeling. 2005 IEEE/PES Transmission and Distribution Conference and Exposition, New Orleans, LA, September 2005.

Brown RE, Spare JH. Asset management and financial risk. DistribuTECH Conference and Exhibition, San Diego, CA, January 2005.

Brown RE, Spare JH. Asset management, risk, and distribution system planning. IEEE Power Systems Conference and Exhibition, New York, NY, October 2004.

Brown RE. Identifying worst performing feeders. Probabilistic Methods Applied to Power Systems, PMAPS 2004, Ames, IA, September 2004.

Willis HL, Engel MV, Brown RE. Equipment demographics - Failure analysis of aging T&D infrastructures. 2004 Canada Power Conference, Toronto, Canada, September 2004.

Brown RE. Failure rate modeling using equipment inspection data. IEEE PES 2004 General Meeting, Denver, CO, June 2004.

Brown RE. Coming to grips with distribution asset management. 2003 Real World Conference: It's All About Cost and Reliability, Transmission and Distribution World, Ft. Lauderdale, FL, October 2003.

Brown RE. Reliability standards and customer satisfaction. 2003 IEEE/PES Transmission and Distribution Conference and Exposition, Dallas, TX, September 2003.

Pahwa A, Gupta S, Zhou Y, Brown RE, Das S. Data selection to train a fuzzy model for overhead distribution feeders failure rates. International Conference on Intelligent Systems Applications to Power Systems, Lemnos, Greece, September 2003.

Brown RE. Network reconfiguration for improving reliability in distribution systems. IEEE PES 2003 General Meeting, Toronto, Canada, July 2003.

Brown RE, Pan J, Liao Y, Feng X. An application of genetic algorithms to integrated system expansion optimization. IEEE PES 2003 General Meeting, Toronto, Canada, July 2003.

Brown RE, Freeman LAA. A Cost/benefit comparison of reliability improvement strategies. DistribuTECH Conference and Exhibition, Las Vegas, NV, February 2003.

Gupta S, Pahwa A, Brown RE, Das S. A fuzzy model for overhead distribution feeders failure rates. NAPS 2002: 34th Annual North American Power Symposium, Tempe, AZ, October 2002.

Brown RE. Web-based distribution system planning. IEEE PES Summer Power Meeting, Chicago, IL, July 2002.

Brown RE. System reliability and power quality: Performance-based rates and guarantees. IEEE PES Summer Power Meeting, Chicago, IL, July 2002.

Brown RE. Modeling the reliability impact of distributed generation. IEEE PES Summer Power Meeting, Chicago, IL, July 2002.

Gupta S, Pahwa A, Brown RE. Data needs for reliability assessment of distribution systems. IEEE PES Summer Power Meeting, Chicago, IL, July 2002.

Brown RE. Meeting reliability targets for least cost. DistribuTECH Conference and Exhibition, Miami, FL, February 2002.

Gupta S, Pahwa A, Brown RE. Predicting the failure rates of overhead distribution lines using an adaptive-fuzzy technique. NAPS 2001: 33rd Annual North American Power Symposium, College Station, TX, October 2001.

Jones PR, Brown RE. Advanced modeling techniques to identify and minimize the risk of aging assets on network performance. Utilities Asset Management 2001, London, UK, July 2001.

Brown RE. Distribution reliability modeling at Commonwealth Edison. 2001 IEEE/PES Transmission and Distribution Conference and Exposition, Atlanta, GA, October 2001.

Brown RE. Distribution reliability assessment and reconfiguration optimization. 2001 IEEE/PES Transmission and Distribution Conference and Exposition, Atlanta, GA, October 2001.

Brown RE, Pan J, Feng X, Koutlev K. Siting distributed generation to defer T&D expansion. 2001 IEEE/PES Transmission and Distribution Conference and Exposition, Atlanta, GA, October 2001.

Ross D, Freeman L, Brown RE. Overcoming data problems in predictive distribution reliability modeling. 2001 IEEE/PES Transmission and Distribution Conference and Exposition, Atlanta, GA, October 2001.

Brown RE, Freeman LAA. Analyzing the reliability impact of distributed generation. IEEE PES Summer Power Meeting, Vancouver, BC, Canada, July 2001.

Brown RE, Marshall M. Microeconomic examination of distribution reliability targets. IEEE PES Winter Power Meeting, Columbus, OH, January 2001, Vol. 1, pp. 58-65.

Jones PR, Brown RE. Investment Planning of networks using advanced modeling techniques. Utilities Asset Management 2001, London, UK, January 2001.

Brown RE. Probabilistic reliability and risk assessment of electric power distribution systems. DistribuTECH Conference and Exhibition, San Diego, CA, February 2001.

LaPlace C, Hart D, Brown RE, Mangum W, Tellarini M, Saleeby JE. Intelligent feeder monitoring to minimize outages. Power Quality 2000 Conference, Boston, MA, October 2000.

Brown RE, Nguyen H, Burke JJ. A systematic and cost effecting method to improve distribution reliability. IEEE PES Summer Meeting, Edmonton, AB, Vol. 2, pp. 1037-1042, July 1999.

Brown RE, Taylor TM. Modeling the impact of substations on distribution reliability. IEEE PES Winter Meeting, New York, NY, pp. 349-354, February 1999.

Brown RE, Hanson AP, Marshall MM, Willis HL, Newton B. Reliability and capacity: A spatial load forecasting method for a performance based regulatory environment. 1999 Power Industry Computer Applications Conference, Dayton, OH, pp. 139-144, February 1999.

Brown RE, Hanson AP, Hagan D. Long range spatial load forecasting using non-uniform areas. 1998 IEEE/PES Transmission and Distribution Conference, New Orleans, LA, Vol. 1, pp. 369-373, April 1999.

Brown RE. Zimmermann WS, Bambao Jr PP, Simpao LP. Basic planning for a new fast growing area in Manila with a total electrical load of 650 MVA. 12th Annual Conference of the Electric Power Supply Industry, Pattaya, Tailand, November 1998.

Chao XY, Brown RE, Slump D, Strong C. Reliability benefits of distributed resources. Power Delivery International ‘97 Conference, Dallas, TX, December 1997.

Brown RE. Competitive distribution systems: A reliability perspective. American Power Conference, Vol. 59-II, Chicago, IL, pp. 1115-1120, April 1997.

Brown RE, Venkata SS, Christie RD. Hybrid reliability optimization methods for electric power distribution systems. International Conference on Intelligent Systems Applications to Power Systems, Seoul, Korea, IEEE, July 1997.

Brown RE, Gupta S, Christie RD, Venkata SS, Fletcher RD. Automated primary distribution system design: Reliability and cost optimization. 1996 IEEE/PES Transmission and Distribution Conference, Los Angeles, CA, September, 1996, pp. 1-6.

Brown RE, Gupta S, Christie RD, Venkata SS. A genetic algorithm for reliable distribution system design. International Conference on Intelligent Systems Applications to Power Systems, Orlando, FL, pp. 29-33, January 1996.

Technical Articles

Brown RE. Counterintuitive strategies. Transmission and Distribution World, March 2013.

Brown RE. Storm hardening distribution systems. Transmission and Distribution World, June 2010.

Brown RE. A beautiful grid? Transmission and Distribution World, February 2010.

Brown RE. Business realities. Transmission and Distribution World, January 2009.

Willis HL, Brown RE. What happens with a lack of long range T&D infrastructure planning? Natural Gas & Electricity 2008 Jan; 24(6):22-27.

Brown RE. Increased performance expectations for major storms. Electric Perspectives, EEI, June 2007.

Engel MV, Brown RE, Phillips E, Bingel N. Extreme winds test wood pole strength. Transmission and

Distribution World, May 2007; pp. 34-38.

Brown RE. Asset management: balancing performance, cost, and risk. EnergyPulse Special Issue on Asset Management, www.energycentral.com, February 2005.

Musser P, Brown RE, Eyford T, Warren C. Too many routes of reliability. Transmission and Distribution World, June 2004; pp. 17-22.

Taylor TM, Brown RE, Chan ML, Fletcher RH, Larson S, McDermott T, Pahwa A. Planning for effective distribution. IEEE Power and Energy Magazine 2003; 1(5):54-62.

Brown RE, Freeman LAA. A cost/benefit comparison of reliability improvement strategies. Electric Power and Light, May 2003.

Brown RE, Kazemzadeh H, Williams BR, Mansfield CB. Engineering Tools Move into Cyberspace. Transmission and Distribution World, March 2003; pp. 27-36.

Perani P, Brown RE. Maintaining reliable power for semiconductor manufacture. What's New in Electronics, March 2002.

Perani P, Brown RE. Rock steady: The importance of reliable power distribution in microprocessor manufacturing plants. ABB Review, 2002; 3:29-33.

Willis HL, Brown RE. Is DG ready for the last mile? Power Quality (cover story), March 2002; pp. 16-21.

Brown RE, Marshall MW. The cost of reliability. Transmission and Distribution World (cover story), Dec. 2001; pp. 13-20.

Brown RE, Jones PR, Trotter S. Planning for reliability. Trans-Power Europe 2001 March; 1(1):10-12.

Brown RE, Howe B. Optimal deployment of reliability investments. E-Source, Power Quality Series: PQ-6, March 2000.

Invited Presentations

Panel Member. Demand response as a dispatchable resource. POWER-GEN International, Orlando, FL, November 2013.

Panel Member. Changing infrastructure requirements for major weather events. IEEE PES 2012 General Meeting, San Diego, CA, July 2012.

Speaker. Cost recovery of storm response expenses including mutual aid. EEI Transmission, Distribution, and Metering Conference, Louisville, KY, April, 2011.

Keynote Speaker. Cost effective reliability improvement. Exactor Smart Grid and Overhead Distribution Reliability Conference, Columbus, OH, February 2010.

Speaker. Reliability analysis in a budget constrained world. Georgia EMC Engineer's Conference, Pine Mountain, GA, October 2009.

Speaker. Impact of climate change on power system design. Midwest Energy Association (MEA) Electric Operations Conference, Springfield, Il, May 2009.

Speaker. Storm hardening: What can we do to avoid damage? Emergency Preparedness and Service Restoration for Utilities, Infocast Conference, Houston, TX, March 2009.

Speaker. Costs and benefits of overhead to underground conversion. Webinar on Utility Undergrounding, Chartwell, Aug. 2008.

Speaker. Quantifying the impacts of reliability improvements. EPRI Power Quality Applications (PQA) and Advanced Distribution Automation (ADA) 2008 Joint Conference and Exhibition, Cleveland, OH, Aug. 2008.

Speaker. Towards a greener feeder. The Carbon Challenge: Management Strategies & Practical Approaches, NRECA Cooperative Research Network, Nashville, TN, July 2008.

Session Chair. T&D reliability. IEEE PES 2008 General Meeting, Pittsburg, PA, July 2008.

Speaker. Infrastructure asset management. Marcus Evans T&D Asset Management Conference, Denver, CO, July 2008.

Speaker. Cost effective reliability improvement. 2008 Milsoft User's Group Meeting, Orlando, FL, June 2008.

Speaker. An entrepreneurial adventure. New Ventures, University of North Carolina at Chapel Hill, May 2008.

Speaker. Undergrounding electric distribution cost effectiveness, reliability, & aesthetics. Florida Municipal Electricity Association (FMEA) Energy Connections Conference, Jacksonville, FL, October 2007.

Session Chair. T&D reliability. IEEE PES 2007 General Meeting, Tampa, FL, June 2007.

Session Chair. Transmission market issues. IEEE PES 2007 General Meeting, Tampa, FL, June 2007.

Workshop Leader. Distribution asset management and aging infrastructure. Canadian Electrical Association Workshop on Aging Distribution Infrastructure, Kelowna, Canada, May 2007.

Speaker. Hardening distribution systems for extreme wind. Chartwell Distribution Reliability Summit, Atlanta, Georgia, March 2007.

Speaker. Pole hardening following Hurricane Wilma. 2007 Southeastern Utility Pole Conference, Tunica, MS, February 2007.

Speaker. Hurricane hardening. IEEE International Conference on Transmission & Distribution Construction, Operation & Live-Line Maintenance (ESMO), Albuquerque, NM, October 2006.

Speaker. Hurricane Wilma and FPL. 2006 IEEE PES General Meeting, Montreal, Canada, June 2006.

Speaker. Hurricane hardening. 2006 EEI Transmission, Distribution & Metering Spring Conference, Houston, Texas, April 2006.

Speaker. Evaluating infrastructure integrity. Rebuilding Utility Infrastructure Conference, Louisiana State University, February, 2006.

Speaker. Improving island reliability with better asset management. 2005 CARELEC Engineers Conference and Supply Chain Seminar, Puerto Rico, July 2005.

Session Chair. Project evaluation and selection. 2005 IEEE/PES Transmission and Distribution Conference, New Orleans, LA, October 2005.

Session Chair. Distribution planning and implementation issues for modern power systems. IEEE PES General Meeting, San Francisco, CA, June 2005.

Speaker. Planning for aging infrastructure. IEEE PES General Meeting, San Francisco, CA, June 2005.

Panel Member. Assessing the impact on reliability indices after adding an OMS. 2004 IEEE/PES Transmission and Distribution Conference, New Orleans, LA, October 2005.

Panel Member. Effects of system design on reliability. 2004 IEEE/PES Transmission and Distribution Conference, New Orleans, LA, October 2005.

Instructor. Asset management for transmission and distribution. 1-Day Course, DistribuTECH Conference and Exhibition, San Diego, CA, January 2005.

Session Chair. Planning non-traditional distribution systems. IEEE Power Systems Conference and Exposition, New York, NY, October 2004.

Speaker. Asset management and financial risk. Conference on Probabilistic Methods Applied to Power Systems, Ames, Iowa, September 2004.

Session Chair. Equipment failure rates. IEEE PES General Meeting, Denver, CO, June 2004.

Instructor. Distribution reliability. 1-Day Course, T&D World Expo, Indianapolis, IN, May 2004.

Instructor. Distribution asset management for transmission and distribution. 1-Day Course, PMI Management Development for Indian Utility Executives, Madrid, Spain, April 2004.

Speaker. Distribution asset management. 2003 Real World Conference: It's All About Cost and Reliability, Transmission and Distribution World, Ft. Lauderdale, FL, October 2003.

Speaker. The 2004 Northeast Blackout. NC State IEEE/PES Student Chapter, October 2003.

Panel Member. Distribution reliability standards and their basis. 2003 IEEE/PES Transmission and Distribution Conference, Dallas, TX, September 2003.

Session Chair. Power system planning in an evolving regulatory environment. IEEE PES Summer Power Meeting, Toronto, Ontario, July 2003.

Panel Member. Distribution system reconfiguration. IEEE PES Summer Power Meeting, Toronto, Ontario, July 2003.

Panel Member. IT solutions for distribution system planning. IEEE PES Summer Power Meeting, Chicago, IL, July 2002.

Panel Member. Distribution system reliability assessment. IEEE PES Summer Power Meeting, Chicago, IL, July 2002.

Panel Member. Current status of DG models for feeder analysis. IEEE PES Summer Power Meeting, Chicago, IL, July 2002.

Speaker. Tools for cost-effectively improving reliability. Managing Distribution Systems in a Deregulated Environment, EUCI, Denver, CO, May 2002.

Session Chair. Impact of DG on system reliability. Power Systems 2002 Conference: Impact of Distributed Generation, Clemson, SC, March 2002.

Speaker. How to apply reliability improvement methods to your distribution system. Electric Distribution Reliability Planning Conference, INFOCAST, Seattle, WA, Nov. 2001.

Panel Member. Status of distribution reliability in the United States. 2001 IEEE/PES Transmission and Distribution Conference, Atlanta, GA, October 2001.

Panel Member. Distribution system reliability and reconfiguration software tools. 2001 IEEE/PES Transmission and Distribution Conference, Atlanta, GA, October 2001.

Panel Member. Challenges in distribution system analysis. IEEE PES Summer Power Meeting, Vancouver, BC, Canada, July 2001.

Panel Member. What are the appropriate reliability targets for distribution companies to meet? IEEE PES Winter Power Meeting, Columbus, OH, January 2001.

Speaker. Distribution reliability challenges. Distribution System Planning, Maintenance and Reliability Conference, EUCI, Denver, CO., Nov. 2000.

Speaker. Reliability-based planning methods: How to choose a method that best meets your reliability goals. Electric Distribution Reliability Planning Conference, INFOCAST, Chicago, IL, September 2000.

Speaker. The impact of deregulation on electric power system reliability. CUEPRA Summer Meeting, Charlotte, NC, July 2000.

Speaker. Tools for analyzing and valuing distribution reliability. Power Delivery Reliability Conference, INFOCAST, Denver, CO, June 2000.

Panel Member. Rates and reliability—Peaceful co-existence. DistribuTECH Conference, Miami, FL, February 2000.

Speaker. Optimizing distribution reliability at minimum cost using computer optimization. Improving Distribution Reliability Conference, Washington D.C., January 2000.

Speaker. Managing cost, reliability, and financial risk for power distribution systems. E-Source Power Quality Summit, Chicago, IL, Nov. 1999.

Speaker. Noteworthy topics in power system planning in a deregulated environment. IEEE PES Winter Power Meeting, New York, NY, February 1999.

Speaker. Distribution reliability for de-regulated utilities. IEEE PES Winter Power Meeting, New York, NY, February 1999.

Speaker. Design for reliability: What level of reliability should distribution systems be built for? Rethinking Electricity Distribution Reliability Conference, INFOCCAST, Atlanta, GA, March 1998.

Panel Member. Value of reliability for distribution systems. DistribuTECH Conference, Tampa, FL, January 1998.

Speaker. Design for reliability: What level of reliability should distribution systems be built for? Rethinking Electricity Distribution Reliability Conference, INFOCAST, Chicago, IL, September 1997.

Speaker. Distribution system design: Reliability and cost optimization. IEEE/PES Seattle Section, Seattle, WA, May 1996.

Speaker. Power system reliability assessment. University of Washington Electric Energy Systems Seminar, Seattle, WA, September 1995.

Project Experience

Consulting and Research Project Experience

Dr. Brown has almost thirty years of consulting experience for utilities and related industries. He has performed consulting services for most of the major utilities in the United States and for many around the world. Specific consulting project experience is available upon request. Major areas of consulting that Dr. Brown has performed include the following:

- Developing asset strategy plans for utilities
- Assessing asset management plans for utilities
- Performing reliability and risk assessments for utilities
- Developing reliability improvement plans for utilities
- Developing system hardening plans for utilities
- Developing equipment failure rate models
- Performing life-cycle cost assessments asset classes
- Investigating the direct and root causes of major utility interruption events
- Performing benefit-to-cost assessments and business case justification for CAPEX and OPEX projects
- Performing safety program assessments
- Performing business management audits for utilities
- Performing applied research projects for utility industry consortiums
- Performing industry benchmark surveys
- Assessing major event performance for utilities
- Performing technology assessments (e.g., Smart Grid)
- Developing system automation strategies for utilities
- Performing distribution system planning and load forecasting studies
- Transmission system planning
- Power system design (e.g., construction documents)

Expert Witness Experience for Regulatory Proceedings

Dr. Brown has over twenty years of experience providing expert witness support in regulatory proceedings for utilities and related industries. He has provided a large amount of prefiled testimony, prepared a large number of expert reports, has given many depositions, and has extensive live testimony experience. Specific information is available upon request. Major areas that Dr. Brown has provided expert witness testimony in regulatory proceedings include the following:

- Assessments of applications for certificates of public need and necessity
- Assessments of commission-mandated reliability targets and penalties
- Assessments of commission-mandated storm hardening requirements
- Benefit-to-cost assessment of overhead-to-underground conversion programs
- Prudency assessment of major capital projects
- Assessment of PURPA avoided cost calculations
- Assessments of utility reliability performance
- Assessments of utility major storm restoration performance

- Assessment of aging infrastructure proactive replacement programs
- Assessment of reliability improvement programs
- Performed industry benchmark studies

Expert Witness Experience for Civil Proceedings

Dr. Brown has over twenty years of experience providing expert witness support in civil proceedings for utilities and related industries. He has prepared a large number of expert reports, has given many depositions, and has extensive live testimony experience. Major areas that Dr. Brown has provided expert witness testimony in civil proceedings include the following:

- Fires and explosions
- Downed utility wires
- Utility car-pole accidents
- Public injuries involving utility equipment
- Utility operational response
- Utility operations and maintenance practices
- Interruptions to large industrial customers
- Patent infringement and validity
- Reliability and power quality of utility customers