Paul Hines

Electrical & Biomedical Engineering		Phone:	+1.802.656.9660
University of Vermont, 203 Farrell Hall		E-mail:	paul.hines@uvm.edu
Burlington, VT 05405		URL:	`http://www.uvm.edu/~phines`

Education

Carnegie Mellon University, Pittsburgh, Pennsylvania USA
- Ph.D. in Engineering & Public Policy, 2007, with research in Electrical Engineering (Power Systems).
- Dissertation: "A Decentralized Approach to Reducing the Social Costs of Cascading Failures;" Committee Members: Sarosh Talukdar (CMU Electrical Engineering, chair), Jay Apt, Bruce Krogh, Granger Morgan, Le Tang (ABB Corporate Research)

University of Washington, Seattle, Washington USA
- M.S. in Electrical Engineering. Graduated *Magna Cum Laude*, 2001
- Thesis Title: "A Power Systems Capstone Design Project and Associated Simulation Software Designed to Meet the Changing Needs of the Electrical Power Industry and Engineering Accreditation Requirements"

Seattle Pacific University, Seattle, Washington USA
- B.S. in Electrical Engineering, Graduated *Cum Laude*, 1997

Professional Appointments

University of Vermont School of Engineering, L. Richard Fisher Professor, March 2015 to present; Associate Professor, September 2014 to present; Assistant Professor, December 2007 to August 2014; secondary appointment in Computer Science. April 2007 to present.

Packetized Energy, Co-founder of a clean energy software startup based on IP developed at the University of Vermont, May 2016 to present.

Santa Fe Institute, External Faculty Member, 2018 to present.

Carnegie Mellon Electricity Industry Center, Adjunct research faculty member, 2007 to present

Santa Fe Institute, visiting faculty member (sabbatical appointment), September 2014 to June 2015

Burlington Electric Department, Commissioner, 2009 to 2012; Vice-chair, 2011 to 2012

Science Applications International (SAIC), Research Scientist, 2007
- Conducted research within the Computational Science Division at the US DOE National Energy Technology Laboratory.
- Led the NETL component of a DOE Office of Electricity Delivery and Energy Reliability (OE) funded research project that aims use distributed autonomous agents to improve electricity distribution systems.
- Worked with the OE research group to develop methods for evaluating the benefits of OE research programs.

Carnegie Mellon University, Doctoral Research Assistant, 2003 to 2007
- Worked in the Carnegie Mellon Electricity Industry Center on research sponsored by ABB Corporate Research. The goal of the project was to develop a cooperative, multi-agent system to reduce the costs associated with cascading failures in a power network by intelligently shedding load and generation, when needed. Developed a software test system for ABB researchers that illustrated the usefulness of our approach.
- Co-managed 30 students in an undergraduate engineering and policy capstone course.
- Lectured in graduate courses including, "Optimization and problem formulation" and "Multi-agent systems"

Federal Energy Regulatory Commission, Electrical Engineer, 2005
- Worked with the FERC Reliability Group, which now has responsibility for regulating

reliability in the United States. Performed analysis of several problems related to nuclear power plant operations in the U.S.

Millennium Relief and Development Services, Volunteer, 2001-2002

· Designed and managed a computer laboratory for a community center (Inma Center) in Southern Beirut, which provided services for the poor of the region. Designed and taught an introductory Internet course offered by the center. Prepared course material in Arabic and English.

Alstom ESCA Corp. (now Areva T&D), Energy Systems Intern, 2001

· Designed a neural network short-term load forecasting program for use in the energy management systems used by large power system operators. Developed a new approach to increase the accuracy of short-term load forecasting. The resulting tool has been used by several U.S. regional transmission organizations.

University of Washington, Graduate Research Assistant, 1999 to 2001

· Developed power systems analysis software and market-based engineering capstone course curriculum. The newly designed course resulted in improved course ratings. In addition to power systems coursework and research, completed graduate level coursework in engineering learning and teaching.

Black & Veatch Power Delivery, Electrical Engineer, 1997 to 1999

· Designed control and protection systems, substation bus work configurations, and AC and DC station service systems for several high voltage and extra high voltage substation projects. Worked in interdisciplinary teams, completing complex design and construction projects on tight schedules.

Industra Engineers and Consultants, Electrical Engineering Intern, 1996

· Assisted with the design of industrial electrical distribution systems.

Honors and Awards

L. Richard Fisher Professorship—Selected as the L. Richard Fisher endowed chair in electrical engineering, at the University of Vermont, 2015-present.

IEEE Senior Member—Elevated April 2014. According to the IEEE, "IEEE Senior Membership is an honor bestowed only to those who have made significant contributions to the profession."

National Science Foundation CAREER award—$400,000 grant to support a project entitled "CAREER: Harnessing Smart Grid Data to Enable Resilient and Efficient Electricity."

IEEE Section Scientist of the Year Award—IEEE Green Mountain Section, December 2012. Awarded for contributions to the science of "Smart Grids."

Milt Silveira Award—University of Vermont College of Engineering and Mathematical Sciences, May 2012. The Milt Silveira Award recognizes the junior faculty member in the college who, "best embodies a 'pioneering spirit', drive and potential to succeed at the highest levels of his or her profession."

Outstanding Faculty Advisor—University-wide award for the graduate advising; presented by the Graduate Student Senate, May 2011.

Best paper award—Hawaii International Conference on Systems Sciences, Jan. 2011

"Editor's Choice" in Science Magazine—The article, "Do topological models provide good information about vulnerability in electric power networks?" was featured in the "Editor's Choice" section in the October 2010 issue of *Science*.

Best paper award—Technology, Management and Policy Graduate Consortium, 2007

Stephen Lee Award—Carnegie Mellon, Engineering & Public Policy, 2005

· Project manager for the undergraduate engineering/social science capstone project course entitled, "Sustaining Pittsburgh's Vital Services when the Power Goes Out." The results

were voted the best undergraduate student project for 2005, and were distributed to state and local leaders. The project's findings were highlighted in several local media reports.

Herb Toor Award—Carnegie Mellon, Engineering & Public Policy, 2005
· Granted one of two awards for the department's best doctoral qualifying exam research paper entitled, "Controlling Cascading Failures with Cooperative Autonomous Agents."

Grainger Foundation Graduate Fellow—University of Washington, 2001
· Granted a fellowship for graduate studies at the University of Washington.

Engineer in Training—Washington State, 1997
· Passed the Fundamentals of Engineering (FE) prerequisite for the Professional Engineers (PE) licensure exam.

Ivy Honorary Society—Seattle Pacific University, 1997
· Appointed to the SPU branch of the Mortar Board.

Henry Foss Scholar—Henry Foss High School, 1993
· One of two award recipients from a graduating class of 240.

Patents and Inventions

Jeff Frolik, Paul Hines, and Mads Almassalkhi, "Systems and Methods for Random-Access Power Management of Thermostatically-Controlled Loads and Bi-Directional Electric Energy Systems," U.S. patent application 62/397,393, filed on Sept. 21 2016.

Jeff Frolik and Paul Hines, "Systems and Methods for random access power management using packetization," U.S. patent application 2015/0380936, filed on 1 March 2014. Superseding provisional application no. 61,722,533.

Both patents have been licensed by Packetized Energy, a startup company (co-founded by Hines) that is working to make energy clean, affordable and easy to use.

Publications

Journal articles in review/revision

Samuel Chevalier and Paul D.H. Hines, "Mitigating the Risk of Voltage Collapse using Statistical Measures from PMU Data," *IEEE Transactions on Power Systems* (in review/revision).
`https://arxiv.org/abs/1805.03703`

Peer-reviewed journal articles (accepted or published)

Mark D. Wagy, Josh C. Bongard, James P. Bagrow, Paul D. H. Hines, "Crowdsourcing Predictors of Residential Electric Energy Usage," *IEEE Systems Journal*, in press (Online as of 21 December 2017).
`https://doi.org/10.1109/JSYST.2017.2778144`

Saurav Acharya, Byung Suk Lee, and Paul Hines, "Causal Prediction of Top-k Event Types Over Real-Time Event Streams," *The Computer Journal*, vol. 60, no. 11, pp. 15611581, Nov. 2017.
`https://doi.org/10.1093/comjnl/bxw098`

D. Curtis Saunders, Jeffrey S. Marshall, and Paul D. Hines, "The importance of timescales in a nonlinear model predictive controller for dynamic wind farm performance," *Wind Energy*, vol. 20, no. 11, pp. 1891-1908, Nov. 2017.
`https://doi.org/10.1002/we.2128`

C.T.M. Clack, S.A. Qvist, J. Apt, S.J. Davis, V. Diakov, M. Handschy, P. Hines, P. Jaramillo, D.M. Kammen, M.G. Morgan, J.F. Whitacre, J. Sweeney, D.G. Victor, G.R. Tynan, J.C.S. Long, V. Sivaram, A. Brandt, J.P. Weyant, and K. Caldeira, "Evaluation of a proposal for reliable low-cost grid power with 100% wind, water, and solar," *Proceedings of the National Academy of Sciences*, vol. 114, no.26, June 27, 2017.

https://doi.org/10.1073/pnas.1610381114

Mert Korkali, Jason G. Veneman, Brian F. Tivnan and Paul D.H. Hines, "Reducing Cascading Failure Risk by Increasing Infrastructure Network Interdependence," *Scientific Reports* (Nature), vol. 7, no. 44499, Mar. 2017.
https://doi.org/10.1038/srep44499

Paul Hines, Ian Dobson and Pooya Rezaei, "Cascading Power Outages Propagate Locally in an Influence Graph that is not the Actual Grid Topology," *IEEE Transactions on Power Systems*, vol. 32, no. 2, pp. 958-967, Mar. 2017.
doi:10.1109/TPWRS.2016.2578259

IEEE Working Group on Understanding, Prediction, Mitigation and Restoration of Cascading Failures. (J. Bialek, E. Ciapessoni, D. Cirio, E. Cotilla-Sanchez, C. Dent, I. Dobson, P. Henneaux, P. Hines, J. Jardim, S. Miller, M. Panteli, M. Papic, A. Pitto, J. Quiros-Tortos, and D. Wu), "Benchmarking and Validation of Cascading Failure Analysis Tools," *IEEE Transactions on Power Systems*, vol. 31, no. 6, Nov. 2016.
doi:10.1109/TPWRS.2016.2518660

Jiajia Song, Eduardo Cotilla-Sanchez, Goodarz Ghanavati, Paul D. H. Hines, "Dynamic Modeling of Cascading Failure in Power Systems," *IEEE Transactions on Power Systems*, vol. 31, no. 3, May 2016.
doi:10.1109/10.1109/TPWRS.2015.2439237

G. Ghanavati, P. D. H. Hines, and T. I. Lakoba, "Identifying useful statistical indicators of proximity to instability in stochastic power systems," *IEEE Transactions on Power Systems*, vol. 31, no. 2, 2016.
doi:10.1109/TPWRS.2015.2412115

Pooya Rezaei, Paul D. H. Hines, and Margaret J. Eppstein, "Estimating Cascading Failure Risk with Random Chemistry," *IEEE Transactions on Power Systems*, vol. 30, no. 5, pp. 2726-2735, 2015.
doi:10.1109/TPWRS.2014.2361735

Jonathan Dowds, Paul Hines, Todd Ryan, William Buchanan, Elizabeth Kirby, Jay Apt and Paulina Jaramillo "A Review of Large-Scale Wind Integration Studies," *Renewable and Sustainable Energy Reviews*, vol. 49, pp. 768794, 2015.
doi:10.1016/j.rser.2015.04.134

Robert Swain, Alex Berger, Josh Bongard, and Paul Hines, "Participation and Contribution in Crowdsourced Surveys," *PLOS ONE*, vol. 10, no. 4, e0120521, 2015.
doi:10.1371/journal.pone.0120521

Andrew Seier, Paul Hines, and Jeff Frolik, "Data-Driven Thermal Modeling of Residential Service Transformers," *IEEE Transactions on Smart Grid*, vol. 6, no. 2, pp. 1019-1025, 2015. doi:10.1109/TSG.2015.2390624

Goodarz Ghanavati, Paul D. H. Hines, Taras I. Lakoba, Eduardo Cotilla-Sanchez, "Understanding early indicators of critical transitions in power systems from autocorrelation functions," *IEEE Transactions on Circuits and Systems I: Regular Papers*, vol. 5, no. 2, March 2014. doi:10.1109/TCSI.2014.2332246

Pooya Rezaei, Jeff Frolik, and Paul Hines. "Packetized Plug-in Electric Vehicle Charge Management." *IEEE Transactions on Smart Grid*, vol. 5, no. 2, pp. 642-650, 2014.
doi:10.1109/TSG.2013.2291384

Kirsten E. Bevelander, Kirsikka Kaipainen, Robert Swain, Simone Dohle, Josh C. Bongard, Paul Hines, Brian Wansink, "Crowdsourcing Novel Childhood Predictors of Adult Obesity." *PLOS ONE*, Feb. 5, 2014. doi:10.1371/journal.pone.008775

E. Cotilla-Sanchez, P. Hines, C. Barrows, S. Blumsack, and M. Patel. "Multi-attribute Partitioning of Power Networks Based on Electrical Distance." *IEEE Transactions on Power Systems*, vol. 28, no. 4, pp. 4979-4987, 2013.
doi: 10.1109/TPWRS.2013.2263886

Charles D. Brummitt, Paul D. H. Hines, Ian Dobson, Cristopher Moore, Raissa M. D'Souza, "Transdisciplinary electric power grid science." (peer-reviewed opinion article) *Proceedings of the National Academy of Sciences*, vol. 110, no. 30, 2013.
doi: 10.1073/pnas.1309151110

Alexander D. Hilshey and Paul D. H. Hines. "Estimating the Impact of Electric Vehicle Smart Charging on Distribution Transformer Aging." *IEEE Transactions on Smart Grid*, vol. 4, no. 2, 2013.
10.1109/TSG.2012.2217385

Jon Dowds, Paul Hines, Seth Blumsack, "Estimating the impact of fuel-switching between liquid fuels and electricity under electricity-sector carbon pricing schemes." *Socio-Economic Planning Sciences* (Special issue on Energy Systems), vol. 47, no. 2, pp. 76-88, 2013.
doi:10.1016/j.seps.2012.09.004

Jeffrey S. Marshall, Paul D. Hines, Jiarui D. Zhang, Francesca Minervini and Simtha Rinjitham, "Modeling the Impact of Electric Vehicle Charging on Heat Transfer around Underground Cables." *Electric Power Systems Research*, vol. 97, pp. 76-83, April 2013.
doi:10.1016/j.epsr.2012.12.006

Josh C. Bongard, Paul D. H. Hines, Dylan Conger, Peter Hurd, and Zhenyu Lu. "Crowdsourcing Predictors of Behavioral Outcomes." *IEEE Transactions on Systems, Man, and Cybernetics, Part A*, vol. 43, no. 1, 2013.
doi:10.1109/TSMCA.2012.2195168

Eduardo Cotilla-Sanchez, Paul Hines, and Christopher M. Danforth. "Predicting Critical Transitions from Time Series Synchrophasor Data." *IEEE Transactions on Smart Grid*, vol. 3, no. 4, 2012.
doi: 10.1109/TSG.2012.2213848

Margaret J. Eppstein and Paul D. H. Hines. "A 'Random Chemistry' Algorithm for Identifying Multiple Contingencies that Initiate Cascading Failure." *IEEE Transactions on Power Systems*, vol. 27, no. 3, 2012.
doi: 10.1109/TPWRS.2012.2183624

Justine Sears, Jon Dowds, Lisa Aultman-Hall, Paul Hines. "Travel Demand and Charging Capacity for Electric Vehicles in Rural States: A Vermont Case Study." *Transportation Research Record*, vol. 2287, pp. 27-36, 2012.
doi: 10.3141/2287-04

Eduardo Cotilla-Sanchez, Paul D. H. Hines, Clayton Barrows and Seth Blumsack, "Comparing the Topological and Electrical Structure of the North American Electric Power Infrastructure," *IEEE Systems Journal*, vol. 6, no. 4, pp. 616-626, 2012. (Featured on cover page)
10.1109/JSYST.2012.2183033

IEEE Task Force on Understanding, Prediction, Mitigation and Restoration of Cascading Failures (M. Vaiman, K. Bell, Y. Chen, B. Chowdhury, I. Dobson, P. Hines, M. Papic, S. Miller, P. Zhang). "Risk Assessment of Cascading Outages: Methodologies and Challenges." *IEEE Transactions on Power Systems*, vol. 27, no. 2, pp. 631-641, 2012.
doi: 10.1109/TPWRS.2011.2177868

P. Hines, E. Cotilla-Sanchez, S. Blumsack. "Do topological models provide good information

about vulnerability in electric power networks?" *Chaos*, vol. 20, no. 3, 2010. (Featured in the Editor's Choice section in *Science*.
doi: 10.1063/1.3489887

J. Dowds, P. Hines, "Estimating the Impact of Electric Vehicle Charging on Electricity Costs Given an Electricity Sector Carbon Cap." *Transportation Research Record*, vol. 2191, pp. 43-49, 2010.

P. Hines and S. Talukdar. "Reciprocally Altruistic Agents for the Mitigation of Cascading Failures in Electrical Power Networks." *The International Journal of Critical Infrastructures*, vol. 5, no. 4, pp. 340-356, 2009.

P. Hines, J. Apt, and S. Talukdar. "Large Blackouts in North America: Historical Trends and Policy Implications." *Energy Policy*, vol. 37, pp. 5249-5259, 2009. (Mentioned in both *Scientific American* and *IEEE Spectrum*)

P. Hines and S. Talukdar. "Controlling Cascading Failures with Cooperative Autonomous Agents." *The International Journal of Critical Infrastructures*, vol. 3, nos. 1/2, 2007.

P. D. Hines and R. D. Christie. "A Capstone Design Project to Meet the Needs of the Changing Power Systems Industry and Satisfy New Accreditation Standards." *IEEE Transactions on Power Systems*, vol. 17, no. 3, Aug. 2002.

Book chapters, editor-reviewed journal articles, media contributions, etc.

Mads Almassalkhi, Luis Duffaut Espinosa, Paul D. Hines, Jeff Frolik, Sumit Paudyal, Shoeib Heydari, and Mahraz Amini, "Asynchronous coordination of distributed energy resources with packetized energy management," in *Energy Markets and Responsive Grids: Modeling, Control, and Optimization* by Sean Meyn, Tariq Samad, Ian Hiskens, Jakob Stoustrup, eds., Springer, 2018.

Paul Hines and Pooya Rezaei, "Cascading Failures in Power Systems." in the *Smart Grid Handbook*, edited by Chen-Ching Liu, Stephen McArthur and Seung-Jae Lee. Chichester, UK: John Wiley & Sons, pp. 215-234, 2016.

Jonathan Dowds, Paul Hines, Todd Ryan, William Buchanan, Elizabeth Kirby, Jay Apt, and Paulina Jaramillo, "A Critical Review of Large-Scale Wind Integration Studies in the United States," in *Variable Renewable Energy and the Electricity Grid,* by Jay Apt and Paulina Jaramillo, RFF Press, 2014.

Paul Hines. "Smart Grid Technology has Advantages." *Burlington Free Press*, June 21, 2011.

Paul D. H. Hines, Benjamin O'Hara, Eduardo Cotilla-Sanchez, and Christopher M. Danforth. "Cascading Failures: Extreme Properties of Large Blackouts in the Electric Grid." SIAM Mathematics Awareness Month theme essay. 2011. (invited, editor and peer reviewed)

R. Watts, P. Hines and J. Dowds. "The Debate over Re-Licensing the Vermont Yankee Nuclear Power Plant." *The Electricity Journal*, vol. 23, no. 4, 2010. (editor reviewed)

P. Hines, K. Balasubramaniam, and E. Cotilla Sanchez. "Cascading failures in power grids." *IEEE Potentials*, vol. 28, no. 5, pp. 24-30, 2009. (editor reviewed)

Paul Hines. "Survivability and Reciprocal Altruism: Two Strategies for Intelligent Infrastructure with Applications to Power Grids." Book chapter in *Intelligent Infrastructures*, Springer, 2009. (peer reviewed)

Policy reports

Paulina Jaramillo, Jay Apt, and Paul Hines, "Comments of the RenewElec Project on Integration of Variable Energy Resources, Notice of Proposed Rulemaking," US Federal Energy Regulatory Commission, Docket no. RM10-11-000, March 2, 2011.

Granger Morgan, Jay Apt and Lester Lave, with Joule Bergeson Seth Blumsack, Joseph DeCarolis, Paul Hines, Douglas King, Dalia Patino Echeverri and Hisham Zeriffi. "The U.S. Electric Power Sector and Climate Change Mitigation." Pew Center for Global Climate Change Technical Report, June 2005.

Jay Apt and M. Granger Morgan with Paul Hines, Douglas King, Nicholas McCullar, Kyle Meisterling, Shalini Vajjhala, Hisham Zerriffi, Paul Fischbeck, Marija Ilic, Lester Lave, Dmitri Perekhodstev and Sarosh Talukdar, "Critical Electric Power Issues in Pennsylvania: Transmission, Distributed Generation and Continuing Services when the Grid Fails." 2005.

Dmitri Perekhodstev, Kyle Meisterling and Paul Hines eds., "Sustaining Pittsburgh's Vital Services When the Power Goes Out." Carnegie Mellon University, Engineering & Public Policy Project Report (distributed to Pittsburgh region leaders), June 2004.

Conference Papers and Presentations (peer-reviewed papers and abstract-only publications are noted as such)

Luis A. Duffaut Espinosa, Mads Almassalkhi, Paul Hines, and Jeff Frolik, "System Properties of Packetized Energy Management for Aggregated Diverse Resources," Power Systems Computation Conference (PSCC), Dublin, 2018. (peer reviewed)

Laurence A. Clarfeld, Margaret J. Eppstein, Paul D.H. Hines and Eric M. Hernandez, "Assessing Risk from Cascading Blackouts given Correlated Component Failures," Power Systems Computation Conference (PSCC), Dublin, 2018. (peer reviewed)

Kai Zhou, Ian Dobson, Paul D.H. Hines, Zhaoyu Wang, "Can an influence graph driven by outage data determine transmission line upgrades that mitigate cascading blackouts?" IEEE International Conference on Probabilistic Methods Applied to Power Systems (PMAPS), 2018. (peer reviewed)

Luis A. Duffaut Espinosa, Mads Almassalkhi, Paul Hines, and Jeff Frolik, "Aggregate Modeling and Coordination of Diverse Energy Resources Under Packetized Energy Management," IEEE Conference on Decision and Control, 2017.

Paul D. H. Hines, Seth Blumsack, Markus Schläpfer, "When are decentralized infrastructure networks preferable to centralized ones?" Hawaii International Conference on System Sciences, Jan. 2017. (peer reviewed)

Luis A. Duffaut Espinosa, Mads Almassalkhi, Paul Hines, Shoeib Heydari and Jeff Frolik, "Towards a Macromodel for Packetized Energy Management of Resistive Water Heaters," Conference on Information Sciences and Systems, Baltimore, Maryland, March 2017. (peer reviewed)

Mads Almassalkhi, Jeff Frolik, Paul Hines, "Packetized energy management: asynchronous and anonymous coordination of thermostatically controlled loads," American Control Conference, Seattle, May 2017. (peer reviewed)

Paul Hines, Samuel Chevalier and Konstantin Turitsyn, "Early Warning Signs of Instability in the Statistical Properties of PMU Data," North American Synchrophasor Initiative Work Group Meeting, Seattle, October 2016. (abstract only)

Samuel Chevalier and Paul Hines, "System-Wide Early Warning Signs of Instability in Stochastically Forced Power Systems," IEEE Power and Energy Society General Meeting, Boston, July 2016. (peer reviewed)

Zachary Lee and Paul Hines, "Droop Control in a Mechanical Power Grid Simulator," IEEE

Power and Energy Society General Meeting, Boston, July 2016. (peer reviewed)

Raissa D'Souza, Paul Hines and Pierre-Andrew Noël, "Robustness, resilience, and emergent properties of interdependent networks," DTRA Peer-review meeting, Washington, DC, July 2015. (presentation only)

Raissa D'Souza, Paul Hines and Pierre-Andrew Noël, "Robustness, resilience, and emergent properties of interdependent networks," DTRA Peer-review meeting, Washington, DC, July 2015. (presentation only)

Paul Hines, "Beyond Contingency Analysis: New Approaches to Cascading Failures Risk Analysis," Los Alamos Grid Science Conference, Santa Fe NM, 2015. (abstract only)

Paul Hines, "Estimating and Mitigating Cascading Failure Risk," JST-NSF-DFG-RCN Workshop, US National Science Foundation, Washington DC, April 2015. (presentation only)

Goodarz Ghanavati, Taras Lakoba, Paul Hines, "Finding Useful Statistical Indicators of Instability in Stochastically Forced Power Systems," SIAM Dynamical Systems, 2015. (abstract only)

Paul D. H. Hines, Pooya Rezaei, Margaret J. Eppstein, "Estimating Cascading Failure Risk with Random Chemistry," IEEE Power and Energy Society General Meeting, 2015, Denver, CO. (abstract only)

Pooya Rezaei, Margaret J. Eppstein, and Paul D. H. Hines, "Rapid Assessment, Visualization and Mitigation of Cascading Failure Risk in Power Systems," Hawaii International Conf. on System Sciences, 2015, Kauai, HI. (peer reviewed publication)

Paul Hines, "Overview of Power Systems Concepts and Open Problems," Reinventing the Grid: Designing Resilient, Adaptive and Creative Power Systems, Santa Fe Institute workshop, April, 2015.

Goodarz Ghanavati, Paul D. H. Hines and Taras I. Lakoba, "Investigating early warning signs of oscillatory instability in simulated phasor measurements," IEEE Power & Energy Society General Meeting, Washington, DC, 2014. (peer reviewed)

Pooya Rezaei, Paul D. H. Hines, and Margaret Eppstein, "Estimating Cascading Failure Risk: Comparing Monte Carlo Sampling and Random Chemistry," IEEE Power & Energy Society General Meeting, Washington, DC, 2014. (peer reviewed)

Mert Korkali, Jason Veneman, Brian Tivnan and Paul Hines, "Measuring the Impact of Network Structure, Physics and Coupling in Interconnected Power and Communications Networks," SIAM Workshop on Network Science (NS14), Chicago, 2014. (peer-reviewed extended abstract)

Pooya Rezaei and Paul D. H. Hines, "Cascading Failure Risk Variation with Generator Dispatch and System Load Level," IEEE PES T&D Conference & Exposition, Chicago, 2014. (peer-reviewed)

Emilie Hogan, Eduardo Cotilla-Sanchez, Mahantesh Halappanavar, Shaobu Wang, Patrick Mackey, Paul Hines, Zhenyu Huang, "On Clustering Techniques for the Analysis of Electric Power Grids," HiPCNA-PG, 2013.

Goodarz Ghanavati, Paul D. H. Hines, Taras Lakoba, and Eduardo Cotilla-Sanchez, "Calculation of the Autocorrelation Function of the Stochastic Single Machine Infinite Bus System," North American Power Symposium, 2013. (peer reviewed)

IEEE PES Task Force on Cascading Failure, "Mitigation and Prevention of Cascading Outages: Methodologies and Practical Applications." IEEE Power and Energy Society

General Meeting, Vancouver, July 2013.

P. Hines. "Estimating Cascading Failure Risk with Random Chemistry." DIMACS/CCICADA Workshop on Cascading Failures of Power Transmission Systems: Models and Algorithms, Rutgers University, New Jersey, February 2013. (abstract only)

P. Hines. "Random Chemistry and Dual Graphs: Two ways to understand cascading failures in power grids." SIAM Conference on Computational Science & Engineering, special session on Modeling, Simulation, and Optimization of Complex Energy Systems, Boston, March 2013. (abstract only)

IEEE PES Task Force on Understanding, Prediction, Mitigation and Restoration of Cascading Failures (M. Vaiman, P. Hines, J. Jiang ,S. Norris, M. Papic, A. Pitto, Y. Wang, G. Zweigle). "Mitigation and Prevention of Cascading Outages: Methodologies and Practical Applications." IEEE Power and Energy Society General Meeting, Vancouver, July 2013.

Paul Hines, Ian Dobson, Eduardo Cotilla-Sanchez, and Margaret Eppstein. "Dual Graph and Random Chemistry methods for Cascading Failure Analysis." Hawaii International Conference on System Sciences, Jan. 2013 (peer reviewed).

Ronan Fitzmaurice, Eduardo Cotilla-Sanchez, and Paul Hines. "Evaluating the Impact of Modeling Assumptions for Cascading Failure Simulation." Proc. of the IEEE Power and Energy Society General Meeting, San Diego, 2012 (peer reviewed).

Alexander D. Hilshey, Pooya Rezaei, Paul D. H. Hines, and Jeff Frolik. "Electric vehicle charging: Transformer impacts and smart, decentralized solutions." Proc. of the IEEE Power and Energy Society General Meeting, San Diego, 2012 (peer reviewed).

Jeff Frolik and Paul Hines. "Random access, electric vehicle charge management." Proc. of the First IEEE Electric Vehicle Conference, Greenville, SC, 2012 (peer reviewed).

Lisa Aultman-Hall, Justine Sears, Paul Hines and Jonathan Dowds, "Travel Demand and Charging Capacity for Electric Vehicles in Rural States: A Vermont Case Study," Proc. Transportation Research Board Annual Meeting, Jan. 2012 (peer reviewed).

Christopher Parmer, Eduardo Cotilla-Sanchez, Heidi K. Thornquist, and Paul D. H. Hines. "Developing a Dynamic Model of Cascading Failure for High Performance Computing using Trilinos." Proceedings of the first international workshop on High performance computing, networking and analytics for the power grid, Seattle, 2011 (peer-reviewed).

Alexander Hilshey and Paul Hines. "Estimating the acceleration of transformer aging due to electric vehicle charging." Proc. of the IEEE Power and Energy Society General Meeting. Detroit, 2011. (peer reviewed)

Paul D. H. Hines, Eduardo Cotilla-Sanchez, Benjamin O'Hara, and Christopher Danforth. "Estimating Dynamic Instability Risk by Measuring Critical Slowing Down." Proc. of the IEEE Power and Energy Society General Meeting. Detroit, 2011. (invited)

Task Force on Understanding, Prediction, Mitigation and Restoration of Cascading Failures of the IEEE Computing & Analytical Methods (CAMS) Subcommittee, M. Vaiman, K. Bell, Y. Chen, B. Chowdhury, I. Dobson, P. Hines, M. Papic, S. Miller, P. Zhang, "Risk Assessment of Cascading Outages: Part I - Overview of Methodologies," Proc. of the IEEE Power and Energy Society General Meeting, Detroit, 2011. (invited)

Task Force on Understanding, Prediction, Mitigation and Restoration of Cascading Failures of the IEEE Computing & Analytical Methods (CAMS) Subcommittee. (M. Papic, K. Bell, Y. Chen, I. Dobson, L. Fonte, E. Haq, P. Hines, D. Kirschen, X. Luo, S. Miller, N. Samaan, M. Vaiman, M. Varghese, P. Zhang), "Survey of Tools for Risk Assessment of Cascading Outages," Proc. of the IEEE Power and Energy Society General Meeting, Detroit, 2011.

(invited)

Paul Hines "Critical slowing down as an indicator of dynamic instability in Power Systems," Proc. of the SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, 2011. (abstract and presentation only)

Paul Hines, Eduardo Cotilla-Sanchez, Seth Blumsack. "Topological Models and Critical Slowing Down: Two Approaches to Power System Blackout Risk Analysis." Proc. of Proceedings of the 44th Hawaii International Conference on System Sciences. Kauai, 2011. (peer reviewed, best paper award).

Paulina Jaramillo and Paul Hines. A Review Of Large-scale Renewable Electricity Integration Studies. Proc. of the First Integration and Policy Workshop for the RenewElec Project. Carnegie Mellon University, Pittsburgh, Oct. 2010.

Paul Hines. Estimating Regulation Reserve Requirements As Wind Generation Increases - A Problem Definition. Proc. of the First Integration and Policy Workshop for the RenewElec Project. Carnegie Mellon University, Pittsburgh, Oct. 2010.

P. Hines, S. Blumsack, E. Cotilla Sanchez, C. Barrows. "The Topological and Electrical Structure of Power Grids." Proceedings of The 43rd Hawaii International Conference on System Sciences, Jan. 2010. (peer reviewed)

C. Farmer, P. Hines and J. Dowds. "Modeling the Impact of Increasing PHEV Loads on the Distribution Infrastructure." Proceedings of The 43rd Hawaii International Conference on System Sciences, Jan. 2010. (peer reviewed)

P. Hines, J. Bongard, and M. Brown Burkins. "A Scalable Approach to Smart-Grid Technology or 'A Smarter Smart Grid.' " Proc. of the Fifth Annual Carnegie Mellon Conference on the Electricity Industry: Smart Grids, Pittsburgh, 2009.

S. Blumsack, P. Hines, M. Patel, C. Barrows, E. Cotilla Sanchez, "Defining Power Network Zones from Measures of Electrical Distance," *Proc. of the IEEE Power and Energy Society General Meeting*, Calgary, 2009. (peer reviewed)

P. Hines and S. Talukdar, "Reciprocally Altruistic Agents for the Mitigation of Cascading Failures in Electrical Power Networks," *Proc. of the International Conference on Infrastructure Systems*, Rotterdam, 2008. Invited paper.

P. Hines, J. Apt and S. Talukdar, "Trends in the History of Large Blackouts in the United States," *Proc. of the IEEE Power and Energy Society General Meeting*, Pittsburgh, 2008. (peer reviewed)

S. Blumsack, C. Samaras, and P. Hines. "Long-Term Electric System Investments to Support Plug-in Hybrid Electric Vehicles." *Proc. of the IEEE Power and Energy Society General Meeting,* Pittsburgh, 2008. (peer reviewed)

C. Vartanian, D. Law, P. Hines, R. Yinger, S. Hamilton, and A. Feliachi. "Agent-based Distribution Circuit Automation." *Proc. of the IEEE Power and Energy Society General Meeting*, Pittsburgh, 2008. Invited paper.

P. Hines and S. Blumsack, "A Centrality Measure for Electrical Networks." *Proc. of the 41st. Hawaii International Conference on System Sciences*, Jan. 2008. (peer reviewed)

S. Hamilton, B. Coalson, B. Bhargava, C. Vartanian, P. Hines, A. Feliachi and K. Schoder. "Integrated, agent-based, real-time control systems for transmission and distribution networks." *Proc. of GridWise Architecture Council Grid Interop Forum*, Nov. 2007. Invited paper.

S.L. Hamilton, C.K. Vartanian, M.E. Johnson, A. Feliachi, K. Schoder, and P. Hines.

"Circuit of the Future: Interoperability and SCE's DER Program." *Proc. of IREP 2007: Bulk Power System Dynamics and Control-VII*, Aug. 2007.

Paul Hines. "Understanding and Taming the Complexity of Electrical Power Networks." Presented at the Technology, Management and Policy Graduate Consortium, Carnegie Mellon, June 2007.

Paul Hines, Jay Apt, Sarosh Talukdar and Huaiwei Liao. "The Frequency of Large Blackouts in the United States Electrical Transmission System: An Empirical Study." *Proc. of the Second Carnegie Mellon Conference in Electric Power Systems: Monitoring, Sensing, Software and Its Valuation for the Changing Electric Power Industry*, Jan. 2006.

Sarosh Talukdar, Dong Jia, Paul Hines and Bruce H. Krogh. "Distributed Model Predictive Control for the Mitigation of Cascading Failures." *Proc. of the IEEE Conference on Decision and Control/European Control Conference*, Dec. 2005. (peer reviewed)

Paul Hines. "Controlling Cascading Failures in Electricity Networks Using Cooperative Autonomous Agents." Presented at the Technology, Management and Policy Graduate Consortium, MIT, July 2005.

Hines, Paul, Huaiwei Liao, Dong Jia and Sarosh Talukdar. "Autonomous Agents and Cooperation for the Control of Cascading Failures in Electric Grids." *Proc. of the IEEE Conf. on Networking, Sensing, and Control*, Mar. 2005.

Hines, Paul, Dong Jia and Sarosh Talukdar. "Distributed Model Predictive Control for Electric Grids." *Proc. of First Carnegie Mellon Conference on the Electricity Industry—Electricity Transmission in Deregulated Markets: Challenges, Opportunities, and Necessary R&D Agenda*, Dec. 2004.

Hines, Paul and Sarosh Talukdar. "Reducing the Costs of Disturbances to the Electric Power Network." Presented at the International Association for Energy Economics Conference, June 2004.

Hines, Paul D. and Richard D. Christie. "A Capstone Design Project to Meet the Needs of the Changing Power Systems Industry and Satisfy New Accreditation Standards." *Proc. of IEEE Power Engineering Society Summer Meeting*, 2002.

Graduate Students Mentored

Degrees in progress

- Andrew Klem (advisor), Ph.D., Electrical Engineering
- Molly Kelly-Gorham (advisor), Ph.D., Electrical Engineering
- OlaOluwa Akinola (advisor), Ph.D., Electrical Engineering
- Austin Thomas (committee member), Ph.D., Natural Resources
- Sonja Ahmed (committee member), Ph.D., Natural Resources
- Bonnie Reese (committee member), Ph.D., Natural Resources

Completed degrees

- Mark Wagy (committee member), Ph.D., Computer Science. 2016.
- Christopher Clement (committee member), Ph.D., Natural Resources. 2016.
- Caitlin Bliss (committee member), M.S., Electrical Engineering. 2016.
- Sam Chevalier (advisor), M.S., Electrical Engineering. Summer 2016.
- Shawn Adderly (committee chair, project advisor), M.S., Statistics, Spring 2016.
- Pooya Rezaei (advisee), Ph.D., Electrical Engineering. Fall 2015.
- Elizabeth Kirby (advisee), M.S., Electrical Engineering, "Quantification of the Impact of Intermittent Renewable Penetration Levels on Power Grid Frequency Performance Using Dynamic Modeling," May 2015.
- Goodarz Ghanvati (advisee), Ph.D., Electrical Engineering. "Statistical Analysis of High

Sample Rate Time-Series Data for Power System Stability Assessment." Dec. 2015.

- Ryan Tarring (advisee), M.S., Electrical Engineering. Dec. 2013.
- Andrew Seier (Co-advisor), M.S., Electrical Engineering. Dec 2013.
- Clark Vandam (committee member), Ph.D., Electrical Engineering. Dec 2013.
- Somdeb Chaterjee (co-advisor), M.S., Computer Science. 2012.
- Eduardo Cotilla Sanchez (advisee), Ph.D., Electrical Engineering. "Big Data and Energy Systems: Efficient Computational Methods for the Dynamic Analysis of Electric Power Infrastructure." Summer 2012.
- William Buchanan (advisee), M.S., Electrical Engineering. "Statistical Analysis of Wind Data and Modeling of Regulating Reserves." Summer 2012.
- Alex Hilshey (advisee), M.S., Electrical Engineering. "Electric Vehicle Charging: Distribution Transformer Impacts, Smart Charging, and Transportation Modeling." Summer 2012.
- Amanda James (advisee), M.S., "Design and Empirical Evaluation of Coupled Power and Information System Networks," Summer 2011.
- Eric Garza, Ph.D., Natural Resources (committee chair), "Reacting to the Peak. Multiple Criteria Analysis and Energy Return on Energy Invested in Energy Decision Making," 2010.
- Jon Dowds, M.S., Natural Resources (committee chair), "Assessing the Impact of Carbon Pricing and Electric Vehicle Charging on Power Plant Dispatch and Investment Decisions," September 2010.
- Karthikeyan Balasubramaniam (advisee), M.S., Electrical Engineering. "Criticality in a Cascading Failure Blackout Model," Fall 2009.
- Stephen Posner (committee member). MS, Natural Resources. "Estimating the Genuine Progress Indicator (GPI) for Baltimore, MD," 2009.
- Eduardo Cotilla-Sanchez (advisee), M.S., Electrical Engineering. "A Complex Network Approach to Analyzing the Structure and Dynamics of Power Grids." Summer 2009.
- Paul Montane (committee member), M.S., Electrical Engineering. "Navigational Control of an underactuated autonomous robotic hovercraft using GPS-aided inertial navigation." 2009.
- Changfei Chen (committee member), M.S., Electrical Engineering, "Footprint modeling and connectivity analysis for wireless sensor networks." Degree completed in Summer 2008.

Research Grants Awarded

P. Hines (PI), M. Eppstein, E. Modiano, A. Glasmeier, K. Turitsyn, I. Dobson, "CRISP Type 2: Collaborative Research: Understanding the benefits and mitigating the risks of interdependence in critical infrastructure systems ," ∼$2,400,000, U.S. National Science Foundation, 2018-2021.

P. Hines (PI), M. Almassalkhi, "The TESLa/VELCO Weather/Grid Project: Transmission System Applications to Support the Growth of Renewable Energy in Vermont," ∼$193,060, Vermont Electric Power Company (VELCO), 2017-2019.

M. Almassalkhi (PI), P. Hines (Co-PI), J. Frolik, S. Paudyal, "Packetized energy management: Coordinating transmission and distribution," ∼$1,700,000, Advanced Research Projects Agency: Energy (ARPA-E), NODES, 2016-2019.

P. Hines (PI); Co-PIs: P. Racherla, M. Almassalkhi, "Vermont Regional Partnership Enabling the Use of DER," ∼$56,000, Sandia National Laboratories, 2016-2017.

R. D'Souza (PI), A. Noel, P. Hines (Co-PI), "Robustness, Resilience and Emergent Properties of Interacting Networks," $39,330 (subcontract amount), U.S. Defense Threat Reduction Agency via U. of CA Davis, 2014-2016.

J. Bagrow (PI), J. Bongard, P. Hines (Co-PI), C. Danforth, P. Dodds, "BIGDATA: F: DKA: CSD: Hunch and Crunch: Iterative Crowdsourced Hypothesis Generation," $600,000 National Science Foundation, 2014-2018.

P. Hines (PI), "Identifying and mitigating vulnerabilities in coupled power/communications networks," ∼$85,000 over two periods, MITRE Corporation, 2013-2014.

P. Hines (PI), "CAREER: Harnessing Smart Grid Data to Enable Resilient and Efficient

Electricity." $400,000, US National Science Foundation, 2013-2018.

J. Marshall (PI), M. Eppstein, S. Higgins, P. Hines (Co-PI), C. Koliba, "IGERT: Smart Grid: Technology, Human Behavior, and Policy," $3,000,000, US National Science Foundation, 2012-2017.

P. Hines, J. Marshall and J. Frolik, "Electric Vehicles and their Impact on the Electric Power Distribution System." $136,876, US Department of Transportation/UVM Transportation Research Center, 2012-2014.

P. Hines and C. Danforth, "Estimating and mitigating cascading failure risk in power systems with smart grid technology." $500,000, US Department of Energy, 2010-2014.

P. Hines and J. Bongard, "EnergyMinder: An Energy Efficiency Social Network Supporting the eEnergy Vermont Project." $156,136, Burlington Electric Department/US Dept. of Energy, 2011-2014.

P. Hines, "Analytical Support for Dynamic and Critical Peak Pricing Research." $141,078, Green Mountain Power/US Dept. of Energy, 2011-2014.

P. Hines, "Analytical and Modeling Support for the Carnegie Mellon University RenewElec Project." $120,000, Carnegie Mellon University, 2010-2013.

P. Hines, "Complex system models to estimate the benefits, costs and risks of large-scale wind power deployment." $25,000, Vermont NSF EPSCoR.

P. Hines and D. Porter, "Intelligent Microgrid Strategies for Marsh-Billings-Rockefeller National Historic Park." $68,000, US National Park Service. Spread over three separate awards.

S. Blumsack and P. Hines, "Identifying and mitigating risk and vulnerability in PJM with tools from Complex Networks." $69,263 (over 3 projects), PJM Interconnection, Inc.

P. Hines and S. Blumsack, "Characterizing Power Systems with Tools from Complex Networks." $84,404, US National Science Foundation.

P. Hines, R. Watts, and S. Letendre, "Modeling plug-in hybrid electric vehicle impacts in Vermont from empirical vehicle/user data." $50,000, UVM Transportation Research Center.

Invited Lectures and Presentations

The following is a representative (not comprehensive) list of events and locations at which I have given invited lectures.

- "Cascading Failure, Critical Slowing Down and Wind Balancing Dynamics," National Renewable Energy Lab, July 2015. *"Assessing and Reducing Cascading Failure Risk," Tutorial at the IEEE PES General Meeting, July 2015.*
- *"Cascading Failure Risk, with and without Communication System Interdependency," Sandia National Labs, April 2015.*
- *"Taming the Complexity of Electricity: Cascading Failures and Statistical Early Warning Signs," Santa Fe Institute, Oct. 2014*
- *"Cascading Failure Risk in Interdependent Power and Communications Systems," Northeastern University, Oct. 2014*
- *"Cascading Failure Risk in Interdependent Power and Communications Systems," Massachusetts Institute of Technology, Oct. 2014*
- *"Vulnerability and Robustness in Interdependent Power/Cyber Networks," National Academy of Sciences, July 2014*
- *"Energy Engineering: Solving Energy Problems Creatively," Governor's Institute of Vermont, July 2014*
- *"Using data and people to make the grid work better," Vermont-Quebec Bio-energy Challenge, Oct. 2013*
- *"Large blackouts in power grids: Why they happen and what to do about it," Middlebury College, Oct. 2013*
- *"The Power Grid as a Complex Network," Santa Fe Institute/MITRE workshop on Infras-*

tructure Modeling and Security, Washington, DC, September 2013

- *"The Power Grid as a Complex Network," Santa Fe Institute's Short Course on Complexity, Austin, Texas, September 2013*
- *"Crazy (and important) things you can do with an engineering degree," Governors Institute of Vermont, June 2013*
- *"Smart Grid: Technology, Human Behavior, and Policy," NRG Systems, April 2013*
- *"Assessing the Health of a Power Grid using Random Chemistry and Noisy Synchrophasor Data," ISO New England, Holyoke, MA, March 2013*
- *"Smart Grid Technology, Human Behavior, and Policy," Univ. of Massachusetts, Amherst, Feb. 2013*
- *"Why power grids fail in spectacular ways, and what to do about it," Univ. of Vermont TEDx, Feb. 2013*
- *"Large Blackouts in Power Grids: Why they happen, and what to do about it," St. Michael's College, Jan. 2013*
- *ETH Zurich (The Swiss Federal Institute of Technology), Zurich, Switzerland, November 2012*
- *IBM, Essex, Vermont, June 2012*
- *Los Alamos National Laboratories, Los Alamos, New Mexico, May 2012*
- *Santa Fe Institute, Santa Fe, New Mexico, May 2012*
- *American Society of Mechanical Engineers, Albuquerque, New Mexico, May 2012*
- *United Technologies Research Center, East Hartford, CT, May 2012*
- *Skolkovo Foundation, Moscow, Russia, November 2011*
- *Sandia National Laboratories, June 2011*
- *Lawrence Livermore National Laboratories, May 2011*
- *IBM Watson Research Center, March 2011*
- *Naval Postgraduate School, May 2010*
- *NASA Goddard Space Center (MD), Mar. 2010*
- *A123, Feb. 2010*
- *Penn State Universities, Nov. 2009*
- *Los Alamos National Laboratories, Mar. 2009*
- *Indiana U. Purdue. U., Indianapolis, Mar. 2009*
- *PJM Interconnect, April 2008*

Courses Taught

- *EE 295 - Smarter Electric Energy Systems.* This is a new course, designed specifically for the NSF IGERT program in Smart Grid: Technology, Behavior, and Policy, which provides an overview of Smart Grid primarily from a technology and policy perspective. First offered: Fall 2013.
- *EE 3 - Linear Circuit Analysis I.* This course is a fundamentals course for sophomore-level electrical engineering students.
- *EE 395 - Optimization Methods for Engineering.* This course is a broad tour of optimization methods that can be useful for engineering. We will focus particularly on example problems from power systems and environmental engineering. First offered: Spring 2012.
- *EE 100 - Fundamentals of Electrical Engineering.* An introductory course in electrical engineering for non-majors. First offered: Fall 2010.
- *EE 215 - Electric Energy Systems Analysis.* This course provides students with a graduate-level (or advanced undergraduate) treatment of power flow calculations, generator modeling and controls and transmission line protection/relaying. First offered: Fall 2008.
- *EE 113 - Introduction to Electric Energy Systems.* This course is a revised version of the existing course on electro-mechanical power, giving students a broad introduction to the world of electro-mechanical energy systems. First offered: Spring 2008.

Service and Memberships

Membership on journal editorial boards:

- Associate Editor, *IEEE Transactions on Smart Grid*, 2013 to present.

Table 1: Table of courses taught

Year	Sem.	Course	Title	Ugrads	Grads	Credits
2014	Spring	EE 113	Intro to Electric Energy Systems	23	0	4
2013	Fall	EE 295	Smarter Electric Energy Systems	1	13	3
2013	Spring	EE 113	Intro to Electric Energy Systems	13	0	4
2012	Fall	EE 003	Linear Circuit Analysis	35	0	3
2012	Fall	EE 215	Electric Energy Systems Analysis	7	3	3
2012	Spring	EE 395	Optimization Methods for Engr.	0	7	3
2012	Spring	EE 113	Intro to Electric Energy Systems	19	0	4
2011	Fall	EE 215	Electric Energy Systems Analysis	7	8	3
2011	Spring	EE 113	Intro to Electric Energy Systems	20	0	4
2010	Fall	EE 100	Fundamentals of Elec. Engr.	67	0	3
2010	Spring	EE 295	Electric Power Systems Analysis	6	6	4
2009	Fall	EE 185	Electric Power Lab	13	0	2
2009	Fall	EE 113	Intro to Electric Energy Systems	6	0	3
2009	Spring	EE 113	Intro to Electric Energy Systems	9	0	3
2009	Fall	EE 185	Electric Power Lab	13	0	2
2008	Fall	EE 295A	Electric Energy Systems Dynamics	7		3
2008	Spring	EE 113	Intro to Electric Energy Systems	11	0	3
2008	Spring	EE 295	Intro to Electric Energy Systems	4	0	3

Organizer for conferences and panel sessions, including:

· Program committee for the, "SIAM Workshop on Network Science (NS15)," Snowbird, UT, May 2015.

· Co-chair for the international workshop entitled, "SIAM Workshop on Network Science (NS14)," Chicago, May 2014.

· Session co-chair for IEEE panel session entitled, "Mitigation and Prevention of Cascading Outages: Methodologies and Practical Applications." IEEE Power and Energy Society General Meeting, July 2013. Vancouver, Canada.

· Co-organizer for an international workshop entitled, "Rethinking Network Science and Modeling for Critical Infrastructure Protection, Analysis, and Development." Sep. 10-12, 2013. Santa Fe Institute/MITRE, Washington, DC, USA.

· Co-organizer for an international workshop entitled, "Power Grids as Complex Networks: Formulating Problems for Useful Science and Science Based Engineering." May 17-19, 2012. Santa Fe Institute, New Mexico, USA.

· Program committee member for a "Satellite Meeting" entitled, "Complexity in Energy Infrastructures: Models, Metrics and Metaphors." Sept. 2011. European Conference on Complex Systems. Vienna, Austria.

Peer reviewer for journals and conferences including:

· *Automatica*
· *Energy Policy*
· *Energy*
· *Environmental Science and Technology*
· *European Control Journal*
· *IEEE Transactions on Power Systems*
· *IEEE Transactions on Power Delivery*
· *IEEE Transactions on Smart Grid*
· *IEEE Transactions on Information Forensics & Security*
· *Physica A*
· *Proceedings of the National Academies of Science*
· *Risk Analysis*
· *SIAM Jornal of Discrete Mathematics*

· IEEE Control Systems Society, Conference on Decision and Control
· IEEE Int. Conf. on Systems, Man and Cybernetics
· IEEE Power and Energy Society General Meeting
· Hawaii International Conference on System Sciences

Member of University of Vermont committees including:
· Search committee for the "IGERT/Power Systems/Complex Systems" positions (2) in the College of Engineering and Mathematical Sciences.
· Search committee for the "Power Systems/Smart Grid/Electrical Engineering" position in the School of Engineering. 2012/2013.
· Member of the Complex Systems Spire steering committee, 2012 to present.
· College of Engineering and Mathematical Sciences, Information Technology Committee, 2010 to present.
· Working with team to develop a collaborative partnership between Sandia National Lab and UVM.
· Trans-disciplinary Research Initiative (TRI), Policy Studies working group, 2009 to 2010.
· Search committee for "Transportation and Complex Systems" in the School of Engineering. Sp. 2009.
· Electrical engineering graduate studies committee (recorder). 2008-present.
· School of Engineering co-secretary. 2008-2009.
· School of Engineering teaching laboratory working group (ad hoc). 2007-2008.
· Policy Ph.D. planning committee. 2007-2008.

Member of the *Institute for Electrical and Electronics Engineers*
· Treasurer of the IEEE Green Mountain Section (Vermont Chapter of the IEEE). 2015-2017.
· Chair of the IEEE Green Mountain Section (Vermont Chapter of the IEEE). 2013-2014.
· Vice-Chair of the IEEE Green Mountain Section (Vermont Chapter of the IEEE). 2011-2013.
· PES Task Force on Understanding, Prediction, Mitigation and Restoration of Cascading Failures, Vice-chair (2011-present), Member (2009-present).
· Power & Energy Society (PES) member. 2007-present.
· PES Multi-agent systems task force, Member.
· PES International Practices Sub-Committee, Member (2000-2008).

Society for Industrial and Applied Mathematics, Member

American Association for the Advancement of Science, Member

International Association for Energy Economics, Member

Partner Aid International—Pakistan earthquake relief team member, December 2005. Led a team of volunteers to distribute and assemble emergency shelter in Northern Pakistan.

Shelter Now International—Western Sahara solar project team member, Sept. 2000. Implemented solar refrigeration for several small medical clinics in North African refugee camps.

LANGUAGE SKILLS
· *Modern Standard Arabic* (intermediate)
· *Lebanese Arabic dialect* (advanced)
· *German* (intermediate)

OTHER SKILLS
· Computer Languages: Matlab, C/C++, MPI parallel processing library, SAS statistical package; familiarity with R, Perl, Python, Bash, HTML/XML, Julia.
· Optimization tools including: CPLEX, SNOPT, Coin-OR tools (Ipopt, Bonmin, and Osi/Clp).