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Bri-Mathias Hodge

Education:

Doctor of Philosophy in Chemical Engineering *2006-2010*
School of Chemical Engineering, Purdue University, West Lafayette, Indiana
Thesis Title: *"A Multi-Paradigm Modeling Approach for Energy Systems Analysis"*
Advisors: Joseph F. Pekny & Gintaras V. Reklaitis
Intern – Sandia National Laboratory, Exploratory Simulation Technologies *2008*

Master of Science in Chemical Engineering with Distinction *2004-2005*
Process Design Laboratory, Åbo Akademi University, Turku, Finland
Thesis Title: *"A Genetic Algorithm based Metaheuristic for Production Scheduling"*
Advisor: Tapio Westerlund

Bachelor of Science in Chemical Engineering with University and College Honors *2000-2004*
Carnegie Mellon University, Pittsburgh, Pennsylvania
Minor in German
Exchange Student, Rheinisch-Westfälische Technische Hochschule – Aachen, Germany *2002-2003*

Experience:

Associate Professor *2018 - Present*
University of Colorado – Boulder – Department of Electrical, Computer and Energy Engineering
- Fellow of the Renewable and Sustainable Energy Institute (RASEI)
- Lead a group focusing on energy systems simulation and renewable energy integration.

Chief Scientist *2018 - Present*
National Renewable Energy Laboratory
- Principal Investigator on DOE, ARPA-E, and industrial projects with a yearly funding level of over $3.5M in FY19.
- Principal Investigator on projects in the areas of: power system communications, power systems data, solar power forecasting, wind power forecasting visualization, wind and solar resource assessment, grid sensing and measurement, commercial building electricity savings, microgrid design, and ancillary service products from renewable energy.

Manager – Power System Design and Studies Group *2016 - 2018*
National Renewable Energy Laboratory
- Management of 25 full-time NREL employees in addition to up to 20 visiting Ph.D. students and interns. Grew the group from 12 FTEs to 25 FTEs in first year.
- Principal Investigator on DOE, ARPA-E, and industrial projects with a yearly funding level of over $3.5M in FY18.
- Principal Investigator on projects in the areas of: power system communications, power systems data, solar power forecasting, wind power forecasting visualization, wind and solar resource assessment, grid sensing and measurement, commercial building electricity savings, microgrid design, and ancillary service products from renewable energy.

Lecturer and Assistant Professor Adjoint *2016 - 2018*
University of Colorado – Boulder – Department of Electrical, Computer and Energy Engineering
- Taught graduate course – Renewable Energy and the Future of the Electricity Grid – every fall semester.
- Ph.D. advisor for two students working on renewable energy integration.

Adjunct and Affiliate Professor *2014 - Present*
Colorado School of Mines – Department of Chemical and Biological Engineering
- Taught senior design course, CBEN402 – Chemical Engineering Design (Spring 2014)
- Co-supervising a Ph.D. student on the modeling of cyanobacteria consortia

Fulbright Scholar *Summer 2016*
VTT – Wind Power Integration Team, Finland
- Funded through a Fulbright-VTT Grant in Science, Technology and Innovation

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- Research on the economics of bulk power flexibility options with high renewable energy penetrations

Section Supervisor – System Planning and Reliability *2014 - 2015*

National Renewable Energy Laboratory – Transmission and Grid Integration Group

- Management of seven full-time NREL employees in addition to eight visiting students and interns.
- Managed wind, solar, and electricity projects with combined yearly funding level of over $1.8M in FY15.
- Principal investigator on projects in the areas of: power system flexibility requirements, integrated distribution-transmission systems modeling, the value of wind power forecasting, wind resource assessment, solar resource assessment, reliability impacts of wind power forecasting, solar power forecasting, and the impacts of electric vehicles on bulk power systems.

Senior Engineer *2013 - 2014*

National Renewable Energy Laboratory – Transmission and Grid Integration Group

- Managed wind, solar, and electricity projects with combined yearly funding level of over $1.8M in FY14, including supervision of NREL staff, postdoctoral researchers, subcontractors, visiting graduate students, and student interns.
- Principal investigator on projects in the areas of: cyber-physical-energy systems, distribution level PMUs, mesoscale climate modeling (WIND Toolkit dataset), the value of wind power forecasting, solar power forecasting, and the impacts of distributed wind on transmission level operations.
- Presented at numerous conferences and technical review committees to disseminate key findings to stakeholders.

Research Engineer *2011 - 2013*

National Renewable Energy Laboratory – Transmission and Grid Integration Group

- Managed wind, solar, and electricity projects with combined yearly funding level of over $400k in FY12 and $2M in FY13, including supervision of NREL staff, postdoctoral researchers, subcontractors, visiting graduate students, and student interns.
- Principal investigator on projects in the areas of: mesoscale climate modeling, wind power forecasting and resource assessment, solar power forecasting, renewable integration costs, the impacts of distributed wind on transmission level operations, the value of wind power forecasting, and sub-hourly solar variability.
- Presented at numerous conferences and technical review committees to disseminate key findings to stakeholders.
- Led statistical analysis of wind and solar forecasting errors for the Western Wind and Solar Integration Study Phase 2.

Post-Doctoral Researcher *2010 - 2011*

National Renewable Energy Laboratory – Transmission and Grid Integration Group

- Examined statistical properties of wind and solar power forecast errors, leading to improved operating reserve requirements in Western utilities.
- Performed research on the role of stochastic unit commitment in systems with high wind power penetration.
- Conducted numerical simulations to establish the potential for residential demand response systems to provide flexibility reserve for wind and solar power integration.

Graduate Research Assistant *2006 - 2010*

Purdue University – School of Chemical Engineering

- Developed a multi-paradigm modeling approach used to analyze the impact of plug-in hybrid electric vehicles on the United States electricity system infrastructure.
- Studied the interactions between plug-in hybrid electric vehicles and wind power integration through vehicle-to-grid power supply.
- Utilized the modeling approach to study the optimal placement of vehicle charging stations in Indianapolis, IN in collaboration with a local utility.

Graduate Research Assistant *2005*

Åbo Akademi University – Process Design Laboratory

- Designed and implemented a genetic algorithm based metaheuristic for solving classes of classical scheduling problems.

Senior Honors Research *2004*

Carnegie Mellon University - Department of Chemical Engineering

- Designed optimization methods for solving black box fitness function problems.

- Applied algorithms to the optimal production of Gibberellic acid in *Gibberella fujikuroi* fermentation.

Undergraduate Research *2002 - 2003*

RWTH-Aachen - Institute for Process Technology

- Developed mathematical models for crystallization separation processes.
- Optimized distillation column configurations and sequences for complex distillation processes.

Industry Experience:

Lonza, Inc., Williamsport, Pennsylvania *2004*

Intern -Production Research and Development Section

- Determined causes of deviation from production standards.
- Aided in the scale-up of new products in the from lab scale to pilot plant scale.

Competitive Funding at CU Boulder:

Co-PI: "*Deep stochastic models for space-time weather-driven grid simulations*", Funding Agency: National Science Foundation – Division of Mathematical Sciences Algorithms for Modern Power Systems (AMPS) . PI: William Kleiber, CU Boulder, Department of Applied Mathematics. **Total Award:** $336,924. Duration: September 2019 – August 2022.

Competitive Funding at NREL:

PI: "*Duke Energy Zero-Emission Resource Integration Study (ZERIS)*", Funding Agency: Duke Energy. **Total Award: $150,000**. Duration: March 2019 – August 2019.

PI: "*100% Renewable Energy Design for Niijima Island*", Funding Agency: Tokyo Electric Power Company. **Total Award: $200,000**. Duration: September 2018 – March 2019.

PI: "*Evaluating the potential threat that Internet-connected smart devices pose to the security of the United States Electric Grid*", Funding Agency: NREL Seed Laboratory Directed Research and Development (LDRD). Co-PI: Dane Christensen (NREL) **Total Award: $100,000**. Duration: June 2018 – September 2019.

PI: "*Solar Uncertainty Management and Mitigation for Exceptional Reliability in Grid Operations (SUMMER-GO)*". Funding Agency: U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, Solar Systems Integration Program. Co-PIs: Stephen Jascourt, MDA, Sandip Sharma, ERCOT, Jie Zhang, University of Texas - Dallas. **Total Award: $1,698,933; NREL Award: $849,466**. Duration: July 2018 – July 2021.

PI: "*100% Renewable Energy Islands*", Funding Agency: Tokyo Electric Power Company. **Total Award: $180,000**. Duration: September 2017 – March 2018.

PI: "*Natural Gas – Electricity Interface Study*", Funding Agency: American Electric Power, Environmental Defense Fund, Hewlett Foundation, Kinder Morgan. **Total Award: $600,000**. Duration: October 2017 – September 2019.

PI: "*Peña Station Energy Master Plan – Designing New Rate Structures for Local Energy Districts*", Funding Agency: Panasonic/Xcel Energy. **Total Award: $250,000**. Duration: June 2017 – May 2018.

PI: "*Assistance with HECO's PSIP Revision Plan – Resources Data*", Funding Agency: Hawaiian Electric Company. **Total Award: $70,000**. Duration: May – August 2016.

PI: "*Smart-DS: Synthetic Models for Advanced, Realistic Testing; Distribution Systems and Scenarios*", Funding Agency: ARPA-E. Co-PIs: Bryan Palmintier, NREL, Ignacio Perez-Arriaga, MIT-Comillas, David Sun, ALSTOM Grid. **Total Award: $2,300,000**. Duration: August 2016 – August 2018.

PI: "*Providing Ramping Service with Wind to Enhance Power System Operational Flexibility*", Funding Agency: DOE Wind and Water Program. Co-PI: Jie Zhang, UT-Dallas. **Total Award: $1,500,000**. Duration: March 2016 – March 2019.

Co-PI: "*WindView: An Open Platform for Wind Energy Forecast Visualization*", Funding Agency: DOE Wind and Water Program. PI: Shrirang Abhyankar, Argonne National Laboratory. **Total Award: $1,500,000**. **NREL Award: $750,000**. Duration: March 2016 – March 2019.

PI: "*Assistance with HECO's PSIP Revision Plan*", Funding Agency: Hawaiian Electric Company. **Total Award: $107,822**. Duration: January – March 2016.

PI: "*Opportunistic Hybrid Communications Systems for Distributed PV Coordination*", Funding Agency: SunShot National Laboratory Multiyear Partnership (SuNLaMP). Co-PIs: Liuqing Yang, Colorado State University, Jin Wei, University of Akron. **Total Award: $2,709,398**. Duration: October 2015 – October 2018.

PI: "*Power System Interactions between Renewable Energy and Battery Electric Vehicles*", Funding Agency: Confidential Company. **Total Award: $35,000**. Duration: September 2014 – November 2014.

PI: "*Cyber-Physical-Energy Systems: Theory and Test Bed*", Funding Agency: NREL Laboratory Directed Research and Development (LDRD). **Total Award: $300,536**. Duration: October 2013 – September 2014.

PI: "*Using Low-Cost Distribution System Phasor Measurements to Evaluate Grid Effects of Distributed Solar PV*", Funding Agency: NREL Innovation Challenge. **Total Award: $37,500**. Duration September 2013 – March 2014.

Co-PI: "*Watt-sun: A Multi-scale, Multi-Model, Machine- Learning Solar Forecasting Technology*". Funding Agency: U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, Solar Program. Collaborators: IBM, Argonne National Laboratory, Northeastern University, University of Arizona, Northrop Grumman, ISO New England, Tucson Electric Power. **Total Award: $3,800,000; NREL Award: $640,000**. Duration: February 2013 – July 2016.

PI: "*Assessing the Value of Short-Term Wind Power Forecasting in CAISO*", Funding Agency: Lockheed Martin Corporation. **Total Award: $124,000**. Duration: September 2012 – April 2014.

DOE AOP Funding at NREL:

PI: "Flexibility Assessment in WECC", Funding Agency: DOE Office of Electricity. **FY15 Award: $120,000**.

PI: "Wind Resource Characterization: WFIP Economic Support", Funding Agency: DOE Wind Program. **FY15 Award: $390,000**.

Co-PI: "Integrated Distribution and Transmission Analysis for Very High Penetration Solar PV", Funding Agency: DOE Solar Program. **FY15 Award: $300,000**.

PI: "Flexibility Assessment in WECC", Funding Agency: DOE Office of Electricity. **FY14 Award: $491,000**.

PI: "Wind Resource Characterization: Mesoscale Datasets", Funding Agency: DOE Wind Program. **FY14 Award: $275,000**.

PI: "Grid/Transmission Issues for Distributed Generation", Funding Agency: DOE Wind Program. **FY14 Award: $250,000**.

PI: "Metrics/BA Analysis", Funding Agency: DOE Wind Program. **FY13 Award: $100,000**.

PI: "Wind Resource Characterization: Forecasting Using Analogs", Funding Agency: DOE Wind Program. **FY13 Award: $240,000**.

PI: "Grid/Transmission Issues for Distributed Generation", Funding Agency: DOE Wind Program. **FY13 Award: $450,000**.

PI: "Sub-Hourly Reserves on High Time-Resolution Modeling", Funding Agency: DOE Solar System Integration Program. **FY13 Award: $300,000**.

PI: "Variable Generation Integration Rate Analysis", Funding Agency: DOE Office of Electricity. **FY12 Award: $60,000**.

Book Chapters and Magazine Articles (*Senior Author, † Student/Intern, ‡ Postdoc):

1. Yingchen Zhang, Rui Yang, Jie Zhang, Yang Weng, Bri-Mathias Hodge: "Predictive Analytics for Comprehensive Energy Systems State Estimation", in: Big Data Application in Power Systems, R. Arghandeh, Y. Zhou (Eds.), Elsevier, 2018.

2. Benjamin Kroposki, Brian Johnson, Yingchen Zhang, Vahan Gevorgian, Paul Deholm, Bri-Mathias Hodge, Bryan Hannegan: "Achieving 100% Renewable Grids – Operating Electric Power Systems with Extremely High Levels of Variable Renewable Energy", IEEE Power & Energy Magazine, Vol. 15, Issue 2, March/April 2017.

3. Brady Stoll, Rishabh Jain†, Carlo Brancucci Martinez-Anido, Eduardo Ibanez, Anthony Florita, Bri-Mathias Hodge*: "Reserve Estimation in Renewable Integration Studies", in: Integration of Large Scale Renewable Energy into Bulk Power System: From Planning to Operation, P. Du, A. Tuohy (Eds.), Springer, 2017

4. Jason Ganley, Jie Zhang‡, Bri-Mathias Hodge*: "Wind Energy", in: Alternative Energy Sources and Technologies: Process Design and Operations, M. Martin (Ed.), Springer, 2016.

5. Mohit Singh, Alicia Allen‡, Bri-Mathias Hodge*: "Grid Connection and Power Conditioning of Wind Farms", in: Handbook of Clean Energy Systems, R. Boehm, H. Yang, J. Yan (Eds.), Wiley, 2015.

6. Bri-Mathias Hodge, Erik Ela, Paul Denholm: "Integration of Renewable Generation", in: Encyclopedia of Sustainability Science and Technology, R. Meyers (Ed.), Springer, 2012.

Journal Publications (*Senior Author, † Student/Intern, ‡ Postdoc):

1. Jari Miettinen†, Hannele Holttinen, Bri-Mathias Hodge: "Simulating wind power forecast error distributions for spatially aggregated wind power plants", Accepted for **Wind Energy**.

2. Omar Guerra‡, Joshua Eichman, Jennifer Kurtz, Bri-Mathias Hodge: "Cost competitiveness of electroysis-based hydrogen production across the U.S.", **Joule**, In Press.

3. Todd Zhen†, Tarek Elgindy, S M Shafiul Alam‡, Bri-Mathias Hodge*, Carl Laird: "Optimal Placement of Data Concentrators for Expansion of the Smart Grid Communications Network ", **IET Smart Grid**, In Press.

4. Cong Feng, Mingjian Cui, Bri-Mathias Hodge, Siyuan Lu, Hendrik Hamann, Jie Zhang: "An Unsupervised Clustering-Based Short-Term Solar Forecasting Methodology", **IEEE Transactions on Sustainable Energy**, In Press.

5. Cong Feng, Dazhi Yang, Bri-Mathias Hodge, Jie Zhang: "OpenSolar: Promoting the Openness and Accessibility of Diverse Public Solar Datasets", **Solar Energy**, Vol. 188, 2019.

6. Mingjian Cui, Venkat Krishnan, Bri-Mathias Hodge, Jie Zhang: "A Copula-Based Conditional Probabilistic Forecast Model for Wind Power Ramps", **IEEE Transactions on Smart Grid**, Vol. 10, Iss. 4, 2019.

7. Kate Doubleday†, Andrew Parker, Faeza Hafiz†, Benjamin Irwin, Samuel Hancock, Shanti Pless, Bri-Mathias Hodge*: "Toward a Sub-Hourly Net-Zero Energy District Design Through Integrated Building and Distribution System Modeling", **Journal of Renewable and Sustainable Energy**, Vol. 11, Iss. 3, 2019.

8. Xin Fang, Bri-Mathias Hodge*, Ershun Du†, Fangxing Li, Chongqing Kang: "Introducing Risk Components in Locational Marginal Pricing Wind Power and Load Uncertainty", **IEEE Transactions on Power Systems**, Vol. 34, Issue 3, 2019.

9. Andrew Kumler, Ignacio Losada Carreno†, Michael Craig, Bri-Mathias Hodge, Wesley Cole, Carlo Brancucci: "Inter-annual Variability of Wind and Solar Electricity Generation and Capacity Values in Texas", **Environmental Research Letters**, Vol. 14, 2019.

10. Cong Feng, Mucun Sun, Mingjian Cui, Erol Chartan, Bri-Mathias Hodge, Jie Zhang: "Characterizing Forecastability of Wind Sites in the United States", **Renewable Energy**, Vol. 133, 2019.

11. Niina Helistö Juha Kiviluoma, Hannele Holttinen, Jose Daniel Lara†, Bri-Mathias Hodge: "Including operational aspects in the planning of power systems with large amounts of variable generation: a review of modelling approaches", **WIRES Energy and Environment**, 2019.

12. Mucun Sun, Cong Feng, Erol Chartan, Bri-Mathias Hodge, Jie Zhang: "A Two-Step Short-Term Probabilistic Wind Forecasting Methodology Based on Predictive Distribution Optimization" **Applied Energy**, Vol 238, 2019.

13. Mingjian Cui, Jie Zhang, Qin Wang, Venkat Krishnan, Bri-Mathias Hodge*: "A Data-Driven Methodology for Probabilistic Wind Power Ramp Forecasting", **IEEE Transactions on Smart Grid**, Vol. 10, Iss. 2, 2019.

14. Michael Craig, Ignacio Losada Carreno†, Michael Rossol, Bri-Mathias Hodge, Carlo Brancucci: "Effects on Power System Operations of Potential Changes in Wind and Solar Generation Potential under Climate Change", **Environmental Research Letters**, Vol 14, 2019.

15. Kate Doubleday†, Faeza Hafız†, Andrew Parker, Tarek Elgindy, Anthony Florita, Graziano Salvalai, Gregor Henze, Shanti Pless, Bri-Mathias Hodge*: "Integrated Sustainable Urban District Planning and Distribution System Design", **WIRES Energy and Environment**, 2019.

16. Xinmin Zhang, Yuan Li, Siyuan Lu, Hendrik Hamann, Bri-Mathias Hodge, Brad Lehman: "A Solar Time-based Analog Ensemble Method for Regional Solar Power Forecasting", **IEEE Transactions on Sustainable Energy**, Vol. 10, Iss. 1, 2019.

17. Ershun Du†, Ning Zhang, Qin Wang, Bri-Mathias Hodge, Chongqing Kang, Benjamin Kroposki, Qing Xia: "Operation of a High Renewable Penetrated Power System with CSP plants: A Look-ahead Stochastic Unit Commitment Model", **IEEE Transactions on Power Systems**, Vol. 34, Iss. 1, 2019.

18. Wenqi Zhang†, William Kleiber, Anthony Florita, Bri-Mathias Hodge, Barry Mather: "Modeling and Simulation of High Frequency Solar Irradiance", **IEEE Journal of Photovoltaics**, Vol. 9, Iss. 1, 2019.

19. Michael Craig, Stuart Cohen, Jordan Macknick, Caroline Draxl, Omar Guerra‡, Manajit Sengupta, Sue Ellen Haupt, Bri-Mathias Hodge, Carlo Brancucci: "A Review of the Potential Impacts of Climate Change on Bulk Power System Planning and Operations in the United States", **Renewable & Sustainable Energy Reviews**, Vol. 98, 2018.

20. Xin Fang, Bri-Mathias Hodge*, Fangxing Li, Ershun Du†, Chongqing Kang, Fangxing Li: "Modelling Wind Power Spatial-Temporal Correlation in Multi-Interval Optimal Power Flow: A Sparse Correlation Matrix Approach", **Applied Energy**, Vol. 230, 2018.

21. Xin Fang, Linquan Bai, Fangxing Li, Bri-Mathias Hodge: "Hybrid Component and Configuration Model for Combined-Cycle Units in the Unit Commitment Problem", **Journal of Modern Power Systems and Clean Energy**, Vol. 6, Iss. 6, 2018.

22. Xin Fang, Bri-Mathias Hodge, Linquan Bai, Hantao Cui, Fangxing Li: "Mean-Variance Optimization-Based Energy Storage Scheduling Considering Day-Ahead and Real-Time LMP Uncertainties", **IEEE Transactions on Power Systems**, Vol. 33, Iss. 6, 2018.

23. Ershun Du†, Ning Zhang, Qin Wang, Bri-Mathias Hodge, Chongqing Kang, Benjamin Kroposki: "The Role of Concentrating Solar Power Towards High Renewable Energy Penetrated Power Systems", **IEEE Transactions on Power Systems**, Vol. 33, Iss. 6, 2018.

24. Mingjian Cui, Jie Zhang, Bri-Mathias Hodge, Siyuan Lu, Hendrik Hamann: "A Methodology for Quantifying Reliability Benefits from Improved Solar Power Forecasting in Multi-Timescale Power System Operations", **IEEE Transactions on Smart Grid**, Vol. 9 Iss. 6, 2018.

25. Wenqi Zhang†, William Kleiber, Anthony Florita, Bri-Mathias Hodge, Barry Mather: "A Stochastic Downscaling Approach for Generating High-Frequency Solar Irradiance Scenarios", **Solar Energy**, Vol. 176, 2018.

26. Dominik Dominković†, Greg Stark, Bri-Mathias Hodge, Allan Schrøder Pedersen: "Integrated energy planning with a high share of variable renewable energy sources for a Caribbean island", **Energies**, Vol. 11, Iss. 9, 2018.

27. Xin Fang, Venkat Krishnan, Bri-Mathias Hodge*: "Strategic Offering for Wind Power Producers Considering Energy and Flexible Ramping Products", **Energies**, Vol. 11, Iss. 5, 2018.

28. Michael Craig, Paulina Jaramillo, Bri-Mathias Hodge, Nathaniel Williams, Edson Severnini: "A Retrospective Analysis of the Market Price Response to Distributed Photovoltaic Generation in California", **Energy Policy**, Vol. 121, 2018.

29. Steven Davis, Nathan Lewis, Matthew Shaner, Sonia Aggarwal, Doug Arent, Ines Azevedo, Sally Benson, Thomas Bradley, Jack Brouwer, Yet-Ming Chiang, Christopher Clack, Armond Cohen, Stephen Doig, Jae Edmonds, Paul Fennell, Christopher Field, Bryan Hannegan, Bri-Mathias Hodge, Martin Hoffert, Eric Ingersoll, Paulina Jaramillo, Klaus Lackner, Katharine Mach, Michael Mastrandrea, Joan Ogden, Per Peterson, Daniel Sanchez, Daniel Sperling, Joseph Stagner, Jessika Trancik, Chi-Jen Yang, Ken Calderia: "Net-zero emissions energy systems", **Science**, Vol. 360 Iss. 6396, 2018.

30. Kwabena Pambour, Rostand Sopgwi, Bri-Mathias Hodge, Carlo Brancucci: "The value of day-ahead coordination of power and natural gas network operations", **Energies**, Vol. 11, Iss. 7, 2018.

31. Fei Wang, Kangping Li, Neven Duic, Zengqiang Mi, Bri-Mathias Hodge, Miadreza Shafie-khah, João Catalão: "Association rule mining based quantitative analysis approach of household characteristics impacts on residential electricity consumption patterns", **Energy Conversion and Management**, Vol. 171, 2018.

32. Richard Bryce†, Ignacio Losada Carreno†, Andrew Kumler, Bri-Mathias Hodge, Billy Roberts, Carlo Brancucci Martinez-Anido: "Consequences of Neglecting the Interannual Variability of the Solar Resource: A Case Study of Photovoltaic Power Among the Hawaiian Islands", **Solar Energy**, Vol. 167, 2018.

33. Ershun Du†, Ning Zhang, Bri-Mathias Hodge, Chongqing Kang, Benjamin Kroposki, Qing Xia: "Economic justification of concentrating solar power in high renewable energy penetrated power systems", **Applied Energy**, Vol. 222, 2018.

34. Jianhua Zhang‡, Adarsh Hasandka†, Jin Wei, S M Shafiul Alam‡, Tarek Elgindy, Anthony Florita, Bri-Mathias Hodge*: "Simulating Hybrid Communications for Distributed Smart Grid Applications", **Energies,** Vol. 11, Iss. 4, 2018**.**

35. Bri-Mathias Hodge*, Carlo Brancucci Martinez-Andio, Qin Wang, Erol Chartan, Anthony Florita, Juha Kiviluoma: "The Combined Value of Wind and Solar Power Forecasting Improvements and Electricity Storage", **Applied Energy,** Vol. 214, 2018.

36. Andrew Clifton, Bri-Mathias Hodge*, Caroline Draxl, Jake Badger, Aron Habte: "Wind and Solar Resource Data Sets", **WIRES Energy and Environment**, Vol. 7, Iss. 2, 2018.

37. Michael Craig, Paulina Jaramillo, Bri-Mathias Hodge: "Carbon Dioxide Emissions Effects of Grid-Scale Electricity Storage in a Decarbonizing Power System", **Environmental Research Letters**, Vol. 13, No. 1, 2018.

38. Fei Wang, Zhao Zhen, Chun Liu, Zengqian Mi, Bri-Mathias Hodge, Miadreza Shafie-khah, João Catalão: "Image phase shift invariance based cloud motion displacement vector calculation method for ultra-short-term solar PV power forecasting", **Energy Conversion and Management**, Vol. 157, pp. 123 – 135, 2018.

39. Ivonne Peña†, Carlo Brancucci Martinez-Anido‡, Bri-Mathias Hodge*: "An Extended IEEE 118-bus Test System with High Renewable Penetration", **IEEE Transactions on Power Systems**, Vol. 33, Iss. 1, pp. 281 – 289, 2018.

40. Fernando Postigo Marcos, Carlos Mateo Domingo, Tomás Gómez San Roman, Bryan Palmintier, Bri-Mathias Hodge, Venkat Krishnan, Fernando de Cuadra Garcia, and Barry Mather: "A review of power distribution test feeders in the United States and the need for synthetic representative networks", **Energies**, Vol. 10, Issue 11, 2017.

41. Ricardo Bessa, Corinna Möhrlen, Vanessa Fundel, Malte Siefert, Jethro Browell, Sebastian Haglund El Gaidi, Bri-Mathias Hodge, Umit Cali, George Kariniotakis: "Towards Improved Understanding of the Applicability of Uncertainty Forecasts in the Electric Power Industry", **Energies**, Vol. 10, Issue 9, 2017.

42. Qifang Chen, Fei Wang, Bri-Mathias Hodge, Zhigang Li, Miadreza Shafie-khah, Joao Catalao: "Dynamic Price Vector Formation Model Based Automatic Demand Response Strategy for PV-assisted EV Charging Stations", **IEEE Transactions on Smart Grid**, Vol. 8, Issue 6, pp. 1949 - 3061, 2017.

43. Qin Wang‡, Bri-Mathias Hodge*: "Enhancing Power System Operational Flexibility with Flexible Ramping Products: A Review", **IEEE Transactions on Industrial Informatics,** Vol. 13, Issue 4, pp. 1652 – 1664, 2017.

44. Hongyu Wu, Ibrahim Krad, Erik Ela, Anthony Florita, Eduardo Ibanez, Jie Zhang‡, Bri-Mathias Hodge*: "Stochastic Multi-Timescale Power Systems Operation with Variable Wind Generation", **IEEE Transactions on Power Systems,** Vol. 32, Issue 5, pp. 3325 - 3337, 2017.

45. Mingjian Cui†, Jie Zhang‡, Hongyu Wu, Bri-Mathias Hodge*: "Wind-Friendly Flexible Ramping Product Design in Multi-Timescale Power System Operations", **IEEE Transactions on Sustainable Energy,** Vol. 8, pp. 1064 – 1075, 2017.

46. Mingjian Cui†, Jie Zhang‡, Cong Feng, Anthony Florita, Yuanzhang Sun, Bri-Mathias Hodge*: "Characterizing and Analyzing Ramping Events in Wind Power, Solar Power, Load, and Netload", **Renewable Energy**, Vol. 11, pp. 227 – 244, 2017.

47. Jie Zhang‡, Mingjian Cui†, Bri-Mathias Hodge*, Anthony Florita, Jeffrey Friedman: "Ramp Forecasting Performance from Improved Short-Term Wind Power Forecasting Over Multiple Spatial and Temporal Scales", **Energy,** Vol. 122, pp. 528-541, 2017.

48. Cong Feng, Mingjian Cui, Bri-Mathias Hodge, Jie Zhang: "A Data-Driven Multi-Model Methodology with Deep Feature Selection for Short-Term Wind Forecasting", **Applied Energy,** Vol. 190, pp. 1245 – 1257, 2017.

49. Bryan Palmintier, Elaine Hale, Timothy Hansen†, Wesley Jones, David Biagioni, Harry Sorensen, Hongyu Wu, Bri-Mathias Hodge*: "IGMS: An Integrated ISO-to-Appliance Scale Grid Modeling System", **IEEE Transactions on Smart Grid,** Vol. 8, Iss. 3, pp. 1525 – 1534, 2016.

50. Qin Wang‡, Hongyu Wu, Anthony Florita, Carlo Brancucci Martinez-Anido, Bri-Mathias Hodge*: "The Value of Improved Wind Power Forecasting: Grid Flexibility Quantification, Ramp Capability Analysis, and Impacts of Electricity Market Operation Timescales", **Applied Energy,** Vol. 184, pp. 696 – 713, 2016.

51. Jie Zhang‡, Risabh Jain†, Bri-Mathias Hodge*: "A Data-Driven Method to Characterize Turbulence-Caused Uncertainty in Wind Power Generation", **Energy,** Vol. 112, pp. 1139 – 1152, 2016.

52. Qin Wang‡, Carlo Brancucci Martinez-Anido‡, Hongyu Wu, Anthony Florita, Bri-Mathias Hodge*: "Quantifying the Economic and Grid Reliability Impacts of Improved Wind Power Forecasting", **IEEE Transactions on Sustainable Energy,** Vol. 7, Iss. 4, pp. 1525 – 1537, 2016.

53. Carlo Brancucci Martinez-Anido‡, Gregory Brinkman, Bri-Mathias Hodge*: "The Impact of Wind Power on Electricity Prices", **Renewable Energy,** Vol. 94, pp. 474 – 487, 2016.

54. Carlo Brancucci Martinez-Anido‡, Benjamin Botor†, Anthony Florita, Siyuan Lu, Hendrik F. Hamann, Bri-Mathias Hodge*: "The Value of Day-Ahead Solar Forecasting Improvement", **Solar Energy,** Vol. 129, pp. 192 – 203, 2016.

55. Emilio Gomez-Lazaro, M. Carmen Bueso, Mathieu Kessler, Sergio Martin-Martinez, Jie Zhang, Bri-Mathias Hodge, Angel Molina-Garcia: "Characterization of Aggregated Large-Scale Wind Power with Weibull Mixtures", **Energies**, Vol. 9, Iss. 2, 2016.

56. Mingjian Cui†, Jie Zhang‡, Anthony Florita, Bri-Mathias Hodge, Deping Ke, Yuanzhang Sun: "An Optimized Swinging Door Algorithm for Identifying Wind Ramping Events", **IEEE Transactions on Sustainable Energy,** Vol. 7, Iss. 1, pp. 150 – 162**,** 2016.

57. Jie Zhang‡, Bri-Mathias Hodge*, Siyuan Lu, Hendrik F. Hamann, Brad Lehman, Joseph Simmons, Edwin Campos, Venkat Banunarayanan: "Baseline and Target for Regional and Point Solar Power Forecasts: Toward Improved Solar Power Forecasting", **Solar Energy,** Vol 122, pp. 804 – 819, 2015.

58. Jie Zhang‡, Caroline Draxl, Thomas Hopson, Luca Delle Monache, Emilie Vanvyve, Bri-Mathias Hodge*: "Comparison of Numerical Weather Prediction Based Deterministic and Probabilistic Wind Resource Assessment Methods", **Applied Energy,** Vol. 156, pp. 528 – 541, 2015.

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7. Jack King, Andrew Clifton, Bri-Mathias Hodge*: "Validation of Power Output for the WIND Toolkit", **NREL Technical Report:** NREL/TP-5D00-61714, 2014.

8. Carlo Brancucci Martinez-Anido‡, Bri-Mathias Hodge*: "Impact of Utility-Scale Distributed Wind on Transmission-Level System Operations", **NREL Technical Report:** NREL/TP-5D00-61824, 2014.

9. Andrew Mills, Audun Botterud, Jing Wu, Zhi Zhou, Bri-Mathias Hodge, Michael Heaney: "Integrating Solar PV into Utility Operations", **ANL Technical Report:** ANL/DIS-13/18, 2013.

10. Kevin Porter, Sari Fink, Michael Buckley, Jennifer Rogers, Bri-Mathias Hodge*: "A Survey of Variable Generation Integration Charges", **NREL Technical Report**: TP – 5500-57583, 2013.

11. Debra Lew, Greg Brinkman, Eduardo Ibanez, Bri-Mathias Hodge, Marissa Hummon, Anthony Florita, Michael Heaney, Greg Stark, Jack King, Nikhil Kumar, Steve Lefton, Dwight Agan, Gary Jordan, Sundar Venkataraman: "The Western Wind and Solar Integration Study Phase 2", **NREL Technical Report**: TP – 5500-55888, 2012.

12. Michael Milligan, Erik Ela, Bri-Mathias Hodge, Brendan Kirby, Debra Lew, Charlton Clark, Jennifer DeCesaro, Kevin Lynn: "Cost-Causation and Integration Cost Analysis for Variable Generation", **NREL Technical Report**: TP – 5500-51860, 2011.

13. Bri-Mathias Hodge*, Debra Lew, Michael Milligan: "The Impact of High Wind Power Penetration on Hydroelectric Unit Operations in the WWSIS", **NREL Technical Report**: TP – 5500-52251, 2011.

14. Per Jernström, Bri-Mathias Hodge, K. Tapio Westerlund: "A Comparison Between a MILP-based Decomposition Method and a Genetic Algorithm in Scheduling Applications", Report of the Process Design Systems Engineering Institute, **Åbo Akademi Technical Report**: 06-190-A, ISBN 952-121-1793-6, 2006.

Patents:

U.S Provisional Application No. 62/253,847, "Heterogeneous Network Topology Management and Control", Patent filed November 2018.

Selected Invited Presentations:

"*Designing a Sustainable and Reliable Future: Simulating Next Generation Energy Systems*", Danish Technical University, Department of Applied Mathematics and Computer Science, June 2019.

"*Designing a Sustainable and Reliable Future: Simulating Next Generation Energy Systems*", University of California Berkeley, Energy and Resources Group Colloquium, November 2018.

"*The WIND Toolkit: A National Dataset for Wind Integration Studies*", 4th Conference on Stochastic Weather Generators (SWGEN 2018), October 2018.

"*Distribution Integration Research*", Colorado Public Utilities Commission, Commission's Review of its Rules Governing ERP, RES and Enabling New Technology Integration – Distribution System Planning, April 2018.

"*Renewable Energy Integration: from Resource Data to Power System Impacts*", Ascend Analytics 2017 Summit on Changing Market Dynamics for Portfolio Management and Planning Decisions, October 2017.

"*Solar Power Forecasting and Power System Impacts*", Yuannan Province Electric Power Research Institute, Southern China Power Grid, May 2017.

"*Renewable Energy Integration: from Resource Data to Solar Power Forecasting and Power System Impacts*", North China Electric Power University, May 2017.

"*Next Generation Power System Test Cases*", Colorado School of Mines, Energy Seminar Series, April 2017.

"*The Value of Wind and Solar Power Forecasting Improvements at Multiple Timescales*", Electric Power Research Institute (EPRI) – Artificial Neural Network Short-Term Load Forecaster Users' Group Meeting, November 2016.

"*Renewable Energy Integration: from Resource Data to Power System Impacts*", Cranfield University, School of Water, Energy and Environment, July 2016.

"*The Modern Grid with High Penetration of Renewables*", Western Area Power Administration (WAPA) Resource Planning for Power Systems, April 2016.

"*The Wind Integration National Dataset (WIND) and Solar Integration National Dataset (SIND) Toolkits*", Conference on Data Analysis (CoDA) 2016, March 2016.

"*Solar and Wind Resources Review*", Colorado Public Utilities Commission, Commissioners' Information Meeting – Future Issues for Renewable Energy and Transmission, February 2016.

"*Setting the Scene: Forecasting 101*", USAID Regional Workshop for Asia on Advancing the Use of Wind and Solar Forecasting to Facilitate the Integration of Variable Renewable Energy to the Grid, Bangkok, Thailand, February 2016.

"*Data Requirements for Forecasting*", USAID Regional Workshop for Asia on Advancing the Use of Wind and Solar Forecasting to Facilitate the Integration of Variable Renewable Energy to the Grid, Bangkok, Thailand, February 2016.

"*Renewable Energy Integration: from Resource Assessment to Power System Impacts*", Colorado School of Mines, Department of Mechanical Engineering, February 2016.

"*The Value of Forecasting*", USAID Regional Workshop for Latin America and the Caribean on Advancing the Use of Wind and Solar Forecasting to Facilitate the Integration of Variable Renewable Energy to the Grid, Mexico City, Mexico, January 2016.

"*Forecasting Requirements for System Operations*", USAID Regional Workshop for Latin America and the Caribean on Advancing the Use of Wind and Solar Forecasting to Facilitate the Integration of Variable Renewable Energy to the Grid, Mexico City, Mexico, January 2016.

"Renewables Integration Research and Development", Western Electricity Coordinating Council (WECC) Dispatch Chief's Fall Meeting,October 2015.

"Regulatory & Policy Role: Renewable Energy Grid Integration International Experience & Lessons for India", Forum of Indian Regulators, June 2015.

"The Value of Very Short-Term Wind Power Forecasting in California in the Context of an Overall Forecasting Value Framework", Utility Variable Generation Integration Group Forecasting Workshop, February 2014.

"The State-of-the-Art in Wind and Solar Power Forecasting", Eskom and the 21st Century Power Partnership Workshop on Integrating Variable Renewable Energy into Transmission and Distribution Networks, Eskom (South African State Utility), December 2013.

"Renewable Energy: Grid Integration Panel", AMS 2013 Summer Community Meeting, American Meteorological Society, August 2013

"*Best Practices in Solar Interconnection and Operations*", ERCOT Photovoltaic/Storage Interconnection Workshop, Electric Reliability Council of Texas, October 2012.

"*Multi-Paradigm Energy Systems Modeling*", Purdue Energy Systems Workshop, Energy Center, Purdue University, September 2011.

"*Wind Forecasting Error Distributions and Implications*", Electricity Industry Center, Department of Engineering and Public Policy, Carnegie Mellon University, May 2011.

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Selected Conference Presentations:

Tarek Elgindy, Nicolas Gensollen, Bryan Palmintier, Carlos Mateo Domingo, Tomas Gomez San Roman, Venkat Krishnan, Bri-Mathias Hodge: "Smart-DS: Large-scale, synthetic distribution test systems for evaluating next-generation distributed grid algorithms and technologies", **2018 IEEE Power and Energy Society General Meeting**, *August 9th, 2018, Portland, OR.*

S.M. Shafiul Alam, Jianhua Zhang, Adarsh Hasandka, Bri-Mathias Hodge: "An Opportunistic Hybrid Communications Systems for Distributed PV Coordination", **2018 IEEE Power and Energy Society Transmission & Distribution Conference**, *April 18th, 2018, Denver, CO.*

S.M. Shafiul Alam, Tarek Elgindy, Anthony Florita, Bri-Mathias Hodge: "An Opportunistic Hybrid Communications System for Distributed PV Coordination and Control", **2016 AIChE Annual Meeting**, *November 17th, 2016, San Francisco, CA.*

Bri-Mathias Hodge: "The Wind Integration National Dataset (WIND) and Solar Integration National Dataset (SIND) Toolkits", **Conference on Data Analysis (CoDA) 2016**, *March 2nd, 2016, Sante Fe, NM.*

Andrew Weekley, Anthony Lopez, Marissa Hummon, Bri-Mathias Hodge: "The Solar Integration National Dataset (SIND) Toolkit", **2015 AIChE Annual Meeting**, *November 9th, 2015, Salt Lake City, UT.*

Bri-Mathias Hodge, Caroline Draxl, Dan Getman, Wesley Jones, Jim McCaa: "The Wind Integration National Dataset (WIND) Toolkit: Wind Power Forecasts and Production Time Series", **2014 AIChE Annual Meeting**, *November 17th, 2014, Atlanta, GA.*

Bri-Mathias Hodge, Elaine Hale, Bryan Palmintier, Jin Wei, Julieta Giraldez, Wesley Jones, David Biagioni, Roisin Mossop: "Cyber-Physical-Energy Systems Testbed: A Distributed Solar Power Case Study", **2014 AIChE Annual Meeting**, *November 19th, 2014, Atlanta, GA.*

Jie Zhang, Bri-Mathias Hodge, Anthony Florita, Siyuan Lu, Hendrik Hamann, Venkat Banunarayanan: "Metrics Development for Evaluating the Accuracy of Solar Power Forecasting", **American Meteorological Society 94th Annual Meeting**, *February 3rd, 2014, Atlanta, GA.*

Caroline Draxl, Dan Getman, Wesley Jones, Kirsten Orwig, Jim McCaa, Padriac Fowler, Eric Grimit, Bri-Mathias Hodge: "The Wind Integration National Dataset (WIND) Toolkit", **American Meteorological Society 94th Annual Meeting**, *February 3rd, 2014, Atlanta, GA.*

Jie Zhang, Anthony Florita, Bri-Mathias Hodge: "Joint Probability and Correlation Analysis of Wind and Solar Power Forecast Errors in the Western Interconnection", **2013 AIChE Annual Meeting**, *November 7th, 2013, San Francisco, CA.*

Nicholas Steckler, Anthony Florita, Jie Zhang, Bri-Mathias Hodge: "Analysis and Synthesis of Load Forecasting Data for Renewable Integration Studies", **12th International Workshop on Large-Scale Integration of Wind Power into Power Systems**, *October 22-24, 2013, London, UK.*

Jie Zhang, Bri-Mathias Hodge, Anthony Florita, Siyuan Lu, Hendrik F. Hamann, Venkat Banunarayanan: "Metrics for Evaluating the Accuracy of Solar Power Forecasting", **3rd International Workshop on Integration of Solar Power into Power Systems**, *October 21-22, 2013, London, UK.*

Bri-Mathias Hodge, Debra Lew, Michael Milligan: "Short-Term Load Forecasting Error Distributions and Implications for Renewable Integration Studies", **2013 IEEE Fifth Annual Green Technologies Conference**, *April 4-5, 2013, Denver, CO, USA.*

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Bri-Mathias Hodge, "The Value of Variable Generation Forecasting at Multiple Time Scales", **Utility Variable Generation Integration Group Workshop on Variable Generation Forecasting Applications to Utility Planning and Operations**, *February 26th, 2013, Salt Lake City, UT, USA.*

Bri-Mathias Hodge, Hannele Holttinen, Samueli Sillanpää, Emilio Gómez-Lázaro, Richard Scharff, Lennart Söder, Xiaoli Larsén, Gregor Giebel, Damian Flynn, Debra Lew, Michael Milligan, Jan Dobschinski: "Wind Power Forecasting Error Distributions: An International Comparison", **The 11th International Workshop on Large-Scale Integration of Wind Power into Power Systems**, *November 13, 2012, Lisbon, Portugal.*

Bri-Mathias Hodge, Sandra Shedd, Anthony Florita, and Kirsten Orwig: "Examining the Variability of Load, Wind, and Solar Power in the Regulation Timeframe", **2012 AIChE Annual Meeting**, *October 31, 2012, Pittsburgh, PA, USA.*

Bri-Mathias Hodge, Anthony Florita: "Characterizing and Modeling Wind Power Forecast Errors from Operational System for use in Wind Integration Planning Studies", **Modeling, Simulation and Optimization for the 21st Century Electric Power Grid**, *October 23, 2012, Lake Geneva, WI, USA.*

Bri-Mathias Hodge, Anthony Florita: "Characterizing and Modeling Wind Power Forecast Errors from Operational System for use in Wind Integration Planning Studies", **INFORMS 2012 Annual Meeting**, *October 17, 2012, Phoenix, AZ, USA.*

Bri-Mathias Hodge, Kirsten Orwig, Michael Milligan: "Examining Information Entropy Approaches as Wind Power Forecasting Performance Metrics", **The 12th International Conference on Probabilistic Methods Applied to Power Systems**, *June 12, 2012, Istanbul, Turkey.*

Bri-Mathias Hodge, Anthony Florita, Kirsten Orwig, Debra Lew, Michael Milligan: "A Comparison of Wind Power and Load Forecasting Error Distributions", **The World Renewable Energy Forum**, *May 15, 2012, Denver, CO, USA.*

Bri-Mathias Hodge, Erik Ela, Michael Milligan: "The Distribution of Wind Power Forecasting Errors from Operational Systems", **Utility Variable Generation Integration Group Workshop on Variable Generation Forecasting Applications to Utility Planning and Operations**, *February 8th, 2012, Tucson, AZ, USA.*

Bri-Mathias Hodge, Marissa Hummon, Kirsten Orwig: "Solar Ramping Distributions over Multiple Timescales and Weather Patterns", **1st International Workshop on Integration of Solar Power into Power Systems**, *October 24th, 2011, Aarhus, Denmark.*

Bri-Mathias Hodge, Erik Ela, Michael Milligan: "The Distribution of Wind Power Forecast Errors from Operational Systems", **10th International Workshop on Large-Scale Integration of Wind Power into Power Systems**, *October 25th, 2011, Aarhus, Denmark.*

Bri-Mathias Hodge, Erik Ela, Michael Milligan: "Stochastic Programming and Uncertainty Management in Electricity System Operation", **2011 AIChE Annual Meeting**, *October 19th, 2011, Minneapolis, MN, USA.*

Bri-Mathias Hodge, Michael Milligan: "Wind Power Forecasting Error Distributions over Multiple Timescales", **2011 IEEE Power & Energy Society General Meeting**, *July 27th, 2011, Detroit, MI, USA.*

Bri-Mathias Hodge, Shisheng Huang, Aviral Shukla, Joseph Pekny, Venkat Venkatasubramanian, Gintaras Reklaitis: "The Effects of Vehicle-to-Grid Systems on Wind Power Integration in California", **The 20th European Symposium on Computer Aided Process Engineering**, *June 8th, 2010, Ischia, Italy.*

Bri-Mathias Hodge, Selen Aydogan-Cremaschi, Gary E. Blau, Joseph F. Pekny, Gintaras V. Reklaitis: "A Prototype Agent-Based Modeling Approach For Energy System Analysis", **The 18th European Symposium on Computer Aided Process Engineering**, *June 3rd, 2008, Lyon, France.*

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Bri-Mathias Hodge, Selen Aydogan-Cremaschi, Gary E. Blau, Joseph F. Pekny, Gintaras V. Reklaitis: "A Prototype Agent-Based Modeling Approach For Energy System Analysis", **2007 AIChE Annual Meeting**, *November 8th, 2007, Salt Lake City, Utah.*

Teaching Experience:

University of Colorado Boulder – Department of Electrical, Computer and Energy Engineering

ECEN 2250 – Introduction to Circuits and Electronics *Fall 2018*

- Designed and conducted lectures
- Designed and conducted studio sessions focused on engineering design

ECEN 5007 – Renewable Energy and the Future Power Grid *Fall 2016, 2017, 2019*

- Designed and conducted lectures
- Supervised and advised design project teams

Colorado School of Mines – Department of Chemical and Biological Engineering

Adjunct Faculty – CHEN 402 – Chemical Engineering Design *Spring 2014*

- Designed and conducted lectures
- Supervised and advised design project teams

Purdue University – School of Chemical Engineering

Teaching Assistant - CHE 450 - Design and Analysis of Processing Systems *Spring 2007, 2009*

- Designed and supervised computer laboratory sessions
- Formulated design projects
- Designed and conducted lectures

Åbo Akademi, Process Design Laboratory

Lecturer – Basics in Process Design *Fall 2005*

- Designed and conducted lectures and recitation sessions
- Created homework sets and solutions

Mentoring Experience:

University of Colorado Boulder – Department of Electrical, Computer & Energy Engineering

Ph.D. Students Advised

- Adarsh Hasandka *Fall 2017 – Fall 2018*
  - Ph.D. Student, Department of Electrical, Computer & Energy Engineering
  - Ph.D. Topic *"Novel Power System Communications System Designs for Renewable Integration"*
- Katharine Doubleday *Fall 2017 – Present*
  - Ph.D. Student, Department of Electrical, Computer & Energy Engineering
  - Ph.D. Topic *"Probabilistic Solar Power Forecasting and its Use in Power System Operations "*
- Richard Wallace Kenyon *Spring 2019 – Present*
  - Ph.D. Student, Department of Electrical, Computer & Energy Engineering
  - Ph.D. Topic *"Power System Dynamics in High Variable Inverter-Based Renewable Energy Futures"*
- Marija Markovic *Spring 2019 – Present*
  - Ph.D. Student, Department of Electrical, Computer & Energy Engineering
  - Ph.D. Topic *"Advanced Distribution System Planning with Sustainable Energy Technologies"*

Undergraduate Students Advised

- Mason Huyge *Spring 2019*
  - B.Sc. Student, Department of Electrical, Computer & Energy Engineering
- Natasha Wischmeyer *Spring 2019*
  - B.Sc. Student, Department of Electrical, Computer & Energy Engineering
- Simon Julien *Spring 2019*
  - B.Sc. Student, Department of Applied Mathematics and Engineering Physics

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Technical University of Eindhoven – Department of Electrical Engineering
Co-Promotor

- Iris van Beuzekom (co-advised with Han Slootweg – TU/E) *Summer 2017 – Present*
  - Ph.D. Student, Department of Electrical Engineering
  - Ph.D Topic: *"Integrated Natural Gas and Power Systems Planning"*

National Renewable Energy Laboratory – Power System Design & Studies Group
Postdoctoral Researchers Mentored

- Jie Zhang *Nov. 2012 – Nov. 2014*
  - Ph.D. Rensselaer Polytechnic Institute – Mechanical Engineering
  - Projects: *Solar power forecasting, wind power forecasting, wind resource assessment*
  - Current Position: Assistant Professor, University of Texas at Dallas – Mechanical Engineering
- Alicia Allen *Mar. 2013 – Sept. 2014*
  - Ph.D. University of Texas Austin – Electrical Engineering
  - Project: *Impacts of utility-scale wind power on distribution systems*
- Carlo Brancucci Martinez-Anido *Dec. 2013 – Dec. 2014*
  - Ph.D. Technical University of Delft – Technology, Policy, & Management
  - Projects: *Transmission systems modeling, unit commitment and economic dispatch*
- Giulia Gallo (co-advised with Michael Milligan - NREL) *April 2014 -April 2016*
  - Ph.D. University of Genoa –Biophysical & Electronic Engineering
  - NREL Director's Fellowship – *Future electricity markets*
- Jin Wei Kocsis *April 2014 – July 2014*
  - Ph.D. University of Toronto – Electrical & Computer Engineering
  - Project: *Cyber-physical energy systems*
  - Current Position: Assistant Professor, University of Akron - Electrical & Computer Engineering
- Qin Wang *Feb. 2015 – Dec. 2016*
  - Ph.D. Iowa State University – Electrical & Computer Engineering
  - Project: *The value of wind power forecasting improvements*
- S M Shafiul Alam *February '16 – Sept. '18*
  - Ph.D. Kansas State University – Electrical & Computer Engineering
  - Project: *Distribution State Estimation*
- Jianhua Zhang *August 2016 - Present*
  - Ph.D. North Carolina State University – Electrical & Computer Engineering
  - Project: *Communications systems design and simulation for distributed PV coordination*
  - Current Position: Assistant Professor, Clarkson University – Electrical & Computer Engineering
- Omar Guerra Fernandez *May 2017 - Present*
  - Ph.D. Purdue University –School of Chemical Engineering
  - Project: *Combined hydrogen and power systems for renewables integration*
- Kwami Sedzro *March 2018 - Present*
  - Ph.D. Lehigh University –Department of Electrical and Computer Engineering
  - Project: *Ancillary Services from Wind Power*

Students Mentored

- David Luke Oates *Summer 2011*
  - Ph.D. Student, Carnegie Mellon University, Department of Engineering and Public Policy
  - Project: *"Emissions Implications of Coal Cycling in Systems with Large Wind Power Penetration"*
- Sandra Shedd *Summer 2012*
  - DOE Science Undergraduate Laboratory Internship (SULI), Williams College
  - Project: *"Examining the Variability of Wind Power, Solar Power, and Load in the Regulation Timeframe"*
- Nicholas Steckler *Summer 2013*
  - DOE Science Undergraduate Laboratory Internship (SULI), University of Washington
  - Project: *"Statistical Properties of Load Forecasting Errors for Renewable Integration Studies"*
- Robert Bantz *Spring 2014*

  - DOE Science Undergraduate Laboratory Internship (SULI), University of Central Florida
  - Project: *"Bayesian Network Analysis of Load Forecasting Errors"*
- Jari Miettinen *March – October 2014*
  - Ph.D. Student, Lappenranta University of Technology, Department of Electrical Engineering
  - Project: *"Wind Power Forecasting Errors"*
- Samuel Putnam *Summer 2014*
  - DOE Science Undergraduate Laboratory Internship (SULI), University of Vermont
  - Project: *"The Value of Wind Power Forecasting Improvements"*
- Marc Hüsch *Summer 2014*
  - DAAD RISE Program, Technical University of Dortmund
  - Project: *"Clustering of Wind Power and Forecasting Regimes"*
- Mingjian Cui *Sept. '14 – Sept. '15*
  - Ph.D. Student, Wuhan University, School of Electrical Engineering
  - Project: *"Wind and Solar Power Ramp Forecasting"*
- Jesus Nieto-Martin *April – October 2015*
  - Ph.D. Student, Cranfield University
  - Project: *"Simulation-Optimization for Design of Power System Operations"*
- Wan Yin (Wendy) Cheung *Spring & Summer 2015*
  - DOE Science Undergraduate Laboratory Internship (SULI), University of California, San Diego
  - Project: *"Uncertainty Quantification and Propagation in Irradiance and Solar Power"*
- Hanchen Xu *Summer 2015*
  - Ph.D. Student, UIUC, Department of Electrical & Computer Engineering
  - Project: *"Power System Flexibility Options for the Western Interconnection"*
- Rishabh Jain *Summer 2015*
  - Ph.D. Student, North Carolina State, Department of Electrical & Computer Engineering
  - Project: *"Power System Reserves in Renewable Integration Studies"*
- Tarek Elgindy *August '15 – May '16*
  - M.S. Student, Carnegie Mellon University, Operations Research
  - Project: *"Ultra-Short-Term Solar Power Forecasting"*
- Ivonne Pena *Summer - Fall 2015*
  - Ph.D., Carnegie Mellon University, Engineering & Public Policy
  - Project: *"A New IEEE 118-Bus System for Renewables Integration"*
- Benjamin Botor *Fall 2015*
  - DAAD RISE Program, University of Duisburg-Essen
  - Project: *"Modeling of Bulk Power System Flexibility Options"*
- Joshua Rosenkranz *Fall 2015*
  - DAAD RISE Program, University of Kiel
  - Project: *"Multi-hour Ramping Constraints due to Solar Energy Integration"*
- Brandon Reyes *Spring 2016*
  - B.Sc. Student, Applied Mathematics, Colorado School of Mines
  - Project: *"Spatio-Temporal Forecasting of Solar Power"*
- Merce Labordena Mir *March – September 2016*
  - Ph.D. Student, ETH – Zürich – Climate Policy Group
  - Project: *"Co-locating Concentrating Solar Thermal and Wind Power Plants"*
- Lyle Collins *July - December 2016*
  - Ph.D. Student, University of Newcastle/CSIRO
  - Project: *"Game Theoretic Approaches to Demand Response"*
- Cristiana Lopes Lara *July – August 2016*
  - Ph.D. Student, Carnegie Mellon University – Chemical Engineering
  - Project: *"Capacity Expansion Modeling with High Renewables"*
- Todd Zhen *July – December 2016*
  - Ph.D. Student, Purdue University – Chemical Engineering
  - Project: *"Facility Location Problem Applied to Communications System Planning for Distributed Solar PV"*
- Gyujung Cho *August '16 – Feb. '17*

  - Ph.D. Student, Sungkyunkwan University – Power System Innovation Laboratory
  - Project: *"Distribution Systems Modeling with High PV Penetration"*
- Min-Sung Kim *August '16 – Feb. '17*
  - M.S. Student, Sungkyunkwan University – Power System Innovation Laboratory
  - Project: *"Distribution Systems Modeling with High PV Penetration"*
- Ji-Soo Kim *August '16 – Feb. '17*
  - M.S. Student, Sungkyunkwan University – Power System Innovation Laboratory
  - Project: *"Distribution Systems Modeling with High PV Penetration"*
- Ershun Du *Sept. '16 – Sept. '17*
  - Ph.D. Student, Tsinghua University – Power System Innovation Laboratory
  - Project: *"Integration of Concentrating Solar Power Plants"*
- Adarsh Hasandhka *Jan. '17 – August '17*
  - M.S. Student, University of Colorado Boulder, Department of Electrical, Computer & Energy Engineering
  - Project: *"Communication System Simulation for Distributed PV Coordination and Control"*
- Bing Huang *May '17 – August '17*
  - Ph.D. Student, University of Texas - Austin, Department of Electrical & Computer Engineering
  - Project: *"Flexible Wind Power Ramping Products"*
- Katharine Doubleday *June '17 – August '17*
  - Ph.D. Student, University of Colorado Boulder, Department of Electrical, Computer & Energy Engineering
  - Project: *"Multi-energy System District Planning and Modeling"*
- Mohammed Masum Siraj Khan *June '17 – Present*
  - M.S. Student, Florida State University, Department of Electrical & Computer Engineering
  - Project: *"Hardware-in-the-loop Testing of Communications System Design"*
- Dustin Michels *June '17 – August '17*
  - B.Sc. Student, Carleton College, Computer Science Department
  - Project: *"Flexible Reserves in Unit Commitment and Economic Dispatch Models"*
- Naeem Turner-Bandele *June '17 – August '17*
  - B.Sc. Student, Santa Clara University, Department of Electrical Engineering
  - Project: *"Impact of Residential PV Policies on Battery Sizing"*
- Jose Daniel Lara *June '17 – August '17*
  - Ph.D. Student, University of California Berkeley, Energy & Resources Group
  - Project: *"Economic Dispatch of Solar Power with Probabilistic Forecasting"*
- Richard Bryce *June '17 – Present*
  - Ph.D. Student, University of Massachusets, Department of Mechanical and Industrial Engineering
  - Project: *"Inter-annual Variability of Wind and Solar Resources" and "Microgrid Simulation"*
- Iris van Beuzekom *July '17 – February '18*
  - Ph.D. Student, TU Eindhoven, Department of Electrical Engineering
  - Project: *"Integrated Natural Gas and Power Systems Planning"*
- Javier Antoñanzas Torres *Sept. '17 – Feb. '17*
  - Ph.D. Student, Universidad de la Rioja, Department of Electrical Engineering
  - Project: *"Probabilistic Solar Power Forecasting and their Usage in Power System Operations"*
- Dominik Dominkovic *January '18 –April '18*
  - Ph.D. Student, Technical University of Denmark, , Department of Energy
  - Project: *"Modeling Energy Supply of Future Smart Cities"*
- Tessa Rider *June '18 – Aug. '18*
  - Ph.D. Student, Colorado School of Mines, Department of Mechanical Engineering
  - Project: *"Examining the Complementarity of Renewables and Small Modular Nuclear Reactors"*
- Reiko Matsuda-Dunn *October '18 – Present*
  - B.Sc.. Student, University of Colorado Boulder, Department of Electrical, Computer & Energy Engineering
  - Project: *"Renewable Integration Studies for Island Power Systems"*

- Simon Julien *Summer 2019*
  - B.Sc.. Student, University of Colorado Boulder, Department of Applied Mathematics
  - Project: *"Impacts of Power Electronic Loads on Power System Stability"*
- Vanessa van Syoc-Hernandez *Summer 2019*
  - B.Sc.. Student, University of Colorado Boulder, Department of Electrical, Computer & Energy Engineering
  - Project: *"Probabilistic Solar Power Forecasting with Bayesian Model Averaging"*

Visiting Postdocs

- Jethro Browell *May – June 2017*
  - Postdoctoral Researcher, University of Strathclyde, Electronic and Electrical Engineering

Visiting Faculty Members

- Jun-Hyung Ryu *August '15 – July '16*
  - Associate Professor, Dongguk University, Department of Nuclear & Energy Systems

Student Committee Member/Co-Advisor

- Marc Hüsch *Graduated Spring 2015*
  - Technical University of Dortmund – Faculty of Statistics
  - B.Sc. Thesis: *"Clustering of Wind Power"*
  - B.Sc. Thesis Co-Advisor: Joachim Kunert
- David Luke Oates *Graduated Spring 2015*
  - Carnegie Mellon University – Department of Engineering and Public Policy
  - Ph.D. Thesis: *"Low Carbon Policy and Technology in the Power Sector: Evaluating Economic and Environmental Effects"*
  - Ph.D. Advisor: Paulina Jaramillo
- Michael Craig *Graduated Fall 2017*
  - Carnegie Mellon University – Department of Engineering and Public Policy
  - Ph.D. Thesis: *"Economic and Environmental Costs, Benefits, and Trade-Offs of Low-Carbon Technologies in the Electric Power Sector"*
  - Ph.D. Advisor: Paulina Jaramillo
- Emily Ruby *Graduated Fall 2018*
  - University of Colorado Boulder – Department of Environmental Science
  - M.S. Thesis: *"Analysis of California's Formative Energy Storage Policy"*
  - M.S. Advisors: Max Boykoff and Susan Tegen

- Giulia De Zotti *Graduated Summer 2019*
  - Danish Technical University – Department of Applied Mathematics and Computer Science
  - Ph.D. Thesis: *"Leveraging Consumers' Flexibility for the Provision of Ancillary Services"*
  - Ph.D. Advisors: Niels Kjølstad Poulsen and Henrik Madsen

- Joseph Gardner (co-advised with Nanette Boyle - CSM) *Graduated Summer 2019*
  - Colorado School of Mines – Deparmtnet of Chemical and Biological Engineering
  - Ph.D Topic: *"Multi-Scale Modeling of Photosynthetic Organisms"*
  - Ph.D. Advisor: Nanette Boyle
- Robert Cruickshank III *Graduated Summer 2019*
  - University of Colorado Boulder – Department of Civil, Environmental and Architectural Engineering
  - Ph.D. Thesis: *"Estimating the Spatiotemporal Value of Jointly Optimized Electric Power Generation and Residential Electrical Use"*
  - Ph.D. Advisor: Gregor Henze
- Jose Daniel Lara *Anticipated Fall 2019*
  - University of California Berkeley – Energy and Resources Group
  - Ph.D. Thesis: *"Managing Uncertainty in Renewable Energy Integration"*

  - Ph.D. Advisor: Daniel Kammen
- Wenqi Zhang *Anticipated Spring 2020*
  - University of Colorado Boulder – Department of Applied Mathematics
  - Ph.D. Thesis: *"Statistical Approaches to Assess High Frequency Variability of Solar Irradiance"*
  - Ph.D. Advisor: William Kleiber

Purdue University – School of Chemical Engineering
Graduate Research Mentor

- Austin Zeiler – "Wind Power Forecasting with ARIMA Models" *Summer 2010*
- Duncan Brooks – "Wind Energy Market Characterization and Forecasting" *Fall 2009/Spring 2010*
- Adrienne Heinzelman – "Batteries: Large-scale Energy Storage Applications" *Fall 2009/Spring 2010*
- Eddie McLaughlin – "Mobile Batteries for EVs" *Fall 2009*
- Zachary Singer – "Solar Photovoltaics: Technological Prospects" *Fall 2009*
- Sam Steffen – "Solar Thermal Power: Market Prospects" *Fall 2009*
- Eoin Hayes– "Statistical Modeling and Forecasting: A Tutorial" *Summer 2007*

Workshops Attended:

Applied Management Principles Program - Krannert School of Management, Purdue University
West Lafayette, Indiana, May 17th to 28th, 2010

Next Generation Infrastructures Academy – Energy Markets Track
Venlo, The Netherlands, September 21st to 25th, 2009

Selected Honors:

- NREL Outstanding Mentor Award *September 2018*
- Best Paper Award (x2), IEEE Power & Energy Society General Meeting *August 2018*
- NREL Outstanding New Partnership Award –Peña Station Next *March 2018*
- Best Paper Award, IEEE Power & Energy Society General Meeting *July 2017*
- NREL President's Award *August 2016*
- Fulbright Fellowship, VTT, Finland *May – August 2016*
- Best Paper Award, IEEE Power & Energy Society General Meeting *July 2016*
- NREL RPP Outstanding Mentor Award *September 2015*
- Best Paper Award, IEEE Power & Energy Society General Meeting *July 2015*
- NREL Outstanding SULI Mentor Award *Spring 2015*
- NREL RPP Outstanding Mentor Award *September 2014*
- FOCAPD Young Researcher Travel Grant *July 2014*
- NREL Outstanding SULI Mentor Award *Summer 2012*
- Undergraduate Award for Teaching Excellence – Purdue Chemical Engineering *Spring 2009*
- Eastman Graduate Student Travel Grant *Spring 2008*
- President, Chemical Engineering Graduate Student Organization - Purdue *2007-2008*
- Charlemagne Scholarship - RWTH Aachen, Germany *2002-2003*

Professional Activities:

Journal Reviewer for: *Applied Energy; Applied Soft Computing; Bulletin of the American Meteorological Society (BAMS); Computers & Chemical Engineering; Energy; Energy Conversion & Management; Energy Policy; Energy Research & Social Science; Energy Strategy Reviews; European Journal of Operational Research; Frontiers in Energy Research: Energy Systems and Policy; Frontiers in Energy Research: Process and Energy Systems Engineering; IEEE PES Letters; IEEE Power & Energy Technology Systems Journal; IEEE Transactions on Control Systems Technology; IEEE Transactions on Power Systems; IEEE Transactions on Sustainable Energy; IET Generation,Transmission & Distribution; IET Renewable Power Generation, Industrial & Engineering Chemistry Research; International Journal of Forecasting; International Journal of Power and Energy Systems; International Journal of Sustainable Transportation; Journal of Renewable and Sustainable Energy; Journal of Zhejiang University*

– Computers & Electronics; Materials and Manufacturing Processes; Mathematical Problems in Engineering; Nature Energy; PLOS One; Renewable Energy; Renewable Energy Focus; Resources; Solar Energy; Utilities Policy; Wind Energy.

Conference Paper Reviewer for: *The 12th International Conference on Probabilistic Methods Applied to Power Systems (PMAPS) 2012; IEEE GreenTech 2013; IEEE GreenTech 2014, The 13th International Conference on Probabilistic Methods Applied to Power Systems (PMAPS) 2014; 8th International Conference on Foundations of Computer-Aided Process Design (FOCAPD) 2014; 2015 Summer Simulation Multi-Conference; IEEE GreenTech 2016; 55th IEEE Conference on Decision and Control; The 14th International Conference on Probabilistic Methods Applied to Power Systems (PMAPS) 2016; ASME Turbo Expo 2019; 9th International Conference on Foundations of Computer-Aided Process Design (FOCAPD) 2019.*

Book Proposal Reviewer for: *Wiley – Electrical Engineering, Elsevier – Engineering.*

Associate Editor: *Journal of Renewable and Sustainable Energy; June 2019 – Present.*

Editorial Board: *IEEE Transactions on Sustainable Energy; January 2019 – Present.*

Funding Proposal Reviewer for: *National Science Foundation: Cyber-Enabled Sustainability Science and Engineering (CyberSEES) program*; *Department of Energy: Small Business Innovation Research/Small Business Technology Transfer.*

High Performance Computing Proposal Reviewer for: *LinkSCEEM & Cy-Tera Joint Call for HPC Access.*

Review Editor for: *Frontiers in Energy Research: Energy Systems and Policy, Frontiers in Energy Research: Process and Energy Systems Engineering.*

Technical Program Committee Member, 2020 IEEE Green Technologies Conference, April 1-3, 2020, Oklahoma City, OK, USA.

Guest Editor for: *Journal of Energy Engineering*, Special Issue on "*Modeling, Monitoring, and Algorithmic Opportunities in the Next-Generation Power Grid*".

Session Chair, "Forecasting 2", Energy Systems Integration Group (ESIG), Meteorology & Market Design for Grid Services Workshop, June 4-6 2019, Denver, CO USA.

International Programming Committee, Foundations of Computer Aided Process Design (FOCAPD) 2019, July 14-18, Copper Mountain, CO, USA.

Salt River Project Grid Modernization Advisory Board, 2018 - 2019.

Program Committee, 2017 Summer Computer Simulation Conference, July 9-12, Seattle, WA, USA.

Session Chair, "Industrial Applications of Data Analysis, Information Management, and Intelligent Systems", American Institute of Chemical Engineers Annual Meeting, November 13-18, 2016, San Francisco, CA, USA.

Session Chair, "Forecast Issues", 5th International Workshop on Integration of Solar Power into Power Systems, October 19-20, 2015, Brussels, Belgium.

Program Coordinator, AIChE CAST Division 10E: Information Management and Intelligent Systems, 2015

Session Co-Chair, "Data Analysis and Big Data in Chemical Engineering" American Institute of Chemical Engineers Annual Meeting, November 8-13, 2015, Salt Lake City, UT, USA.

Session Co-Chair, "Advances in Smart Grid" American Institute of Chemical Engineers Annual Meeting, November 8-13, 2015, Salt Lake City, UT, USA.

Session Co-Chair, "Advances in Data Analysis: Theory and Applications", American Institute of Chemical Engineers Annual Meeting, November 16-21, 2014, Atlanta, GA, USA.

Session Co-Chair, "Information Management and Intelligent Systems", American Institute of Chemical Engineers Annual Meeting, November 16-21, 2014, Atlanta, GA, USA.

Session Co-Chair, "Design of Energy Systems I", 8th International Conference on Foundations of Computer-Aided Process Design (FOCAPD), July 13 – 17, 2014, Cle Elum, WA, USA.

Technical Program Committee Member, 2014 Sixth Annual IEEE Green Technologies Conference, April 3-4, 2014, Corpus Christi, TX, USA.

Program Co-Coordinator, AIChE CAST Division 10E: Information Management and Intelligent Systems, 2014

Session Chair, "Big Data Applications in Chemical Engineering", American Institute of Chemical Engineers Annual Meeting, November 3-8, 2013, San Francisco, CA, USA.

Session Chair, "Forecasting I", 12th International Workshop on Large-Scale Integration of Wind Power into Power Systems as well as on Transmission Networks for Offshore Wind Power Plants, October 22-24, 2013, London, UK.

Program Committee Member, The American Meteorological Society 2013 Summer Community Meeting, August 12-16, 2013, Boulder, CO, USA.

Session Chair, "Wind Power – Session A", 5th Annual IEEE Green Technologies Conference, April 4th, 2013, Denver, CO, USA.

Session Co-Chair, "Energy and Sustainability in Operations", American Institute of Chemical Engineers Annual Meeting, October 28th, 2012, Pittsburgh, PA, USA.

Session Chair, "Smart Grid and Wind Power – Part II", 10th International Workshop on Large-Scale Integration of Wind Power into Power Systems, October 26th, 2011, Aarhus, Denmark.

Languages:

English:	Native Speaker
German:	Fluent
Swedish:	Fluent